

The
Natural
Energy
Laboratory
of Hawaii
Annual
Report
1981



**THE NATURAL ENERGY LABORATORY
OF HAWAII
FISCAL YEAR 1981 REPORT**

Board of Directors, June 30, 1981

A. Duane Black

Research and Development, County of Hawaii

John P. Craven

Dean of Marine Programs, University of Hawaii at Manoa and State
Marine Affairs Coordinator

Hidetoto Kono

Director of the Department of Planning and Economic Development
and State Energy Resources Coordinator, State of Hawaii

Herbert T. Matayoshi

Mayor, County of Hawaii

Susumu Ono

Chairman and Member, Board of Land and Natural Resources, State of
Hawaii

Barbara Z. Siegel

Interim Dean of the Graduate Division and Director of Research,
University of Hawaii at Manoa

John W. Shupe

Energy Research Coordinator, University of Hawaii at Manoa

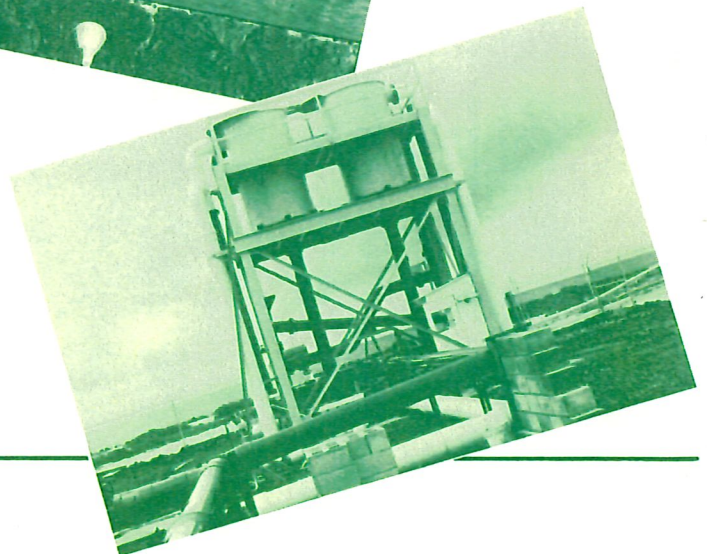
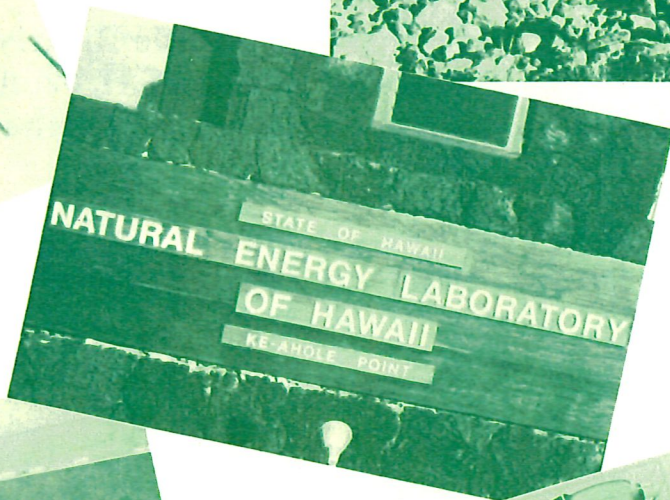
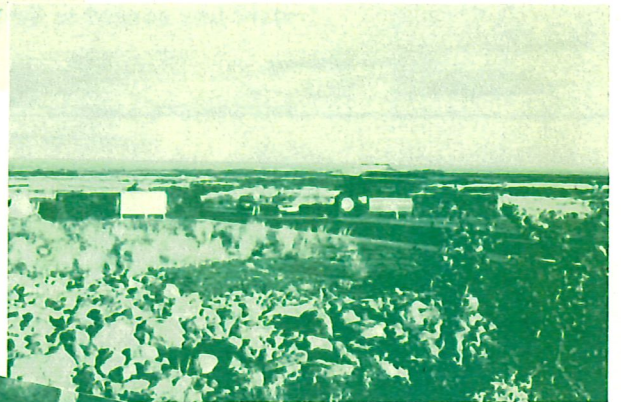
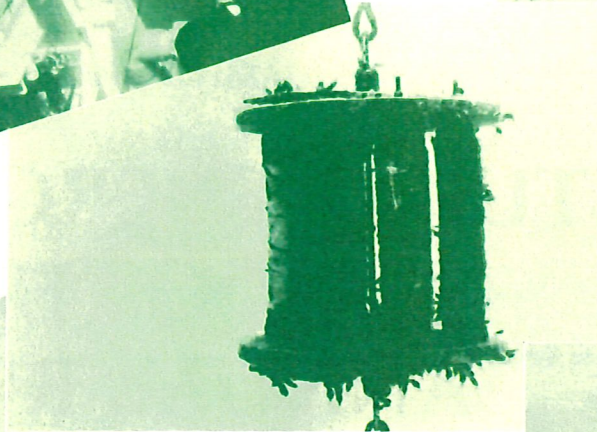
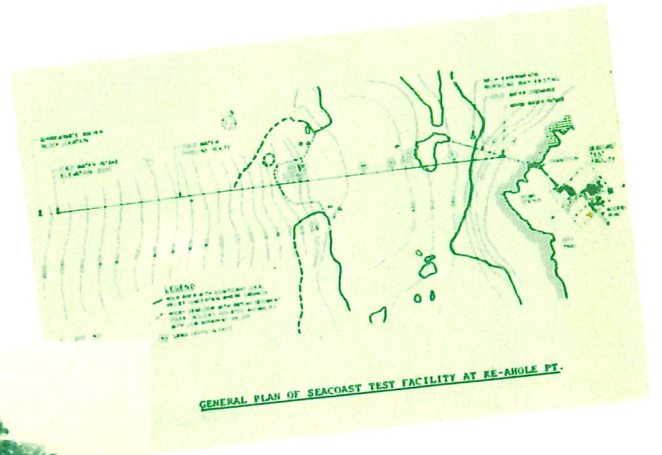
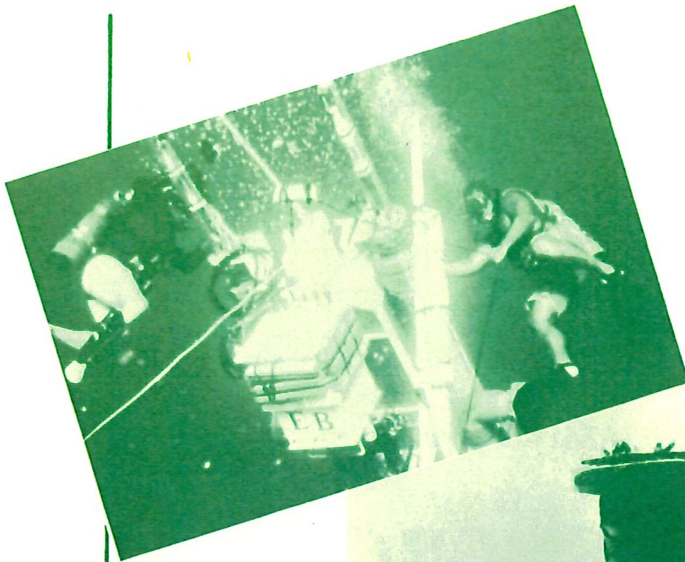
Office:

Varsity Building, Suite 503
1110 University Avenue
Honolulu, Hawaii 96826

THE NATURAL ENERGY LAB OF HAWAII ANNUAL REPORT

1981

TO: The Honorable George R. Ariyoshi, Governor of Hawaii
The Honorable Richard S.H. Wong, President of the Senate
The Honorable Henry H. Peters, Speaker of the House of Representatives



PREFACE

The Natural Energy Laboratory of Hawaii (NELH) has made significant progress during fiscal year 1981.

The Seacoast Test Facility (STF) has been established at the NELH, and experimental hardware is being installed and tested in the main laboratory space. We anticipate that Stage 1 construction will be completed early in FY '82. The warm surface seawater system has been refurbished to support the STF experiments and the system is operational.

The design and construction of an interim cold water pipe system to provide deep cold seawater for OTEC and aquaculture projects is nearly complete. This experimental facility will give the NELH the only such system in the world and opens the door to a wide variety of research possibilities. The first two OTEC aquaculture experiments will be initiated as soon as this system becomes operational.

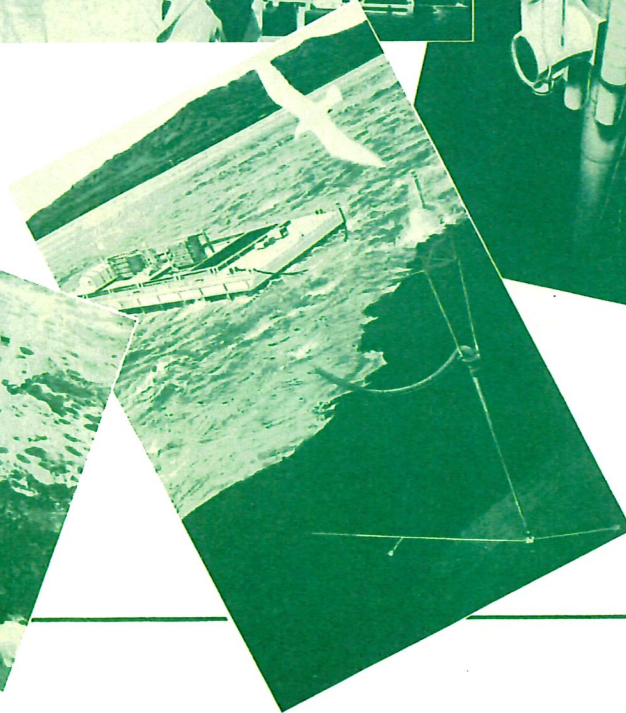
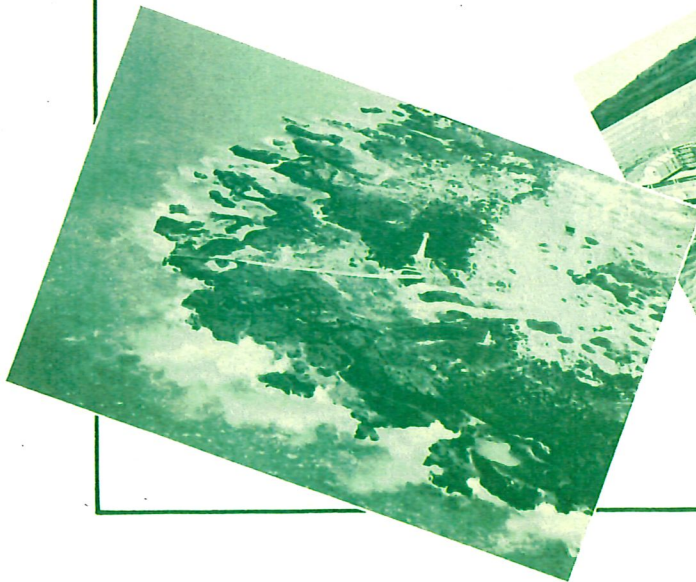
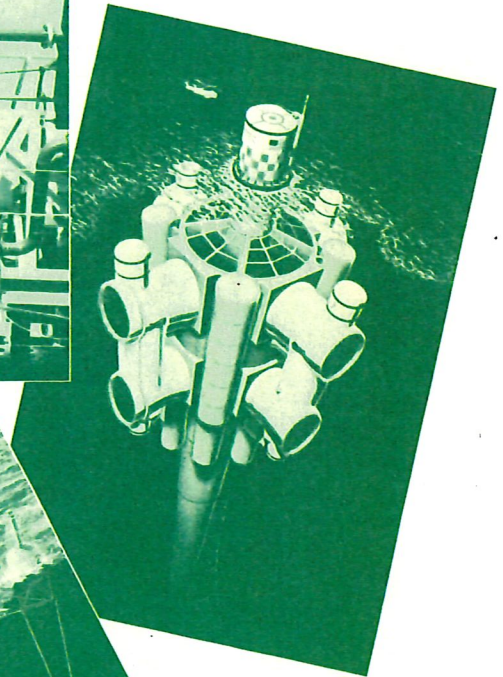
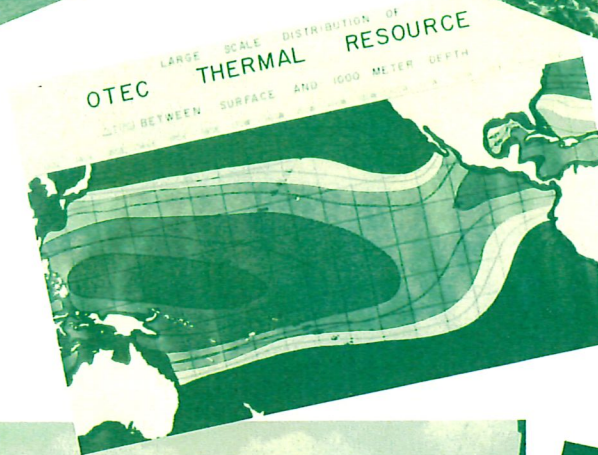
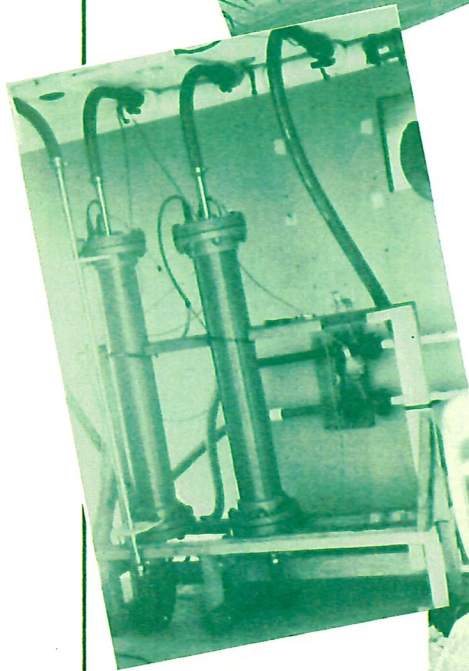
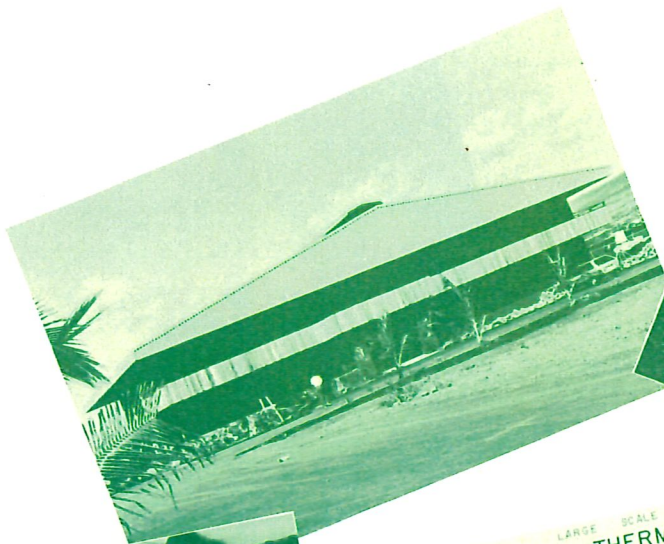
While our attention is focused principally on OTEC, NELH has a mandate to serve as a research facility for all appropriate forms of natural energy research and ocean resource use. The tentative "Master Developmental Plan" reproduced on page 2 in this report sets forth areas for OTEC aquaculture and direct solar testing.

We look forward to activities in these and many other areas in the coming years.

We submit this report as a useful update on the growth and development of the NELH.



John P. Craven
Chairman
NELH Board of Directors



CONTENTS

INTRODUCTION	1
OVERVIEW OF ACTIVITIES	
Institutional Progress	3
Research Activities	3
Facility Capabilities	3
BUILDING THE SEACOAST TEST FACILITY	5
BUDGET SUMMARY	7
APPENDIX A: NELH-Related Projects	A-1
APPENDIX B: NELH Policy on Project Acceptance	B-1



INTRODUCTION

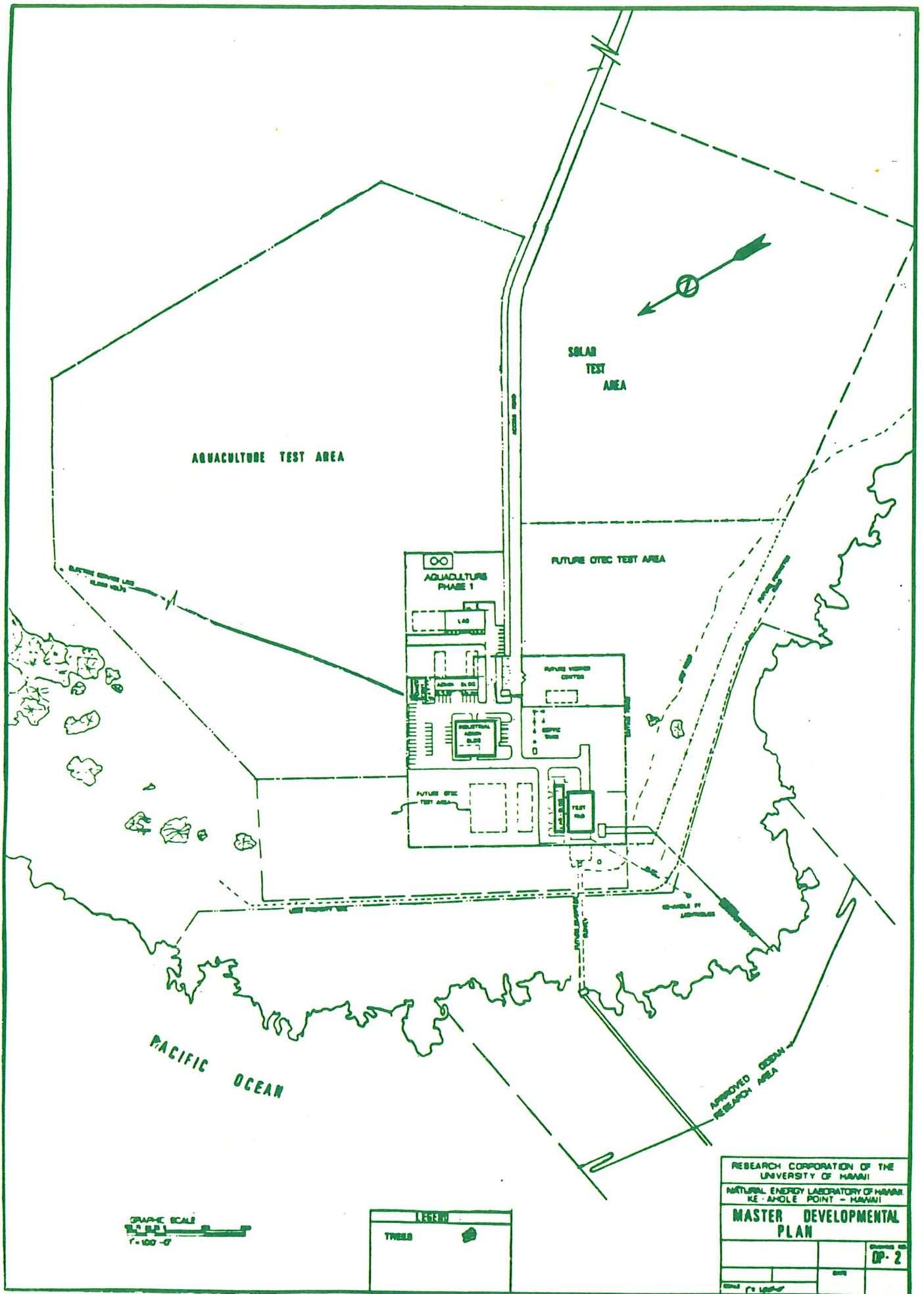
This report summarizes the 1981 Fiscal Year activities and projects associated with the Natural Energy Laboratory of Hawaii (NELH). Earlier activities (1972-1980) are listed in Appendix A.

NELH was created by the Hawaii State Legislature in 1974 as a facility for natural energy research. It is located on 328 acres of state-owned land at Ke-ahole Point, adjacent to the Ke-ahole Airport on the Kona Coast of the Island of Hawaii. This site was chosen because of the nearby availability of cold, deep ocean water; a warm ocean surface layer not subject to strong seasonal cooling; high annual solar radiation; accessibility to logistical support including major airports, harbors, and highways; and adequate quantities of undeveloped land. Among the nine sites investigated, Ke-ahole Point is unique in meeting all of these major criteria.

NELH is governed by a Board of Directors consisting of the Director of the State Department of Planning and Economic Development, the State Marine Affairs Coordinator, the Chairman of the Board of Land and Natural Resources, two officers or employees of the University of Hawaii appointed by the President of the University, and two County of Hawaii officials appointed by the Mayor of the County.

The Board is responsible for maintaining NELH property, reviewing and approving research proposals from prospective users, and planning and coordinating the development of the NELH site. While NELH personnel may become directly involved in research, the primary function of NELH is to serve as the facilities manager for the research activities carried out by others. The Board has engaged the services of the Research Corporation of the University of Hawaii to provide administrative support for the operation of the NELH. To date, NELH has been supported by State and County of Hawaii funds plus project user fees, primarily from the U.S. Department of Energy. It is anticipated that eventually NELH operations will become self-sustaining through user's fees.

NELH welcomes research proposals from both the public and private sectors. With the approval of the Board, researchers may arrange to share existing facilities or construct their own facilities. Areas of planned expansion are OTEC, OTEC aquaculture, and direct solar energy applications research. Inquiries concerning NELH should be addressed to the Executive Director.



ACTIVITIES OVERVIEW

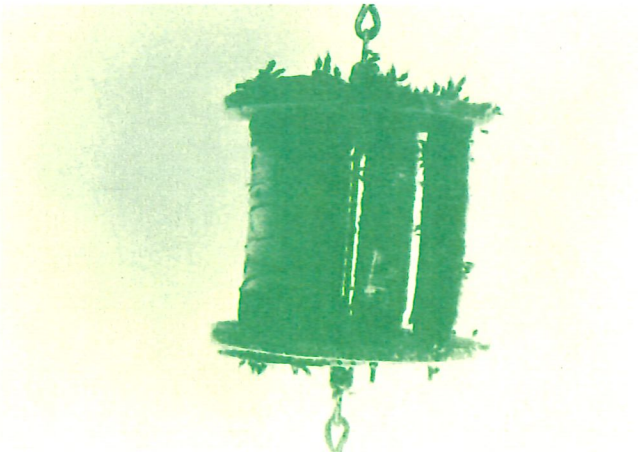
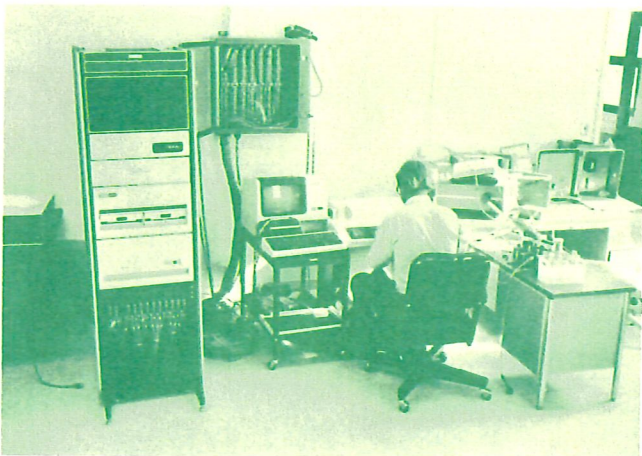
Institutional Progress

Fiscal Year 1981 was a year of building on the foundation laid down in previous years. During these developmental years, the necessary basic permits were obtained and the plans for the first permanent onshore facilities were completed. FY 1981 saw a major construction effort resulting in the completion of the laboratory building, test pad, power center, and the beginning of the industrial building containing the warehouse, shops and offices. The organization itself grew to include a total of 8 full-time personnel at Ke-ahole, of which 5 were in direct project technical support positions. The organization structure also grew to enable it to respond more efficiently to the growing needs of the experimental program.

Research Activities

The major effort during 1981 was focused on the Argonne Test Project and its biofouling, biofouling countermeasures, and materials corrosion research experiments. These experiments, directed toward OTEC heat exchanger applications, involved the fabrication of eighteen separate test loops. Each loop involves: a) one heat transfer monitor (HTM) for measuring the rate of heat transfer across the surface of the experimental tube wall; b) a precision flow measurement device; c) a series of tube sections to be extracted during the experiment to monitor what is happening biologically in the loop; and d) in most cases one or more biofouling countermeasure devices. Countermeasure devices initially installed include chlorination, Amertap balls and slurry systems. Data acquisition and reduction is by on-line computer.

An additional experiment in OTEC technology was funded by DOE through the Simplex Wire and Cable Company to the U.H. It involves placing samples of candidate OTEC electric power cable sections and materials at depths of about 50 and 200 feet. These samples are supported from subsurface buoys that are moored in about 240 feet of water in the NELH offshore research corridor. Recovery of the samples is planned for 6 months and 1 year after installation.



Facility Capabilities

As of December 31, 1981 the NELH had the following operational support capabilities:

Warm Seawater Supply System	2,000 gpm 25°C to 27.5°C
Cold Seawater Supply System	500 gpm (expandable to 1500 gpm) 8.5°C to 9.0°C

Water Chemistry Laboratory	Flow Temperature Salinity Suspended solids pH and alkalinity Nutrients Dissolved oxygen Biochemical Oxygen Demand (BOD) Chlorine Demand
----------------------------	---

Technician Support	Mechanical Electronic/ instrumentation Diving
--------------------	--

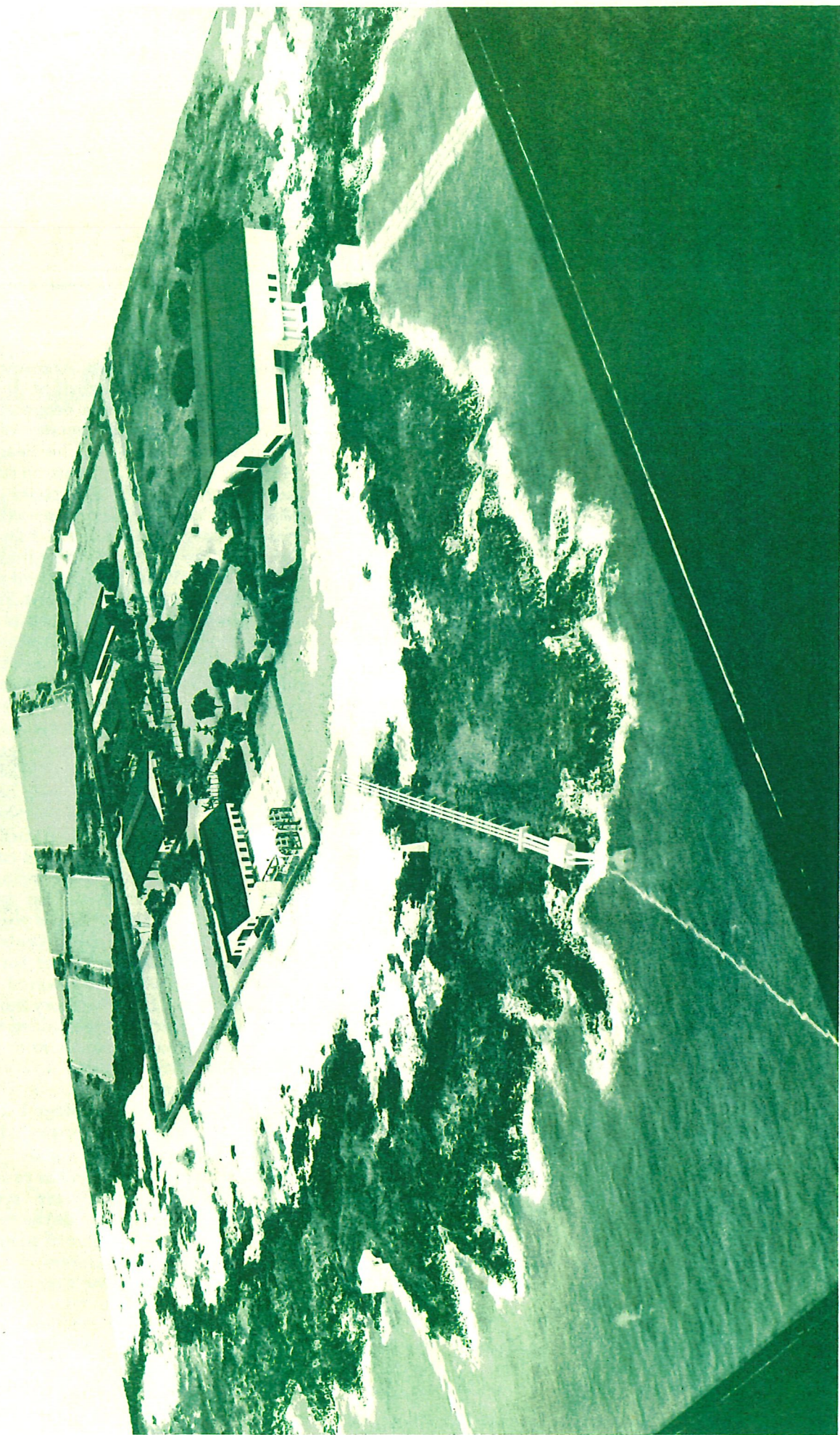
Facilities	Laboratory space (in & outdoor) Shop and warehouse support Office space Offshore research corridor
------------	--

BUILDING THE SEACOAST TEST FACILITY

In September of 1978, Argonne National Laboratory (ANL), acting on behalf of the U.S. Department of Energy, accepted the proposal of the Research Corporation of the University of Hawaii (RCUH), acting as the agents for the Seacoast Test Facility Development Group, to locate an on-shore OTEC test facility at NELH. The first phase of the project, the design of the test and supporting facilities, was awarded to Hawaii, and Dr. Edward K. Noda was appointed Project Manager by the STF Development Group. Authorization to proceed with Phase I work was given by ANL, and Parsons, Brinckerhoff, Quade and Douglas, Inc. was selected as the architectural-engineering firm. The final design was completed at the end of 1979, and was the result of extensive trade off studies dealing with pipe material characteristics, protection, deployment, risk analysis and costs.

Phase II, construction of the pipe system and shore facilities, was divided into two stages. Stage 1 includes the refurbishment of an existing state-owned temporary warm water supply capable of pumping 2000 gallons per minute of nearshore water, and the construction of onshore test facilities. These facilities include: a) a 60-by-100-foot concrete test pad; b) a laboratory building which includes a control and data acquisition room; c) an industrial building housing administrative offices plus shops and warehouse space; and d) a power center which serves as the power distribution center for the site and also contains standby diesel-powered generators. Both the test pad and the laboratory building are designed for easy expansion to meet added test requirements. The access road construction, site grading and fencing, security building, and utilities to the site which were completed during 1979, are also considered to be apart of the Stage 1 construction effort. Completion of Stage 1 is expected early in FY '82.

The major water supply system and an administration building will be provided in Stage 2 of construction. This seawater system utilizes an innovative design to provide the required volumes of warm and cold ocean water of adequate quality at the desired temperature differential. Current plans calls for a deep water pipeline supplying 6400 gallons per minute of cold seawater from a depth of 2100 feet and a warm surface water pipeline pumping up to 9600 gallons per minute of warm seawater from a depth of 50 feet. Design of the facilities has been funded primarily by the federal government while the early portions of the Stage 1 construction have been funded by the state.



BUDGET SUMMARY

ABBREVIATIONS

ANL	Argonne National Laboratory
ERDA	Energy Research and Development Administration (now DOE)
DOE	Department of Energy
DPED	Department of Planning and Economic Development
HIG	Hawaii Institute of Geophysics
HNEI	Hawaii Natural Energy Institute
MAC	Marine Affairs Coordinator
NELH	Natural Energy Laboratory of Hawaii
NSF	National Science Foundation
OI	Oceanic Institute
RCUH	Research Corporation of the University of Hawaii
SG	Sea Grant
UH	University of Hawaii

BUDGET SUMMARY FY-1981 (07/01/80 - 06/30/81)

	State		Federal		Other
A. Operational Support					
Operational Support for NELH	\$ 293,519	DPED			
B. Site Studies					
No funded projects this year					
C. Site Development					
Seacoast Test Facility			\$1,720,000	DOE	
12" Cold Seawater Supply System	550,000	UH			
	370,000	MAC			
D. Ocean Energy					
ANL OTEC Heat Exchanger, Biofouling,			449,500	DOE	
Corrosion and Biofouling					
Countermeasures Experiments					
UH/Simplex Cable Corrosion Project					\$5,000
					UH/SIMPLEX
E. Mariculture					
Preliminary Studies for Cold Water	275,000	MAC			
Aquaculture Facilities					
F. Other					
No Funded Projects During This Year					
TOTALS FY-1981	<u>\$1,488,519</u>		<u>\$2,169,500</u>		<u>\$5,000</u>

BUDGET SUMMARY FY-1972 — FY-1980

	Year	County of Hawaii	State	Federal
A. Operational Support				
Natural Energy Proposals	1975		\$ 38,000	MAC
Project Support for NELH	1975	\$50,000	50,000	MAC
	1976		58,000	MAC
Operational Support for NELH	1977		92,000	DPED
	1978		97,000	DPED
	1979		97,758	DPED
	1980		479,920	DPED
Sub-Totals		\$50,000	\$ 912,678	
B. Site Studies				
Report on Aquaculture and Ocean Energy Systems for the County of Hawaii	1972	\$ 5,000	\$ 5,000	MAC
An Evaluation of Oceanographic and Socioeconomic Aspects of a Nearshore OTEC Pilot Plant in Subtropical Hawaiian Waters	1975			\$ 48,000 NSF/ERDA
A Further Evaluation of the Oceano- graphic Conditions Found off Ke-ahole Point, Hawaii and the Environmental Impact of Nearshore Ocean Energy Conversion Plants on Subtropical Hawaiian Waters	1975		10,000	DPED
Environmental Survey Benthic Ecosystem at Ke-ahole Point	1977		25,625	DPED
	1978		21,710	DPED
Field Observations of Ocean Currents, Temperature Profiles, and Surface Plankton off Ke-ahole Point, Hawaii	1977		2,400	MAC
Site Selection Bathymetry Survey Ke-ahole Point, Hawaii for Deepwater OTEC Pipeline	1978		35,670	DPED
Engineering Studies and Land Surveys of the Ke-ahole Point Site of NELH	1978		46,000	DPED
Phytoplankton Monitoring at Ke-ahole Point, Hawaii Related to OTEC Environmental Research Project	1979		32,000	MAC 238,000 DOE
Bottom Current Survey	1979		31,733	DPED
Sub-Totals		\$ 5,000	\$ 210,138	\$ 286,000

BUDGET SUMMARY FY-1972 — FY-1980 (continued)

	Year	County of Hawaii	State	Federal
C. Site Development				
NELH Uncontaminated Surface Seawater Supply System	1977		\$ 65,000 DPED	
Preliminary Design of Ocean Thermal Energy Conversion (OTEC) Deep Cold Water and Warm Water Pipeline Systems Proposed for Ke-ahole Point	1978		24,928 DPED	
Seacoast Test Facility	1979		31,000 UH	\$ 550,599 DOE
	1980		633,000 UH	207,627 DOE
			12,000 MAC	
NELH Facilities and Road Construction	1979		750,000 DPED	
			330,000 MAC	
3-inch Pipeline at the NELH	1979		35,700 MAC	
Warm Seawater Supply System	1980		420,000 MAC	
Sub-Totals			\$2,301,628	\$ 758,226
D. Ocean Energy				
A Pilot Engineering Study of OTEC	1975		\$ 6,686 HNEI	
The Oceanic Institute's OTEC	1975		9,625 UH	\$ 111,594 SG
Ocean Structure Model Project			4,907 OI	
Pipeline Survival Under Ocean Wave Attack	1975		10,000 MAC	37,000 SG
	1976		10,000 MAC	39,000 SG
Operational Sea State and Design Wave Criteria for OTEC Projects	1976			36,000 ERDA
The Isaacs Wave Energy Pump: Tests off the Coast of Kaneohe Bay, Oahu, Hawaii	1977		43,323 DPED	
Consolidated Oceanographic and Meteorological Data for Four North Pacific OTEC Sites	1977		4,500	
Corrosion and Fouling Removal	1976		7,598 HNEI	
Fouling and Corrosion in OTEC Heat Exchangers	1976			114,000 NSF/ERDA
	1977			246,000 NSF/ERDA
	1978		\$ 15,000 MAC	294,000 DOE
OTEC Heat Exchanger Biofouling Experiment	1977		23,716 DPED	\$ 53,591 SG
	1978			52,477 SG
	1979		600,000 DPED	47,230 SG
Mini-OTEC	1978		450,000 DPED	
	1979		12,000 MAC	
Environmental Impact of Mini-OTEC Operations	1979		51,305 UH	
Sub-Totals			\$1,248,660	\$1,030,892

	Year	County of Hawaii	State	Federal
E. Mariculture				
OTEC Mariculture/Algal Project	1977		\$ 10,000 DPED	
Phase I Study of Aquaculture	1979		115,000 MAC	
Compound at NELH				
Sub-Totals			\$ 125,000	
F. Other				
Mantle Conductivity Beneath the	1978			\$ 10,000 NSF
Hawaiian Ridge				
TOTALS FY-1972-80		<u>\$55,000</u>	<u>\$4,798,104</u>	<u>\$2,085,118</u>

	County of Hawaii	State	Federal	Other
TOTAL SUPPORT FYs-1972 - 1981	<u>\$55,000</u>	<u>\$6,286,623</u>	<u>\$4,254,618</u>	<u>\$5,000</u>

APPENDIX A

NELH RELATED PROJECTS

The following section lists NELH-related projects conducted in past years. They are organized in major categories which include:

- A. Operational Support
- B. Site Studies
- C. Site Development
- D. Ocean Energy
 - General
 - Biofouling and Corrosion
 - Mini-OTEC
- E. Mariculture
- F. Other

Following the list of projects within each of these major categories the 1981 projects are described in greater detail.

A. OPERATIONAL SUPPORT

Title	Project Managers	Year	Funding	Funding Agency
A-1 Natural Energy Proposals	Dr. John P. Craven, Marine Programs, MAC	1975	\$ 38,000	MAC
A-2 Project Support for NELH, Includes development of Master Plan and Phase I EIS	Dr. James H. Jones, NELH	1975	50,000	MAC
	Dr. John P. Craven	1975	50,000	County of Hawaii
	Marine Programs, MAC	1976	58,000	State of Hawaii
A-3 Operational Support for NELH	William R. Coops, RCUH	1977	92,000	DPED
		1978	97,000	DPED
		1979	97,758	DPED
	Dr. Lawrence W. Hallanger, NELH	1980	479,920	DPED
		1981	293,519	DPED

Project No.: A-3

Title: Operational Support for Natural Energy Laboratory of Hawaii (NELH)

Project Manager: William R. Coops, Dr. Lawrence W. Hallanger

Funding: 1977 \$ 92,000 (DPED)
 1978 97,000 (DPED)
 1979 97,758 (DPED)
 1980 479,920 (DPED)
 1981 293,519 (DPED)

Description:

Operational support provided under this project

is to fund NELH in the following functions:

- Administration
- Grant solicitation
- Laboratory operations

The administration of NELH is continued under the auspices of the RCUH, while the NELH grant solicitation is continued as a joint HNEI/NELH effort with the NELH Board of Directors exercising final authority.

The laboratory operations include the cost of maintaining and operating facilities at Ke-ahole Point, communications, and authorized support in project co-ventures.

B. SITE STUDIES

Title	Investigators/Managers	Year	Funding	Funding Agency
B-1 Report on Aquaculture and Ocean Energy Systems for the County of Hawaii	Prof. Kaare R. Gunderson, Dr. Robert Q. Palmer, UH	1972	\$ 5,000 5,000	MAC County of Hawaii
B-2 Evaluation of Oceanographic and Socio-Economic Aspects of Nearshore Ocean Thermal Conversion Pilot Plant in Sub-Tropical Hawaiian Waters	Dr. Karl H. Bathen, with R.M. Kamins, K. Kornreich, J.E.T. Moncour, UH	1975	48,000	NSF/RANN/ERDA
B-3 A Further Evaluation of the Conditions Found Off Ke-ahole Point, Hawaii, and the Environmental Impact of Nearshore Tropical Energy Conversion Plants on Subtropical Hawaiian Waters	Dr. Karl H. Bathen, UH	1975	10,000	DPED
B-4 Environmental Survey Benthic Ecosystem at Ke-ahole Point	Dr. James H. Jones, NELH	1977	25,625	DPED
	Dr. R.S. Nolan, Dr. E. Alison Kay and Dr. Daniel P. Cheney, ORCA	1978	21,710	DPED
B-5 Field Observations of Ocean Currents, Temperature Profiles, and Surface Plankton off Ke-ahole Point, Hawaii	Dr. Karl H. Bathen, UH	1977	2,400	MAC
B-6 Site Selection Bathymetry Survey, Ke-ahole Point, Hawaii for Deepwater OTEC Pipeline	Dr. Edward K. Noda, UH	1978	\$ 35,670	DPED

B. SITE STUDIES

(continued)

Title	Investigators/Managers	Year	Funding	Funding Agency
B-7 Engineering Studies and Land Surveys of the Ke-ahole Point Site of NELH	William R. Coops, RCUH	1978	\$ 46,000	DPED
B-8 Phytoplankton Monitoring at Ke-ahole Point, Hawaii Related to OTEC Environmental Research Program	Dr. Edward K. Noda, UH	1979	32,000 238,000	MAC DOE
B-9 Bottom Current Survey	Dr. Edward K. Noda and Lawrence E. Brower, UH	1979	31,733	DPED

C. SITE DEVELOPMENT

Title	Investigators/Managers	Year	Funding	Funding Agency
C-1 NELH Uncontaminated Surface Seawater Supply System	Dr. James H. Jones, NELH	1977	\$ 65,000	DPED
C-2 Preliminary Design of Ocean Thermal Energy Conversion (OTEC) Deep Cold Water and Warm Water Pipeline Systems Proposed for Ke-ahole Point	Dr. Edward K. Noda, HNEI	1978	24,928	DPED
C-3 Seacoast Test Facility	Dr. Lawrence W. Hallanger, NELH Dr. Edward K. Noda, HNEI	1979 1980 1981	31,000 550,599 633,000 12,000 207,627 1,720,000	UH DOE UH MAC DOE DOE
C-4 Manned Submersible Reconnaissance Survey	Dr. Edward K. Noda J.K.K. Look Laboratory	1978	5,000	NOAA
C-5 NELH - Facilities and Road Construction	William R. Coops, RCUH	1979	750,000 330,000	DPED MAC
C-6 3-Inch Pipeline at the Natural Energy Laboratory of Hawaii	Henry J. White, RCUH	1979	35,700	MAC
C-7 Warm Seawater Supply System Refurbishment	William R. Coops, RCUH	1980	420,000	MAC
C-8 12" Cold Seawater Supply System	William R. Coops, RCUH	1981	550,000 370,000	UH MAC

Project No.: C-3

Title: Seacoast Test Facility

Project Managers: Dr. Lawrence W. Hallanger
Dr. Edward K. Noda

Funding: 1979 \$ 31,000 (UH)
550,599 (DOE)
1980 633,000 (UH)
12,000 (MAC)
207,627 (DOE)
1981 1,720,000 (DOE)

Description:

The Seacoast Test Facility (STF), is an onshore research, development and demonstration laboratory which is being constructed at NELH at Ke-ahole Point. The STF Project will evaluate components of an OTEC system, as well as conduct related bio-fouling and corrosion research. When completed the facility will include an onshore laboratory building, administration space, electronic and machine shops,

warehouse space, warm water pipes and deep cold water pipes. Because of funding limitations within the U.S. DOE, facilities construction is being carried out in two separate stages. Stage 1, planned for completion in early FY '82, provides all of the onshore facilities with the exception of the administration building. During Stage 1, operations office space will be provided as part of the warehouse building. Stage 2 of construction will include the administration building and the main seawater supply system. Until completion of the Stage 2 construction warm seawater will be supplied to the facility through the interim seawater system which was refurbished in 1980 as project C-7; and cold water will be supplied by the interim system installed as Project C-8.

The completed facility has plans for at least 10 years of operations, and offers Hawaii the opportunity to become a world leader in OTEC research and development.

Project No.: C-8**Title:** 12" Cold Water Pipe System at the NELH**Project Manager:** William R. Coops**Year Funded:** 1981**Funding:** \$920,000**Description:**

Research needs for deep cold seawater, plus the apparent delay in construction of the STF Stage 2 seawater system, has resulted in the design and construction of an interim deep cold seawater supply system. The system is designed around a single 12-

inch diameter polyethylene pipe using a design based on the work done for the STF. The nearshore section is securely fastened to the bottom, with the pumps located offshore at about a 30 foot depth. The deep offshore section, below the 500 foot depth, is suspended in a long catenary ending at the 2,000 foot depth. All materials used are biologically and chemically inert so that the cold seawater is not "contaminated" as it is brought up from the depths. Onshore the water is delivered to the test pad area adjacent to the existing warm water supply system. Project completion is expected in October 1981.

D1. OCEAN ENERGY GENERAL

Title	Investigators/Managers	Year	Funding	Funding Agency
D1-1 A Pilot Engineering Study on OTEC	Dr. Theodore T. Lee, UH	1975	\$ 6,686	HNEI
D1-2 The Oceanic Institute's OTEC Ocean Structure Scale Model Project	Dr. Joe A. Hanson, Oceanic Institute	1975	111,594 9,625 4,907	SG UH Oceanic Institute
D1-3 Pipeline Survival Under Ocean Wave Attack	Dr. Robert Grace, UH	1975	10,000 37,000	MAC SG
		1976	10,000 39,000	MAC SG
D1-3 Operational Sea State and Design Wave Criteria for OTEC Projects	Dr. C.L. Bretschneider, UH	1976	36,000	ERDA
D1-5 The Isaacs Wave Energy Pump: Tests off the Coast of Kaneohe Bay, Oahu, Hawaii	Dr. James H. Jones, NELH Gerald L. Wick and David Castel	1977	43,323	DPED
D1-6 Consolidated Oceanographic and Meteorological Data for Four North Pacific OTEC sites	Dr. Karl H. Bathen, UH	1977	4,500	State of Hawaii

D2. OCEAN ENERGY — BIOFOULING AND CORROSION

Title	Investigators/Managers	Year	Funding	Funding Agency
D2-1 Corrosion and Fouling Removal	Dr. Jorn Larsen-Basse, UH	1976	\$ 7,598	HNEI
D2-2 Fouling and Corrosion in OTEC Heat Exchangers	Dr. Frederick C. Munchmeyer, UH	1976 1977 1978	114,000 246,000 294,000	NSF/ERDA NSF/ERDA DOE
D2-3 OTEC Heat Exchanger Biofouling Experiment	Dr. Paul Yuen, HNEI Dr. James H. Jones, NELH Peter P. Pandolifini, APL, Johns Hopkins	1977 1978 1979	53,591 15,000 52,477 23,716 47,230	SG MAC SG DPED SG
D2-4 ANL OTEC Heat Exchanger Biofouling, Corrosion and Biofouling Countermeasures Experiments	Dr. Jeffrey A. Moore, RCUH	1981	449,500	DOE/ANL
D2-5 UHM/Simplex OTEC Power Cable Corrosion Experiment	Dr. Jorn Larsen-Basse, UH	1981	5,000	UH/Simplex

D3. OCEAN ENERGY — MINI-OTEC

D3-1 Mini OTEC	Dr. Eugene Grabbe, DPED	1978 1979	600,000 450,000	DPED DPED
D3-2 Environmental Impact of Mini-OTEC Operation	Dr. John Caperon	1979	12,000 51,305	MAC HNEI

Project No.: D2-4

Title: OTEC/STF Heat Exchanger Biofouling, Corrosion, and Biofouling Countermeasures Experiment

Investigator: Dr. Jeffrey A. Moore

Funding: 1981 \$449,500 (DOE/ANL)

Description:

One of the most essential elements in demonstrating the economic feasibility of OTEC is to establish that scaling, biofouling and corrosion can be adequately controlled for the life of the plant without adding excessively to the capital or operating costs. Studies of fouling and corrosion must be done under conditions approximating those expected to exist in operating OTEC plants. A series of test apparatus, consisting of heat exchanger tubes operating under various conditions of water flow, utilizing different materials, and exposed to a variety of cleaning methods were installed and prepared for extensive testing during this reporting period.

The planned test program will use conditions simulating those in the evaporator where, because of the higher temperatures and greater abundance of sea life and dissolved oxygen in the surface waters,

fouling and corrosion is expected to be more severe. Later tests will be run simulating the conditions to be found in the OTEC condensor by utilizing the deep cold seawater that will be available upon completion of Project C-8.

Project No.: D2-5

Title: UH/Simplex Cable Corrosion Project

Investigator: Dr. Jorn Larsen-Basse

Funding: 1981 \$5,000 (UH/SIMPLEX)

Description:

One element of OTEC research is concerned with the development of cables to transmit electrical power from nearshore floating OTEC plants to shore. This project is concerned with the corrosion of the materials used in the outer jacket of such cables. A series of samples are suspended at about 50 feet and 200 foot depths from subsurface buoys moored in the NELH offshore research corridor. Samples are collected after 6 months and 1 year and returned to the laboratory for examination.

E. MARICULTURE

Title	Investigators/Managers	Year	Funding	Funding Agency
E-1 OTEC Mariculture/Algal Project	Dr. James H. Jones, NELH	1977	\$ 10,000	DPED
E-2 Phase I of Aquaculture Component at NELH	Dr. John P. Craven, Marine Programs, MAC William R. Coops, RCUH	1979	115,000	MAC
E-3 Preliminary Studies for Cold Water Aquaculture Facilities	William R. Coops, RCUH	1981	275,000	MAC

Project No.: E-3

Title: Preliminary Studies for Cold Water Aquaculture at the NELH

Project Manager: William R. Coops

Year Funded: 1981

Funding: \$275,000 (MAC)

Description:

Preliminary designs for a complete cold water aquaculture research facility were developed by the Oceanic Institute. The resulting master plan includes preliminary designs for a research laboratory, water distribution system, and ponds, plus cost estimates.

F. Other

Title	Investigator	Year	Funding	Funding Agency
F-1 Mantle Conductivity Beneath the Hawaiian Ridge	Dr. Charles E. Helsey, HIG	1978	\$10,000	NSF
F-2 Solar Radiation Data from a Radiometer Affixed to the Data Collection Facility	HIG	1978		

APPENDIX B

NELH POLICY ON PROJECT ACCEPTANCE

The criteria for acceptance of projects for pursuit at the NELH facilities shall be based upon the projects relation to development of natural energy resources and also upon its utilization of those resources that are available at the NELH facility at Ke-ahole Point. Projects that are only tenuously related to alternate energy development and/or do not require the resources that are available at Ke-ahole Point shall be referred to the appropriate governmental agency for action and recommendations.

The resources considered available at the NELH include:

- Proximity to undisturbed deep ocean
- Availability of deep cold seawater
- Natural offshore circulation gyre and resulting oceanic quality surface water nearshore
- Land availability
- Topography
- Absence of vegetation
- Availability of natural site preparation materials
- Coastal tropical marine environment
- High solar radiation

Illustrative examples include:

OTEC research	high priority, alternate energy development plus uses available NELH resource (deep cold seawater).
Solar pond power systems	high priority, alternate energy development plus uses available NELH resource (high solar radiation).
Cold water aquaculture	Medium priority, may be an adjunct to OTEC research plus utilizes available NELH resource (deep cold seawater).
Solar desalination	medium priority, indirectly energy related and utilizes available NELH resource (high solar radiation).
DUMAND	medium priority, tenuous relation to energy but needs proximity to undisturbed deep ocean.

Adopted by the NELH Board of Directors 21 December 1981.

STAFF, June 30, 1981

Honolulu Office

LAWRENCE W. HALLANGER

*Executive Director (Acting)
Natural Energy Laboratory of Hawaii*

WILLIAM R. COOPS

*Director of Administration
Research Corporation of the
University of Hawaii*

WILLIAM M. HEAMAN

Facilities Planning Engineer

KENT M. KEITH

Attorney

EVA M. LEHMANN

Management Assistant/Secretary

AUDREY TAMASHIRO

Student Worker

Kona Office

JAN C. WAR

Operations Manager (Acting)

DON BROWN

Mechanical Technician

CLEMENT KANUHA, JR.

Mechanical Technician

CULLEN B. TENDICK

Electronic Engineer

JAMES W. PLACEK

Electronics Technician

ALLEN R. WILLIAMSON

Facilities Superintendent

STEPHEN B. WILSON

Facilities Maintenance

JEAN CONNER

Management Assistant/Secretary

CAROL A. ROGERS

Project Secretary