

CENTER FOR ENERGY AND ENVIRONMENT RESEARCH  
THREE YEAR PLAN  
(FY 1983-1985)



CENTER FOR ENERGY AND ENVIRONMENT RESEARCH  
UNIVERSITY OF PUERTO RICO — U.S. DEPARTMENT OF ENERGY

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## INTRODUCTION

This document presents a strategic plan for the allocation of the resources of the Center for Energy and Environment Research (CEER) for FY 1983-85. The plan concentrates on the funds provided from the University of Puerto Rico (UPR) budget to substitute for the loss of federal funds. It provides programmatic and budgetary guidance and an outline of mechanisms for implementation.

The starting point for this plan is a restatement of the CEER mission, which remains critical and relevant to the University and to Puerto Rico:

- (1) to serve as the focus for energy and environment research and development for Puerto Rico;
- (2) to develop for the U.S. mainland and Puerto Rico economically competitive alternative energy technologies that are socially and environmentally acceptable;
- (3) to conduct tropical ecological research for sound resource management; and,
- (4) to serve as the focus for technology transfer in energy and environmental matters for the Caribbean.

This mission presents a charter for CEER operations. Nevertheless, limitations in federal and external funding are expected to continue during the planning period and to preclude a comprehensive effort by CEER in all areas.

Given the local source of funding for base operations, the strategy presented herein concentrates on a program of service to Puerto Rico which CEER is uniquely suited to provide. Emphasis is made on problem-focused research and development and on providing leadership in technology transfer and adaptation for the Caribbean region.

#### BACKGROUND

In May 1980, the Center for Energy and Environment Research of the University of Puerto Rico published a Five Year Plan for Continued Operations as a Resource to the Commonwealth of Puerto Rico (FY 1982-86) (CEER Report No. A-073). This report summarized previous accomplishments and future projections and emphasized the uniqueness of CEER to contribute to the development of energy alternatives and to undertake research toward the solution of the environmental problems of the Island.

The CEER Five Year Plan established the need for a minimum base of institutional funding to provide for the research and development needs of Puerto Rico in the areas of energy and environment. Institutional funds for FY 1982 were projected at \$1.5 million with yearly increases to account for inflation. The source of this institutional funding was expected to be \$500,000 each from the U.S. Department of Energy (DOE), the University of Puerto Rico and the Commonwealth of Puerto Rico.

In addition to the institutional base, program support from DOE for environmental work was projected at between \$1.273 and \$1.79 million per year for the FY 1982-86 period. Competitive funds were projected, based on previous trends, at levels of \$2,547 to \$3.729 million for the five year period. The total CEER budget for the period was between \$5.37 and \$7.718 million. Table 1 summarizes the budget.

On the basis of this plan, the Council of Higher Education of the University of Puerto Rico allocated to CEER \$300,000 in FY 1980-81 and \$500,000 in FY 1981-82 from the UPR budget. This represented the first instance of direct base support from Puerto Rico to CEER or to its predecessor, the Puerto Rico Nuclear Center, in its twenty-three year history.

Although the Five Year Plan served to generate the necessary financial commitments from the University, similar commitments from DOE and the Puerto Rican government were not forthcoming. Changes in federal energy policies and budgetary constraints on both the federal and commonwealth governments have thus rendered the assumptions of the Five Year Plan invalid and have led to the need for a revised institutional plan for CEER operations. For this reason, in October 1981 the CEER Director named a five member committee to prepare the present plan.

The changes at the federal and commonwealth levels which have had the most effect upon prospects for future funding are as follows:

TABLE 1

CEER BUDGET PROJECTIONS AND SOURCE OF FUNDS  
 FIVE YEAR PLAN (FY 1982-86)  
 (In Thousand Dollars)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
FY	INSTITUTIONAL FUNDS			SUBTOTAL (2+3+4)	DOE		P.R.+ DOE	P.R. RATIO	COMPETITIVE FUNDS	TOTAL BUDGET	BASE FUNDING RATIO
	DOE	P.R. GOV.	UPR		EVN.	OTHER					
80	800 <sup>1</sup>	--	--	800	935 <sup>1</sup>	260 <sup>2</sup>	1995	--	2130 <sup>3</sup>	4125	0.484
81	850 <sup>1</sup>	500	300	1650	1104 <sup>1</sup>	460 <sup>2</sup>	3214	0.249	2316	5530	0.581
82	500 <sup>1</sup>	500	500	1500	1273 <sup>1</sup>	50 <sup>2</sup>	2823	0.354	2547	5370	0.526
83	550	550	550	1650	1345	--	2995	0.367	2802	5797	0.517
84	605	605	605	1815	1480	--	3295	0.367	3082	6377	0.517
85	666	666	666	1998	1628	--	3626	0.367	3390	7016	0.517
86	733	733	733	2199	1790	--	3989	0.367	3729	7718	0.517

<sup>1</sup> DOE recommendations and approvals.

<sup>2</sup> Other DOE appropriations for Decontamination of Mayaguez Reactor Facilities

<sup>3</sup> Additional funds (in the order of \$35,000) included to reflect recent DOE increased competitive assignments.

- (1) The termination of institutional support to CEER from DOE's University Research Support Program. From a peak of \$800,000 funding in FY 1980, \$662,000 were obtained from DOE in FY 1981 and \$287,900 in FY 1982.

No funding is projected for FY 1983 or thereafter.

This compares with \$500,000 in FY 1982 and \$550,000 in FY 1983 as projected in the Five Year Plan.

- (2) A severe reduction has occurred in programmatic support to CEER environmental programs from DOE's Office of Health and Environmental Research (OHER). Constant policy shifts have led to reductions and/or elimination of specific CEER programs. This led to the termination of the CEER Human Ecology Program in FY 1980. Recent policy guidelines from OHER restrict DOE funded environmental research to long term generic ecological work. Under these guidelines, technology specific research such as CEER's OTEC Environmental Program are receiving terminal funding, with a reduced level for FY 1982. The CEER Rain Forest Cycling and Transport Program is expected to continue during FY 1983. Total support for CEER's Environmental Research has declined from \$880,000 in FY 1981 to \$476,000 in FY 1982.

With the cessation of the OTEC Environmental program only \$200,000 is expected in FY 1983. These funding levels compare with \$1.273 million in FY 1982 and \$1.345 million in FY 1983, as projected in the Five Year Plan.



- (3) The opportunities for obtaining competitive funding from DOE have been drastically reduced due to severe budget cutbacks for research and development in solar and renewable energy technologies. Other DOE programs such as Fossil Fuels have also been reduced. The free market energy policies of the present administration place greater emphasis on the private sector rather than on federal programs to develop and commercialize energy technologies. The total obligational authority of \$471.8 million in FY 1981 for federal solar energy R&D has been reduced to \$256.9 million in FY 1982. The Administration's budget request for FY 1983 reflects an 85 percent reduction from FY 1981 levels. Under these conditions the expectations for obtaining the competitive funding contained in the Five Year Plan cannot be met. In particular, the OTEC and Biomass Programs have been severely curtailed and the Fossil Fuels Program has been eliminated.
- (4) Other federal and local opportunities for obtaining competitive funding have been severely cut. This affects programs in both energy and environment.
- (5) The appropriation of \$500,000 in institutional funding for FY 1982 requested from the Commonwealth Government has not been obtained. The availability of \$4.9 million for alternative energy R&D for Puerto Rico as authorized by Joint Resolution No. 65 of June 8, 1979 has been perceived by government leaders as providing

for CEER research needs. Although a total of \$270,000 has been allocated to CEER under this law, the project specificity required for obtaining funding, the long delays, and the requirement that the projects be cost-shared do not permit J.R. No. 69 to serve as a substitute for institutional funding. This is particularly true because most competitive sources for cost-sharing have disappeared.

On the positive side, \$1.2 million in base institutional funding has been requested by the UPR President and approved by the Council of Higher Education for FY 1983. The \$700,000 increase in funding from FY 1982 levels will substitute for the rescinded institutional and programmatic federal funding. Nevertheless, the total federal and local funding available in these two categories is \$1.6 million less than that projected in the original Five Year Plan.

#### PLANNING AND ASSUMPTIONS

A five member committee comprised of both staff advisors and line managers was appointed in October 1981 by the CEER Director to develop a new plan. This committee, in concert with the Director, initially established that the major criterion was the appropriateness of the research efforts for Puerto Rico. Preliminary discussions established agreements in principle to guide program content and implementation. The following needs were identified:

1. The need for research and demonstration in three main areas: Energy, Environment, and Technology and Policy Assessment;
2. The need for research to be aimed at the solutions of practical problems for Puerto Rico and the Caribbean, including technology adaptation and transfer;
3. The need for institutional stability and autonomy;
4. The need to institutionalize innovation and diversity while preserving stability;
5. The need to preserve and enhance the unique opportunity in CEER for interdisciplinary problem solving; and,
6. The need to consider restructuring the loci and management plans for CEER in the light of budget and mission.

Consideration of these needs led to the adoption of the following guidelines for the plan:

- 1) Base funding will go to core program areas and staff;
- 2) Planning will be for the three year period in order to foster stability and progress in the solution of non-trivial problems;
- 3) Main emphasis will be on practical problems needing solutions important for Puerto Rico;
- 4) The organization of program areas will attempt to maximize interdisciplinary interaction in problem solving; and,

- 5) Plans will include assumptions of "most probable" outside funding, recognizing that there is an optimal ratio of competitive to base funding.

A review and planning process was adopted in which budgetary allocations for programs were reviewed on the basis of their potential to contribute to the CEER mission and objectives stated earlier. The steps in this process were:

- (1) the identification of a large list of possible CEER programs based on the suggestions of staff and committee;
- (2) the evaluation of proposed programs using a Delphi technique employing as criteria (a) appropriateness and suitability for CEER in terms of capability and mission, (b) opportunity to satisfy Puerto Rico's research and development needs, (c) prospects for funding from sources other than UPR;
- (3) the selection of a set of high priority programs from each of the three areas: Environment, Energy, and Technology and Policy Assessment;
- (4) the formulation of a zero based budget for each of the main programs;
- (5) the reconciliation of programs and budgets with the \$1.2 million total budget constraint for fiscal year 1983 and outside funding expectations; and,
- (6) Projection of programs and budgets to conditions appropriate for 1984 and 1985.

Following the completion of the above review, the planning goals for CEER were restated as follows:

1. Service to Puerto Rico

CEER will provide a program of service to Puerto Rico through problem-focused research and development in the areas of energy and environment. Given the limitations in outside funding for this purpose, institutional funds will be provided to undertake high quality in selected priority areas independent of the availability of competitive funding. These priority areas will be based on the ability of CEER to make substantial contributions to the island. These priority areas include:

Biomass

Solar Thermal

Water Quality

Waste Disposal and Management

Ecology Effects of Energy Production and Utilization

Resource Management

Technology and Policy Assessment

2. Leadership in the Caribbean

CEER will establish, through competitive and programmatic funding, its technical leadership in technology transfer for the Caribbean Basin.

Technology transfer is defined broadly to include:

1) Education and Training of scientists, engineers, technicians and educators;

2) Adaptations of technologies developed in Puerto Rico and the U.S. to the needs of the regions; and

- 3) Assessments of the resources and needs of the region in energy and environment, and plans toward the sound management of these resources.

Institutional funds may be utilized as seed funding for Caribbean programs.

### 3. High Quality Science and Engineering

CEER can accomplish its mission of becoming the focus for energy and environment research and development for Puerto Rico only through a program of high quality science and engineering. The output of such a program should include:

- 1) Scientific publications in quality, peer-reviewed journals;
- 2) Dissemination of funding through international conferences and symposiums; and,
- 3) The development of commercially applicable products and processes.

CEER's human resources are its principal resource in producing high quality science and engineering. Its high quality team of professionals can be maintained only through compensation policies competitive with Puerto Rico and the mainland and employment stability

### 4. Budgetary stability

CEER's mission and the above three goals can only be attained through a stable level of funding. A minimum level of \$3.2 million in 1982 dollars has been determined as being needed for this purpose. An appropriate mix of institutional and competitive funding is also needed.

## BUDGET SUMMARY

The overall budget for the next three years with allocations to the main program areas is summarized in Table 2. The 1983 year of transition from a federal to a commonwealth base has been treated as special with different proportions in allocations than in subsequent years and includes \$125,000 as "transition funds" to be allocated to programs at the Director's discretion. In all program areas assumptions have been made about most probable sources for outside funding. Overhead has been assumed constant at 50 percent.

The three year budget scenario assumes a stabilization period for fiscal years 1983 and 1984 which should allow for strengthening of base programs and afford opportunities for additional competitive funding. Therefore, there is a proposed fixed level total budget for the initial two years and an increased total budget for fiscal year 1985. This increased budget, however, does not require an increase in UPR funds; only programmatic DOE funds and targeted competitive funds are increased.

The proposed increase in UPR funds will be used to replace the lost federal funds. The UPR funds represent less than half of the total budget but they allow for a period of growth with stability. Internal studies at CEER have indicated that a \$3.2 million budget is the minimum needed for a stable operation and that competitive funding should not exceed more than half of the total budget. This condition is maintained within this scenario.

TABLE 2

CEER THREE YEAR PLAN BUDGET

FUNDING RESOURCE AND MAJOR DISTRIBUTION  
(In Thousand Dollars)

	FY-1983					FY 1984					FY 1985					
	ENERGY	ASSES	ENV	EDUC	TRANS. FUNDS	TOTAL	ENERGY	ASSES	ENV	EDUC	TOTAL	ENERGY	ASSES	ENV	EDUC	OTHER
Salaries	1125	150	940	115	-	2330	1125	210	1090	140	2565	1250	250	1150	150	2800
Mat. and Supplies	125	5	85	10	-	225	125	10	100	10	245	140	15	140	15	310
Other	250	20	275	10	125	680	250	30	130	10	420	250	35	190	15	490
Total	1500	175	1300	135	125	3225	1500	250	1320	160	3230	1640	300	1480	180	3600
BUDGET ALLOCATIONS WITHIN PROGRAMS																
	UPR	DOE	COMP	TOTAL	UPR	DOE	COMP	TOTAL	UPR	DOE	COMP	TOTAL	UPR	DOE	COMP	TOTAL
Energy	635	265	600	1500	810	10	680	1500	810	10	820	1640	810	10	820	1640
Envir.	375	460	465	1300	680	320	320	1320	680	400	400	1480	680	400	400	1480
Asses.	125	15	35	175	160	-	90	250	160	-	140	300	160	-	140	300
Educ.	85	20	30	135	85	-	75	160	85	-	95	180	85	-	95	180
Transition Funds	125	-	-	125	-	-	-	-	-	-	-	-	-	-	-	-
Total	1345	760	1130	3235	1735	330	1165	3230	1735	410	1455	3600	1735	410	1455	3600



The details about the distributions of funding within each main program area will now be discussed along with the program descriptions.

## PROGRAM DESCRIPTIONS

### ENERGY PROGRAM

#### Background

Since the formation of CEER from the Puerto Rico Nuclear Center in 1977, the primary research and development on energy has included programs in direct solar, biomass and OTEC and has had divisions so-named. In addition, projects in basic sciences, bioconversion, conservation and transportation were performed by staff scientists at CEER and faculty and students of various campuses of the UPR system. Competitive funding was generated in all the major divisions and in some of these program areas. In light of the experience gained through these programs, their specific applicability to Puerto Rico was the major factor that has been considered in the formulation of this plan. The curtailment of funds for certain programs at the federal level has made it necessary for CEER to continue these programs because they are relevant to Puerto Rico and to the Caribbean countries.

## Programs and Objectives

### 1. Biomass and Bioconversion

This program will emphasize energy cane field production and demonstrations with investments from the landowners. It will start with small tracts of land to demonstrate profit availability. Profits will be shared between the landowners and CEER, which will then reinvest in biomass research and demonstration projects using larger tracts of land. A small woody biomass project using a sugar mill process production of biomass for firing could also be considered, again in conjunction with private industry. The common problems of fuel handling between biomass and coal could also be determined here.

### 2. Solar Thermal

Performance and modeling of solar heated air conditioning, improved solar collectors and the use of air conditioning solar collectors systems at Mayaguez for Rankine cycle applications will be researched. Solar ponds as collector systems for application to industry including consideration of various types such as saltgradient, gel, and shallow systems and other appropriate applications for the Caribbean are also topics for investigation.

### 3. Conservation and Special Projects

These are combined and should be considered in priority to whichever program or combinations are considered most promising for Puerto Rico.

### 3.1 Conservation

If funds do not appear from competitive sources, at least one program should measure the performance and model the solar heated air conditioning solar system at Mayaguez. This information will be vital for any future technology transfer to the Caribbean Basin.

### 3.2 Wind

Wind monitoring, modeling and correlations projects are included. Two forthcoming wind turbine generator systems of 5KW and 2KW that have been sent to CEER by DOE will be installed. There will also be performance analyses on the operation of the systems and identification of operational difficulties.

### 3.3. OTEC

World wide OTEC developments will be monitored. It is expected that the OTEC situation may improve in the near future and that CEER could reopen its program.

### General Comments

1. The budget assumes a prime use site operation at Mayaguez. Biomass could also use this laboratory as its home administrative and scientific base.
2. The size of the entire section in terms of the number of people indicates the logic for operating as one section. There is a total of five scientific man-years, and one program is off-site by its nature. Therefore, flexibility

is needed for shifting manpower at the scientific, technical and administrative levels; this flexibility cannot be achieved in a small division.

### Staffing

The Energy Section is composed of five scientific man-year equivalents, with the support of two secretaries, two technicians and four students. The proposed distribution is as follows:

<u>Program</u>	<u>Scientific Man-Years</u>
Biomass	1.5
Solar Thermal	2.0
Wind	0.5
Conservation	0.5
Other: (OTEC, Bioconversion, Etc.)	<u>0.5</u>
TOTAL	5.0

### Budget Summary

The overall CEER budget has been presented in Table 2. The summary of the Energy Section budget has been extracted from Table 2 and is shown here as Table 3, and the distribution of UPR funds by programs within the Energy Section is shown here as in Table 4. The Budget assumes that the Energy Section can be operated as one unit to provide the needed personnel flexibility at the scientific, technical and administrative levels. It also assumes a prime use

site operation at Mayaguez and suggests that the Biomass section could use this laboratory as its administrative and scientific base, if this proves to be desirable in the future.

TABLE 3  
ENERGY SECTION BUDGET SUMMARY  
(In Thousand Dollars)

	<u>1983</u>	<u>1984</u>	<u>1985</u>
Salaries	1,125	1,125	1,250
Materials & Equip	125	125	140
Other	<u>250</u>	<u>250</u>	<u>250</u>
Total	1,500	1,500	1,640
UPR	635	810	810
DOE	265	10	10
Competitive	<u>600</u>	<u>680</u>	<u>820</u>
Total	1,500	1,500	1,640

TABLE 4  
ENERGY SECTION UPR BUDGET DISTRIBUTION BY PROGRAMS  
(In Thousand Dollars)

<u>PROGRAMS AND SUB-PROGRAMS</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Biomass and Bioconversion	<u>199</u>	<u>330</u>	<u>330</u>
Energy Cane	179	200	200
Woody Biomass	20	130	130
Solar Thermal	<u>181</u>	<u>210</u>	<u>210</u>
Improved Solar Collectors	160	100	100
Solar Ponds	21	110	110
Conservation & Special Projects	<u>255</u>	<u>270</u>	<u>270</u>
Conservation	60	70	70
Special Projects (Data net, wind, OTEC, etc.)	195	200	200
TOTAL	<u><u>635</u></u>	<u><u>810</u></u>	<u><u>810</u></u>

#### ENVIRONMENT PROGRAM

##### Background

Real solutions to environmental/ecological problems are rooted in the understanding of how ecosystems are organized and work. Most "problems" are related to the movements of materials in and through systems or to the energy flows which maintain a particular structure in those systems. It is possible to work on specific projects aimed at diagnosing

and solving acute problems and to use the resulting information to develop a general understanding of how systems work. This is the goal of the Environmental Program. In order to construct a minimum program, consideration was given to putting immediate emphasis on acute island problems while maintaining the maximum capability for continuing activity in the program areas of Ecological Effects, Resource Management and Ecological Structure and Process. The objectives of these research areas are described in the Environment Section of the Five Year Plan.

Within the Ecological Effects area, continuing research in the subprograms of Water Quality, Waste Disposal and Management, and Energy Production and Utilization will be continued. Representative projects may include the development of an oil spill trajectory model suitable for regions of Puerto Rico, the study of ecological transport of mining pollutants and marine organisms, and studies of nutrient leakage from cane producing fields. If possible, environmental impacts of solar ponds will be targeted for project attention in collaboration with the solar energy staff.

Ecosystem structure and process studies will include subprograms in terrestrial, marine and aquatic site characterization. Projects in this area would include the baseline measurement of pollutant analogues transported from an undisturbed forested watershed and baseline productivity in relation to limiting factors in aquatic systems.

Resource management will encompass subprograms in water and wildlife with possible projects in critical life stage and population studies of the land crab and the role of introduced birds on economic crops such as rice in Puerto Rico.

Although this document is focusing on the base funding allocations, certain assumptions have been made about the prospects for competitive funding and resultant staff requirements. One important assumption is that CEER will retain control of the operation of the El Verde rain forest field station. DOE/OHER has projected \$200,000 per year for cycling and transport studies there and is presently negotiating to set up a long-term legal status for the station within DOE. With this official DOE status comes the probable continuing commitment of General Plant Projects funds for major repair, maintenance, operation funds and construction on the facility.

The continued operation of the Wet Laboratory/Bioassay facilities as well as the sustained operation of a chemical support group in Mayaguez is also projected.

From marine freshwater and applied terrestrial proposals, it is reasonable to project additional outside funding of over \$500,000 during 1983 and \$350,000 in subsequent years. PRASA, EQB, AID, NOAA, NSF, and various industries are the most likely sources of these competitive funds.



## Programs and Objectives

### 1. Water Quality

This program will identify and characterize the major water quality problems facing Puerto Rico and will assist island agencies in developing ecologically appropriate site specific water quality criteria.

### 2. Waste Disposal

The major problems with waste or pollutants being released to the environment in Puerto Rico will be identified. The modes of transport and ecological effect of selected important wastes will be characterized. Methodologies appropriate for studying waste substances fates and effects will be developed as background for managing wastes in Puerto Rico.

### 3. Energy Production and Utilization

Environmental problems associated with the production and utilization of energy will be identified and quantified.

### 4. Water and Wildlife Resource Management

Quantification and characterization of the ecological bases of resource problems in Puerto Rico will be provided, and ecologically sound prescriptions for managing and restoring selected important environmental resources of Puerto Rico will be developed.

### 5. Site Characterization

Baseline information about major representative ecosystem types of Puerto Rico will be collected as a background for understanding the effects of development.

## Staffing

Because of the complexity and multidimensional character of most serious environmental problems, a certain minimum diversity of expertise must be maintained within the staff. A core staff of generalists must be combined with a pool of specialists who will be employed on a part-time basis - primarily from several departments and branches of the UPR. Base funding for the staff will be applied according to the following scheme:

### Base Program and Subprogram Areas (1983)

#### Scientist Years

Ecological Effects	(3.75)
Water Quality	1.75
Waste Disposal and Management	1.0
Energy Production and Utilization	1.0
Ecosystem Structure and Process	<u>(1.75)</u>
Forests Site Characterization	1.0
Freshwater Characterization	.25
Marine Characterization	.5
Resource Management	<u>(0.5)</u>
Wildlife	0.5
Water	x
Forests/Land	<u>x</u>
Total	(6.0)

The overall budget for this section has been extracted from Table 2 and is shown in Table 5 below; the breakdown of U.P.R. budget into major areas is shown in Table 6.

TABLE 5  
ENVIRONMENT SECTION BUDGET SUMMARY  
(In Thousand Dollars)

	<u>1983</u>	<u>1984</u>	<u>1985</u>
Salaries	940	1,090	1,150
Materials & Equip.	85	100	140
Other	<u>275</u>	<u>130</u>	<u>190</u>
Total	1,300	1,320	1,480
UPR	375	680	680
DOE	460	320	400
Competitive	<u>465</u>	<u>320</u>	<u>400</u>
Total	1,300	1,320	1,480

TABLE 6  
 ENVIRONMENT SECTION UPR BUDGET DISTRIBUTION BY PROGRAMS  
 (In Thousand Dollars)

<u>PROGRAMS AND SUB-PROGRAMS</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Ecological Effects	<u>230</u>	<u>415</u>	<u>415</u>
Water Quality	125	225	225
Waste Disposal	60	105	105
Energy Production and Utilization	45	85	85
Resource Management	<u>85</u>	<u>155</u>	<u>155</u>
Water	40	70	70
Wildlife	45	85	85
Ecosystem Structure and Process	<u>60</u>	<u>110</u>	<u>110</u>
Site Characterization	60	110	110
TOTAL	<u>375</u>	<u>680</u>	<u>680</u>

## TECHNOLOGY AND POLICY ASSESSMENT PROGRAM

### Background

The adoption of energy and environmental technologies is dependent not just on technical feasibility but on a myriad of economic and social issues. The development of strategies for the utilization of these technologies presupposes an integrated assessment of such factors. Applications oriented research and development programs such as those at CEER require parallel efforts in technology and policy assessment.

Technology transfer efforts for the Caribbean are likewise dependent on an understanding of the economic, social and political impacts of the relevant technologies. CEER efforts to expand in this area will be greatly strengthened through its Technology and Policy Assessment Program. An interdisciplinary team will work closely with staff members of the Energy and Environment Sections. Opportunities for co-staffing and joint research projects will be sought. However, for administrative purposes this program will be administrated as a division of the energy section.

### Programs and Objectives

This program will have three major objectives.

- (1) To serve as a focal point for energy and environment policy research in Puerto Rico;

- (2) To provide economic and policy assessment for in-house and external research, development and demonstration projects; and,
- (3) To aid in international cooperative efforts in planning and assessment of renewable energy technologies.

The following are a sample of the type of research projects to be undertaken by the CEER Technology and Policy Assessment Program. Given possible changes in project staffing, the choices presented are tentative:

- (1) Energy security issues in the Caribbean Basin;
- (2) Applications assessment for CEER R&D projects;
- (3) Financing alternatives for renewable energy industries in Puerto Rico;
- (4) Technology transfer mechanisms for new energy technologies;
- (5) Costs and benefits of pollution abatement in Puerto Rico;
- (6) Socio-economic issues in environmental planning and resources management; and,
- (7) Econometric modelling of energy demand.

#### Staffing

Two core staff members will be supported from UPR Institutional Funds.

Budget Summary

The budget for Technology and Policy Assessment has been extracted from Table 2 and is shown in Table 7. Likely sources for competitive funding include USAID as well as a variety of international organizations such as the World Bank. Other opportunities from the National Science Foundation, the Department of Commerce, the Department of Energy, Environmental Protection Agency, and the government of Puerto Rico will be sought.

A total of \$35,000 in competitive funding will be targeted for FY 1983, \$90,000 will be sought by FY 1984, and \$140,000 by FY 1985.

TABLE 7

## TECHNOLOGY AND POLICY ASSESSMENT BUDGET SUMMARY

	<u>1983</u>	<u>1984</u>	<u>1985</u>
Salaries	150	210	250
Materials & Equip.	5	10	15
Other	<u>20</u>	<u>30</u>	<u>35</u>
Total	175	250	300
UPR	125	160	160
DOE	15		
Competitive	<u>35</u>	<u>90</u>	<u>140</u>
Total	175	250	300

## EDUCATION AND PUBLIC AWARENESS PROGRAM

### Background

The activities of this program are involved with both energy and environment and the budget must be administered flexibly. Because of diversity of the program, however, it will be administered at a staff level through the Office of Planning and Development. The budget for Education and Public Awareness has been extracted from Table 2 and is presented in Table 8.

### Programs and Objectives

(1) CEER information dissemination activities including NOTICEERO and the Annual Report;

(2) Organization of training activities at technical and professional levels aimed at technology transfer for the Caribbean;

(3) Organization of professional efforts including graduate student research; and,

(4) Preparation of proposals for education and training activities at all educational levels, elementary through graduate.



TABLE 8  
EDUCATION AND PUBLIC AWARENESS BUDGET SUMMARY

	<u>1983</u>	<u>1984</u>	<u>1985</u>
Salaries	115	140	150
Materials & Equip.	10	10	15
Other	<u>10</u>	<u>10</u>	<u>15</u>
Total	135	160	180
UPR	85	85	85
DOE	20		
Competitive	<u>30</u>	<u>75</u>	<u>95</u>
	135	160	180

#### IMPLEMENTATION ISSUES

The committee discussed implementation issues arising from the new three year plan. For the most part, what was achieved was an identification of these issues and recommendations about how to proceed to operate effectively while resolving them.

The issues are:

1. How to identify, hire, contract with and budget for core staff needed to provide stability, flexibility and vitality for core programs;
2. Whether the required core programs can justify and pay for the several necessary sites;

3. How to identify the minimum services which must be provided by the central administration and paid for from overhead, and the true costs of such services;
4. How to structure management to mate responsibility with authority and flexibility with stability in an interdisciplinary, problem oriented milieu with a limited budget.

1) The Core Staffing/Stability Issue

The committee recommends in general that a formula be devised to make possible long term (three year) contracts for the core staff renewable yearly to the extent permitted by the base funding. The committee suggests that consideration be given to the assignment of base funds primarily to salaries plus overhead while reserving soft moneys for hardware, materials and supplies, and special services. The development of this procedure should be the responsibility of the Committee on Promotions and Personnel Evaluation with input from heads of sections.

2) The Multiple Site Issue

The committee recognizes that the operation of several sites presents both problems and advantages. The issue can be divided into the field station question and the central administration question. It is clear that retention of the El Verde station, the waterfront facilities and the wet lab is essential to the continuation of Environment Section activities needed for the new program and that the Toa Baja Farm is integral to the Energy programs. The cost of those

operations can be absorbed within the new budget scenario given the "most probable" outside funding expectations. The logistical need for an operations base in San Juan plus the fact that some of the cost of operations can be covered by user charges, argue for the retention of the Rio Piedras Medical Center location for the office of the Director, support laboratories for the El Verde station activities, and possibly as headquarters for the Technology and Policy Assessment group. The arguments for retention of Mayaguez central headquarters are the relative magnitude of the science and engineering activities there and the proximity to the Mayaguez Campus of the UPR with its engineering and science strength. Uncertainties in the decision are the personnel relocation impacts if either central location were to shut down, and the magnitude of costs and benefits from centralizing administrative and support activities.

It is recommended that the efforts to economize on support activities and overhead items be continued and that a critical analysis be made of the real costs of all support facilities. It is further recommended that any decision to close any of the existing facilities be made and announced during FY 1983.

### 3. The Issue of Overhead

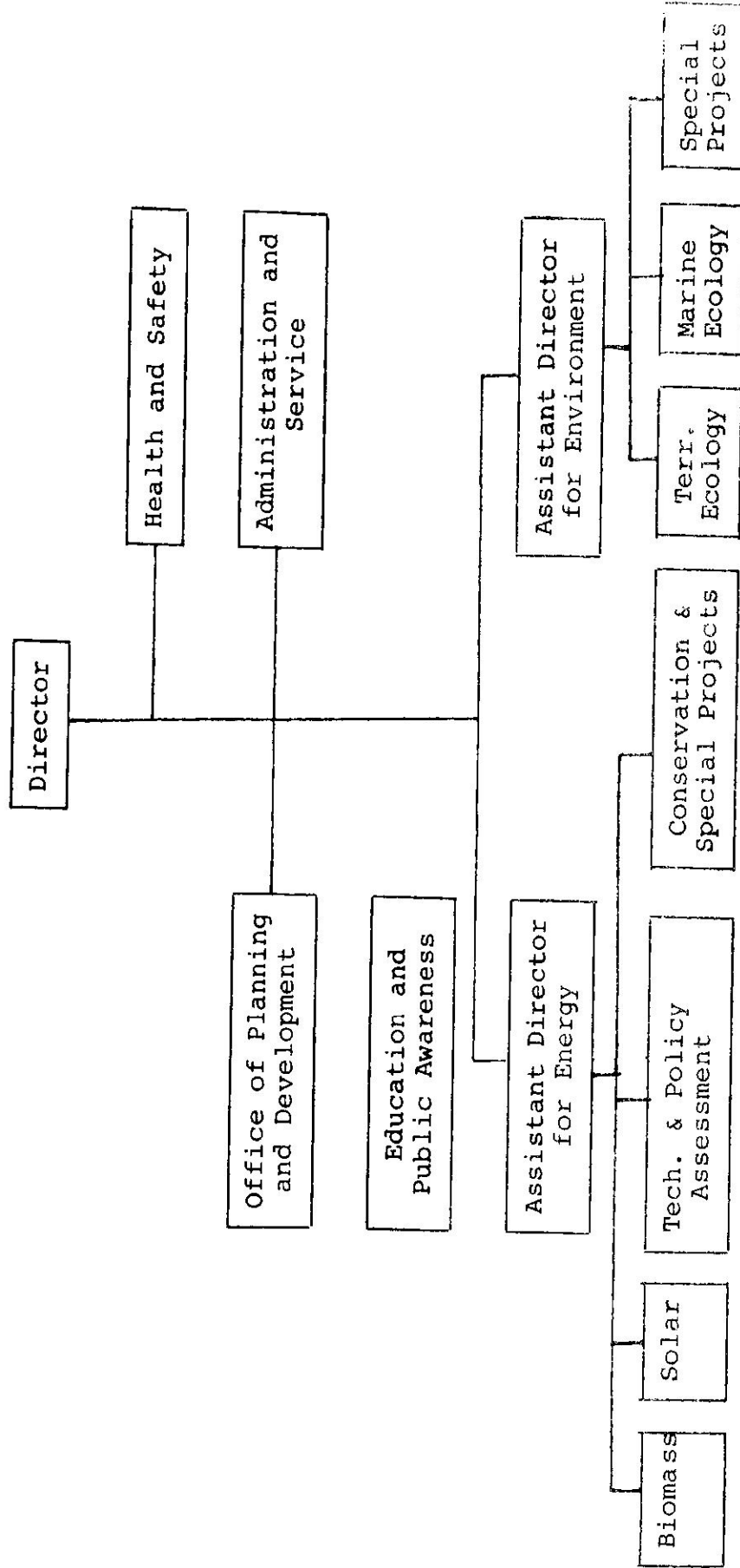
The committee recommends that a full analysis be made of all support costs and that a decision be made about which of these should legitimately be borne on a proportional basis by all programs and which should be charged to specific programs. The committee recommends that the costs

of power, building and grounds maintenance, purchasing, personnel, accounting, and the Director's Office be charged to general overhead, and that the costs of secretarial services, reproductions, telephone, postage, vehicles, ship and boat, other special equipment and shops be program specific.

4. The Management Structure Issue:

The committee recommends that the heads of the offices of Health and Safety, Administration and Services, Planning and Development, and Assistant Directors for Energy and Environment report directly to the Director, as shown in the following organization chart.

The committee recommends that the two main technical areas, Energy and Environment, be organized by divisions according to programs with appropriately compensated and titled managers designated where responsibilities require them. The committee further suggests that a research area having stable funding of more than \$100,000 per year probably demands such management. The Technology and Policy Assessment Program should be administrated by the Energy Section. The Education and Public Awareness program should be administrated through the Office of Planning and Development.



CEER ORGANIZATION CHART

CENTER FOR ENERGY AND ENVIRONMENT RESEARCH  
THREE YEAR PLAN

(FY 1983-1985)  
EXECUTIVE SUMMARY

CENTER FOR ENERGY AND ENVIRONMENT RESEARCH  
UNIVERSITY OF PUERTO RICO  
AUGUST 1982

## EXECUTIVE SUMMARY

In May, 1980, the Center for Energy and Environment Research (CEER) of the University of Puerto Rico (UPR) published a Five Year Plan to guide the Center's activities through FY 1986. In addition to emphasizing CEER's ability to contribute to the development of energy alternatives and to undertake research on the environmental problems facing Puerto Rico, the Plan stressed the need for increased institutional funding support from the U.S. Department of Energy (DOE), UPR, and the Commonwealth of Puerto Rico. Competitive funding from various sources and program support from DOE increased the projected budget to a high of \$7.7 million for FY 1986.

Although UPR has fulfilled its commitment with an allocation of \$ 500,000 and \$1.2 million for FY 1982 and FY 1983, changes in federal energy policies and budgetary constraints on both the federal and Commonwealth levels have eliminated DOE and the Commonwealth of Puerto Rico as sources for institutional funding. Severe reductions in key DOE programs, reductions in the availability of competitive funds, and the inapplicability of a joint resolution by the legislature of Puerto Rico to provide support funds for CEER have changed the financial projections drastically and rendered the Five Year Plan inoperative.

The Director of CEER appointed a five member committee in October, 1981, to prepare a Three Year Plan to meet the challenges presented by the cutbacks in the institutional,

competitive and programmatic funding levels previously projected. The Three Year Plan that has been prepared by the committee reiterates the previously stated CEER mission and concentrates on a problem-focused research and development program of service to Puerto Rico which CEER is uniquely suited to provide.

The committee indentified the following needs as being key to the continued operation of CEER as a factor in the energy situation in Puerto Rico.

- (1) The need for research and demonstration in three main areas: Energy, Environment, and Technology and Policy Assessment;
- (2) The need for research to be aimed at the solutions of practical problems for Puerto Rico and the Caribbean, including technology adaptation and transfer;
- (3) The need for institutional stability and autonomy;
- (4) The need to institutionalize innovation and diversity while preserving stability;
- (5) The need to preserve and enhance the unique opportunity in CEER for interdisciplinary problem solving; and,
- (6) The need to consider restructuring the loci and management plans for CEER in the light of budget and mission.

Consideration of these needs led to the adoption of the following guidelines for the preparation of the plan:



- (1) Base funding will go to core program areas and staff;
- (2) Planning will be for the three year period in order to foster stability and progress in the solution of non-trivial problems;
- (3) Main emphasis will be on practical problems important for Puerto Rico;
- (4) The organization of program areas will attempt to maximize interdisciplinary interaction in problem solving; and,
- (5) Plans will include assumptions of "most probable" outside funding, recognizing that there is an optimal ratio of competitive to base funding.

Concerning the budget, the committee assumed that FY 1983 and FY 1984 would be stable years of transition from a federal base to a commonwealth base and that CEER would be sufficiently strengthened by FY 1985 to be able to increase its total budget through increased competitive and programmatic funding. UPR funds are less than half of the total budget for the first two years, but they are essential for the stable operation of CEER. The committee made assumptions about the most probable sources for outside funding for each of the main program areas and discussed the distribution of funds along with the program descriptions for each main area. The CEER Three Year Plan budget table follows.

The Energy Program, which includes the areas of Biomass and Bioconversion, Solar Thermal, and Conservation and Special Projects, will operate with five scientific man-year

TABLE\*  
 CEER THREE YEAR PLAN BUDGET  
 FUNDING RESOURCE AND MAJOR DISTRIBUTION  
 (In Thousand Dollars)

	FY-1983					FY 1984					FY 1985				
	ENERGY	ASSES	ENV	EDUC	OTHER	ENERGY	ASSES	ENV	EDUC	OTHER	ENERGY	ASSES	ENV	EDUC	OTHER
Salaries	1125	150	940	115	-	1125	210	1090	140	-	1250	250	1150	150	-
Mat. and Supplies	125	5	85	10	-	125	10	100	10	-	140	15	140	15	-
Other	250	20	275	10	-	250	30	130	10	-	250	35	190	15	-
Total	1500	175	1300	135	125	1500	250	1320	160	-	1640	300	1480	180	-

BUDGET ALLOCATIONS WITHIN PROGRAMS

	UPR	DOE	COMP	TOTAL	UPR	DOE	COMP	TOTAL	UPR	DOE	COMP	TOTAL
Energy	635	265	600	1500	810	10	680	1500	810	10	820	1640
Envir.	375	460	465	1300	680	320	320	1320	680	400	400	1480
Asses.	125	15	35	175	160	-	90	250	160	-	140	300
Educ.	85	20	30	135	85	-	75	160	85	-	95	180
Other	125	-	-	125	-	-	-	-	-	-	-	-
Total	1345	760	1130	3235	1735	330	1165	3230	1735	410	1455	3600

\*This table also appears as Table 2 in the Plan.

equivalents. The Environment Program which includes the areas of Ecological Effects, Resource Management, and Ecosystem Structure and Process Studies, will operate with six scientific man-year equivalent. The Technology and Policy Assessment Program will have two staff members and will be administered at a staff level through the office of Planning and Development. The Education and Public Awareness Program will be administered through the Office of Planning and Development.

Finally, the committee made recommendations in four key areas that will affect CEER operations during the next several years.

1. Base funds should be used as salaries for a core staff and as overhead, and soft moneys should be used for materials, supplies and special services.
2. There are strong arguments for the retention of both the Rio Piedras facility and the Mayaguez facility, and for the on-site laboratories needed to support the various programs. Personnel relocation impacts and savings from centralizing administrative activities are still uncertain at this time. Any decision to close existing facilities should be made and announced during FY 1983.
3. A full analysis of support cost should be made as soon as possible to determine which should be charged on a proportional basis to all programs and which should be charged to specific programs.

4. The two main technical areas, Energy and Environment, should be organized into divisions headed by Assistant Directors. These positions and the heads of the offices of Health and Safety, Administration and Services, and Planning and Development should report to the Director. A new organization chart appears at the end of the Three Year Plan.

