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INTEGRATED PROGRAM PLAN FOR UPR/CEER

?FY 1980 AND FY 1981

CENTER FOR ENERGY AND ENVIRONMENT RESEARCH

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INTEGRATED PROGRAM PLAN FOR UPR/CEER

FY 1980 AND FY 1981

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INTEGRATED PROGRAM PLAN FOR UPR/CEER

FY 1980 AND 1981

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INTEGRATED PROGRAM PLAN FOR UPR/CEER

1980 AND FY 1982

Introduction

The Council of Higher Education authorized the establishment of CEER effective July 1, 1976 after one year successful negotiation with ERDA (now DOE). The negotiations with ERDA (now DOE) were summarized in an action memorandum dated April 11, 1976. The establishment of CEER phased out the operation of the Princeton University Nuclear Center (PRNC) which had been in operation since 1957. This change was a result of the new needs to focus on the changing world energy situation,

A document was prepared in April 1977 entitled "Integrated Program Plan for UPR/CEER FY 1977-82". It consisted of a 50 pages plus five appendixes entitled: (1) Biomass Research, (2) Solar Research, (3) Solar Materials Research, (4) Conservation Research, and (5) Bifacial conversion Research. This document was to serve as a guide for energy

and research programs for the recently established CEER organization.

?The programs described in the above document and the funding and budget allocations have undergone changes and revisions. These changes

of ree

and revisions are the result of the natural development process:

search findings, budget restrictions, time schedule restrictions, personnel availability, newly set priorities, etc. This document revises the

original Integrated Program Plan, establishing new plans for the FY 1980

and FY 1981,

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(GEER Organization

The original organization chart of CEFR indicated four main Divisions:

(a) Base Programs, (b) Biomedical Research, (c) Environmental

Research and (?) Energy Research, In addition to the above Divisions

there were Five adminis

ve unies attached to the Center's Director's

Office: (a) Health and Safety, (b) Training and Education, (c) Adminis-
tration and Services, (d) Technical Services and (e) Facility Deconta-

Various organizational changes have occurred during the period
ainly due to program reorientation, budget restrictions, personnel
availability, etc.

Figure 1 is the present CEER organization chart. As can be seen
in Figure 1, there are five main Divisions as follows: a) Solar;
0) OTEC; Environsental Sciences Comprising c) Marine Ecology,
4) Terrestrial Ecology; and e) Bionass, There are five adainistrative
units attached to the Director's Office: a) Energy Assessment and Ana-
lysis b) Public Awareness; c) Library; d) Adpinistration and Support

Services, and e) lealth and Safety.

get Restriction

?The greatest changes occurring in the original programs are nainly

duc to Budget Restrictions.

Table 1 "Federal Funding" promised for CHER/UPR Transition Period?

show the funding assignments contained in the referenced April 11,1976

ERDA (DOE) Action Memorandum, The dollars indicated in Table I are FY

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1977 dollars, Table 1 was modified to reflect inflation; the result

of this modification is shown in Table 2.

Federal Funding that has been actually allocated in Fiscal Years 1976-

1981 based on current dollars, If Table 3 is deflated to 1977 dollars,

the result will be Table 4, "Federal Funding Allocated Fiscal Years

1976-81 in FY 1977 Current Dollars

| The ratio of the dollars "pro

!" (1977 dollars ~ Table 3) to actually allocated (1978 dollars -

Table 4) is shown in Table 5,

Federal Funding Allocated as a Percent

of "Promise",

The indicated budget changes had considerable effect in program

can be seen from Table 5, Base support which includes

overhead funds such as water and electricity, finance and maintenance

overhead,

?rials science, Health and Safety, Human Ecology, tropi-

cal agro sciences, etc, were gradually cut to zero, Similarly the funds for Training and Education were also cut to zero, Research and Development and Institutional Progré

15 also suffered severe budget reductions as Well as the Basic Health and Environmental Research (BER) Program.

Not included in the funds illustrated in Tables 1-3 are what is normally called Competitive Funding Awards. These funds are obtained from various private, state and federal agencies on @ competitive basis

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to develop specific projects of interest for a particular customer.

Competitive awards are normally attracted through initial research

work developed in related areas with the funds described in Tables

4:5 and labelled "Research and Development Programs" and "Institutional?",

GEER expertise in Health and Environment also has attracted funds

under a competitive basis award. Competitive awards funding for spe

cific customer needs are another source of program revision and changes.

Major Revisions

The major program revisions are as follows:

HEALTH AND ENVIRONMENT RESEARCH PROGRAMS (BER)

(2) Environment (RT03 in Original 1977 Plan)

This program was intended to cover two major areas: Terrestrial and Marine Ecology. The objectives were to provide an ecological data base for assessment of alternative energy technologies as they developed.

Each component of this program was to work in different geographical

areas, but with the usual

the aim of integrating them into a more cooperative mode in order to assess the energy technologies being developed by BRDA (now DOE) and CHER.

(a) Terrestrial Ecology

Had as its primary objective, the description and characterization of the ecology of a drainage basin and its inter-relationships

to land use and man's activities. Another objective was to

Provide baseline for future ecological studies and assessments

related to planned energy production and utilization. In addition

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and subsequent to the issuance of the original Program Plan, the EL Verde Research Park Project and the El Faro Environmental Research Project were added.

The three major projects (Drainage Basin; El Verde Park:
B1 Faro Project) were completed and reported by the end of FY 79.
Subsequent work in the area would concentrate on the forested
Portion of the Basin with emphasis on hydrological and climatological research, New directions, in accordance with the pri

ary thrust of CER

alternative energy program will be explored,
Projects are planned or already implemented in waste treatment

(composting; water hyacinth

tertiary sewage treatment

Yonkers assessment of coal fired power plant.

ete.) and a

number of other related project

(®) Marine Ecology

The original scope and objectives were to investigate and

evaluate the effects of pollutants from an energy related industrial complex on a marine ecosystem. The entire operation was

to concentrate around the Tallaboa-Gusyanilla Bay system located on the South Coast of Puerto Rico. The emphasis in the study was

the determination of the ?

imposed upon the ecosystem by

the various pollutants, using different experiments with varying degrees of water exchange with the adjacent open sea.

The re:

arch program as described in the original plan is in
ite final states and will result in a report during the current

fiscal year. The new revised

yearch program of the Marine Ecology

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Division will concentrate on providing "an ecological analysis
of spacial and temporal patterns of pelagic ecosystem components
which potentially may interact with the operation of an Ocean
Thermal Energy Conversion (OTEC) plant near Punta Tuna, P.R."

?The wajor goals of the study are to identify vater movenent pate
ters in the discharge regions of an OTEC plant: to assess the

impact of that di

OrRe on the surrounding marine biota; and

to measure biological responses to OTEC operational factors.

The data obtained will relate to other CEER OTEC projects concerned with biofouling, corrosion, and material studies, and economic variability in terms of OTEC operations. A moored buoy and a convert Landing Craft (UCU), anchored off Punta Tuna will

be used as the base station for these studies.

(2) Wealth Studies (RP-01 in Original 1977 Plan

This program was concerned with the health impact of ecological alternatives due to human activities in the tropics. The intended emphasis was on the study and statistical analysis of diseases caused by energy related sources of environmental contamination. Collateral studies to be completed and phased out by 1979 were: Health Impact of Hydroelectric Reservoirs; Epidemiological HoJels; and Fossil Fuel Pottutants.

The primary concern of a revised program is to establish the health impact information needed in a regional planning model for locating future power plants. Correlation regression studies are to be performed

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for cancer and respiratory diseases reported to the 25 sub-regional hospitals in Puerto Rico. These studies will relate to the location of power plants and major air pollutants.

EDUCATION AND TRAINING

(706 and \$305 in 1977)

This was

one of the important programs contemplated in the design of the original (1977) plan for CHER. As indicated in Tables 1-5 this program has been reduced to zero funding.

CHER conducted several significant programs in this area including an international three week seminar in which scientists from Latin America participated. In addition several summer energy-environment oriented training courses for local high school teachers and students have been conducted. GEER has also sponsored professional level semi

ars each year in the areas of energy and environment.

DEVELOPMENTAL RESEARCH PROGRAMS

1) Biomass Program

?The objectives of the Biomass Program are: 1) to determine the

gricultural and economic feasibility of tropical biomass production

4 renewable energy source; 2) to identify superior clones of sugar~

?cane and other tropical grasses, and 3) to expand the *Saccharum* genetic

base for hybridization of superior biomass producing clones. The Bio-

Progr:

has not been altered from the original plans and is presently @ continuation of that planned in the original Progras document. Te will continue along the cane lines for the remainder of the contract period.

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(2) Solar Progran Plas and Solar Materials Program Plan

The original 1977 document contained two separate programs, one entitled Solar Program Plan and the other Solar Materials, The Solar Program Plan included two projects, OTEC and a Feasibility Desiga Study Project for a 100 kve Level Pilot Plant Fueled by Hydrogen Produced by Direct Solar Radiation, The Solar Materials Program included four projects: (a) Photo induced electron transfer processes for hydrogen production, (b) Study of selective surtaces, (c) ferroelectric saterial development and (4) Photovoltaic CS, cells research.

?The OTEC progran has grom into a major research operation. The

100 kwe Pilot Plant Hydrogen Project was never funded by DOE. The Solar Material Program terminated the photoinduced electron transfer hydrogen project and the selective surface studies.

The program has been reoriented into two separate programs as

follow

(a) Solar Technology

1, Direct thermal applications. Hot water, process heat, space cooling

2. Photovoltaic systems. Expansion of commercial uses of photovoltaics

+ Solar data network, Obtaining accurate consistent island solar data

4. Solar materials. Test weatherability of solar materials

and support development of new materials for solar appli-

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as

5. International Programs on Solar Technology Transfer.

To help increase the widespread use of solar energy in developing countries.

(R) ocean Thersat Energy Conversion (cTEC!

The program plan for 1980 calls for the implementation of three research projects: Biofouling, corrosion and heat transfer:

physical oceanography at Punta Tuna; and advanced OTEC foan con

cept studies, During FY 81 the plans are to continue these studies and possibly implement additional ones presently in the proposal stage. It is believed that successful development of these projects, which are funded on the basis of competitive awards, can contribute substantially to the development of an OTEC functional 100 megawatt plant in Puerto Rico and to the development of world

wide application of OTEC technology.

(3). Energy Conservation Program Plan

This program originally contained two projects: a) Energy Conservation in the Residential Sectors by Shading and Insulating of a Typical Puerto Rican House, and b) Low Temperature Power Cycles. The latter project included the utilization of waste heat from stack gases in electric power plants.

The first project was completed and reported in FY 79. The second project was slightly modified and retitled "Assessment of the Potential of Energy Cogeneration on the P. R. System", It was funded and reported in FY 79.

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This progr

ves expanded to include the preparation of 2 comprehensive Energy Conservation Plan for the UPR system. This program has been terminated and approved by the UPR President. Other new energy conservation programs are included within Transportation and include Transportation Policy Studies and the Assessment of Hybrid Vehicles Utilization.

(4) Bioconversion

The original plan contained two bioconversion projects, one on carbohydrates from cellulose and another on rumvastes. The program has been expanded to include the following objective:

1) Biologically produce useful forms of energy from renewable biomass

Resources, primarily agro-industrial wastes, municipal wastes, and animal wastes; 2) enhance the environment by conversion of biological

wastes into valuable non-polluting products and energy; 3) transfer the new technology from the research laboratory to the potential users (local, national, and Third World) as rapidly as possible; 4) begin exploratory research in more advanced bioconversion methodologies. Among these latter projects are: methane production from Landfills; marine biomass (Sargassum) production and utilization; hydrogen production via photolysis; and establishment of a CER biomass research

field station near San Juan for field testing and demonstration of bioconversion technologies.

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ion of Reactor Facility (R04)

This project included the decontamination of the CHER nuclear

Reactor facility, Reactor operations were re-activated on October 1976

1976, The project plan has been carried out as originally described

The engineering assessment of the Decontamination Project was contracted

with

General Atomics, The assessment work was completed. The next

step will consist in selecting a Decontamination Contractor,

OPERATIONAL ACCOMPLISHMENTS

The major accomplishments of CEER during the last three years of

operation has been the establishment

of a base for research and development

of joint programs for alternative energy sources and the solution of

environmental problems associated with these, baseline information has

been collected, analyzed and reported for such important programs as

the siting of an Ocean Thermal Energy Conversion (OTEC) Plant in Southern

Puerto Rico. CER intere:

in an OTEC program in Puerto Rico is due to

the fact that Puerto Rico has one of the best world sites, if not the

best, for the location of an OTEC facility. OTEC plant baseline inform

tion developed includes biofouling corrosion and material studies, ee~

surements of oceanographic environmental studies paraneters, sevater

surfactant systens and variability relationships to an open cycle FOAM

OTEC System and OTEC Paraneter Ocean Spatial Variability.

Due to Puerto Rico's geographical location in a high insolation re

sion with sufficient rainfall, good agricultural land and the avai labi-

Lity of facilities and agricultural research scientists, bionase for

energy research programs has been under development at CEER and the

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Agriculture Experiment Station of UPR. Baseline information in relation to Biomass includes the development of agricultural technologies and optimization for harvesting large volumes of biomass and their economic and agricultural feasibility,

Bioconversion projects producing methane from wastes have been deve-

oped. Wastes biologically digested together with biomass in an optimized Bix, can represent an attractive project from the point of view of integrated energy and environment research in Puerto Rico as well as other areas, including the USA mainland. A demonstration project (waste digestion only) for the US Army at Fort Buchanan has been developed by CEER and is in operation. Important information has been gathered for the design of larger systems. Various methane generators including newly designed systems to digest rum distilling has produced important baseline information,

A solar research program can not be logically developed unless a baseline solar radiation data is developed for the area under consideration.

Solar radiation data has been under continuous monitoring by a series of

CER measuring stations located in }

jaguet, Cabo Rojo, Lajas, Rio Piedras,

Ponce and Catafio. These data, both global and diffuse, are taken on an hour by hour basis, stored in a computer, and have been mathematically sodeled for practical use for research and design applications. Reports have been issued containing this isportant and vital information. Addi tional measuring stations are planned to generate ore detailed information.

4m evacuated tube CRC concentrator for producing steas for industrial Fequiresents has been developed by CEER which will form the base of future industrial solar stean programs, In addition, CEER hae participated in the

Gesign phase of solar denonstration projects (photovoltaics and sola

thermal.)

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The design, testing, and evaluation of a solid dessicant air condi-

tioning machine using silica gel has provided basic information for the further study and consideration of this important system in the tropics. Air conditioning is a significant electrical load in Puerto Rico, especially in the commercial sector.

Among the ecology area's salient accomplishments are the establishment of baseline information for future ecological studies and assessment related

to planned energy production and utilization. This has been accomplished through El Verde Project and the Tallaboa-Cuayanilla Bay ecosystem study. Ten years of several years duration that carries over from PANC programs. In addition, the ecology section presently has a large role in the eco-

system study for the OTSC site and in new siting consideration for a coal

fired plant.

Health progress forms an important part of CEER programs. The main efforts in the past have been in controlling water quality and tropical

disease transmission through aquatic systems (schistosomiasis). As a result of CEER's efforts, schistosomiasis in P. R. has been nearly eradicated. Ongoing programs are establishing baseline information required in connection with correlation of respiratory diseases, cancer and air quality as well as the correlation between gastrointestinal disorders and water quality are common in Puerto Rico,

Materials programs have developed basic information related to improvements and optimization of fuel cell electrodes, determination of properties

of several solar selective surfaces and material degradation on solar

cells in the

collectors and water heaters in the tropics. A base already exists

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area of materials research in terms of availability

y of scientists and

laboratories,

On integrated technological assessment, energy analysis of various

alternative energy sources

conclude, providing basic economic infor-

mation and period of competitiveness for the timely selection and develop

ment of alterna

?energy sources. The studies indicate that nuclear

energy, on @ cost basis only, is the lowest cost energy for the rest of the

century and, beyond Bio=:

W35 and UTEC are strong contenders with costs

lower than coal fired power plants. Photovoltaic, economics look highly

promising. The engineering ec

onomic analysis of alternatives is a very

important aspect in an energy em

ployment program and CELR is not overlooking

this aspect.

Public Awareness or Training and Educa!

Programs have received very

little funding. However

SEER has conducted several significant programs

in this area including an International three weeks energy seminar in

scientists from Latin America participated. In addition, several summer energy-environment oriented training courses for local high school teachers and students have been conducted. Base information has been accumulated for future programs. CEER also sponsors and participates in any professional level seminars each year in the areas of energy and environment.

In the Transportation and Conservation Sector, significant economic

and policy studies have been

and are presently being conducted. Base data

has been established for important future policy and decision making

considerations. Over twenty five (25)% of P.R. net petroleum imports are

in the transportation sector.

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Present studies and experimentation is focused toward the fe.

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of utilizing electric or hybrid electric vehicles. Both of these vehicles show promises for substantial reduction in gasoline usage due to the pre-

dominant high density traffic in the metropolitan areas.

To keep abreast of the 1a

te developments in energy and environst

Fesearch, CEER has sent their scientists to visit various research Jahora-
tories for discussion of special projects and current research in the

areas of prime interest to CEER, Some of these laboratories visited have

been: ORL, JPL, SERL, &

+ WS, SRL, BNL, Sandia, and LBL. In addition,

visits to major university research laboratories have also been carried out,

among some of which are: MIT, U of Colo., Colorado State U, U. of Fla., Cal

Tech, UCLA, U. of Cal-Berkeley and U. of Mich. and U. of Miami.

Additional programs and accomplishments at CEEX during the last four

years include the success of the magnetic separation program (removal of

Pollutants from aqueous waste discharges); tertiary treatment of waste

water with water hyacinths; use of sludge and hyacinth compost to produce

methane; joint efforts with the Venezuelan Government in the research

Required to establish the practicability of using a microbial stimulation

method in marginal wells producing extra heavy crudes and biodegradation

of heavy crudes by means of selected microorganisms.

Extremely careful planning w

necessary in making periodic all the

above CEER accomplishments through very limited funding, an average total on the

order of \$3 million per year for all programs.

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PROGRAMS AND BUDGET

(a) Developmental and Institutional Programs

A tabulation of all the Institutional and Development Programs since 1977 is illustrated in Appendix A. Table 6. Appendix A Summary describes by classification the Institutional and Development Funding and projected budgets for FY 60 and FY 81.

The FY 81 budget requirements for Institutional & Developmental Programs are \$1,328,150. This figure supersedes the corresponding FY 61 projections made in April 1979 in Budget Form 120.2. However, planning estimates of \$850,000 for fiscal year 1981 were made by DOE for Institutional and Developmental through letter dated August 1, 1979

land signed by Mr. Richard Stephens. This imposes considerable restriction to CEER program goals and mission accomplishments.

(b) Competitive Research Programs

A tabulation of all the Competitive Research Programs since 1977

is illustrated in Appendix B. Table 7 "Summary of Appendix

describes

by classification the competitive research awarded and projected funding for FY 80 and FY 81. The FY 81 budget is \$1,144,000. This figure in

excludes already contracted work plus reasonably expected contract extension

of various other projects. No new projects have been included.

(e) Environmental Research

Environmental research programs and budget for 1981 are projected

in the Budget Form 5120.2 for FY 1981 submitted to DOE on April 1979.

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The total is \$1,117,000, Recent revision of these programs (to be subeitted in the CEER Proposed Five Year Plan 1982-86) illustrates funding requireseats of approximately 2.5 tines of the indicated pro Jections made in the April 1979 Budget Form 5120.2. Recent indications by ORD is tha the budget submission to the Presidency (U.S.) by the DOE Honorable Secretary allocates only \$939,000 for CEER Environmental Research Programs. However, in light of program reorieatation now undervay @ more reasonable budget for purposes of this plan vill project wore than \$1.3 willion for these programs in fiscal year 1961. The component breakdown of the Environmental Research Program is {llustrated in Table 8 "Revised Total Budget",

(2) Others and Total Budget

The total Budget including Reactor Decontamination, BONUS Surveillance and Competitive Programs is illustrated in Table 8, The DOE Support budget for FY 1980 is \$1,735,000 and for FY 1981 is 51,785,000. These are the budgets quoted in Table 3,

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APPENDIX A

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