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DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D.C. 20523

PROJECT PAPER

Proposal and Recommendations
For the Review of the
Development Loan Committee

PHILIPPINES - NONCONVENTIONAL ENERGY DEVELOPMENT

AID-DLC/P-2288

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DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

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April 11, 1978

MEMORANDUM FOR THE DEVELOPMENT LOAN COMMITTEE

SUBJECT: Philippines - Nonconventional Energy Development

Attached for your review are recommendations for authorization of a loan to the Government of the Philippines in an amount not to exceed Seven Million One Hundred Thousand United States Dollars ($7,100,000) to help in financing certain foreign exchange and local currency costs of goods and services required for the project.

This loan is scheduled for consideration by the Development Loan Staff Committee on Friday, April 21, 1978, in Room 3886 New State, at 2:30 p.m.

Please note that your views are requested at the close of the meeting. If you are a voting member, a poll sheet has been enclosed for your response.

Development Loan Committee
Office of Policy Development and
Program Review

Attachments:
Summary and Recommendations
Project Analysis
Annexes A - N

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NONCONVENTIONAL ENERGY DEVELOPMENT

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ACRONYMS AND ABBREVIATIONS

AID	Agency for International Development
ASIA/PD	Asia Bureau Project Development Bureau
BAI	Bureau of Animal Industries
BATEK	Barangay Teknolohiya
BED	Bureau of Energy Development
BEU	Bureau of Energy Utilization
BFD	Bureau of Forestry Development
DLSU	De La Salle University
DNR	Department of Natural Resources
DOE	Department of Energy (Philippines)
EDB	Energy Development Board
EDF	Economic Development Foundation
FRI	Forest Research Institute
GOP	Government of the Philippines
HSC	Human Settlements Commission
IRRI	International Rice Research Institute
KW	Kilowatt
MMB	Million Barrels of Oil
MW	Megawatt
NCRD	Nonconventional Energy Resources Development
NEA	National Electrification Administration
NHA	National Housing Authority
NIA	National Irrigation Administration
NIST	National Institute of Science and Technology
NSDB	National Science Development Board
PAGASA	Philippine Atmospheric Geophysical and Astronomical Services Administration
PASA	Participating Agency Service Agreement

PART I

SUMMARY AND RECOMMENDATIONS

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

1. TRANSACTION CODE: C (A = ADD, C = CHANGE, D = DELETE)

PP

2. DOCUMENT CODE: 3

3. COUNTRY/ENTITY: Philippines

4. DOCUMENT REVISION NUMBER: 1

5. PROJECT NUMBER (7 digits): 492-0294

6. BUREAU/OFFICE: A. SYMBOL: ASIA; B. CODE: 04

7. PROJECT TITLE (Maximum 40 characters): Nonconventional Energy Development

8. ESTIMATED FY OF PROJECT COMPLETION: FY 83

9. ESTIMATED DATE OF OBLIGATION: A. INITIAL FY 78; B. QUARTER 3 (Enter 1, 2, 3, or 4); C. FINAL FY

10. ESTIMATED COSTS ($000 OR EQUIVALENT $1 -)

A. FUNDING SOURCE	FIRST FY B. FX	FIRST FY C. L/C	FIRST FY D. TOTAL	LIFE OF PROJECT E. FX	LIFE OF PROJECT F. L/C	LIFE OF PROJECT G. TOTAL
AID APPROPRIATED TOTAL	7,215	1,435	8,650	7,215	1,435	8,650
(GRANT)	(1,215)	(335)	(1,550)	(1,215)	(335)	(1,550)
(LOAN)	(6,000)	(1,100)	(7,100)	(6,000)	(1,100)	(7,100)
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY		3,595	3,595		3,595	3,595
OTHER DONOR(S)						
TOTALS	7,215	5,030	12,245	7,215	5,030	12,245

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. 1ST FY ___ F. GRANT	E. 1ST FY ___ G. LOAN	H. 2ND FY ___ I. GRANT	H. 2ND FY ___ J. LOAN	K. 3RD FY ___ L. GRANT	K. 3RD FY ___ M. LOAN
(1) ST	B743	873	878	1,550	7,100				
(2)									
(3)									
(4)									
TOTALS				1,550	7,100				

A. APPROPRIATION	N. 4TH FY ___ O. GRANT	N. 4TH FY ___ P. LOAN	Q. 5TH FY ___ R. GRANT	Q. 5TH FY ___ S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
(1)						
(2)						
(3)						
(4)						
TOTALS						

12. IN-DEPTH EVALUATION SCHEDULED: MM 12, YY 79

13. DATA CHANGE INDICATOR. WERE CHANGES MADE IN THE PID FACESHEET DATA, BLOCKS 12, 13, 14, OR 15 OR IN PRP FACESHEET DATA, BLOCK 12? IF YES, ATTACH CHANGED PID FACESHEET.

1 (1 = NO, 2 = YES)

14. ORIGINATING OFFICE CLEARANCE

SIGNATURE: Alexander R. Love

TITLE: Director, ASIA/PD

DATE SIGNED: MM 04, DD 07, YY 78

15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM 03, DD 13, YY 78

AID 1330-4 (3-76)

Philippines - Nonconventional Energy Development

SUMMARY AND RECOMMENDATIONS

1. Borrower/Executing Agency:

The Government of the Republic of the Philippines (GOP) will be the Borrower. The executing agency will be the Bureau of Energy Development of the DOE, specifically the Nonconventional Resources Department of BED. Implementing agencies for individual subprojects will include other Government agencies, such as NPC, NEA and NIA, the University of the Philippines, and other local institutions.

2. Amount of Loan: $ 7.1 million

3. Terms:

Repayment within 20 years, including a ten-year grace period, interest at 2% annually during the grace period and 3% thereafter.

4. Amount of Grant: $ 1.55 million

5. Purpose of Project:

To determine the technical/economic feasibility of exploiting nonconventional renewable energy resources as an alternative to foreign-procured fossil fuels. Primary emphasis will be on those technologies which appear to be appropriate for rural areas.

6. Project Description:

The program consists of ten individual pilot demonstration projects designed to exploit nonconventional energy resources through direct solar conversion, small-scale hydro plants, windmills and wind generators, and biomass conversion. Participant training, technical assistance, and activities relating to the collection of basic energy data and the dissemination of information are also included.

7. Beneficiaries:

The project is basically an applied research activity. Direct beneficiaries will be limited in number, i.e., (1) staff of the BED and other implementing agencies whose capabilities are enhanced through technical assistance and participant training, and (2) the population living in those rural areas where the pilot demonstration projects are carried out. Ultimately, assuming it proves feasible to replicate the results on a broader scale, the energy made available for domestic, agricultural and industrial use should have a significant impact on remote area development and hence benefit a large segment of the rural populace, including women.

8. Project Costs and Financing Arrangements:

The $7.1 million AID loan will be made available to BED to finance foreign exchange costs and a portion of the local currency costs of carrying out the pilot demonstration projects. The $1.55 million grant will be made available to finance the foreign exchange costs and a portion of the local currency costs of participant training, technical assistance, a survey of energy use patterns and resources in rural areas of the Philippines, basic research equipment, and seminars and conferences for the dissemination of information.

9. Summary of Project Analyses:

The nonconventional energy development project is an applied research activity. The technologies to be investigated are well established, currently available, and appear to be relevant to rural areas of the Philippines. With further anticipated reductions in the cost of hardware, we believe it will be economically feasible to utilize these technologies for specific small-scale applications in the short term. For the Philippines to exploit these energy resources, the technology available must be effectively integrated into the economy and the culture. The program under consideration is designed to assist the GOP in organizing and implementing pilot energy-oriented demonstration projects, a requisite to acquiring the necessary energy technology and developing a means to exploit nonconventional energy sources. The BED and other implementing agencies, with the assistance of U.S. consultants to be funded under the grant, will have the capability to carry out the proposed subprojects.

10. Recommendations:

A. A loan be authorized in the amount of $7.1 million.

B. A grant be authorized in the amount of $1.55 million.

PART II

PROJECT BACKGROUND, DETAILED DESCRIPTION AND ANALYSES

A. THE PROJECT

1. Detailed Description

The Nonconventional Energy Development Project is made up of ten individual subprojects designed to explore the development of alternative renewable energy sources appropriate for use in the rural Philippines. Demonstration projects will be developed in four major areas:

— Direct solar conversion
— Small-scale hydropower
— Wind energy
— Biomass conversion

The first area, solar energy, will concentrate on three specific subprojects to develop:

a. Solar drying units - For drying rice, other grains, fruit, and other agricultural products.

b. Solar refrigeration units - To be used in remote rural areas to preserve perishable foodstuffs, particularly meat and fish.

c. Solar powered irrigation pumps - For use in remote rural areas not yet served by electricity and having limited access to other conventional energy sources.

The second area, small-scale hydropower, will concentrate on two projects to design and install:

a. One mini-hydro electric generating unit (300-500 kw).

b. Twelve micro-hydro (10-100 kw) units to be installed to supply off-grid power needs.

In the area of wind energy, the project will focus on two research efforts to demonstrate:

a. Wind-driven water pumps - For agricultural and domestic use.

b. Wind-driven electrical turbines - For rural electricity generation.

In the fourth area, biomass conversion, the project will explore the feasibility of three biomass conversion activities by:

a. Construction of a dendro-thermal plant to be fueled from an energy plantation.

b. Construction of a waste-fired thermal plant to generate electricity for domestic and industrial use.

c. Construction of a pyrolitic converter for the production of charcoal, pyrolitic oils, producer gas and/or fertilizers.

To develop an effective program, the BED must retain the flexibility to alter the scope or focus of individual subprojects as a result of more detailed planning information developed during the site identification/ system definition phase of the implementation process. For example, the number of small-scale hydro units or wind-driven devices may be increased or decreased depending on the availability of favorable sites. Likewise, BED may determine that communication systems powered from solar cells are of greater importance than the solar powered irrigation pumps described earlier. Such systems would be of major value in isolated areas for telemedicine or for general public information and education.

The bulk of the subprojects will be carried out in remote areas which do not have access to conventional power sources; the energy generated will greatly enhance the development potential for such areas. Nonconventional technologies which prove to be technically and economically feasible may ultimately reduce the need for fossil fuels, thus saving the GOP substantial foreign exchange and promoting the use of environmentally-safe, renewable energy resources.

The Bureau of Energy Development (BED) of the Department of Energy will be the overall project coordinator for the GOP. To assist the BED in effectively planning and managing the multitude of activities to be undertaken, a full-time project coordinator with experience in developing alternative energy programs will be funded under the grant element of the program. Individual subproject designs will be accomplished with the short-time assistance of U.S. consultants having specific experience in the energy technology to be investigated, i.e., direct solar conversion, small-scale hydropower, wind energy, or biomass conversion. This assistance will include participation in development of a detailed scope of work for the activity to be undertaken, site selection, and preparation of technical specifications for hardware and equipment to be procured. Based on the scope of work, the BED will solicit technical proposals from appropriate entities, (normally other Government Agencies) for implementing the specific subproject. The proposal will include a comprehensive work plan and budget; following approval of the work plan by the BED and AID, sub-project implementation will begin. At designated points in the implementation process, the BED, working in conjunction with the grant-financed technical consultants, will review progress under the subproject to determine if redesign is warranted. By the time these decision points are reached, preliminary data will have been obtained from a comprehensive survey on rural energy demands and resources which will be helpful in determining whether a project should be continued, altered or terminated. Since the project is innovative in nature, and previous appropriate and relevant project data are unavailable, the evaluation component of the project will be extremely important.

In addition to the application of currently available alternative energy technologies, the program will also include:

-- a survey to determine rural energy use patterns and resources.

-- short and long term participant training at relevant U.S. institutions to improve GOP institutional capability to conduct independent applied research.

-- country-wide seminars and conferences for the exchange and dissemination of information.

-- procurement of equipment for the Philippine Atmospheric Geophysical and Astronomical Service Administration (PAGASA) to establish a comprehensive network of solar radiation and wind monitoring stations.

-- procurement of research equipment and books and technical journals to enable BED to establish a library and permanent information and display center.

As a result of subproject evaluations and an analysis of the survey date, a determination will be made as to the technical/economic feasibility of replicating appropriate subprojects on a larger-scale. If favorable results are obtained, we envision that other donors would provide funds to replicate the results and/or to undertake additional pilot demonstration projects which might become attractive as a result of further research and development in the industrialized countries over the next several years. Ultimately, after the viability of a particular alternative energy technology is proven, it is assumed that over time, Philippine private industry would begin manufacturing the required hardware and equipment to fully exploit these renewable energy resources. Some educational/promotional activities may be required to facilitate this assumption, including possible GOP inducements in the way of tax concessions.

2. Background

The GOP's desire to develop its appreciable solar and other non-conventional energy resources is best viewed in relation to the country's overall energy situation.

Currently, approximately 95% of the energy requirements in the Philippines is supplied from imported crude oil and the drastic effect of recent price increases on the country's economy can be deduced from Table 1.

TABLE 1

Crude Oil Importations

Year	73	74	75	76	77
Quantity (MMB)	73.7	65.6	73.2	76.5	83.4
$ Cost per Barrel (Average)	$ 3.14	$ 10.90	$ 11.52	$ 11.9[illegible]	$ 13.00
Oil Import Bill ($ Millions)	231.4	716.0	843.0	916.9	1,084.2
% of Total Imports	12.9%	20.6%	22.3%	24.0%	2[illegible].9

Current projections are that by 1987 total energy consumption will increase from 88 MMB to about 190 MMB. This energy bill would clearly be an overwhelming burden for the country if the present proportion of imported fuel is maintained. Hence, there is a critical need to diversify fuel sources and maximize usage of indigenous energy resources.

Government recognition of this need took concrete form in early 1976 with the establishment of the Energy Development Board (EDB) by Presidential Decree No. 910, which also declared it a policy of the state to "achieve self-reliance in the country's energy requirements". The EDB functions were to formulate policies; establish programs; and administer, regulate, and implement activities for the exploration, exploitation and development of fossil and nuclear fuels, geothermal resources and other less conventional forms of indigenous extracted energy resources.

Subsequently, a National Energy Plan was drawn up in late 1976 which, for the first time in the country's energy planning history, officially considered nonconventional energy resources, such as solar energy, as having significant contributory potential. This recognition was further formalized by Presidential Decree No. 1068 which directed the EDB to "accelerate the research development, demonstration, and utilization of nonconventional energy". A later decree, P.D. 1206, expanded the EDB into the Bureau of Energy Development under the Department of Energy but carried over all pertinent provisions of PD 1068. Nonconventional energy was defined as being mainly solar energy, with the important categories of direct solar, wind and biomass energy.

This major policy consideration recognized that the fragmented nature of the Philippine Islands makes localized energy sources, such as solar radiation, particularly relevant. It also recognized that the country was imbued with abundant solar, wind, and biomass resources. Hence, while the BED will focus major efforts on other indigenous energy resources such as coal, geothermal, and oil, nonconventional sources will be exploited to the fullest degree possible.

The considerable nonconventional energy resources of the country can be tapped by applying various conversion technologies. A surprisingly large number of these technologies are well developed but, for various reasons, have been applied sparingly. The major reason, undoubtedly, has been the long era of cheap oil which suppressed most initiatives to utilize alternatives.

In a country with scarce financial resources, pure research is essentially a luxury; emphasis in a development program must be on relatively well established technologies. While the GOP realizes it is not wise nor feasible to entirely avoid basic energy research, it is stated Government policy to be highly selective and to lean as much as possible on adaptive or applied research. For example, the goal of drastically lowering the cost of solar cells, either by using new materials or developing mass production techniques, is clearly out of the Philippine context. GOP strategy is to maintain a close surveillance of progress abroad and transplant desirable technology as soon as it is available.

What is more difficult in programming research efforts is the ranking of project areas identified as relevant. In the Philippines, there are two primary considerations. The first is that GOP policy places a high priority on rural development. Thus, nonconventional energy applications which would result in direct benefits to the rural population are clearly important. The sociological benefits of such rural applications

and their long-term effect on the country cannot be overestimated. A second consideration is to achieve a substantial reduction in the percentage of imported fuel. Hence, equal development emphasis is placed on applications which may be urban-based but which have potential large-scale outputs.

Many relevant applications of nonconventional energy technologies meet the first criterion; however, they do not displace imported fuels to a significant degree. For example, the introduction of a solar dryer will often only substitute for direct sun drying, and the annual energy equivalent of a hundred small-scale dryers may be only about 70 barrels of oil. That there are real benefits to the user in the form of increased income is inarguable; in terms of aggregate energy output, however, the numbers may not be significant. Nevertheless, GOP policy requires that applied research efforts be concentrated in both areas, and it is primarily the rural-based technologies which will be investigated under the proposed AID-financed program.

The GOP further recognizes that private sector participation is of critical importance to the nonconventional energy development program. To encourage such participation, PD 1068 (Annex G) provides for an incentive to persons installing nonconventional energy devices in their homes or business establishments. The GOP hopes this incentive will stimulate the early appearance of a local industry for the mass production of devices such as solar grain driers.

Together with a continuing public education program, the Department of Energy believes these development policies and strategies will enable the country to attain the ambitious long-term fuel-substitution targets shown in Table 2, while more modest, but nonetheless significant, benefits are realized in the short-term.

TABLE 2

Projected Fuel Requirements by Energy Source (MMB)

Year	1975		1985		2000	
Source	MMB	%	MMB	%	MMB	%
Hydro	3.6	4.8	14.6	8.3	37.0	8.0
Geothermal	-	-	14.0	8.5	46.0	10.0
Oil	70.5	94.7	119.2	72.0	245.0	53.0
Coal	0.3	0.5	10.7	6.5	46.0	10.0
Nuclear	-	-	6.0	3.6	41.0	8.9
Nonconventional	-	-	1.0	0.6	47.0	10.1
	34.4	100.0	165.5	100.0	462.0	100.0

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As demands for energy in the Philippines are multiplied by an increasing population and as conventional resources are depleted, a greater proportion of available energy will, of necessity, be allocated to transportation, industry and other requirements of urban communities. This reallocation of available resources will seriously constrain the development of rural areas, a constraint which is currently being felt and which will become more critical in the foreseeable future unless alternative energy sources are developed and tapped.

For the short term, the utilization of nonconventional energy resources will be limited to specific small-scale applications based on technologies which are well established and currently available. A significant amount of research has been conducted in both the U.S. and other industrialized countries on alternative, renewable energy sources. Technology is currently available for the direct conversion of solar energy; conversion of solar energy stored in plant life (biomass conversion); conversion of thermal gradients in space (wind energy) to mechanical and electrical power; and the utilization of small-scale hydroelectric plants. The bulk of these technologies are more appropriate for rural areas and their widespread introduction into remote, powerless regions could dramatically improve the living conditions of the rural population.

The power-deprived areas of the Philippines generally have inefficient and inadequate food production and preservation; large family size, lack of transport facilities; lack of adequate medical supplies and care; poor communication links, a shortage of water for both domestic and agricultural uses; and idle manpower. The interaction of these factors results in low income levels, substandard living conditions and either a general feeling of resignation or a desire to migrate to the large urban communities.

For the next several decades, a large segment of the rural population will not benefit from the increased power production of planned electric generating stations. Nevertheless, a substantial portion of the energy requirements of the remote areas can be met through energy resources which already exist in rural localities. For example, direct solar energy and wind energy are available in usable quantities in virtually all parts of the Philippines. What is required is a thorough assessment of the potential of localized, nonconventional resources, the introduction of the appropriate technologies to make the resources usable, and a national commitment to embark on a systematic effort to exploit these resources.

The application of existing technology to the rural areas of the country require an initial survey to define energy use patterns and to identify energy resources and bottlenecks. Concurrently, available technologies must be reviewed and assessed. Prototype units should be developed and pilot demonstration projects undertaken to determine the feasibility of adopting existing technology to the proposed areas of concentration. These pilot projects must be evaluated as to performance

and cost of appropriate hardware, as well as a determination of local acceptance of the proposed method. Finally, a determination must be made as to the best procedures for replicating the results in broader areas and integrating the proposals into national development plans. Hardware selection will ultimately depend on the primary sources of energy availabile, the impact on the national economy and resources base, and the availability of trained technicians to install and maintain the hardware.

The major drawback to the widespread utilization of nonconventional energy resources in the Philippines is their present high cost. However, the desire of the country to be self-sufficient and self-reliant, the continuously increasing costs of fossil fuels, and the need to meet the basic energy requirements of the large sector of the population located in areas not served by electricity, has required the GOP to begin an investigation of nonconventional energy technology. While current hardware costs are high, there are no "fuel costs" associated with direct solar and wind energy conversion. In the bio-conversion of organic waste matter, raw material is practically free. On the other hand, the comparative costs of fossil and nuclear fuels are not as low as they might appear if full consideration is given to the "social costs" associated with the mining, drilling, refining, marketing and utilization of these fuels. There is no doubt that the capital costs of systems designed to exploit renewable energy resources will decline significantly as further research and development are carried out in the industrialized nations and mass production techniques are perfected. For example, solar cells for space applications cost about $150/watt prior to 1974. In early 1976 the price of solar cells for terrestrial uses had declined to $21/watt and in late 1977 had further declined to about $11/watt. In addition, even at present high costs, the economics of exploiting nonconventional energy resources in the remote areas are favorable when compared to the immense investment required to extend and maintain power grids to these regions.

Adverse environmental effects for the nonconventional energy systems to be investigated are minimal when compared to those resulting from the use of conventional fuels. Fossil fuels and geothermal sources emit significant amounts of carbon dioxide and other chemical pollutants to the atmosphere. Nuclear plants accumulate radioactive wastes which pose increasingly difficult disposal problems. Moreover, all of these conventional sources release a significant amount of heat into the environment. Except for pyrolitic conversion and the direct burning of biomass, the technologies to be explored do not result in any additional heat release at the earth's surface, and the combustion of biomass will not result in significant atmospheric pollution because biomass feedstock has a very low sulfur content, With regards to bioconversion, there are some problems of rural communities and the production of fertilizer. On the scale envisioned under the loan, large tracts of land will not be required for any of the pilot projects, hence, land use considerations are not of major concern. They should, however be recognized.

Ultimately, there may be public acceptance problems with the introduction of nonconventional energy devices in rural communities, largely related to the traditional resistance of rural populations to externally introduced technological changes. Such problems can be minimized by a properly conducted educational campaign and, subsequently, by the involvement of the rural residents themselves in the fabrication and installation of many of the nonconventional energy systems.

To assess and apply nonconventional energy technologies, in addition to conducting further research on the development of other indigenous conventional resources such as coal and geothermal reserves, the GOP, as noted earlier, has established by Presidential Decree a Bureau of Energy Development (BED) under the Department of Energy. The Nonconventional Resources Department (NCRD) of the BED is specifically responsible for the exploitation of the alternative renewable resources to be explored under the proposed loan. The NCRD, currently headed by a Ph.D. knowledgeable in research management, is already coordinating a significant number of basic and applied research activities being undertaken by other Government agencies and the University of the Philippines.

During project development, a three-man U.S. consulting team, consisting of specialists in direct solar conversion, small-scale hydropower, and biomass conversion, assessed the appropriateness of the technologies to be investigated and the capabilities of the BED and other agencies likely to be involved in project implementation. The team recommended that the program include both long-term technical assistance for project coordination and data collection and short-term technical assistance for the design and evaluation of specific subproject activities. They further suggested that short-term participant training in the form of brief observation/familiarization trips to selected U.S. institutions could greatly enhance the ability of these agencies to design and manage relevant demonstration projects. These training elements will be grant-financed under the proposed program. The team concluded that the program could be effectively carried out with this external assistance and the technical staff available within BED and the other implementing entities.

B. PROJECT ANALYSES

1. Social Analysis

The social impact of rural electrification in the Philippines is documented in AID-financed evaluative studies of the MORESCO pilot project in Misamis Oriental and the other rural electrification projects carried out over the past seven or eight years by NEA and the Mission. In addition, the socio-economic benefits which can be attributed to the introduction of electricity into remote areas are described in studies made by the Institute of Philippine Culture at Ateneo University.

While there are substantial data on which to quantify social benefits, the nonconventional energy development project is an applied research activity; as such, it will not have an immediate social impact.

If, however, viable energy producing systems are developed, then socio-cultural analyses will be mandatory to insure successful broad-scale field applications. In appraising the project, the Mission conducted a review of existing literature pertaining to the rural application of nonconventional energy resources. The Mission further conducted a rudimentary survey to substantiate that rural residents perceive a need for the infusion of reliable sources of energy. The results of this preliminary social anslysis are summarized in Annex 1. We do not feel that this effort can adequately assess the potential social benefits of innovations not yet in place in the Philippines or in other parts of the world. It is difficult to predict the impact of the unknown and to do so would be presumptuous.

The Mission has woven social considerations into the fabric of the project to insure that cultural sensitivity will be an essential component of the nonconventional energy program. Emphasis will be placed on social considerations during the evaluations conducted at designated points in the implementation process; the post-project evaluation, as described under Part 2, will focus specifically on socio-economic impacts.

Social analysis is not the concern of USAID alone; the BED is aware of the importance of socio-cultural considerations if the results of the applied research are to be successfully replicated on a broad scale. Energy use patterns and resources in rural areas are currently being studied, and planning efforts will be based on the results of this study. The Mission is thus confident that social concerns will continue to be a high priority for the GOP and will be fully considered in evaluating the feasibility of exploiting nonconventional energy resources.

2. Environmental Analysis

During preparation of the Project Review Paper, an initial environmental examination was conducted by a consultant with considerable experience in nonconventional energy programs and the Mission engineer. The IEE recommended a negative determination. The Assistant Administrator of the Asia Bureau approved the recommendation in October, 1977. The IEE is attached to the PP as Annex 2B.

C. TECHNICAL ECONOMIC AND ADMINISTRATIVE FEASIBILITY

1. Technical Feasibility

a. Overview

The energy technologies to be explored and applied under the proposed loan are those deemed most likely to contribute to an improvement in the quality of life in rural villages where conventional systems have not yet penetrated or are too costly. There is a wide variety of energy sources available as alternatives to existing systems depending primarily on fossil fuels and other conventional sources. While current

technical and economic constraints make immediate prospects dim for a wide-spread adoption of nonconventional energy technologies in developing countries, prospects for the intermediate and long-term are more encouraging. For the developing countries of the world to exploit these alternative energy sources, the technology required to utilize the energy must be developed and must be effectively integrated into the economy and the culture. The program under consideration is designed to assist the GOP in organizing and implementing a pilot energy-oriented development program, a requisite to acquiring the necessary energy technology and developing a means to exploit available nonconventional energy sources.

The energy systems to be investigated under the proposed loan will not likely contribute significantly to national economic productivity and hence economic growth nor make a substantial impact on the national energy budget over the next decade. Transportation and communication services which are key elements in the development of a more effective marketing system, a more efficient utilization of labor, and improved access to natural resources will continue to depend largely on conventional forms of energy. Nevertheless, the inability of many LDC's to produce small intermittent increments of energy has proven a major bottleneck in the development of rural areas -- the primary focus of the Mission program and the proposed loan.

b. Direct Solar Conversion

The potential for the utilization of solar energy may be more favorable in the Philippines than in most industrialized countries:

(1) The economics of solar utilization are not greatly influenced by the size of the installation; hence, solar systems could be readily adapted to individual buildings or to small rural villages.

(2) Only about 10% of the rural populace currently has access to the rural electrification network and a significant investment will be required to extend that network.

(3) The cost of electric generation by fossil fuels will continue to increase. Solar energy systems would thus be in direct competition with relatively expensive conventional energy.

(4) The Philippines lies within 5-20° of the equator and thus has solar intensities higher than most industrialized nations. Based on weather bureau data, the average insolation for the country is about 400 cal/cm^2/day, with yearly bright sunshine totalling over 2,000 hours.

Applications of solar energy to be considered under the loan involve equipment which is currently available and could be adapted to rural areas. Likewise, many of the solar systems utilize equipment which could readily be manufactured in the Philippines and other LDC's.

(1) Crop-Drying

Drying of crops is currently the most widespread use of solar energy. The normal technique practiced in the Philippines and other LDC's involves spreading grain on the ground to expose it to the direct rays of the sun and air. More recently, the term "solar drying" has been broadened to include drying by solar heated air in protected enclosures. This process is undoubtedly the cheapest and simplest method of drying crops in those areas having abundant sunlight. In the Philippines, solar dryers could be used by farmers with limited technical skills and small capital resources. Locally available materials and labor should be adequate to construct dryers utilizing simplified designs. In all cases, the potential economic advantages of solar dryers must be analyzed on a case by case basis, depending on the size of the crop and prevailing weather conditions. The addition of a solar air heater to an unheated air-drying system can shorten drying time by 50-75%.

To remain stable in storage, most agricultural crops are dried to a moisture content of 12-15%. The relative humidity of the air that would be in equilibrium with crops of that moisture content varies from crop to crop and ranges from about 48-60% for fruits, grain and hay. As significant decreases in relative humidity result from small increases in air temperature, adequate drying of crops can be achieved in humid climates by raising the temperature of the air circulating among the items to be dried.

The adaptation of existing solar drying technology to the agricultural sector of the Philippines should make a significant impact on the production system. An estimated 5 to 10% loss of the basic rice harvest is attributed to incomplete and/or inefficient drying resulting in crop spoilage. Solar drying techniques developed for grains will also be adaptable to other crops such as copra, tobacco, fruits and fish for meal.

To optimize the design of the solar drying unit, it is necessary to investigate the parameters and variables affecting its performance. During the early stages of this phase of the nonconventional energy program, operating conditions for drying specific crops will be defined, present fuel consumption will be assessed, and different modes by which the dryers can be integrated into the process will be investigated.

The next objective will be to examine the feasibility of utilizing locally available materials for the construction of 20-30 prototype dryers. Designs will be based on standardized modules and will entail simple construction techniques and connections. The demonstration structures will be equipped with instrumentation for

measuring the physical variables of the system. The data gathered will provide some indication of the thermal performance of the unit, the efficiency of the solar collectors, and the effectiveness of operational control based on actual weather conditions. These values together with actual fuel savings will establish the cost-effectiveness of the system. After field testing of the prototype design, the information base will be disseminated using rural education and extension systems.

(2) Photovoltaics (Solar Cells)

In areas remote from existing or planned utility networks, the direct conversion of solar energy into electricity may be one of the most promising future applications of solar technology. Solar cells function in a manner similar to a low voltage battery whose charge is replenished at a rate proportionate to incident sunlight. In combination with energy-storage and power-conditioning equipment, solar cells can form an integral part of a complete electric conversion system. For rural areas with modest power requirements, it may be less expensive to install a solar generating capacity rather than incur the major capital expense of constructing and maintaining a lengthy electrical distribution network.

While numerous materials possess photovoltaic properties needed to convert solar radiation to electricity, only three have been successfully used, primarily in spacecraft application. Solar cells developed from silicon are capable of converting 14-15% of incident solar energy into electricity and higher efficiencies are expected with further research and development. In addition, such cells are extremely reliable, provide stable long-term performance and are highly resistant to severe climatic conditions. Continued research on the calcium sulfide and gallium arsenide cells is currently being undertaken in both the United States and other industrialized countries.

The solar/photovoltaic system has no moving parts and is simple to operate. Systems vary in size from only a few watts to several megawatts. Properly sealed cells degrade slowly eliminating the need for frequent replacement. The basic physical mechanism which accounts for photovoltaic properties in silicon has a lifetime which is measured in thousands of years and the closer the seal approaches airtightness, the closer the lifespan of the cell will approach that of the basic silicon material.

The level of maintenance required for properly designed solar cells to provide reliable service is low, consisting primarily of protection from abrasion and periodic cleaning of the transparent surfaces. Numerous photovoltaic systems have performed satisfactorily for nearly a decade with little or no cleaning and no observable deterioration in the solar cells. Because of the low maintenance requirements, these cells are ideally suited for rural applications. Supportive infrastructure, specialized training of maintenance personnel, and elaborate tools normally needed to maintain generator installations are not required.

Despite the obvious advantages of photovoltaic systems, the high cost of procuring or fabricating solar cells has discouraged the widespread use of this form of solar technology. The present price for individual silicon solar cells is about $10 per peak watt. Research is underway to investigate methods of mass producing solar cells which would substantially reduce costs. One technique currently under development may result in reductions sufficient to bring total costs to less than $1 per peak watt within 5 years. If cost reductions of this magnitude can be realized, the widespread use of solar cells for power generation in remote areas is a distinct possibility by 1985.

Even at their present high cost, solar cells are currently being used to power television sets in rural areas of Niger. The basic purpose of the program is to provide educational benefits to students in primary schools located in regions without electricity. By 1973 approximately 800 students in 22 classrooms were receiving instruction via solar-powered television sets. Results of the pilot program have been so encouraging that the Government of Niger intends to establish a network of solar-powered television sets which will reach about 80% of the population by 1985.

The demonstration system envisioned under this program will consist of an array of silicon cells connected to a storage battery and irrigation pump. Power ratings will be approximately 1/3 horsepower. The irrigation pumps will be installed in small farms (under 1.5 hectares) where irrigation water is available for lifts of 5 meters of less. The research effort will involve the installation of some 25 units and will be monitored by IRRI and NIA. System performance and evaluation will aid in the economic and technical assessment of the role of photovoltaics in the rural areas of the Philippines.

As noted earlier, BED may determine during the "system definition" stage of the implementation process that communication systems powered from solar cells hold more promise for rural areas than solar-powered irrigation pumps. If so, the focus of the subproject will be redirected.

(3) Solar Refrigeration

Solar refrigeration can be accomplished by use of an absorption cycle in which the pressure of the refrigerant vapor is raised by heating instead of by mechanical compression. The vaporized refrigerant is recovered for recycling by absorption in a solution of the refrigerant and a salt. The low pressure of the expansion/vaporization region is maintained by the reduced vapor pressure of the refrigerant above the absorbent solution and the vapor is regenerated by allowing the refrigerant solution to flow into a generator where solar heat is applied. Most research efforts have been associated with systems utilizing ammonia/water or lithium bromide/water as the absorbent-refrigerant mixture. Temperatures of operation are compatible with efficient flat-plate collectors; hence, the system can be adapted to a solar heat supply by substituting solar-heated fluid for the conventional heat source.

The technical feasibility of providing solar refrigeration, generally intended for food preservation, is already assured; however, research results to date indicate comparatively high costs as

against conventional compression cooling. It is likely that substantial reductions in cost can be effected when further research and development have been conducted. Community-size systems will offer economy of scale and the possibility of distributing ice to small users. Hence, the application of solar refrigeration will enable rural households to benefit from an increased utilization of available foodstuffs.

Research efforts under this program will be directed toward a systematic investigation of the economic feasibility of developing solar refrigeration units for use in the preservation of foodstuffs, particularly fish and meat, in rural areas.

A small prototype installation will serve as a demonstration unit which is large enough to reflect significant fuel savings but small enough to be controlled from a research viewpoint. A study of alternative absorbent/refrigerant mixtures will also be undertaken. Performance values for each absorbent/refrigerant combination will be obtained and compared to theoretical values. Initial results of these experiments will be utilized in designing and constructing an experimental ice-maker of 1.5-2 tons per day capacity. The subproject will also explore the possibility of ice production based on a continuous system utilizing conventional methods during periods of low solar radiation.

c. Small-Scale Hydropower

In recent years, primarily due to the significant increases in the price of fossil fuel, renewed interest has been shown in small-scale hydroelectric units. The technology for installing these units is well-developed and "packaged" units are currently offered for sale by several manufacturers in both the U.S. and abroad.

(1) Mini-Hydro Plants

Under the proposed loan, 200-500 KW units will be installed on irrigation canals or small streams where heads are expected to be in the 5-25 meter range. The National Electrification Administration will identify a number of sites it considers feasible for development. NEA will provide information on the location and elevation; water quantity, including seasonal variations; reservoir storage capacity requirements; water quality; head; distance from water source to turbine; and an estimate of the power to be developed. System design will be accomplished with the assistance of U.S. consultants, if required. It is expected that the units will be tied directly into the NEA grid; although, the units will be capable of operating independently. NEA will operate and maintain the units and market the power through existing rural electric cooperatives. For systems having low load factors, consideration will be given to utilizing excess power for small-scale industrial plants, such as the manufacture of nitrogen fertilizer using the electric arc process.

Equipment required (turbines, inlet valves, generators, switchgear, control panels, and governor) will be imported. The capital cost will be $1000 - $1500 per KW with unit costs declining as scale and head

increase. Equipment costs will be approximately 40% of the total, with the remainder being the cost of required civil works.

(2) Micro-Hydro Plants

Where relatively high heads of 80+ meters and low flows are available, 10-100 kw units will be installed. These units will consist of a simple diversion structure, strainer, siphon and pipe leading to the turbine. A minimum of civil works will be required. Choice of turbine will depend largely on available head, water quality and load characteristics.

The same site-specific information required for the mini-hydro units will be developed for the smaller units. Site selection and design will be carried out with the assistance of U.S. consultants.

The micro-units will not be installed for immediate connection to the NEA grid; however, they could be connected at a later date. While it is anticipated that most units will generate electricity, consideration will also be given to the installation of simple hydraulic rams to provide direct mechanical power for rice milling, water pumping, and cane crushing.

Demand characteristics will be determined to (1) select the proper type of turbine; (2) decide between direct electricity generation or power production; and (3) evaluate the economic feasibility of the system. If electricity is to be generated, load components will be estimated together with daily and seasonal patterns of demand.

Capital costs including trash rack, filter, pipe, turbine, generator, batteries, and invertor, will vary from $1000 - $2000/kw depending on head and system layout. An average cost of $1500 per kilowatt is used for estimating purpose of which approximately 85% is foreign exchange.

d. Wind Energy

Traditionally, population in rural areas have harnessed wind for pumping water and performing mechanical operations associated with agricultural production. More recently, windmills have been used in remote areas for the generation of electricity. Hence, wind technology is both familiar and established and continues to be appropriate for rural applications where sufficient wind occurs.

Windmills designed to supply mechanical power are simple enough to be built by local people using local materials. When utilized for the production of electricity, expertise not normally available in remote areas of developing countries is required to design generation, control, and distribution equipment. In these instances, it may be more appropriate to consider commercially available systems.

While technology is available to extract power from the wind, other questions must be addressed to determine the feasibility of utilizing this technology at a particular location. Wind power increases with

the cube of the velocity, and wind power production increases with the square of the propeller. The wind velocity may be too low to allow the windmill to begin producing power or too high to make use of a mechanical design which is practical for average wind speeds. In addition, occasional storms bring high winds to normally calm areas, and areas usually experiencing high winds often have calm spells. Hence, it is not realistic to rely on wind power at a given time no matter how windy the site nor is it realistic to reduce the safety factor of the windmill design for a relatively calm site. The cost analysis depends on the average wind speed over the year and on the speed at which the windmill begins producing useful power. The amount of useful power also depends on the ability of the consumer to utilize the energy as it is produced, or to store it. To determine the annual energy output of a windmill at a particular site, it thus becomes necessary to obtain data on average wind speed, as well as information on the period of time during the year that the wind exceeds a given minimum velocity.

Mechanically, windmills are simpler than diesel or gasoline-powered engines. Thus they are more reliable in rural applications. They require no fuel supply and a minimum of maintenance and repair. Many are self-regulating and require little attention even under the most adverse environmental conditions. Routine maintenance consists of a periodic inspection, lubrication, and occasionally, replacement of a part. Nevertheless, the use of windmills in remote areas of developing countries has not always been successful. In many African countries, failure to provide a minimum of maintenance and the inability to procure needed spare parts have resulted in the abandonment of numerous windmills installed for pumping water for both livestock and domestic use. In addition, many windmills were not properly designed for local wind conditions. Better results have been obtained when some institutional capability to operate and maintain the system existed or was developed as an integral part of the program.

U.S. manufacturers can provide windmill pumps capable of producing several hundred gallons of water per hour depending on the depth of well, diameter of pump, and the wind velocity. Prices, including reciprocating cylinder pump but exclusive of tower, range from about $500 - $3000 F.O.B. Towers are normally fabricated locally.

Small wind turbines are also available from U.S. manufactures and range in price from about $2500/KW for 200 W sets designed for operation with storage batteries to $500/KW for 15 KW and up generators.

Available wind data in the Philippines indicates there are numerous areas with average wind speeds in excess of 10 kilometers per hour. There are areas in Batanes, Palawan, and Panay which have average wind speeds in excess of 17 kilometers per hour. The number of such sites are sufficient to warrant a wind energy utilization program for water pumping and low power electricity generation.

One major problem with wind energy usage in the Philippines is that most of the areas with high mean wind speeds also have a high

incidence of tropical cyclones. On the average about nineteen storms pass through the country each year, some of which have center winds in excess of 200 kilometers per hour; hence, "typhoon-resistant" designs will clearly be required.

Under the proposed program, 12 wind generators will be installed in remote communities not connected to the power grid and where the transport of conventional fuels is prohibitively expensive. Generators will be in the 3-30 KW range. In addition, approximately 20 wind-powered pumps will be installed in rural villages for pumping water for both irrigation and domestic use.

e. Biomass Conversion

The use of renewable indigenous fuels are of import in several ways: (1) balance of payments can be affected when organic materials are used as fuels, (2) pyrolitic conversion offers several alternatives - char as fuel or chemical absorbent and process material, ammonia to be used as a crop fertilizer, condensible oils as possible chemical feedstock, methanol for mobile fuels and low BTU gas for fuel, (3) biomass systems are labor intensive thus providing jobs for the rural population.

Biomass conversion has great potential as an alternate energy source. Table 3 lists the principal agro-forestry wastes and the tonnage of each generated annually in the Philippines. If processed properly, these wastes could produce the equivalent of about 60 million barrels of oil and thus represent a significant national energy resource. In addition to these agro-forestry wastes, BED estimates that approximately 13 million metric tons of animal wastes are generated yearly from which methane gas could be produced. BED further estimates that fuel wood production from 300,000 hectares of marginal agricultural land could produce the equivalent of an additional 25 million barrels of oil.

The technology for converting wastes and fuelwood into usable forms of energy is well developed. Three processes are normally utilized: (1) direct burning (2) anaerobic digestion, and (3) pyrolysis.

(1) Direct Burning

Direct burning is the most widely applied method of biomass conversion. Sawmill wastes, other agricultural wastes and/or fuel wood can be burned to produce steam to operate equipment or dry crops, or generate electricity. By direct burning of bagasse, coconut shells and husks and sawmill wastes, the agro and wood-processing industries in the Philippines generated power and process heat in 1976 equivalent to about 7 MMB of oil, or about 8% of the country's total usage of commercial energy at that time. The amount of waste utilized by these industrial users represents only about 12% of the total

TABLE 3

Annual Generation of Agro-Forestry Wastes

Waste	Metric Tons	Equivalent MMB
Bagasse	7.5	12.1
Coconut Shells	1.9	5.7
Coconut Husks	4.3	6.4
Rice Hulls	1.3	2.7
Wood Wastes	1.3	2.0
Logging Wastes	2.6	4.0
Straw	14.4	26.9
Totals	33.3	59.8

Source: Bureau of Forest Development
National Grain Authority
Bureau of Agricultural Economics

agro-forestry wastes being produced in the country. While a large portion of these wastes may be unavailable or unusable, the remaining portion is of such magnitude as to warrant a serious effort at large-scale utilization.

Two subprojects will be undertaken under the proposed program to investigate biomass conversion through direct burning: (1) design and construction of a 3-5 MW wood-fired thermal plant to be coupled with an energy plantation which will serve as the source of fuel; and (2) design and construction of a 300-500 KW generating plant to be fueled from agricultural and forestry wastes.

i. Dendro-Thermal Plant and Energy Plantation

Man-made forests or energy plantations represent an immense potential biomass resource. The tropical forests of the Philippines are decidedly more productive than equivalent areas in the temperate zones. The yield of the giant "ipil-ipil" species, which is receiving considerable attention in the country today, averages about 27 bonedry tons per hectare per year. With a heating value of about 8000 Btu/lb, the energy equivalent of a million barrels of oil is theoretically obtainable yearly from about 12,000 hectares of ipil-ipil land. A recent study revealed that at least 300,000 hectares of marginal lands (not suitable for conventional agriculture) are available in the Luzon and Visayas regions alone. If utilized for the production of ipil-ipil, the energy potential from this land mass would be about 25 MMB of oil yearly.

The use of forest biomass as an energy source will have two basic objectives: (1) to reduce, wherever possible, the need for expensive fossil fuels and (2) to reestablish forest cover on denuded sites which are subject to severe erosion. The remaining forests of the Philippines are currently under heavy exploitation and are forecast to be completely cut over within the next two decades unless pressure on them is eased and serious reforestation commenced. Estimates of forest cover remaining on the islands vary between 20 and 50% of the original forest cover. Between 3 and 5 million hectares of land have been denuded and the 1.65 million households involved in slash and burn agriculture increase this denuded land area by about 250,000 hectares each year.

An effective long term program to meet these objectives will emphasize the following elements: (1) the creation of an effective extension service to aid local populations in establishing, maintaining, and marketing forest energy plantings and (2) the acceleration of the forest research program to determine the most suitable sites and cultural practices for

several fuel wood candidate species with heavy emphasis on giant ipil-ipil, and (3) the establishment of sustained yield practices.

Perhaps the most critical element of a tree planting program is the continuing interest of the local population. Past efforts failed because no provisions were made to ensure survival, free growth or viable markets for the trees once grown. A successful venture of the Paper Industries Corporation of the Philippines (PICOP) features training sessions for farmers conducted by specialists, provision of planting stock, intermediate payments for successful plantings and a guaranteed market. In a similarly successful small scale project by the Department of Natural Resources farmers were paid to grow and establish seedlings on government lands. These and other methods of ensuring a supply of raw material for the dendro-thermal plant will be considered under the proposed program.

A research program is a necessary part of any effort to develop energy plantings. Research to be funded under the grant element of the program will initially focus on the proper field practices such as site preparation, spacing of seedlings or seed, weed control, need for nutrients, site relationships and rotation ages for ipil-ipil. Test plantings at several locations will be established and evaluated. The College of Forestry at U.P., Los Banos and the Forest Research Institute appear to be logical agencies to conduct this research.

The basic plan of action will involve selecting a site in a region having available areas for the forest plantation and a demand for electric power. The plantation system will be established with annual harvests based on three to five year rotations. Actual lengths of rotations and selection of species will depend on an economic and silvicultural analysis for the given region. From 400 to 600 hectares of land area will be required for a self-sufficient biomass system, unless the region produces large volumes of organic residue.

ii. Waste-Fired Thermal Plant

The rapid growth of organic materials in energy deprived rural environments provides an ideal base for developing small-scale power facilities. These systems can utilize residue materials derived from agricultural and forestry processing plants for energy production.

Under the proposed loan, power facilities will be established at a minimal scale (300-500 kilowatts) to provide the power needs of small communities and industries. An integral link can be established by utilizing biomass residue resulting from these same industries. A recently enacted embargo on the export of logs and the resulting development of primary and secondary wood processing plants on Mindanao now provides such a linkage.

(2) Anaerobic Digestion

Anaerobic digestion of animal waste materials for the production of methane gas has been practical in many European and Asian countries since the early 1900's. Biogas plants have been designed for gas production rates of as little as 50 cubic feet per day to as much as 10,000 cubic feet per day, corresponding to 50 pounds to 5 tons per day of processed waste. The digestion process involves shredding and mixing the feed material with other nutrients in a charge pit and sending the mixture in slurry form to the digestor. Digestion time varies with the plant design. The biogas plant is of relatively simple design and can be built of common construction materials. The methane gas generated is normally used to operate diesel or gasoline engines, to provide lighting, and for heating and cooking . One of the obvious advantages of the biogas plant is that it is readily adaptable to rural areas of developing countries.

The BED is currently carrying out several research projects concerning industrial and domestic use of methane gas generated through anaerobic digestion of wastes.

(3) Pyrolysis

Pyrolisis is the destructive distillation of organic materials as a result of heating in the absence of oxygen. The process has been utilized for hundreds of years to produce charcoal from wood. However, in recent years renewed interest has been shown in the process because of other byproducts: pyrolitic oils, which represent a potential source of energy for industrial and utility boilers; and a relatively low-Btu gas. Gas generated by a pyrolitic convertor is normally used to fuel a drier for the feed material but could be utilized for other purposes if the convertor is located adjacent to an industrial plant. Factors governing the relative amounts of oil, gas, and charcoal produced through pyrolitic conversion include the operating pressure and temperature of the process. At high temperatures, greater amounts of gas and oil are produced while charcoal yields are small. At lower temperatures, charcoal yields are large, oil yields moderate, and gas yields low. Since production of charcoal in LDC's is of much greater importance, low-temperature processes appear to be more relevant.

The BED has recognized that use of the pyrolitic process to generate alternative fuels from agricultural and forestry residues

holds considerable promise in the Philippines. BED has obtained an $80,000 grant from UNIDO to develop a one-ton per day pilot demonstration plant. A team from Georgia Tech, which recently completed feasibility studies for the construction of pyrolitic convertors in Ghana and Indonesia, will provide technical assistance during the design, construction, and evaluation phases of the program. The project will be completed during 1978.

Under the proposed AID program, BED plans to study the system on a larger scale through the design and construction of a 20-30 ton per day plant. The study will involve testing and evaluation of the convertor over a fourteen-month period and conducting a detailed economic feasibility analysis. The plant will be of sufficient size that a reasonable extrapolation of performance and cost data to commercial-size plants can be made.

f. Summary Cost Estimates

Table 4 is a cost summary for the nine individual subprojects to be financed under the loan. Detailed cost estimates for each subproject appear in Annex 2C.

g. Summary of Technical Soundness

The technologies to be applied under the project are currently available and appear to be appropriate for rural areas of the Philippines. While many of these technologies have not gained widespread use because of initial high capital costs, we believe further R and D in the industrialized countries during the next several years will result in significant cost reductions. Hence, in the near future, it may be economically feasible to utilize some nonconventional energy technologies for specific small scale applications.

As shown in the Statutory Checklist included as Annex 2D, the project meets all applicable statutory criteria.

2. Economic Feasibility

The Nonconventional Energy Development project does not lend itself to cost/benefit or cost/effectiveness analyses. The project is essentially a research and development effort, and the specific outputs from the project will be in the form of completed research related to nonconventional energy production. Nonconventional energy production, should experimentation prove successful, will be particularly well suited for rural application (grain drying, irrigation pumps, household heat, electricity generation, refrigeration); however, location of the energy production units in some cases will be limited by the availability of the appropriate natural resource: adequate wind, consistent bright sunlight or falling water.

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Table 4

SUMMARY COST ESTIMATE 1/

	Subproject	AID-Loan	GOP	TOTAL	FX
1.	Solar Dryers	$ 591,000	$ 180,000	$ 771,000	$ 528,000
2.	Solar Refrigeration	$ 351,000	$ 67,000	$ 418,000	$ 226,000
3.	Photovoltaics	$ 132,000	$ 68,000	$ 200,000	$ 113,000
4.	Pyrolysis	$ 186,000	$ 56,000	$ 242,000	$ 99,000
5.	Waste-Fired Thermal Plant	$ 244,000	$ 80,000	$ 324,000	$ 187,000
6.	Mini-Hydro Power	$ 542,000	$ 181,000	$ 723,000	$ 472,000
7.	Micro-Hydro Power	$ 474,000	$ 171,000	$ 645,000	$ 347,000
8.	Wind Energy 2/	$ 280,000	$ 93,000	$ 374,000	$ 228,000
9.	Dendro-Thermal Plant & Energy Plantation	$2,847,000	$1,620,000	$ 4,380,000	$2,586,000
	Subtotals	$5,647,000	$2,516,000	$ 8,163,000	$4,786,000
	Contingencies (10%)	$ 565,000	$ 252,000	$ 817,000	$ 479,000
	Cost Escalation (15%)	$ 847,000	$ 378,000	$ 1,225,000	$ 719,000
	TOTAL	$7,059,000	$3,146,000	$10,205,000	$5,984,000

1/ Detailed cost estimates for each subproject appear in Annex 2C.

2/ Shown as two separate sub-projects on p. 4.

a. Cost of Philippine Energy Consumption

In 1977, energy needs that have an economic cost (i.e. those energy needs that currently are being quantified in the market place) are estimated by the Government of the Philippines to be 1.1 billion dollars; by 1987 the cost is expected to rise 128% to 2.7 billion dollars. As the energy needs of the country are now being supplied primarily through imported fossil fuel (93.8%) the Philippines is spending a substantial amount of its total import dollar on energy costs: 1.1 billion dollars or 28.8%. As the country is presently facing a trade deficit of approximately one billion dollars (1977 imports of 4 billion dollars vs. exports of 3 billion dollars) energy costs have a significant impact upon the nation's economy. In addition, the current peso/dollar exchange rate of approximately ₱7.5: $1 has been maintained only by heavy government market intervention and foreign exchange borrowing from abroad. The peso is believed to be overvalued. The government's National Economic Development Authority (NEDA) has, suggested the shadow price of foreign exchange should be some 20% higher to reflect its scarcity and true economic value or about ₱9:$1. The NEDA study only serves to exacerbate the impact of the import of foreign fossil fuel upon the Philippine economy. In order for the country to reverse the heavy dependence on imported fossil fuels as the primary energy source, the government is looking into the development of alternative indigenous natural resources as well as alternative power sources for electricity production. Philippine coal, geothermal, oil and uranium reserve are presently being explored and quantified; however, the nation is also interested in developing its inexhaustible natural resources: sun, wind, biomass and water.

b. Nonconventional Energy's Role in Philippine Energy Mix

The Department of Energy is projecting that by 1987, the oil share of the energy mix will be about 68%. This means that 32% of the energy requirements for the Philippines will have to come from non-petroleum based resources. The bulk of the non-oil resources will be coal, geothermal, hydro and nuclear; however, nonconventional sources will also contribute to the energy mix. If, as projected, nonconventional sources make up one percent of the demand necessary for the Philippines it will represent about $26 million. By the year 2000, nonconventional sources are estimated to supply 10% of the total energy demand (equivalent to 462 million barrels of oil). This represents an estimated value of 620 million dollars at 1977 prices. If future fossil fuel costs were applied to the nonconventional portion of energy production the value of the contribution would then probably be many times the 620 million dollar value.

c. Costs of Nonconventional Energy

The costs of nonconventional energy production facilities vary according to the specific natural resource employed. Silicon solar cells, for example, cost about $10.00 per peak watt at the present time; however, ten years ago the cost was $150 per peak watt. Perhaps with further development they will cost less than $1.00 per peak watt by 1985.

Solar energy heating or drying technology can be installed at a very low cost and when compared to electrical energy generated from fossil fuels, can be operating on a virtually no cost basis after three years. Mini and micro hydros are similar in that they are expensive initially but utilize a free natural resources as their energy source. Wind generating units at present would be expensive to construct, but, if properly maintained, could supply power at very little cost for many years. Presently, direct-fired biomass systems have high initial capital costs but fuel can be grown locally, thus aiding in the balance of payments. Much of the nonconventional technology is known; however, some applications are in a relatively early stage of development.

d. Benefits of Nonconventional Energy

The economic value of nonconventional resources cannot be measured in energy equivalent alone as there are additional unique features attributed to nonconventional sources. Nonconventional alternatives presently being considered do not require sophisticated transmission systems -- in terms of roads or electrical cable -- hence there will be a savings over traditional power sources. More importantly, the basic energy resource is non-depletable, hence eliminating the need to make a choice between present consumption and future need (an extremely interesting consideration when talking of oil as an energy or chemical source). Thirdly, nonconventional resources lend themselves to rural applications by providing adequate and useful power sources at the site of the raw material, allowing for secondary benefits that otherwise would not be realized.

e. Secondary Benefits

Benefits can be atrributed to each of the subprojects. Three examples are:

(1) Grain Drying

An example of the spread effect of nonconventional power sources can be seen in the introduction of improved crop drying methods. At the present time, the average moisture level in harvested grain is about 20%; however, the National Grain Authority acceptable figure for the full government support price is 14%. (If rice is mechanically dried to 14% it will not only decrease spoilage but also reduce breakage thus enhancing its value on the international as well as domestic market.) The grain drying techniques now being used in the rural Philippines produces grain that cannot always meet the NGA standards and a conservative estimate of about 5% of the crop is lost annually to moisture related rot. (Philippine annual rice production is four million metric tons making the loss to the economy 200,000 metric tons worth $30 million at present prices.) The introduction of inexpensive, effective and easily maintainable solar grain dryers would supplement the mechanically dried grain processed in the Philippines (estimated at 1% in 1977) thus increasing marketable produce through the reduction of post harvest waste due to poor drying technology. The economic value of the introduction of

solar grain dryers if only used by 10% of farmers would be worth $3 million per year in spoilage reduction alone to say nothing of the ability to command the top market price.

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(2) Refrigeration:

Nonconventional energy resources can also be used to power refrigeration units. The proposed units, powered by solar energy, are ideal for installation in rural areas not yet supplied with electrical power -- a situation very similar to many poor fishing villages in the Philippines. With such units, fishermen could preserve their catches by means other than drying thus increasing the market value of their products. Dried fish are worth less than fresh fish in the marketplace. Fishermen who do not have refrigeration available to them are at the mercy of the marketplace as well as the transportation system.

The magnitude of fish production in the Philippines is quite significant. In 1975, the total fish catch of the Philippines, 1,336,803 metric tons, was worth about $800 million. Approximately 5% of the total production was exported leaving the remaining 95% for in-country consumption primarily as a food fish. Since fresh cooked fish is a staple in the Philippine diet, the value of being able to preserve fish without salting, smoking or drying is obvious. Fishermen could market their products based on demand rather than having to be at the mercy of supply thus allowing for income on days when they could not fish. Fish products would bring the optimum price in the marketplace as they would be sold fresh rather than dried or frozen (frozen fish are worth less than fresh fish in the Philippines).

(3) Biogas Plant

Another nonconventional energy system is the methane generator. The gas produced from the waste materials of a rural family of six can supply cooking fuel and the processed slurry can be used for fertilizer. In addition, the methane generator consumes all of the waste/fecal material from humans and animals thus improving the sanitary conditions for the family.

The economic benefits of such a unit are several. The improved health situation although difficult to quantify is obvious as over 80% of the rural population of the Philippines is plagued by parasitic infection and gastro-intestinal disease. Improving sanitary conditions will reduce the days lost to illness thus increasing the productive capacity of farm workers. In addition, the nutrients lost to parasites will be reduced leading to the full utilization of ingested food.

The methane gas produced can easily supply the cooking needs for the family of six. At the present time about 70% of the population of the Philippines cooks on wood fired stoves. This not only is expensive, a family of six burns about a peso's worth ($.13) of wood per day, but it is also harmful to the environment as more and more

timber land is cut to supply needed fuel. The economic effect of the Philippines' current poor forest management practices is well known and has been quantified in other project papers.

The third benefit of the methane generator is the fertilizer made from the slurry. A similar nitrogen rich triple fifteen (nitrogen, potassium, phosphate) fertilizer is currently worth $60 ($8.00) for a 50-kilogram bag or about $145 per ton. A methane generator would produce one bag equivalent per week at no cost other than the original installation costs for the pit and the collector.

3. Administrative Feasibility

a. Recipient

The Bureau of Energy Development (BED), of the Department of Energy (DOE) will be the central coordinating agency for the Government of the Philippines. The Department was created by Presidential Decree in October, 1977, and encompasses the BED, the Bureau of Energy Utilization (BEU) and the Philippine Atomic Energy Commission. The organization chart of the DOE is shown in Annex 2E. The BED is primarily responsible for the exploration, extraction, development and exploitation of fossil, nuclear, geothermal and nonconventional energy resources. The latter covers all areas of applied research to be financed under the proposed grant and loan. The BED assumes the same functions as the Energy Development Board which was created by P.D. in March 1976 and which was superseded by the BED. The BED's powers and functions are stated in P.D. 1068 included as Annex 2F.

The Nonconventional Resources Department (NCRD) of the BED has responsibility for formulating and administering the implementation of a national program to develop nonconventional energy resources. The NCRD reviews all proposals concerning nonconventional energy research and development and funds or facilitates the funding of approved projects. This division also coordinates and monitors the progress of all current research and development activities and where appropriate, provides technical assistance to other Government agencies and private corporations conducting research in the nonconventional energy field.

The BED, including the NCRD, has a staff of approximately 100 professionals, of which 2 hold Ph.D. degrees and 6 hold Masters degrees in various fields of management, engineering and applied science. The Bureau has been able to offer sufficient inducements to attract staff from the private sector. Further staff increases are currently under consideration by the Budget Commission and are expected to be approved. The current staffing pattern of NCRD is shown in Annex 2G.

The present Director of the NCRD has a Ph.D. degree in chemical engineering and has had extensive experience in the management of energy research and development activites. Under his guidance the Bureau has made an impressive start in carrying out its mandate. Table 5 provides a summary of the research projects which are currently under consideration, are ongoing or have been completed.

TABLE 5

NCRD Projects: 1977 - 1978

Project Title	BED Funding	Implementing Agency
Regional Biogas Plants	₱ 120,000	B A I
BED Solar Water Heater	5,000	in-house
Producer Gas for Irrigation	40,000	UP/NSDB/NIA
Solar Aircon House	675,000	in-house
Solar Test Facility	750,000	in-house
Application of Alternative Sources of Energy in an Integrated Food Processing System	84,600	PSB/BATEK
Barrio Electrification Using Agricultural Waste Fuel	94,000	NSDP/NEA/EDF
Anhydrous Alcohol Pilot Plant	55,000	P S B
Wind Turbine Electric Power System at Basco Tadar Station	163,000	PAGASA
Alternative Energy System for Rice Producing Community	101,000	H S C
Communal System of Converting Waste to Energy	96,000	H S C
Alcogas Project	496,000	PNOC
Biogas Utilization for Internally Combustion Engines*	148,000	Maya Farms
Hybrid Windmill	59,000	P S B
Noncon Promotion Program	685,000	in-house
Pyrolysis of Waste	384,000	UNIDO/in-house
Crop Drying Using Hot Spring*	185,000	UPLB
Utilization of Low Pressure Gas Emanation	100,000	P S B
Solar Distillation*	157,000	UP/BAI

TABLE 5.

NRCD Projects: 1977 - 1978

Project Title	BED Funding	Implementing Agency
Utilization of Hot Spring Water for Power Generation*	₱ 412,000	Geothermal Div., BED
Cow Manure Biogas Production and Utilization in an Integrated Farm System at Alabang	120,000	B A I
Low Cost Continuous Flow Drying System Using Rice Hull as Fuel	159,000	UPLB
Design and Development of a 10-KW Hot Spring Power Plant*	305,000	DLSU
Integrated Energy System for a Small Island	227,000	H S C
Solar Water Heating Demonstration, Industrial Bottling Plant*	285,000	S M C
Solar Water Heating Demonstration, Commercial Hotel*	217,000	Zamboanga Factors
Rural Service Projects	75,000	in-house
Comprehensive Energy Resources/Site Survey*	500,000	Planning Div., DOE
Economics and Net-Energy Analysis of Biogas System*	82,000	NIST
Dendro-Thermal Power Pilot Plant*	1,500,000	NPC
Test for Solar Water Heaters*	695,000	in-house
Project Management (NCRD Operating Budget)	600,000	in-house
Sub - T o t a l	9,576,000	
Contingencies	300,000	
TOTAL	₱9,876,000	

* For 1978

While the Bureau itself does conduct a significant amount of research, the bulk of the pilot demonstration projects included under the proposed loan will be undertaken by other Government agencies and/or other local entities. The BED already has a well defined system of identifying, developing, and implementing projects through other agencies:

(1) the Bureau prepares a detailed scope of work for a specific applied research activity and identifies candidate sites.

(2) the Bureau solicits a technical/cost proposal from an appropriate Government Agency or private institution.

(3) the Bureau reviews and approves or rejects the detailed work plan and budget.

(4) if approval is granted, the Bureau advances the necessary funds to carry out the initial phase of the project.

(5) after reaching designated points in the implementation process, the Bureau reviews progress to date and makes a determination to continue the project as originally envisioned, redesign the activity, or to terminate the project.

(6) following completion of the project, the Bureau conducts a post-project evaluation to determine the technical, economic and social feasibility of replicating the results on a broader scale.

Proposals for some activities planned under the loan are already under consideration by BED while proposals for other activities will be solicited from appropriate sources. The National Electrification Administration, whose capabilities in the power distribution field are well documented, will be responsible for the design, installation and operation of the mini-hydroelectric units to be investigated. The University of the Philippines College of Engineering, which has conducted a significant amount of solar energy research in the past, will be heavily involved in the applied solar research envisioned. The Bureau of Forest Development of the Department of National Resources will participate in the "energy plantation" research and development, as well as the conversion of other forestry wastes into process steam, electricity, charcoal and liquid fuels.

While the Bureau's project development/implementation process is well-defined and the Bureau has effectively carried out its responsibilities for the past two years, the number and scope of additional projects to be undertaken under the proposed program will undoubtedly tax the existing staff. Therefore, to assess the capabilities of the BED, a team of three U.S. consultants visited Manila in November, 1977,

reviewed current research activities and discussed the proposed program with Bureau staff. The team concluded that, with the assistance of a full-time project coordinator and short-term technical consultants, and the inclusion of brief observation/familiarization trips by selected Bureau staff to appropriate U.S. institutions, BED would have the technical capability to effectively design and manage the demonstration projects. Consulting services will be financed under the grant portion of the program. Specialists in biomass conversion, direct solar conversion, small-scale hydropower, and photovoltaics have already been identified by ASIA/TR, and several participated in project design. The consultants will be made available to assist the BED in:

planning individual subprojects;
reviewing subproject proposals;
preparing technical specifications for hardware; and
reviewing and evaluating progress.

The BED is a relatively new organization and has had limited experience in contracting with expatriate personnel and firms. As the technical assistance to be provided under the grant element of the program will generally be required on a short lead time basis, the Mission contracting office will negotiate and administer the initial TA contracts after BED approves the bio-data for individual consultants. Procedures will be reviewed periodically to evaluate the need to continue this method of contracting. As the Mission Director can authorize the use of direct-AID contracts funded under grants, subsequent decisions as to the most appropriate method of contracting will be made on a case by case basis.

b. AID

Normal AID monitoring requirements will be carried out by USAID's Capital Development Office. While full-time assignment of a direct-hire staff member is not envisioned, a significant amount of the project manager's time will be required to effectively participate in the review of subproject proposals, assist the BED in procuring appropriate technical assistance, and arranging both short and long-term training for the staff of the BED and the various other implementing agencies. AID approval of technical proposals, including detailed work plans and budgets, will be required prior to the disbursement of loan funds for individual subprojects. Specialized consultants to assist USAID with these technical reviews will be used as deemed necessary. These services will be funded under the grant. As subprojects reach designated points in the implementation process, the USAID project manager will participate with representatives from the BED and U.S. technical consultants to evaluate progress, make recommendations for modifying the subproject design or concur in continuation of the activity as originally planned. AID monitoring requirements can be accomplished with the capital development staff proposed for FY 79.

D. FINANCIAL ANALYSIS AND PLAN

1. Financial Rate of Return

The Nonconventional Energy Development Project includes both loan and grant elements. Primarily, the grant will finance institution building, data collection, and the dissemination of information; hence there will be no revenue producing activities.

The loan will be utilized to finance applied research related to nonconventional energy technologies. The program is by definition experimental; therefore, actual cost projections allowing for meaningful financial analyses are not available. One of the basic objectives of this pilot project is to generate accurate capital, maintenance, and operating cost data which will enable the GOP to determine the financial feasibility of developing nonconventional energy resources on a broader scale.

Nevertheless, sufficient power will be generated under several of the subprojects to warrant marketing the energy produced during the operational phase of the program. In making the implementation arrangements for these subprojects, BED will negotiate agreements with the implementing agencies, most likely NPC or NEA, for marketing the power. In these instances it is anticipated that the plant will be tied into an existing grid, and the power will be sold directly to the local cooperative at prevailing rates. Revenue generated will be utilized to finance operating and maintenance costs. For other subprojects, O and M costs will be financed directly from project funds.

2. Budget Analysis of Implementing Agencies

The urgency of the energy problem in the Philippines is emphasized by the creation of a separate Department of Energy. The current GOP emphasis on developing indigenous sources of energy is evidenced by the increased expenditures over the past two years for applied energy research. Table 6 shows the development (project) and recurrent (operating) budgets which will be made available to the Bureau of Energy Development for nonconventional energy research during the planned four to five-year life of the AID-financed program.

TABLE 6

NCRD Budget (₱1000)

Year	1978	PY 1 1979	PY 2 1980	PY 3 1981	PY 4 1982	PY 5 1983
Recurrent	600	2,000	2,000	2,200	2,500	2,500
Development	9,800	14,900	11,400	13,100	10,100	10,400
Total	10,400	16,900	13,400	15,300	12,600	12,900

In addition to the direct financial and in-kind support to be provided by BED, approximately 10-15% of each individual subproject total cost will be contributed by the implementing agency. These funds will be committed prior to the initiation of any subproject. Table 7 is a breakdown of U.S. and GOP contributions for each subproject by project year. Table 8 is a summary of the BED and implementing agency contributions. All counterpart funds required for activities other than the pilot projects will be provided directly from the NCRD budget.

NCRD will undertake other applied research not directly related to the AID-financed program during the next four or five years; however, the subprojects to be financed under the loan will be the focal point of the NCRD program and will, in many instances, be extensions of work already underway or completed. The budget to be made available to BED for nonconventional energy research will be adequate to enable the NCRD to accomplish both objectives.

TABLE 7

Cost Breakdown Per PY (Pesos)

	FY 79 PY 1		FY 80 PY 2		FY 81 PY 3		FY 82 & 83 PY 4 & 5	
	U.S.	G.O.P.	U.S.	G.O.P.	U.S.	G.O.P.	U.S.	G.O.P.
1. Mini-Hydro	132,000	44,000	3,810,000	1,270,000	840,000	280,000	295,000	98,000
2. Micro-Hydro	156,000	52,000	3,258,000	1,087,000	785,000	262,000	332,000	111,000
3. Power of Waste	180,000	60,000	1,815,000	605,000	150,000	50,000	135,000	45,000
4. Pyrolysis	386,000	217,000	855,000	--	435,000	179,000	63,000	124,000
5. Solar Refrigeration	20,000	167,000	1,426,000	137,000	1,839,000	152,000	--	177,000
6. Solar Dryer	139,000	169,000	729,000	142,000	4,664,000	801,000	--	586,000
7. Solar Cells	84,000	135,000	754,000	--	400,000	300,000	--	181,000
8. Dendrothermal	200,000	258,000	22,148,000	4,866,000	4,083,000	10,000,000	259,000	64,000
9. Wind Power	750,000	250,000	1,500,000	500,0[illegible]	300,000	97,000	76,000	25,000
TOTAL	2,047,000	1,352,000	36,295,000	8,607,000	13,496,000	12,121,000	1,159,000	1,411,000
1. Surveys	200,000	150,000	400,000	100,000	150,000	100,000	150,000	100,000
2. Solar/Wind	--	115,000	675,000	25,000	375,000	150,000	--	130,000
3. Consultancy	788,000	141,000	788,000	141,000	788,000	141,000	788,000	141,000
4. Project Coord.	630,000	125,000	630,000	125,000	630,000	125,000		--
5. Participant T.	654,000	197,000	654,000	197,000	654,000	197,000	654,000	197,000
6. Public Info	470,000	165,000	250,000	105,000	200,000	85,000	250,000	95,000
TOTAL	2,742,000	893,000	3,397,000	693,000	2,797,000	798,000	1,842,000	663,000
GRAND TOTAL	4,789,000	2,245,000	39,692,000	9,300,000	16,293,000	12,919,000	3,001,000	2,074,000
($ equivalent)	(648,533)	(299,333)	(5,292,266)	(1,240,000)	(2,192,400)	(1,722,533)	(460,133)	(276,533)

TABLE 8

Source of Counterpart Funds for AID Project (Pesos)

Part 1

Activity	FY 79 PY 1 Total G.O.P. Counterpart	FY 79 PY 1 Implementing Agency Counterpart	FY 79 PY 1 BED Counterpart	FY 80 PY 2 Total G.O.P. Counterpart	FY 80 PY 2 Implementing Agency Counterpart	FY 80 PY 2 BED Counterpart
1. Solar dryers	169,000	84,000	85,000	142,000	71,000	71,000
2. Solar Refrigeration	167,000	112,000	55,000	137,000	91,000	46,000
3. Photovoltaics	135,000	68,000	67,000	--	--	--
4. Pyrolysis	217,000	108,000	109,000	--	--	-
5. Waste-fired thermal plants	60,000	30,000	30,000	605,000	300,000	305,000
6. Mini-hydro	44,000	22,000	22,000	1,270,000	635,000	635,000
7. Micro-hydro	52,000	26,000	26,000	1,087,000	544,000	543,000
8. Wind energy	250,000	125,000	125,000	500,000	300,000	200,000
9. Dendro Thermal	258,000	85,000	173,000	4,866,000	1,606,000	3,260,000
1. Project Coordinator	125,000		125,000	125,000		125,000
2. Short-term Consultant	141,000		141,000	141,000		141,000
3. Participants training	197,000		197,000	197,000		197,000
4. Surveys	150.000		150.000	100.000		100,000
5. Public Information	165,000		165,000	105,000		105,000
6. Equipment, Solar/Wind	115,000		115,000	25,000		25,000
Totals	2,245,000	660,000	1,585,000	9,300,000	3,547,000	5,753,000

TABLE 8

Source of Counterpart Funds for AID Project (Pesos)
Part 2

Activity	FY 81 PY 3 Total G.O.P. Counterpart	FY 81 PY 3 Implementing Agency Counterpart	FY 81 PY 3 BED Counterpart	FY 82 & 83 PY 4 & 5 Total G.O.P. Counterpart	FY 82 & 83 PY 4 & 5 Implementing Agency Counterpart	FY 82 & 83 PY 4 & 5 BED Counterpart
1. Solar dryer	801,000	401,000	400,000	586,000	312,000	274,000
2. Solar Refrigeration	152,000	102,000	50,000	177,000	165,000	12,000
3. Photovoltaics	300,000	150,000	150,000	181,000	10,000	171,000
4. Pyrolysis	179,000	89,000	90,000	124,000	75,000	49,000
5. Waste-fired	50,000	25,000	25,000	45,000	10,000	35,000
6. Mini-hydro	280,000	140,000	140,000	98,000	16,000	82,000
7. Micro-hydro	262,000	131,000	131,000	111,000	25,000	86,000
8. Wind Energy	97,000	72,000	25,000	25,000	19,000	6,000
9. Dendro Thermal	10,000,000	3,300,000	6,700,000	64,000	64,000	--
1. Project Coordinator	125,000		125,000	--		--
2. Short-term Consultant	141,000		141,000	141,000		141,000
3. Participant Training	197,000		197,000	197,000		197,000
4. Surveys	100,000		100,000	100,000		100,000
5. Public Information	85,000		85,000	95,000		95,000
6. Equipment S/W	150,000		150,000	130,000		130,000
Totals	12,919,000	4,410,000	8,509,000	2,074,000	696,000	1,378,000

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3. Financial Plan

Table 9 is a summary of the loan and grant elements of the proposed program as well as summary of the GOP contribution to the project. Table 10 is a projection of expenditures by fiscal years.

TABLE 9

Summary Cost Estimate and Financial Plan
($'000,000)

Item	AID Grant	AID Loan	GOP	Total	FX
Pilot Projects	--	5.647	2.516	8.163	4.786
Project Coordinator	0.202	--	0.040	0.242	0.170
Short-Term Consultants	0.336	--	0.060	0.396	0.280
Participant Training	0.279	--	0.084	0.363	0.279
Energy Survey	0.120	--	0.060	0.180	0.100
Solar/Wind Monitoring Equipment	0.140	--	0.056	0.196	0.110
Public Information/ Seminars	0.156	--	0.060	0.216	0.040
Sub-totals	1.233	5.647	2.876	9.756	5.765
Inflation 15%	0.185	0.847	0.431	1.463	0.865
Contingencies 10%	0.123	0.564	0.288	0.976	0.577
TOTALS	1.541	7.058	3.595	12.195	7.207
Total AID	8.599				

Note: AID grant figure rounded to 1.550
AID loan figure rounded to 7.100.

TABLE 10

Projection of Expenditures by Fiscal Year
($000)

Fiscal Year	A.I.D. Loan	A.I.D. Grant	G.O.P.	Total
1979	218	301	239	758
1980	3,871	358	1,016	5,265
1981	1,439	316	1,378	3,133
1982 & 1983	124	245	215	584
Sub Totals	5,652	1,220	2,848	9,720
Inflation 15%	848	198	427	1,473
Contingencies 10%	565	132	285	982
TOTALS	7,065	1,550	3,560	12,175
Total AID	8,615			

Note: AID loan figure rounded to 7.100.

E. IMPLEMENTATION PLAN

1. Demonstration/Pilot Projects

Implementors for individual subprojects will likely include the BED; other government agencies (NEA, NHA, BAI, etc.); local universities (UP, Diliman; UP Los Banos): and the private sector (Maya Farms, San Miguel Corp., etc.). On the basis of research activities carried out over the past two years, these agencies are known to have the technical expertise needed to carry out elements of the proposed program.

The operational flow chart for new projects to be considered or initiated by BED is shown in Annex 2H. Project proposals for the development of nonconventional energy resources are submitted to NCRD for evaluation and, subsequently, for funding. Guidelines for the submission of proposals are outlined in Annex 2I. The proposal must fully describe the work plan, the capability of the proponent and the reasonableness of budget, including presentation of itemized financial requirements. Proposal evaluation is carried out by the Project Development Group (PDG) chaired by the Director of NCRD and includes experts in the particular field under consideration. Data considered during the evaluation process is itemized in Annex 2J. For the proposed program, short-term U.S. consultants will participate in the evaluation process. We envision that U.S. consultants with expertise in solar energy, biomass conversion and small-scale hydropower, will assist the PDG during the planning and site identification stage, design phase, and during some part of the operational phase. Participant training, particularly for NCRD staff who are members of the monitoring and evaluation group, will be included in the program to enhance their expertise. This will be a continuing program to enable NCRD staff to keep abreast of developments in nonconventional energy utilization.

NCRD monitoring will consist of: on-site inspections; review of periodic progress reports; and review of financial statements. USAID will release funds quarterly to BED to allow advance payments to be made to the

contracted agencies. Funds will continue to be released as long as the contracted agencies maintain expected progress. By utilizing this process NCRD and USAID will control progress towards the accomplishment of the stated objectives.

Periodic evaluation of on-going projects will result in:

1. Termination of project
2. Revision of project structure
3. Continuation as programmed

Termination will result if critical evaluation criteria are not satisfied or if the project appears to be duplicating work being done elsewhere. Revision of the project design will be required in case of evident but remediable deficiencies. If the project meets the evaluation criteria, it will be allowed to continue. There also may be redirection of a project or transfer of funds from one area to another if government priorities change.

USAID will monitor progress through review of quarterly and annual reports and financial statements provided by the implementing agency and BED. Additional project information will be supplied by a full-time project coordinator who will also serve as a liaison officer with USAID.

2. Technical Assistance

a. Project Coordinator

BED, with the assistance of the USAID project manager, will develop a detailed scope of work for the project coordinator. BED, with AID assistance, will solicit resumes from U.S. consultants with appropriate expertise in managing energy related research activities. With AID approval, BED will make final selection of the contractor. We envision that the project coordinator will be employed under a host country contract; however, to facilitate the procurement process, BED may opt to have the USAID contracting office negotiate and administer a direct-AID contract with the selected consultant.

b. Short-Term Consulting Services

Short-term technical assistance will be required during the planning, implementation and evaluation of individual subprojects to be financed under the grant. The scopes of work for these services will be developed by the BED in conjunction with the project coordinator and the USAID project manager. The primary contribution of these specialists will be to assist the BED and the implementing agencies in: (1) technical design activities, including site reconnaissance and selection; (2) the preparation of technical specifications for hardware procurement; (3) the development of research programs carried out in conjunction with the pilot demonstration projects, particularly research in silviculture and solar radiation data collection, and (4) evaluation activities carried out both during project implementation and after project completion. ASIA/TR has already identified consultants with specialized experience in biomass conversion, small-scale hydropower, and direct solar

conversion. Several have actively participated in the project appraisal and have indicated an interest in further participation. Hence, the BED is familiar with the work and qualifications of many of these specialists. As their services will generally be required on a short lead-time basis, it is anticipated that, following approval of bio-data for specific individuals, consultants will be employed under direct-AID contracts be negotiated and administered by the USAID contracting office.

c. Other Professional Services

BED will solicit technical proposals from qualified U.S. or local institutions to conduct a comprehensive study aimed at developing a profile of current energy use patterns and energy resources in rural areas of the Philippines. The ultimate goals are to identify energy deficiencies that impede the development of the poor rural community, and to determine if nonconventional energy resources can be employed to correct the deficiencies. The study envisioned is an extension of work already begun by the BED. The detailed scope of work for the survey will be prepared by the BED with the assistance of the project coordinator and other grant financed technical consultants, if required. The scope of work will be reviewed and approved by USAID prior to the solicitation of technical proposals. The contractor will be employed under a host country contract and selection will be made in accordance with criteria contained in Chapter 1 of the Country Contracting Handbook.

3. Commodity Procurement

Hardware and equipment required will be procured through the formal competitive bidding procedures defined in Chapter 3 of AID Handbook 11. Technical specifications and design drawings, if required, will be developed by the BED and/or the implementing agencies with the assistance of U.S. technical consultants. The notice and instructions to bidders, bid form, and general terms and provisions of the supply contracts will be similar to documents used by other GOP agencies for offshore procurement and will be prepared by the Bureau with the assistance of the USAID project manager. All supply contracts will be awarded to the low responsive qualified bidders. Normal AID approvals, specified in Handbook 11, will be required during the procurement process. We anticipate that the bulk of the equipment will be of U.S. source and origin; however, some Code 941 countries in Asia, particularly Taiwan, Korea, and India, may provide a portion of the hardware required.

4. Construction/Installation Services

Some individual subprojects will involve construction/installation activities which are beyond the capabilities of the implementing agencies. In these instances, construction contracts will be awarded to local firms with the capacity to carry out the required work. Formal bid documents will be prepared by the implementing agency, in conjunction with BED, and approved by AID prior to the solicitation of bids. Bidding and evaluation procedures will be in accordance with Chapter 2 of Handbook 11.

Contract awards will be made to the low responsive qualified bidders, and all contracts will be subject to AID approval. Local currency disbursements under the loan will be utilized to make progress payments to the contractors.

5. Participant Training

Both short and long-term participant training will be financed under the program to improve the institutional capabilities of the Bureau of Energy Development and other implementing agencies. Six long-term participants are programmed over the five-year life of the project. Candidates for this training will be proposed by BED and approved by USAID. Long-term participants will normally have the equivalent of an undergraduate degree in engineering or one of the physical sciences. Post graduate training in energy-related fields such as fuel science and solar technology is envisioned under this element of the program.

Twenty short-term participants (2-4 months) have also been scheduled over the life of the project. The bulk of this training will be carried out at appropriate solar energy laboratories in the U.S., such as the Solar Energy and Energy Conversion Lab. at the University of Florida and the Energy Laboratory at M.I.T. Short-term participants will engage in this training in connection with the planning and/or implementation of specific subprojects. Training will include:

(1) basic theory

(2) observing actual equipment (flat and concentrating solar collectors, solar cells, and solar refrigeration units) in operation.

(3) working with the equipment.

(4) modifying available equipment or designing new hardware for a specific use.

6. Implementation Schedules

The overall implementation schedule for the proposed project follows:

(1)	Loan Authorization by AID/W	May 30, 1978
(2)	Initiate Procurement Action for Project Coordinator and Initial Group of Short-Term Consultants	May 30, 1978
(3)	Loan/Grant Agreement Executed	July 30, 1978
(4)	Conditions Precedent to Initial Disbursement Met	Sept. 30, 1978

(5)	Project Coordinator and Initial Group of Short-Term Consultants Arrive	Oct. 30, 1978
(6)	Commence Development of Energy Plantation	Oct. 30, 1978
(7)	Complete Processing Initial Long-Term Participants	Nov. 30, 1978
(8)	Complete Subproject Designs and Issue Requests for Technical Proposals	Dec. 30, 1978 to Mar. 30, 1979
(9)	Initial Participants Depart	Jan. 30, 1979
(10)	Complete Implementation Arrangements	April 30, 1979
(11)	Complete Equipment/Hardware Designs and Initiate Procurement	July 30, 1979
(12)	Complete Procurement (Equipment Delivered)	April 30, 1980 to Mar. 30, 1981
(13)	Complete Processing Final Long-Term Participants	Nov. 30, 1980
(14)	Complete Equipment Installation and Commence Operations	Mar. 30, 1981 to Sept. 30, 1982
(15)	Complete Pilot Plant Operations	July 30, 1981 to Sept. 30, 1983
(16)	Complete Subproject Evaluations	Oct. 30, 1981 to Dec. 30, 1983
(17)	Final Participants Return	Jan. 30, 1983
(18)	Terminal Disbursement Date	Mar. 30, 1984

Note: Short-term technical assistance and observation/familiarization trips will be programmed over the anticipated 5-year life of the project. The most appropriate time to conduct the regional energy conference has not yet been determined.

PROJECT IMPLEMENTATION SCHEDULE

9-30-78

NO. OF MONTHS: 0, 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66

SUB-PROJECT	Phases
1. Solar, Dryers for Agricultural Products	I, II, III, IV, V, VI, VII
2. Solar Refrigeration System	I, II, III, IV, V, VI, VII
3. Solar Cells Powered Irrigation Pumps	I, II, III, IV, V, VI, VII
4. Pyrolysis	I, II, IV, V, VI, VII; III
5. Waste Fired Thermal Plant	I, II, III, IV, VI, VII
6. Mini Hydro Power (500 KW) 1 Unit	I, II, III, IV, V, VI, VII
7. Micro Hydro Power (10-100 KW) 3 Units	I, II, III, IV, V, VI, VII
8. Wind Power	I, II, III, IV, V, VI, VII
9. Dendro Thermal Plant Coupled with Energy Plantation 3-5 MW	I, II, IV, V, VI, VII; III*

I - Site Selection and System Definition
II - Institutional and Implementor Arrangement
III - Engineering Design III* - Plantation Development
IV - Equipment Procurement/Fabrication
V - Installation/Construction
VI - Operation
VII - Technical/Socio-Economic Evaluation

F. EVALUATION PLAN

Periodic evaluations of on-going subprojects will be conducted by representatives of the BED assisted by short-term U.S. specialists in the energy technology under consideration. These evaluations will normally be carried out at the end of each phase of the implementation process as noted in the implementation schedules. Factors to be considered during these routine evaluations will include:

(1) general progress toward attainment of objectives outlined in the subproject proposal.

(2) further research and development data from the industrialized countries which might have some bearing on the viability of the technology under consideration.

(3) preliminary survey data on energy demands and resources of rural areas of the Philippines which might affect the feasibility of replicating results on a larger scale.

(4) unexpected developments in locating, developing or exploiting other indigenous energy resources which might suggest altering some elements of the nonconventional energy program.

On the basis of these periodic evaluations, the BED will make a determination to either:

(1) continue the subproject as originally envisioned;
(2) redesign or redirect the activity; or
(3) terminate the activity.

A more formal socio-economic evaluation will be undertaken following completion of the operational phase of each subproject. The evaluation will explore the socio-economic factors and their effect on the energy use in the country. Baseline data required for the evaluation will be generated through extension of the energy use study already begun by BED. The survey will include:

(1) estimating current fuel use by sector, end use and area.

(2) conducting an energy source assessment by type, temporal distribution and location.

(3) developing village energy budgets for typical villages in each of the major identified agricultural systems of the nation.

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(4) relating economic and social development in each area to energy development by identifying energy bottlenecks to improving the quality of life.

(5) matching available energy sources to end-use needs in terms of quantity and spatial and temporal patterns.

(6) projecting alternative energy futures based on assumed growth rates and sources of energy.

Based on the results of the individual demonstration projects and an analysis of the data generated from the energy survey, realistic determinations can be made regarding the technical/socio-economic feasibility of replicating the results on a broader scale.

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PROJECT ANALYSIS

1. Social Analysis

Preface

The purposes of this analysis are to examine the socio-cultural landscape into which this project will fit, determine its potential for diffusion, and discuss its social consequences and potential benefits.

It should be understood at the outset that this project is an experiment in developing alternative sources of energy. The reason for the experiment is to learn whether or not certain small-scale non-conventional energy technologies are applicable to the Philippines. Given the tentative nature of the project and the fact that sites for subprojects have not yet been determined, it is not possible to discuss with precision how many people will benefit, who these people are, and the manner in which the project will affect them. However, judging from current energy use in the rural Philippines and from what is known of the rural electrification experience, an attempt is made to foretell in general terms and with cautious predictions how this project will be received and how it may benefit people.

A. The Project

The need for developed energy alternatives in the rural Philippines is compelling. Geography and limited resources make the extension of the electric grid to all areas of the country slow or impossible. The Philippines continues to import fossil fuels and these fuels are unlikely to be allocated to rural areas due to high cost and the lack of a transmission system. Similar problems are encountered with other conventional alternatives (coal, geothermal and nuclear): the cost is high and the transmission system is lacking.

The Nonconventional Energy Project will assist the Philippine government in organizing, implementing and evaluating pilot nonconventional energy programs. The projects will be developed, tested and analyzed in energy deprived areas of the country, and then suitable projects can be further developed on a larger scale.

B. The Sociocultural Landscape

Attempting to implant or transfer an innovation to any new milieu means confronting the economic, cultural, social, and institutional barriers that impede change; no one familiar with the problem of accelerating development has any illusions about the speed with which this can be achieved. In coping with the social forces that have played upon his personality and society, the Filipino has continually demonstrated adaptability and receptivity to change[1]. Learning to use energy in new forms and new ways

1/ Cordero, Felicidad, General Sociology: Focus on the Philippines. Ken, Inc., 1977, pp. 42-61.

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will be an equally interesting challenge. The communities in which these technologies will be tested are tradition-dominated rural societies geared to subsistence living and imperfectly linked to imperfectly organized markets and culture centers. Desire or capacity to participate in development projects is low among the very poor and programmers must be aware of the obstacles that slow the acceptance a . dissemination of any teachnology.

Despite the social setting and the various elements of resistance, it may be said that nothing unique or specific exists in the target beneficiaries' social heritage or value system that would preclude experimentation with innovative technology. No cultural barrier or conflict can be identified which will block or forever make acceptance of this project impossible. In fact, because this innovation holds promise for meeting some of the felt needs of the rural people -- electricity, irrigation, more and better water -- there should exist substantial motivation on their part to consider it.

Any list in which community priorities are ranked invariably shows water (for irrigation and human consumption) and electricity among the top ten "needs" or "problems" as perceived by the rural people themselves. For example, from the study, Let My People Lead, a list entitled, "Problems Perceived as Important by Bicol River Basin Household Heads," ranks electricity seventh in order of importance and irrigation among the top five.1/. In a survey conducted in 1974 on the barangay Alibocboc in the province of Pangasinan, the community placed electricity first on their list of priorities and a water system second.2/

There is, of course, great motivation on the part of the Philippine government to see the nonconventional energy project succeed as the Philippines is an energy-importing nation. The slogan heard daily on radio and television and disseminated widely in print, "Save energy - Save yourself" has heightened the population's awareness of energy shortages. While it is doubtful that the target beneficiaries, isolated as they are, have been appreciably affected by such a campaign, it is undeniable that the project is in harmony with the development programs of the national government and as such there has already been some public preparation for it.

Although this project represents the first of its kind in the Philippines, there are already in successful operation limited applications of nonconventional energy. For example, windmills exist in Batangas and Laguna. In Mindoro Oriental the government has built a wind-driven electric dynamo and the University of the Philippines is experimenting with methane digestors. The International Rice Research Institute, also in Laguna, is conducting considerable research on a wind device to pump water for irrigation. Therefore, while this project is the first organized effort at installing and testing nonconventional energy sources, the Philippines has already shown sufficient interest in the technology to begin some small-scale experimentation of its own.

1/ Lynch, Frank, et. al., Let My People Lead. Institution of Philippine Culture, Ateneo University, 1976, p. 37.

2/ Howe, James W. and Knwland, William E., "The Potential of Small-Scale Renewable Energy Techniques", Focus, 1977/3 p. 20.

Although non-conventional energy technology is being tested in other areas of the world, the Philippine setting is unique in that it will field test sub-projects in areas that resemble future application sites. Close scrutiny will be given to progress of the transfer process, and the BED will attempt to isolate the factors that insure program support. Several of the principles being incorporated into the research effort and rural application include:

(1) Barangay residents must be the ones to manage and maintain the system. If rural residents are interested and willing to undertake such a program, it will be because they perceive that the energy source will contribute to their deveelopment and well-being. An important part of the process will be involving villagers in tests and encouraging them to help evaluate results.

(2) The initial projects must be simple. Hardware must be suited to the resources and needs of individual communities. The specific primary energy sources, e.g. sun, wind, or organic wastes, and the tasks to be performed should be carefully determined jointly by the experts and the beneficiaries prior to the selection and installation of the particular device.

(3) It must not be too expensive. A basic goal should be for the technologies to pay for themselves. Because of their generally heavy initial capital cost, full front end payments by beneficiaries will not be feasible. Government subsidies will be necessary just as they now are for the rural electrification project. Increased productivity and reduced fuel costs eventually should compensate for this initial capital burden.[1]

C. Diffusion

Since this project is an experimental one, diffusion of the innovation beyond the initial target population is a critical issue. Again, desire or capacity to participate in development projects is low among the very poor and as the target group shifts more to the poor, the achievement of spread effects will become even more difficult. However, news of the benefits of nonconventional energy devices, and finally the devices themselves, can be expected to diffuse if most or all of the following conditions are present:

(1) There is an awareness of the device. Communication between people as to the existence, availability, and success of a small hydroelectric unit or crop dryer must occur. Leadership authority patterns from the national level to the barangay level should spread the ideas both vertically and horizontally. Mobility of the population will also serve to diffuse progress of the device - the migrations of students, workers, officials, visitors. Disseminators will include barangay officials, leaders, and the media.

1/ Howe, James W. and Knowland, William E., "The Potential of Small-Scale Renewable Energy Techniques", Focus, 1977/3 p. 30.

(2) Experimentation and testing of the device is sufficiently extensive to demonstrate economic benefit. People with very limited incomes have little money to risk. Actual examples of positive results in the form of increased income and satisfied users will have to be made clear to future beneficiaries.

(3) The benefits prove immediate and tangible. Any project that does not show rather immediate and tangible results will not diffuse. Farmers for example, may be motivated to adopt an innovation when they are convinced an increase in palay per hectare will follow.

(4) The benefits accrue directly to the people involved. What can be expected to motivate the target population is an innovation that will benefit them and their families direct. What will activate them is a demonstration as to how project will irrigate their land, increase their income, ease their burdens, improve their lives.

D. Social Impact and the Distribution of Benefits

While the Philippine Bureau of Energy Development is the recipient of the loan proceeds, the energy deprived inhabitants of small, remotely located communities will be the long-term beneficiaries of the proposed experimentation.

Because specific sites where subprojects will be implemented have not yet been determined, specific information regarding the beneficiaries cannot be provided. But because the projects are designed to work in remote, unenergized areas, what can be provided is a description of such areas and the life people lead there.

A typical beneficiary family will live in a remote, rural community that has heretofore been largely by-passed by development efforts. The head of household will probably be a farmer or a fisherman. Lack of irrigation makes more than one cropping unlikely for the farmer and the absence of refrigeration makes cold storage of fish impossible for the fisherman. Because 80 percent of the rural communities have not formal water system, women and children must apportion considerable time each day to portering water from a well as far as two kilometers away. With the probability of contamination great, throughout their lives, family members will suffer from water-borne diseases. The beneficiary family will live in a dwelling of nipa palm or salvaged wood lacking most amenities. Precise annual income figures are unavailable, but the beneficiaries will represent the lowest 40 percent of the nation's economic strata. While rural communities and rural families vary in size, the average family has six members and the average community has a thousand people. Irrespective of size, however, rural communities and rural families share four characteristics: they are predominantly agricultural, they are poor, they lack adequate sanitation and health facilities, and they are socially and physically isolated.

Currently, rural residents spend a large portion of their day gathering fuel, carrying water, and pounding grain. Since these activities must go on even during periods of the crop cycle when the demand for labor is greatest, they interfere with production. More available energy could permit increases in the cultivation, irrigation, harvest, and storage of crops. For example, the adaptation of existing solar drying techniques for use in farming communities could make a significant impact on production. An estimated 10 percent loss of the rice harvest is attributed to incomplete and/or inefficient drying resulting in crop spoilage. A solar grain dryer in the village will decrease losses.

The lack of plentiful potable water in rural communities poses a number of problems in health and environmental sanitation and the need for convenient and inexpensive sources of safe water is acutely felt. Increased energy could supply clean water for drinking and hot water for sanitation. Increased energy could also supply villages with more water as sheer quantity is often a problem.

Wind energy could be used for pumping fresh water for domestic, livestock and agricultural needs, and generating electricity.

Improved communication stemming from the availability of modest amounts energy will impact on agricultural problems, public health, nutrition, and family planning. Refrigeration or ice boxes would enable rural households to benefit from an increased utilization of available foodstuffs and the attention now focused on the daily quest for food could be turned to other endeavors.

To the extent that this project would improve the quality of life for the rural Filipino male, it would improve the quality of life for the female. Certain subprojects can be expected to impact directly and equally on both sexes; however, the subprojects that provide electricity in the home would specifically benefit women. The typical rural woman perceives her role in society as that of housekeeper.[1] She spends at least 29 days a month and a minimum of eight hours a day on this activity. In addition, she shares equally in the struggle for economic survival taking on the subsistence part of farm work as an unpaid laborer. Little time is left for recreation or self-growth.[2] Whatever direction electricity development might take, its presence in the lives of rural women presents the potential for an improved existence.

1/ Rojas-Aleta, Isabel, et. al., A Profile of Filipino Women. Philippine Business for Social Progress, p. 195.

2/ Nationwide Survey on the Socioeconomic Impact of Rural Electrification. National Electrification Administration. Completed in 1977, as yet unpublished.

Another major benefit of this program is the fund of non-conventional energy knowledge. Philippine energy policymakers will have available a body of useful information. Also, there would be a much better understanding of how to best introduce new energy technologies to rural communities.

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ANNEX 2

LOG FRAME

Goal	Measures of Goal Achievement	Means of Verification	Important Assumptions
To develop alternative energy sources for use in the Philippines that allow the GOP to decrease its dependence on foreign fossil fuels	Decrease in percentage of energy requirements supplied by foreign fossil fuels	Data from: Department of Energy and National Economic Development Authority	GOP fossil fuel importation continues to consume foreign exchange thus making the development of alternative energy sources a continuing priority for the country
Purpose	**End of Project Status**		
To test economic and technical feasibility of non-conventional energy sources as a substitute for fossil fuels, with particular emphasis on those sources that are available in rural areas.	DOE has full reports on the sub-projects that indicate economic and technical feasibility in addition to assessing replicability and social acceptance. GOP develops plan for use of non-conventional energy that draws on govt. and private sector support and financing	Reports are available and projects continuing, replicable sub-projects are funded by the DOE/GOP or by private sources NEDA planning documents DOE budget proposals	Private sector willing to support non-conventional energy generation Development on non-fossil fuel/energy sources continues to be GOP and private investor priority Non-conventional energy is socially acceptable
Outputs	**Magnitude of Outputs**		
Working field projects in the fields of: solar energy, wind energy, biomass conversion and small scale hydropower Participant training Information sharing conferences and workshops Energy library/information center Functioning solar and wind monitoring and test centers	Solar: drying units, refrigeration units, irrigation pumps Wind: 20 water pumps, 12 wind turbines for electricity Biomass: dendro-thermal plant, waste-fired thermal plant, pyrolitic converter Hydro: 12 micro hydros (100 Kw) 1 mini hydros (500 Kw) 6 long terms and 20 short term participants 12 energy workshops/seminars	Observation, DOE and AID records and evaluations	Appropriate staff can be either recruited or trained both in US and in the Philippines
Inputs	**Implementation Target**		
USAID: $ 7,100,000 (loan) $ 1,550,000 (grant) GOP : $ 3,595,000 (₱ costs)	Grant: 79 80 81 82 83 Training x x x x x Staff x x x x x Conference x Equipment x Loan: Solar x x x x x Hydro x x x x x Wind x x x x x Biomass x x x x x	Budget records and audits	USAID: Full allotment will be received as planned GOP: Budget requirements will be allotted as planned and non-conventional energy exploration and research remains priority

Project Description

Goal:

The goal of this project is to develop alternative energy sources for use in the Philippines that allow the GOP to decrease its dependence on foreign fossil fuels. In 1977, 93.8% of the Philippine energy demands (that have an economic cost) were met with imported oil. The remaining 6% of energy needs were satisfied with coal and hydro energy sources. Since the Government of the Philippines is presently relying on foreign imports to satisfy nearly all of its energy needs, the country's economy (in 1977, crude oil importation made up 28.9% or $1.1 billion of total imports to the Philippines) is heavily dependent upon the pricing and productive capacity of the oil producing nations. Clearly, the nation must develop alternative energy sources in order to free the Philippines from almost complete dependence on the oil cartel for its energy needs.

In the Government of the Philippine's ten-year power development plan of October 22, 1977, a National Energy Policy has been formulated to: "promote the stability in the growth of energy supplies while maintaining equity in energy distribution within the country that is aligned with areas identified as priority for social and economic reasons." In addition, the GOP's Department of Energy is seeking to explore new sources of energy for the country. Although fossil fuels will continue to supply a major portion of the future Philippine energy needs, the Government intends to step up research and development activities in the two major energy resource areas;

domestic natural resources (oil, coal, geothermal and nuclear) as well as nonconventional energy resources - heretofore underdeveloped.

Purpose:

The purpose of this project is to test the economic and technical feasibility of nonconventional energy sources to develop an appropriate alternative to foreign-procured fossil fuel. By 1985, the Government of the Philippines hopes to develop nonconventional energy sources to the extent that they can supply nearly 1% of the country's energy needs. By the year 2000, the government projects that a little over 10% of its energy requirements will be supplied by nonconventional energy sources. The increase in the reliance on nonconventional energy sources will be accompanied by a comcomittant percentage decrease in oil dependency as well as an increase in other energy alternatives. Projections for the future usage of various energy sources is given below:

Energy Source	Equivalent MMB and % Distribution		
	1977	1985	2000
Hydro	4.6 (5.5%)	14.6 (8.8%)	37.0 (8.0%)
Geothermal	--	14.0 (8.5%)	46.0 (10.0%)
Oil	83.4 (93.8%)	119.2 (72.0%)	245.0 (53.0%)
Coal	.6 (.7%)	10.7 (6.5%)	46.0 (10.0%)
Nuclear	---	6.0 (3.6%)	41.0 (8.9%)
Nonconventional	---	1.0 (.6%)	47.0 (10.1%)
	88.6 (100.0)	165.5 (100.0)	462.0 (100.0)

Upon completion of the project, the Department of Energy will have complete reports concerning the various experiments in non-conventional energy sources funded under the project. In addition to the technical and economic feasibility of the project, the DOE will also be interested in determining the social acceptability of the individual methods of energy generation, as many of the specific projects will be suited to a rural application. The degree of social acceptability will have a strong influence over the willingness of private investors to exploit alternative nonconventional energy sources.

It is assumed in the project that the development of alternative energy sources will remain a high priority for the Philippine's Department of Energy for two major reasons:

-- oil is fast becoming more valuable as a chemical resource rather than an energy source, thus stimulating alternative energy development.

-- even if oil is discovered on the Philippine archipelago -- specifically in the Palawan area -- it will be many years before it is commercially exploitable thus emphasizing the immediacy of the Philippine energy problem.

Nonconventional energy source exploration is particularly appropriate for the Philippines as it exploits non-cost, non-depletable resources and is suited for rural populations previously unserved due to economic and logistical considerations.

Outputs:

The Nonconventional Energy Development Project is made up of nine individual subprojects designed to explore the development of alternative renewable energy sources appropriate for use in the rural Philippines. Demonstration projects will be developed in four major areas:

-- Direct solar conversion

-- Small scale hydropower

-- Wind energy

-- Biomass conversion

The first area, solar energy, will concentrate on three specific subprojects:

1. Solar drying units - Essentially these will be drying units appropriate for drying rice, other grains, fruit, other foodstuffs and tobacco
2. Solar refrigeration units - Development of refrigeration units that could be used in remote rural areas to preserve perishable foodstuffs: particularly meat and fish.
3. Solar power irrigation pumps - Development of twenty small scale irrigation pumps powered by solar energy for use in remote rural areas not yet served by electricity and having limited access to other popular energy sources.

In the area of wind energy, the project intends to sponsor two research efforts:

1. Wind-driven water pumps -- Development and installation of 15-20 wind-driven water pumps for agricultural and domestic use.

2. Wind-driven electrical turbine -- Installation of 10-12 wind-turbines for rural electricity generation.

In the third area, biomass conversion, the project will explore the feasibility of three biomass conversion activities:

1. Construction of a dendro-thermal plant to be fueled from an energy plantation.

2. Construction of a waste-fired thermal plant to generate electricity for domestic and industrial use.

3. Construction of a pyrolitic converter for the production of charcoal, pyrolitic oils and producer gas.

The fourth area, small-scale hydropower, will concentrate on two projects:

1. Design and installation of one micro-hydroelectric generating units (200-500 kw).

2. Design and installation of twelve mini-hydro (10-100 kw) units to be installed to supply off-grid power needs.

All of the above subprojects will concentrate efforts in remote rural areas that would not have access to conventional power/energy sources, and will greatly enhance the development potential for such areas. The more successful project activities may eventually supplant the need for costly conventional energy sources thus providing needed

energy sources for rural area, saving the Government of the Philippines sorely needed foreign exchange funds, and promoting the use of non-polluting, environmentally safe energy resources.

In addition to the application of currently available alternative energy technologies, the program will also include:

-- short and long term participant training at relevant U.S. institutions to improve GOP institutional capability to conduct independent research .

-- country-wide seminars for the exchange and dissemination of information.

-- procurement of equipment for the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) to establish a comprehensive network of solar radiation and wind monitoring stations .

-- procurement of research equipment, books and technical journals.

-- procurement of commodities enabling BED to establish a library and permanent information and display center .

Following the construction and operation of all subprojects, an evaluation will be conducted in order to determine the technical/economic feasibility of projects. The two major answers sought during the evaluation will be whether the project is replicable at the present scale and can be duplicated on a larger scale.

If the results are favorable, it is thought that AID would want to continue partial funding of further research efforts either in the Philippines or in other developing nations. Once conclusive proof of the viability of a specific project is obtained it is assumed that Philippine private industry will begin exploitation through the manufacturing of the appropriate hardware and the distribution of both commodities and technical expertise.

Inputs:

The grant requirements of the proposed nonconventional energy development project are $1,550,000 in U.S. funds, and $450,000 in GOP funding making a total of $2,000,000. The money will be spent for a project coordinator, short-term consultants, participant training, surveys, workshops, equipment and a regional energy conference. The loan portion of the project will include $7,100,000 from USAID funding and $3,146,000 in GOP contributions. The foreign exchange costs are are estimated at $5,984,000 and the money will be spent on actual project development and research. The project is expected to run for five years and the terminal date for disbursement is fiscal year 1983.

Nonconventional Energy Development

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INITIAL ENVIRONMENTAL EXAMINATION

Project Location : Republic of the Philippines

Project Title : (Energy Exploration and Development) Nonconventional Energy Development

Funding : FY 78 Development Loan - $ 8,000,000

Life of Project : 4 years following the signing of the Loan Agreement

IEE Prepared by : Dr. Wayne Murphey and John B. Saccheri
Penn State University USAID/Philippines

Date : October 13, 1976

Environmental Action Recommended: Negative Determination

Concurrence: _____ Date: 10/28/76
Charles C. Christian, Acting Director

Assistant Administrator's Decision: AA/ASIA 10/27/77

_____ 10/27/77
Approval of Environmental Action Recommended

_____ _____
Disapproval of Environmental Action Recommended

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Nonconventional Energy Development

I. Examination of Nature, Scope, and Magnitude of Environmental Impacts

A. Description of Project

This project will explore three areas of non-conventional energy sources: (1) Direct Solar, (2) Bio-mass and (3) Wind Power. Direct Solar applications include photovoltaic, water heating, and crop drying. Bio-mass will be examined in bio-gas generation units and as direct-fired fuel sources. Windmills are to be applied to water pumping and electric generation. Each of these individual projects will be developed to the demonstration stage. This program which will be supported with USAID financing during its initial four to five-year development period will focus on the construction of prototype structures, with designs adaptable to educational units, community centers and small commercial buildings. Verification and modification of the above system designs would permit subsequent construction of final design units within a few years of the individual project's onset. Several of the above system designs would be oriented to standardized module construction, ease of maintenance and, where possible, utilization of materials fabricated within the Philippines. Crop Dryers would be largely constructed from local materials using available labor supplies. The photovoltaic system envisioned will consist of an array of silicon cells hooked up to a storage battery and a two-way radio or direct current type TV set. The power rating could be from 5 to 20 watts. Bio-conversion of organics is a product oriented research project in which raw materials will be developed into specific products. The products of the enzyme action on biomass are glucose and residue. The glucose is modified by yeast to produce an alcohol. The alcohol is fuel that can be mixed with gasoline or burned. In bio-gas processes the organic materials are reduced to simpler compounds by biota. The transformation is through a form of digester. The products of the biota action are methane, glucose and residue depending on the process. Methane is the principle product in the digestion of organic wastes and is termed bio-gas. An additional approach to the biomass scheme would be the generation of forest plantations as a direct feed to energy production. Fast growing wood species as Ipil-Ipil would provide a convenient biologic base for these "energy plantations". The combination of prolific tree growth rates and a ready supply of labor for the establishment, management and harvesting of this crop should provide a source of energy competitive with fossil fuels.

There are areas in the Philippines where winds are sufficient and constant to be used as an energy source. Plans call for placing wind driven pumps and generators in areas where winds are reliable. Mini and micro-hydro systems use falling water to generate both mechanical and electric power. Probable sites will be identified, power requirements quantified, and power units placed. Water head and local power needs will define the type of hydro system to be constructed at a given site.

B. IMPACT IDENTIFICATION AND EVALUATION FORM

Impact Areas and Sub-areas[1/]	Impact Identification and Evaluation[2/]
A. LAND USE	
1. Changing the character of the land through:	
a. Increasing the population	N
b. Extracting natural resources	L
c. Land clearing	L
d. Changing soil character	L
2. Altering natural defenses	L
3. Foreclosing important uses	N
4. Jeopardizing man or his works	N
5. Other factors	
_____	_____
_____	_____
B. WATER QUALITY	
1. Physical state of water	N
2. Chemical and biological states	N
3. Ecological balance	N
4. Other factors	
_____	_____
_____	_____

1/ See Explanatory Notes for this form.

2/ Use the following symbols:
- N - No environmental impact
- L - Little environmental impact
- M. - Moderate environmental impact
- H - High environmental impact
- U - Unknown environmental impact

Nonconventional Energy Development
IMPACT IDENTIFICATION AND EVALUATION FORM

C. ATMOSPHERIC

1. Air additives ---------- N
2. Air pollution ---------- N
3. Noise pollution ---------- N
4. Other factors

D. NATURAL RESOURCES

1. Diversion, altered use of water ---------- N
2. Irreversible, inefficient commitments ---------- N
3. Other factors

E. CULTURAL

1. Altering physical symbols ---------- N
2. Dilution of cultural traditions ---------- N
3. Other factors

F. SOCIO-ECONOMIC

1. Changes in economic/employment patterns ---------- N
2. Changes in population ---------- N
3. Changes in cultural patterns ---------- N
4. Other factors

IMPACT IDENTIFICATION AND EVALUATION FORM

G. HEALTH

1. Changing a natural environment ---------- N
2. Eliminating an ecosystem element ---------- N
3. Other factors

_____ _____

_____ _____

H. GENERAL

1. International impacts ---------- N
2. Controversial impacts ---------- N
3. Larger program impacts ---------- N
4. Other factors

_____ _____

_____ _____

I. OTHER POSSIBLE IMPACTS (not listed above)

_____ _____

_____ _____

_____ _____

See attached Discussion of Impacts.

C. Discussion of Impacts

The individual projects planned under the five-year AID assisted program are in the nature of controlled experimentation for the purpose of research and will be carefully monitored. All of the projects, except Energy Cropping, which shall be treated in detail shortly, are confined to small physical areas. In direct solar applications work, the areas involved are the flat-plate collector areas which can be up to 1000 ft^2 for a single building installation. In terms of inducing environmental effects, such an area is way below what could be called as the threshold of concern. It can therefore be generalized that the development and use of the solar energy devices or systems planned in the program will not create chemical or thermal pollution, will not change the character of the land and will not affect local, national or global ecological balances in any perceptible manner.

Energy plantations must be managed to insure a continuing supply of material while maintaining a balanced ecosystem. A legume, Ipil-Ipil, is the initial test tree, it fixes nitrogen in the soil and enriches it. Continued cropping can deplete other soil nutrients and these must be monitored to insure soil productivity is not reduced. Ash from conversion systems may be placed back on the plantation to supplement the nutrient cycle. Any monoculture may be subject to disastrous fungal or insect attack. Care will be exercised to assure such an occurrence, if it happens, will be remedied.

Combustion of biological materials return to the atmosphere oxides of carbon and water. High stack temperatures reduce the particulate matter escape to the air. Sulfur is found in trace amounts in the bio-mass and therefore bio-mass incineration is not polluting. Growing bio-mass utilizes the products of bio-mass combustion thus carbon and energy cycles are short.

D. Conclusion

The environmental effects are beneficial in that solar exploitation is non-polluting and non-depleting. Biomass management can be such as to assure that detrimental effects do not occur. The replacement by non-conventional renewable energy sources instead of sulfur containing fossil fuels will reduce air pollution. The shortened heat and carbon cycles will diminish global thermal enrichment problems. It is, therefore, concluded that the implementation of individual projects under this AID assisted program will be beneficial or have very minor or no impact on the environment.

II. Recommendation for Environmental Action

The individual projects planned under this AID assisted program are in the nature of controlled experimentation for the purpose of research and development of prototypes and extension of existing technologies. Program work will be confined to small areas and will be carefully monitored. It is concluded that this project will not have a significant effect on the environment and, therefore, a "Negative Determination" is appropriate.

SOLAR DRYERS FOR AGRICULTURAL PRODUCTS

The Solar Dryers will directly collect, store and use energy from the sun to dry agricultural products. Twenty units will be installed in the selected agricultural regions.

	Project Phases	No. of Months	Costs	FX
I.	Systems Definition and Site Selection for the Improved 20 units of solar dryers	1-6	₱ 137,000	₱ 34,000
II.	Institutional and Implementor Arrangement	2-4	51,000	3,500
III.	Adaptive Research and Development of 2 Prototype Solar Barns	10-14	992,000	592,500
IV.	Fabrication of the Improved 20 Units of Solar Barns	6-8	4,664,000	3,732,500
V.	Installation of Units at the Selected Sites	4-6	1,201,000	580,000
VI.	Operation	8	148,000	17,500
VII.	Economic Evaluation	2	37,000	2,000
		48 mos.	₱ 7,230,000	₱ 4,962,000

	US	GOP	TOTAL	FX
PY 1	₱ 139,000	₱ 169,000	₱ 308,000	₱ 37,500
PY 2	729,000	142,000	871,000	592,500
PY 3	4,664.000	801,000	5,465,000	4,312,500
FY 4	--	586,000	586,000	19,500
	₱5,532,000	₱1,698,000	₱7,230,000	₱ 4,962,000
	$ 737,600	$ 226,400	$ 964,000	$ 661,600

Note: $1 = ₱7.50

All estimates include approximately 10% for contingencies and 15% for cost escalation.

PHASES

	I	II	III	IV	V	VI	VII	TOTAL
I. Personnel Cost	₱ 47,000	₱ 31,000	₱142,000	₱ 119,000	₱ 71,000	₱ 63,000	₱17,000	₱ 490,000
II. Equipment/ Accessories	20,000	--	600,000	4,000,000	500,000	--	--	5,120,000
(FX)	(18,000)		(540,000)	(3,600,000)	(450,000)			(4,608,000)
III. Maintenance and Other Operating Exp.	60,000	10,000	150,000	520,000	100,000	60,000	--	900,000
(FX)	(15,000)	(2,500)	(37,500)	(130,000)	(25,000)	(15,000)		((225,000)
IV. Capital Outlay			50,000	--	520,000	--	--	570,000
(FX)	--	--	(10,000)		(104,000)			(114,000)
V. Special Purposes	10,000	10,000	50,000	25,000	10,000	25,000	20,000	150,000
(FX)	(1,000)	(1,000)	(5,000)	(2,500)	(1,000)	(2,500)	(2,000)	(15,000)
TOTAL	₱137,000	₱ 51,000	₱992,000	₱4,664,000	₱1,201,000	₱148,000	₱37,000	₱7,230,000
	(34,000)	(3,500)	(592,500)	(3,732,500)	(580,000)	(17,500)	(2,000)	(4,962,000)

SOLAR REFRIGERATION SYSTEM

Another means of preserving marine and agricultural product is by means of solar refrigeration. Solar refrigeration has great value in remote areas where electric power is not available.

	Phases	No. of Months	Cost	FX
I.	Site Selection and System Definition	1-3	₱ 84,000	₱ 26,000
II.	Institution and Implementor Arrangement	2-4	51,000	3,500
III.	Engineering Design	6-8	83,000	2,000
IV.	Equipment Procurement Fabrication	10-12	2,026,000	1,551,000
V.	System Installation	8	1,481,000	520,000
VI.	Operation	10	159,000	17,000
VII.	Technical and Socio-Economic Evaluation	3	34,000	1,000
		48 mos.	₱3,918,000	₱2,120,500

	US	GOP	TOTAL	FX
PY 1	₱ 20,000	₱ 167,000	₱ 187,000	₱ 31,500
PY 2	1,426,000	137,000	1,563,000	1,551,000
PY 3	1,839,000	152,000	1,991,000	520,000
PY 4	--	177,000	177,000	18,000
	₱3,285,000	₱ 633,000	₱3,918.000	₱2,120,500
	$ 438,000	$ 84,400	$ 522,400	$ 282,733

Note: $1 = ₱ 7.50

PHASES

		I	II	III	IV	V	VI	VII	VIII
I.	Personnel Costs	₱ 24,000	₱ 31,000	₱ 63,000	₱ 151,000	₱ 119,000	₱ 79,000	₱24,000	₱ 491,000
II.	Equipment/Accessories (FX)	20,000 (18,000)	--	--	1,700,000 (1,500,000)	372,000 (100,000)	--	--	2,092.000 (1,618,000
III.	Maintenance and Other Operating Expenses (FX)	25,000 (7,000)	10,000 (2,500)	10,000 (1,000)	25,000 (11,000)	40,000 (20,000)	60,000 (15,000)	--	170,000 (56,500
IV.	Capital Outlay (FX)	--	--	--	--	800,000 (350,000)	--	--	800,000 (350,000
V.	Special Purposes (FX)	15,000 (1,000)	10,000 (1,000)	10,000 (1,000)	150,000 (40,000)	150,000 (50,000)	20,000 (2,000)	10,000 (1,000)	365,000 (96,000
	TOTAL	₱ 84,000 $ 26,000	₱51,000 $ 3,500	₱ 83,000 $ 2,000	₱2,026,000 $1,551,000	₱1,481,000 $ 520,000	₱159,000 $ 17,000	₱34,000 $ 1,000	₱3,918,000 $2,120,500

SOLAR CELL POWERED IRRIGATION PUMPS

A total of 25 solar-powered pumps with 1/3 horsepower capacity will be fielded to farmers for irrigation purposes.

Project Phases	No. of Months	Costs	FX
I. Identification of Sites and Systems Definitions	1-3	₱ 104,000	₱ 31,300
II. Insitutional User Arrangement	2-4	51,000	3,500
III. Engineering Design	6-8	103,000	7,000
IV. Equipment Procurement/ Fabrication Assembly	10-14	1,100,000	900,000
V. Dispersal of Pumps at the Site	4-6	300,000	100,000
VI. Operation	8-10	158,000	15,500
VII. Evaluation	3	38,000	1,500
	48 months	₱ 1,854,000	₱1,059,000

	US	GOP	TOTAL	FX
FY 1	₱ 84,000	₱ 135,000	₱ 219,000	₱ 42,300
FY 2	754,000	-	754,000	900,000
FY 3	400,000	300,000	700,000	15,500
FY 4	-	181,000	181,000	1,500
	₱1,238,000	₱ 616,000	₱ 1,854,000	₱1,059,000
	$ 165,067	$ 82,133	$ 274,200	$ 141,200

Note: ₱7.50/dollar

Note: All estimates include approximately 10% for contingencies and 15% for cost escalation.

PHASES

	I	II	III	IV	V	VI	VII	TOTAL
I. Personnel Costs	₱ 24,000	₱ 31,000	₱ 63,000	₱ 220,000	₱ 60,000	₱ 78,000	₱ 23,000	₱ 499,000
II. Equipment/Accessories (FX)	20,000 (18,000)	--	--	710,000 (860,000)	--	--	--	730,000 (878,000)
III. Maintenance and Other Operating Expenses (FX)	50,000 (12,500)	10,000 (2,500)	20,000 (5,000)	150,000 (38,000)	90,000 (40,000)	50,000 (12,500)	0	370,000 (110,500)
IV. Capital Outlay (FX)	--	--	--	--	100,000 (55,000)	--	--	100,000 (55,000)
V. Special Purposes (FX)	10,000 (1,000)	10,000 (1,000)	20,000 (2,000)	20,000 (2,000)	50,000 (5,000)	30,000 (3,000)	15,000 (1,500)	[illegible] (15,500)
	₱104,000 (31,500)	₱ 51,000 (3,500)	₱103,000 (7,000)	₱1,100,000 (900,000)	₱ 300,000 (100,000)	₱158,000 (15,500)	₱33,000 (1,500)	₱1,854,000 (1,059,000)

MINI-HYDRO POWER
(500 Kw) 1 Unit

Phases	No. of Months	Cost	FX
1. System selection and System Definition	3	₱ 24,000	--
2. Institutional and Implementor Arrangement	4	91,000	--
3. Engineering design	4	61,000	
4. Equipment Procurement	3	4,613,000	4,050,000
5. I. Plant Inst. II. Loan Inst.	12	1,400,000	276,000
6. Operation	12	556,000	95,000
7. Technical and Socio-Economic Evaluation	3	24,000	--
	46 mos.	₱6,769,000	₱ 4,421,000

	U.S.	GOP	TOTAL	FX
PY I	₱ 132,000	₱ 44,000	₱ 176,000	₱ 0
PY II	3,810,000	1,270,000	5,080,000	4,060,000
PY III	840,000	280,000	1,119,000	276,000
PY IV	295,000	98,000	394,000	85,000
	₱ 5,077,000	₱1,692,000	₱ 6,769,000	₱ 4,421,000
	$ 676,933	$ 225,600	$ 902,533	$ 589,470

Note: $1 = ₱ 7.50

PHASES

MINI-HYDRO POWER

	I	II	III	IV	V	VI	VII	TOTAL
I. Personnel Cost (FX)	₱ 24,000	₱ 31,000	₱ 31,000	₱ 63,000	₱ 510,000 (50,000)	₱ 94,000 (30,000)	₱ 24,000	₱ 1,077,000 (30,000)
II. Equipment/Accessories (FX)	--	--	--	4,500,000 (4,050,000)	540,000 (216,000)			5,040,000 (4,266,000)
III. Maintenance and Operating Expenses (FX)	--	--	--	--	--	450,000 (50,000)		450,000 (50,000)
IV. Capital Outlay (FX)	--	50,000	25,000					75,000
V. Special Purposes (FX)	--	10,000	5,000	50,000	50,000 (10,000)	12,000 (15,000)	--	127,000 (25,000)
	₱ 24,000	₱ 91,000	₱ 61,000	₱4,613,000 (4,050,000)	₱1,400,000 (276,000)	₱ 556,000 (95,000)	₱ 24,000	₱ 6,769,000 (4,421,000)

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MICRO HYDRO POWER (3-15 KW) 12 UNITS

Phases	No. of Months	Cost	FX
1. Site Identificatio and System Definition	3	₱ 64,000	20,000
2. Institutional and Implementor Arrangement	4	72,000	--
3. Engineering Design	4	72,000	20,000
4. Equipment Procurement	8	3,919,000	3,067,500
5. I. Plant Inst. II. Load Inst.	12	1,278,500	70,000
6. Operation	12	583,500	75,000
7. Technical and Socio-Economic Evaluation	3	54,000	--
	46 mos.	₱6,043,000	₱ 3,252,500

	US	GOP	TOTAL	FX
PY 1	₱ 156,000	₱ 52,000	₱ 208,000	₱ 40,000
PY 2	3,258,000	1,087,000	4,345,000	3,067,500
PY 3	785,000	262,000	1,047,000	115,000
PY 4	332,000	111,000	443,000	30,000
	₱ 4,531,000	₱1,512,000	₱ 6,043,000	₱3,252,500
	$ 604,133	$ 201,600	$ 805,734	$ 433,700

Note: $1 = ₱7.50

P H A S E S

Micro-Hydro Power

	I	II II	III	IV	V	VI	VII	TOTAL
1. Personnel Cost (FX)	₱54,000 (20,000)	₱ 72,000	₱ 72,000 (20,000)	₱ 144,000	₱ 823,500 (20,000)	₱216,000 (20,000)	₱ 54,000	₱ 1,435,500 (80,000)
2. Equipment/Accessories (FX)	--	--	--	3,375,000 (3,037,500)	405,000 (50,000)	--	--	3,780,000 (3,087,500)
3. Maintenance/Operating Cost (FX)	--	--	--	--	--	337,500 (50,000)	--	337,500 (50,000)
4. Capital Outlay (FX)	--	--	--	100,000	--	--	--	100,000
5. Special Purposes (FX)	10,000	--	--	300,000 (30,000)	50,000	30,000 (5,000)	--	390,000 (35,000)
	₱ 64,000	₱ 72,000	₱₱72,000	₱3,919,000	₱1,278,500	₱ 583,500	₱ 54,000	6,043,000
	(20,000)		(20,000)	(3,067,500)	(70,000)	(75,000)		(3,252,500)

WIND POWER

Wind mills to be installed will be expected to generate 3-30 KW of power for rural lighting, communications and village industries, etc. (6-12 units). Windmills for lower energy capacity will be used for pumps (20 units).

Phases	No. of Months	Costs	FX
1. Identification of sites and Definition of Systems	3	₱ 100,000	₱ 2,000
2. Institutional and Implementor Arrangement	4	50,000	1,000
3. Engineering design and Development of Prototype Models	8	907,000	386,300
4. Equipment Procurement/ Fabrication	12	1,700,000	1,600,000
20 units windmills for village water supply and irrigation.			
6-12 units for rural lighting, communication and village industries			
5. Installation in 6 sites	12	480,000	105,000
6. Operation	18	160,000	40,000
7. Socio-Economic Evaluation	3	100,000	2,000
	60 mos.	₱3,497,000	₱2,136,300

Note: $1 = ₱ 7.50

WIND POWER

6 sites

20 windmills for irrigation

12 windmills for rural lighting

	US	GOP	TOTAL	FX
PY 1	₱ 750,000	₱ 250,000	₱ 1,000,000	₱ 350,000
PY 2	1,500,000	500,000	2,000,000	1,450,000
PY 3	300,000	97,000	397,000	300,000
PY 4 & 5	75,000	25,000	100,000	36,300
	₱2,625,000	₱ 872,000	₱ 3,497,000	₱ 2,136,300
	$ 350,000	$ 116,266	$ 466,266	$ 284,840

PHASES

		I	II	III	IV	V	VI	VII	TOTAL
I.	Personnel Cost	₱ 80,000	₱ 40,000	₱100,000	--	₱ 60,000	--	₱80,000	₱ 360,000
II.	Equipment/Accessories (FX)	--	--	307,000 (276,300)	1,700,000 (1,600,000)	--	--	--	2,007,000 (1,876,300)
III	Maintenance and Other Operating Expenses (FX)	--	--	200,000 (50,000)	--	420,000 (105,000)	160,000 (40,000)	--	780,000 (195,000)
IV	Capital Outlay (FX)	--	--	300,000 (60,000)	--	--	--	--	300,000 (60,000)
V.	Special Purposes (FX)	20,000 (2,000)	10,000 (1,000)	--	--	--	--	20,000 (2,000)	50,000 (5,000)
	TOTAL	₱100,000	₱ 50,000	₱907,000	₱ 1,700,000	₱480,000	₱160,000	₱100,000	₱3,497,000
		(2,000)	(1,000)	(386,300)	(1,600,000)	(105,000)	(40,000)	(2,000)	(2,136,300)

Solar/Wind Monitoring Stations

Solar/Wind monitoring instruments will be installed at 10 PAGASA stations to record solar and wind profiles. These data will provide information as to the adaptability of solar or wind-related installations.

	Phases	No. of Months	Cost	FX
I.	Site Selection and System Definitions	1-13	₱ 25,000	₱ 2,000
II.	Institutional and Implementor Arrangement	2-4	30,000	1,000
III.	Engineering Design/ Catalog Survey	6-8	60,000	2,000
IV.	Procurement of Instruments/Fabrication Assembly	10-14	1,075,000	795,000
V.	Installation of units at selected sites	4-6	150,000	20,000
VI.	Operation	8-13	130,000	5,000
		48 mos.	₱1,470,000	₱825,000

	U.S.	GOP	TOTAL	FX
PY 1	--	₱ 115,000	₱ 115,000	₱ 5,000
PY 2	₱ 675,000	25,000	700,000	513,000
PY 3	375,000	150,000	525,000	302,000
PY 4	--	130,000	130,000	5,000
	₱1,050,000	₱ 420,000	₱1,470,000	₱825,000
	$ 140,000	$ 56,000	$ 196,000	$110,000

$1.00 = ₱ 7.50

PHASES

		I	II	III	IV IV	V	VI	TOTAL
I.	Personnel Cost	₱ 20,000	₱ 26,000	₱ 54,000	₱ 200,000	₱ 50,000	₱ 100,000	₱ 450,000
II.	Equipment/Accessories (FX)	--	--	--	865,000 (793,000)	--	--	865,000 (793,000)
III.	Maintenance & Other Operating Expenses (FX)	3,000 (1,800)	2,000 (800)	5,000 (1,800)	5,000 (1,500)	45,000 (10,000)	20,000 (4,500)	80,000 (20,400)
IV.	Capital Outlay (FX)	--	--	--	--	45,000 (9,000)	--	45,000 (9,000)
V.	Special Purposes (FX)	2,000 (200)	2,000 (200)	1,000 (200)	5,000 (500)	10,000 (1,000)	10,000 (500)	30,000 (2,600)
		₱ 25,000 (2,000)	₱ 30,000 (1,000)	₱ 60,000 (2,000)	₱1,075,000 (795,000)	₱ 150,000 (20,000)	₱ 130,000 (5,000)	₱1,470,000 (825,000)

DENDRO-THERMAL PLANT COUPLED WITH ENERGY PLANTATION (3-5 mw)

The project involves the installation of a wood-fired thermal power plant integrated with an ipil-ipil tree plantation which serve as source of raw material.

	Phases	No. of Months	Costs	FX
I.	Site Selection and System Definition	2-4	₱ 79,000	₱ 14,000
II.	Institutional and Implementors Arrangement	4-6	31,000	--
III.	Plantation Development	48	12,000,000	173,000
IV.	Engineering Design and Equipment Procurement	16-20	26,698,000	22,500,000
V.	Plant Construction, Infrastructure Assembly and Load Installations	10-18	2,862,000	1,535,000
VI.	Operations	12	184,000	15,000
VII.	Socio-Economic Evaluation	3	24,000	--
		60 mos.	₱41,878,000	₱24,237,000

Note: Phases I & III will start at the same time.

	US	GOP	TOTAL	FX
PY 1	₱ 200,000	₱ 258,000	₱ 458,000	₱ 187,000
PY 2	22,148,000	4,866,000	27,014,000	20,500,000
PY 3	4,083,000	10,000,000	14,083,000	3,535,000
PY 4 & 5	259,000	64,000	323,000	15,000
	₱26,690,000	₱15,188,000	₱41,878,000	₱24,237,000
	$ 3,558,667	$ 2,025,067	$ 5,583,734	$ 3,231,600

Note: ₱ 7.50/dollar

PHASES

		I	II	III	IV	V	VI	VII	TOTAL
I.	Personnel Costs	₱ 24,000	₱ 31,000	₱ 79,000	₱ 126,000	₱ 212,000	₱ 94,000	₱24,000	₱ 590,000
II.	Equipment/Accessories (FX)	--	--	--	26,572,000 (22,500,000)	1,500,000 (1,350,000)	--	--	28,072,000 (23,850,000
III.	Maintenance and Other Operating Expenses 25% (FX)	55,000 (14,000)	--	50,000 (13,000)	--	--	40,000 (10,000)	--	145,000 (37,000
IV.	Capital Outlay - 20% (FX)	--	--	11,871,000 (160,000)	--	700,000 (140,000)	--	--	12,571,000 (300,000
V.	Special Purposes - 10% (FX)	--	--	--	--	450,000 (45,000)	50,000 (5,000)	--	500,000 (50,000
	TOTAL	₱ 79,000 (14,000)	₱ 31,000	₱ 12,000,000 (173,000)	₱26,698,000 (22,500,000)	₱2,862,000 (1,535,000)	₱184,000 (15,000)	₱24,000	₱41,878,000 (24,237,000

WASTE-FIRED THERMAL PLANT

Phase	No. of Months	Cost	FX
1. Site selection and System Definition	3	₱ 60,000	₱ 30,000
2. Institutional and Implementor Arrangement	4	20,000	--
3. Engineering Design	3	160,000	50,000
4. Equipment Procurement/Fabrication	12	2,420,000	1,580,000
5. Operation/Maintenance	18	350,000	90,000
6. Technical and Socio-Economic Evaluation	3	30,000	--
	43 mos.	₱ 3,040,000	₱1,750,000

	U.S.	GOP	TOTAL	FX
PY 1	₱ 180,000	₱ 60,000	₱ 240,000	₱ 80,000
PY 2	1,815,000	605,000	2,420,000	1,580,000
PY 3	150,000	50,000	200,000	50,000
PY 4	135,000	45,000	180,000	40,000
	₱ 2,280,000	₱ 760,000	₱ 3,040,000	₱ 1,750,000
	$ 304,000	$ 101,340	$ 405,340	$ 233,300

Note: $1 = ₱7.50

PHASES

Power from Waste

	I	II	III	IV	V	VI		TOTAL
I. Personnel Cost (FX)	₱ 50,000 (30,000)	₱ 20,000	₱ 50,000 (30,000)	₱ 300,000	₱150,000 (30,000)	₱ 20,000	--	₱ 590,000 (90,000)
II. Equipment/Accessories (FX)	--	--	--	2,000,000 (1,500,000)	50,000 (10,000)	--	--	2,050,000 (1,510,000)
III. Maintenance/Operating Expenses (FX)	--	--	--	--	100,000 (30,000)	--	--	100,000 (30,000)
IV. Capital Outlay (FX)	--	--	100,000 (20,000)	20,000	--	--	--	120,000 (20,000)
V. Special Purposes (FX)	10,000	--	10,000	100,000 (80,000)	50,000 (20,000)	10,000		180,000 (100,000)
	₱ 60,000 (30,000)	₱ 20,000	₱160,000 (50,000)	2,420,000 (1,580,000)	₱350,000 (90,000)	₱ 30,000		₱3,040,000 (1,750,000)

PYROLYSIS

This project involves the production of charcoal, oil, and gas fuels from agricultural and forestry wastes by use of a pyrolytic converter.

	Project Phases	No. of Months	Cost	FX
I.	Site Identification	1-2	₱ 178,000	₱ 36,000
II.	Institutional Implementor Agreement	2-4	38,000	--
III.	Design of large scale System	5-7	68,000	11,000
IV.	Acquisition of Major Components and Auxiliary Equipment	11-13	827,000	625,000
V.	Construction of Infrastructure for Converter and Fabricating of Equipment	10	867,000	182,500
VI.	Operations	14	220,000	58,500
VII.	Technology and Socio-Economic Evaluation	4	61,000	6,000
		48 mos.	₱2,259,000	₱ 919,000

	US	GOP	TOTAL	FX
PY 1	₱ 386,000	₱ 217,000	₱ 603,000	₱ 288,000
PY 2	855,000	--	855,000	458,000
PY 3	435,000	179,000	614,000	134,000
PY 4	63,000	124,000	187,000	39,000
	₱1,739,000	₱ 520,000	₱2,259,000	₱ 919,000
	$ 231,867	$ 69,333	$ 301,200	$ 122,533

Note: Phase I & III will start at the same time.

$1 = ₱7.50

PHASES

	I	II	III	IV	V	VI	VII	TOTAL
I. Personnel Costs	₱ 18,000	₱28,000	₱ 18,000	₱102,050	₱192,000	₱110,000	₱31,000	₱ 489,000
II. Equipment/Accessories	--	--	--	685,000	75,000	50,000	--	810,000
(FX)				(616,500)	(67,500)	(45,000)		(729,000)
III. Maintenance and Other Operating Expenses	100,000	--	35,000	30,000	100,000	50,000	20,000	235,000
(FX)	(25,000)		(8,750)	(7,500)	(25,000)	(112,500)	(5,000)	(83,750)
IV. Capital Outlay	50,000	--	--	--	400,000	--	--	450,000
(FX)	(10,000)				(80,000)			(90,000)
V. Special Purposes	10,000	10,000	25,000	10,000	100,000	10,000	10,000	175,000
(FX)	(1,000)		(2,500)	(1,000)	(10,000)	(1,000)	(1,000)	(16,000)
TOTAL	₱178,000	₱38,000	₱68,000	₱827,000	₱867,000	₱220,000	₱61,000	₱2,259,000
Total FX	(36,000)	(--)	(11,000)	(625,000)	(182,500)	(58,500)	(6,000)	(919,000)

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Energy Surveys

The project involves the collection of data to determine energy demands and resources of rural areas of the Philippines.

Project Phases	No. of Months	Cost	FX
1. Development of Scope of Work	6	₱ 150,000	--
2. Contractor Procurement	4-6	250,000	₱ 50,000
3. Data gathering & analysis	Periodic from 2nd Project Year to 4th Project Year	950,000	700,000
		₱1,350,000	₱750,000

	U.S.	GOP	TOTAL	FX
PY 1	₱ 200,000	₱ 150,000	₱ 350,000	₱ 50,000
PY 2	400,000	100,000	500,000	400,000
PY 3	150,000	100,000	250,000	150,000
PY 4	150,000	100,000	250,000	150,000
	₱ 900,000	₱ 450,000	₱1,350,000	₱ 750,000
	$ 120,000	$ 60,000	$ 180,000	$ 100,000

$ 1.00 = ₱ 7.50

SURVEYS

PHASES

I.	Personnel Cost	₱ 105,000	₱ 75,000	₱ 200,000	₱ 380,000
II.	Equipment/Accessories (FX)	--	--	300,000 (500,000)	300,000 (500,000)
III.	Operating Expenses (FX)	--	175,000 (50,000)	400,000 (200,000)	575,000 (250,000)
IV.	Capital Outlay	--	--	--	--
V.	Special Purposes	45,000	--	50,000	95,000
	TOTAL	₱ 150,000	₱ 250,000 (50,000)	₱ 950,000 (700,000)	₱1,350,000 (750,000)

PUBLIC INFORMATION AND PROMOTIONS PROGRAM

Under this element of the program, a sustained multifaceted information campaign will be undertaken to imbue nonconventional energy development and utilization into the consciousness of the nation, both in the urban and the rural areas. This effort will include (a) rural seminar/workshops on nonconventional energy to be conducted on a periodic basis in the provinces, (b) the establishment of an exhibit center for the various static and dynamic noncon devices for public inspection, (c) the production of various briefing films on current applications of non-conventional energy and the prospects of same in the Philippines, (d) a national nonconventional energy congress/exhibition, (e) lectures and symposia, and (f) the publication of brochures, pamphlets, and other information materials for dissemination.

Most of the proposed activities under this project will be launched during 1979 and carried on through the next three years (1980 to 1982). The necessary equipment (such as exhibit devices, instruments, service vehicle, audio-visual aids, etc.) will be acquired during the initial year. The project will make use of extensive media advertising to boost the entire project, and will engage the assistance of rural service workers, government and social groups, and the academic community in the different seminars and workshops.

The ultimate objective of this element of the program is to encourage the people to either initiate community projects on their own or manufacture/patronize noncon products and devices.

WORK PLAN

Year	Type of Activity	Remarks
1979	Rural seminar-workshops	Six Sites
	Exhibit models procurement	
	Production of briefing film	One
	Publication of brochures and other noncon materials	
	Lectures and mini-symposia	Once a Month
	Media advertising	
1980	Rural seminar-workshops	Six Sites
	Film production	One
	Publications	
	Lectures	Once a Month
	Media advertising	
	Noncon Congress/Exhibition	Year-End
1981	Follow-up seminars and provincial tours	
	Publications	
	Lectures	
	Media Advertising	
1982	Follow-up seminars and provincial tours	
	Publications	Once a Month
	Lectures	

PUBLIC INFORMATION AND PROMOTIONS PROGRAM

COST ESTIMATE

	PY 1 1979	PY 2 1980	PY 3 1981	PY 4 1982
Equipment	₱ 335,000 (300,000)	-	-	₱ 35,000
Operational	₱ 300,000	₱ 355,000	₱ 285,000	₱ 310,000
	₱ 635,000 (300,000)	₱ 355,000	₱ 285,000	₱ 345,000

	U.S.	GOP	TOTAL	FX
PY 1	₱ 470,000	₱ 165,000	₱ 635,000	300,000
PY 2	250,000	105,000	355,000	
PY 3	200,000	85,000	285,000	
PY 4	250,000	95,000	345,000	
	₱1,170,000 $ 156,000	₱ 450,000 $ 60,000	₱1,620,000 $ 216,000	₱ 300,000 $ 40,000

$1.00 = ₱ 7.50

Short-Term Consulting Services:

a. Silviculture

3 PM/year x 4 years = 12 PM

b. Biomass Conversion

4 PM/year x 4 years = 16 PM

c. Direct Solar Conversion

4 PM/year x 4 years = 16 PM

d. Small Scale Hydropower

3 PM/year x 4 years = 12 PM

56 PM

Total Costs:

56 PM @ 7500 = $ 420,000

Long-Term Project Coordinator:

36 PM @ 7000 = $ 252,000

Participant Training

a. Long-Term

2 persons per year x 3 years

x 24 months = 144 PM x $1200 = $ 173,000

b. Short-Term

5 trips per year for 4 years @ 3 months

= 20 x 3 = 60 PM @ $3000 = $ 180,000

Total - - - - - - - - $ 353,000

Note: These estimates include approxmately 10% for contingencies and 15% for cost escalation, but do not include in kind contributions to be provided by the Bureau of Energy Development.

NONCONVENTIONAL ENERGY DEVELOPMENT

Statutory Checklist

I. Country Checklist - See Project Paper for Project No. 492-0302, Integrated Agricultural Production and Marketing

II. Project Checklist

A. General Criteria for Project

1. App. Unnumbered: FAA Sec. 653(b)

(a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project.	(a) The House and Senate Appropriations Committees were notified of the project in AID's 1977 Congressional Presentation and in special notifications to Congress.
(b) Is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure plus 10%)?	(b) The assistance is within the country program level.
2. FAA Sec. 611(a)(1). Prior to obligation in excess of $100,000, will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	(a & b) The project is basically an applied research activity to determine the feasibility of developing alternative sources of energy. The project will undertake engineering and economic plans in this regard.
3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	3. None required.

4. FAA Sec. 611(b); App. Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per Memorandum of the President dated Sept. 5, 1973 (replaces Memorandum of May 15, 1962; see Fed. Register, Vol 38, No. 174, Part III, Sept. 10, 1973)?	4. N.A.
5. FAA Sec. 611(e). If project is capital assistance (e.g. construction, and all U.S. assistance for it will exceed $1 million, has Mission Director certified the country's capability effectively to maintain and utilize the project)?	5. N.A.
6. FAA Sec. 209, 619. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs. If assistance is for newly independent country, is it furnished through multilateral organizations or plans to the maximum extent appropriate?	6. GOP is currently receiving assistance in energy research and development from other bilateral and multi-lateral donors, including New Zealand and the UN.
7. FAA Sec. 601(a); (and Sec. 201(f) for development loans). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	7. Since this is basically an applied research project, it will not in itself affect international trade, foster private initiatives, encourage development of credit unions, etc. However, the results of the research will certainly contribute to the fulfillment and satisfaction of FAA Sec. 601(2) and 20(f).

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8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).

8. Hardware and consulting services will be procured from the U.S.; hence US private enterprise will participate. The results of the research could result in a significant amount of U.S. business investment.

9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.

9. Since the loan will finance foreign exchange costs and not more than fifty percent of local costs of the program, we are assured of local currency contributions to the project.

10. FAA Sec. 612(d). Does the U.S. own excess foreign currency and, if so, what arrangements have been made for its release?

10. N.A.

B. Funding Criteria for Project

1. Development Assistance Project Criteria

a. FAA Sec. 102(c); Sec. 111; Sec. 281a. Extent to which activity will (1) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production, spreading investment out from cities to small towns and rural areas; and (2) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions?

a. The research program itself will not greatly involve nor affect the poor. However the results could have a significant effect on rural development. The basic purpose of the program is to test the economic/technical feasibility of utilizing nonconventional energy resources to resolve energy bottlenecks to social and economic development in remote areas of the Philippines.

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b. Is assistance being made available for technical assistance, energy, research, reconstruction, and selected development problems; if so, extent activity is to help alleviate energy problem.

b. This project involves applied research aimed at alleviating a very serious energy problem.

c. FAA Sec. 110(a); Sec. 208(e).

Is the recipient country willing to contribute funds to the project, and in what manner has or will it provide assurances that it will provide at least 25% of the costs of the program, project or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived for a "relatively least-developed" country)?

c. Through direct budget support and in-kind contributions, the Government of the Philippines will contribute approximately 30% of the costs of the project.

d. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years If so, has justification satisfactory to Congress been made, and efforts for other financing?

d. Grant funds for institutional development will be required for more than 3 years. Every effort has been made to minimize and it will be phased out as soon as possible.

e. FAA Sec. 207; Sec. 113. Extent to which assistance reflects appropriate emphasis on: (1) encouraging development of democratic, economic, political and social institutions; (2) self-help in meeting the country's food needs; (3) improving availability of trained worker-power in the country; (4) programs designed to meet the country's health needs; (5) other important areas of economic, political, and social development, including industry; free labor unions, cooperatives, and Voluntary Agencies; transportation, and communication; planning and public administration; urban development, and modernization

e. If replicated on a broader scale, the results of this applied research program could make a significant contribution to resolving many of the development problems described in Sections 207 and 113 of the FAA.

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of existing laws; or (b) integrating women into the recipient country's national economy.

f. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires and capacities of the people of the country; **utilizes the country's intellectual resources to encourage institutional development and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.**

f. A lack of adequate energy resources and the drain current oil imports place on the Philippine economy are serious constraints to rural development. The applied research to be undertaken under this program will seek to alleviate this problem. The bulk of the pilot projects to be financed will be implemented by Philippine Government agencies and other local institutions.

g. FAA Sec. 201(b) (2)-(4) and -(8); Sec. 201(e); Sec. 211(a) (1)-(3) and -(8). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth; or of educational or other institutions directed toward social progress? Is it related to and consistent with other development activities, and will it contribute to realizable long-range objectives? And does project paper provide information and conclusion on an activity's economic and technical soundness?

g. Yes.

h. FAA Sec. 201(b) (5); Sec. 211(a) (5), (6). Information and conclusion on possible effects of the assistance on U.S. economy with special reference to areas of substantial labor surplus, and extent to which U.S. commodities and assistance are furnished in a manner consistent with improving or safeguarding the U.S. balance-of-payments position.

h. The bulk of the loan and grant funds will be used to finance the procurement of commodities and consulting services from the U.S. and participant training at U.S. insitutions.

2. Development Assistance Project Criteria (Loans Only)

a. FAA Sec. 201(b) (1). Information and conclusion on availability of financing from other free-world sources, including private sources within U.S.	a. Other bilateral and multilateral donors are currently contributing to energy research and development in the Philippines.
b. FAA Sec. 201(b)(2); 201(d). Information and conclusion on (1) capacity of the country to repay the loan, including reasonableness of repayment prospects, and (2) reasonableness and legality (under laws of country and U.S.) of lending and relending terms of the loan.	b. The Government of the Philippines is capable of repaying the loan, and we have no reason to expect that it will not be repaid.
c. FAA Sec. 201(e). If loan is not made persuant to a multilateral plan, and the amount of the loan exceeds $100,000, has country submitted to AID an application for such funds together with assurances to indicate that funds will be used in an economically and technically sound manner?	c. GOP has requested the loan, and the project analysis indicates that it will be used in an economically and technically sound manner.
d. FAA Sec. 201(f). Does project paper describe how project will promote the country's economic development taking into account the country's human and material resources requirements and relationship between ultimate objectives of the project and overall economic development?	d. Yes.
e. FAA Sec. 202(a). Total amount of money under loan which is going directly to private enterprise, is going to intermediate credit institutions or other borrowers for use by private enterprise, is being used to finance imports from private sources, or is otherwise being used to finance procurements from private sources?	e. N.A.

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f. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete in the U.S. with U.S. enterprise, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?	f. N.A.

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Annex E

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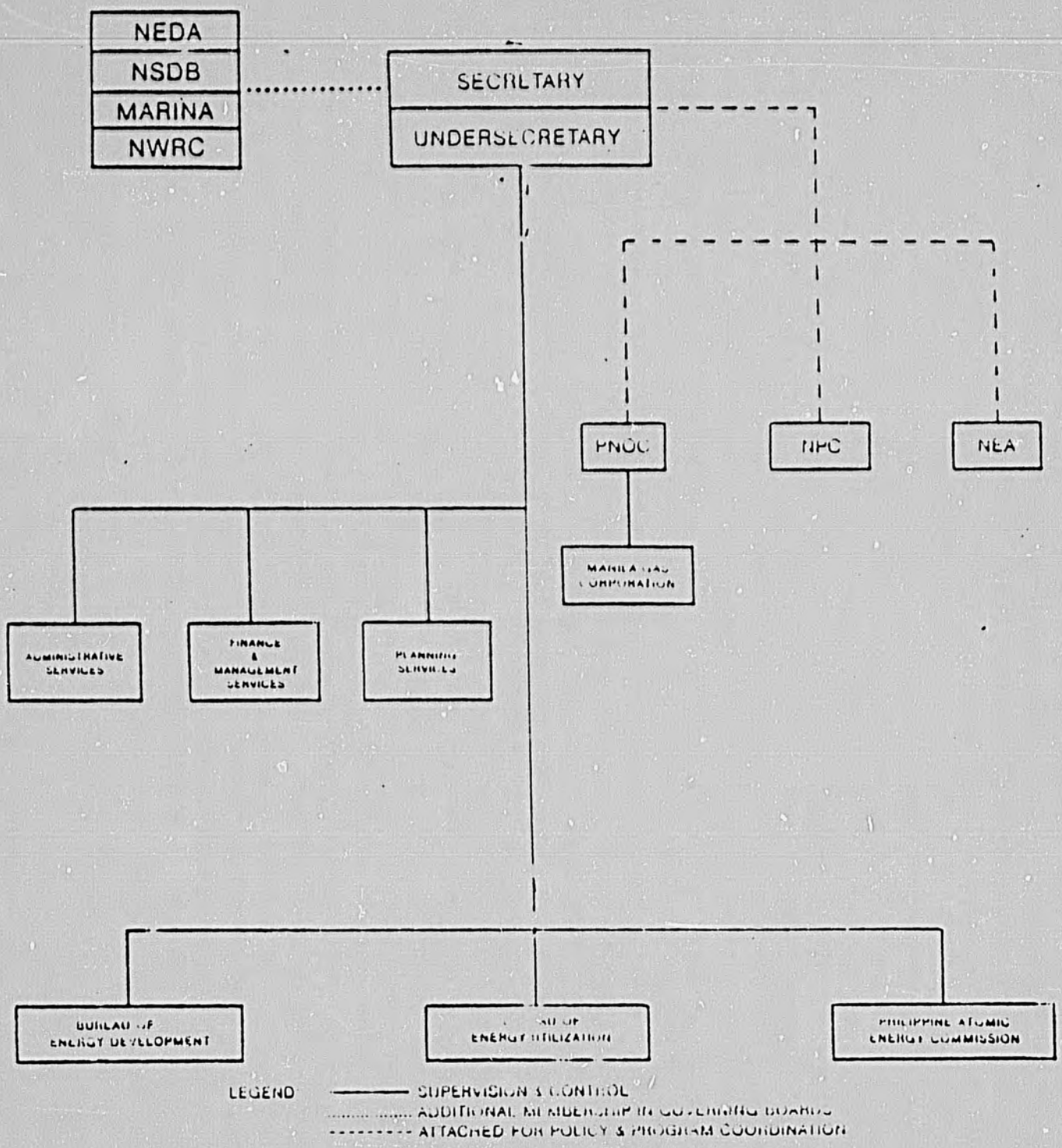
ORGANIZATIONAL CHART
DEPARTMENT OF ENERGY



LEGEND
——— SUPERVISION & CONTROL
..... ADDITIONAL MEMBERSHIP IN GOVERNING BOARDS
- - - - - ATTACHED FOR POLICY & PROGRAM COORDINATION

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MALACAÑAN PALACE
MANILA

PRESIDENTIAL DECREE NO. 1068

DIRECTING THE ACCELERATION OF RESEARCH, DEVELOPMENT AND UTILIZATION OF NON-CONVENTIONAL ENERGY RESOURCES AND VESTING IN THE ENERGY DEVELOPMENT BOARD POWERS AND FUNCTIONS IN CONNECTION THEREWITH, AND FOR OTHER PURPOSES.

WHEREAS, it is imperative to accelerate the development not only of indigenous conventional energy resources but also of those non-conventional alternatives which have great potential for immediate and future applications such as but not limited to solar, wind, tidal and bio-mass energy;

WHEREAS, it is essential in the interest of efficiency, economy and effectiveness to integrate in a single governmental entity the planning, coordination and control of the research, development and utilization efforts and programs in non-conventional forms of energy resources of the various government agencies and instrumentalities, including government owned and controlled corporations;

NOW, THEREFORE, I, FERDINAND E. MARCOS, President of the Philippines, by virtue of the powers and functions vested in me by the Constitution, do hereby order and decree the following as part of the law of the land:

SECTION I - DECLARATION OF POLICY

It is the declared policy of the State to achieve self-reliance in the country's energy requirements primarily through the intensified exploration, development, exploitation and utilization of indigenous conventional energy resources such as petroleum, coal, natural gas and liquids, water and geothermal resources and nuclear fuel resources; and non-conventional alternatives such as solar, wind, tidal and bio-mass energy which have great potential for immediate

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and future applications. In furtherance of this policy there is an urgent need to coordinate, integrate and control the pursuit of research, development and utilization efforts of all government agencies and instrumentalities pursuant to and in accordance with a comprehensive national energy program.

SECTION 2 - DEFINITION OF TERMS

As used in this Decree, the following words and phrases shall have the following respective meanings:

(a) Non-Conventional Energy Resources refers to those energy resources in which the conversion or utilization technology for large-scale (megawatt level) applications are not as well-developed and/or widely used as those for fossil fuels, hydro-geothermal and conventional nuclear. In general, these resources would include the direct and indirect forms of solar, tidal, nuclear converter and breeder reactors and fusion.

(b) Direct Solar Energy means the energy content of solar radiation harnessed by collecting sunlight in man-made devices such as flat-plate or focusing solar collectors.

(c) Indirect Solar Energy means the energy content of solar radiation harnessed by initially collecting sunlight in a natural manner such as absorption by land, atmosphere, ocean surface and plants. This natural collection mode gives rise to winds (by thermal gradients in the atmosphere), produces organic matter or bio-mass and creates ocean thermal gradients between the surface and its depths.

(d) Bio-mass refers to organic matter, whether living or not. This would include, among others, trees, algae, animal and agricultural wastes and decaying plants in swamps.

(e) Bio-conversion to Fuels refers to the various processes, natural or synthetic, by which a solid, liquid or gaseous fuel is produced by utilizing bio-mass feedstock, e.g. anaerobic fermentation of animal manure to yield bio-gas; combustion of firewood to yield heat, steam or power; fermentation of agricultural crops or by-products to yield substitute fuels such as alcohol.

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(f) Bio-gas is a fuel gas consisting of 50-70% methane and the rest non-combustible gases produced by the anaerobic fermentation of organic wastes.

(g) Energy Plantation is a scheme whereby fast growing crops or trees such as ipil-ipil are deliberately and systematically planted in order to continuously provide fuel to a power generating station located at the site.

(h) Comprehensive national energy program for purposes of this Decree is a program of research, development or utilization of non-conventional energy resources duly approved by the Energy Development Board.

SECTION 3 - POWERS AND FUNCTIONS OF THE ENERGY DEVELOPMENT BOARD

IN addition to its powers and functions enumerated in Presidential Decree No. 910 and other laws, rules and regulations, the Energy Development Board shall exercise the following powers and functions:

1. Formulate and direct the implementation of a comprehensive national energy program, subject to periodic review and revisions on non-conventional energy research, development and utilization.

2. Integrate, coordinate, direct and control all research, development and utilization efforts, programs and projects in non -conventional energy resources of all government agencies and instrumentalities including government owned and controlled corporations.

3. Review and approve all on-going or planned research, development and utilization projects on non-conventional energy resources whether basic or applied in nature, supported or planned to be supported by government funds or funds obtainable elsewhere through government intercession or assistance.

4. Formulate criteria for determining priority for proposed research, development and utilization projects on non-conventional energy resources and accordingly identify and select execution, financing and funding schemes.

5. Designate project implementors, coordinate and monitor the progress of all projects and activities, on-going or planned projects, in the implementation of the comprehensive national energy program.

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6. Provide necessary and appropriate supportive efforts to the non-conventional energy research, development and utilization program such as the launching of a vigorous information and promotions drive. assistance and entry of suitable foreign expertise in order to accelerate the pace of local research, development and utilization and the training of qualified Filipino personnel in the various aspects of non-conventional energy, proliferation of those applications in which technologies have proven viable, such as bio-gas generation, windmills for water, pumping and power generation from agricultural and industrial wastes, establishment of demonstration systems like solar water heaters, solar air-conditioning and energy plantations.

7. Develop and implement specific programs requiring the participation not only of government agencies and instrumentalities but also of the private sector.

8. Grant incentivies provided for herein and propose and recommend the grant of such other incentives as shall be necessary and appropriate to enterprises, industries and individuals who shall conduct their own or participate in research and development or apply currently available non-conventional energy technology to their industrial processes or homes.

9. Promulgate such rules and regulations as may be necessary to implement the objectives and provisions of this Decree.

SECTION 4 - INCENTIVES

The provisions of any law to the contrary notwithstanding any person, whether natural or juridical, who will directly participate in the national program to accelerate research, development and utilization of non-conventional energy sources shall have the following privileges:

(a) Costs incurred in the establishment and construction of non-conventional energy conversion facilities or equipment duly certified by the Energy Development Board may, at the option of the taxpayer, be directly chargeable to expense and shall be fully deductible as such from gross income in the year wherein such expenses were incurred.

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(b) Exemption from payment of tariff duties and compensating tax on the importation of machinery and equipment, and spare parts and all materials required in the establishment and construction of non-conventional energy facilities or equipment subject to the conditions that said machinery, equipment, spare parts and materials of comparable price and quality are not manufactured domestically; are directly and actually needed and will be used exclusively by the taxpayer in the establishment and construction of non-conventional facilities or equipment; are covered by shipping documents in the name of the taxpayer to whom the shipment will be delivered direct by the customs authorities; and the prior approval of the Energy Development Board was obtained by the taxpayer before the importation of such machinery, equipment, spare parts and materials which approval shall not be unreasonably withheld: Provided, however, that the taxpayer may not sell, transfer or dispose of these machinery, equipment, spare parts or materials without the prior approval of the Energy Development Board and payment of taxes due the government: Provided further, that should the taxpayer sell, transfer, or dispose of these machinery, equipment, spare parts or materials without the prior consent of the Energy Development Board, it shall pay twice the amount of the tax exemption granted: Provided, finally, that the Energy Development Board shall allow and approve the sale, transfer, or disposition of the said items without tax, if made: (1) to another taxpayer who will establish and construct non-conventional energy conversion facilities or equipment; (2) for reasons of technical obsolescence; or (3) for purposes of replacement to improve and/or expand the operations of the taxpayer.

(c) Government financial institutions such as the Development Bank of the Philippines, the Philippine National Bank, the Government Service Insurance System, the Land Bank of the Philippines and such other government institutions as are now engaged or may hereafter engage in financing of investment operations shall, in accordance with and to the extent allowed by the enabling provisions of their respective charters or applicable laws, accord high priority to applications for financial assistance by individuals/enterprises/industries participating in the national program to accelerate the research, development and utilization of non-conventional energy sources, as duly recommended and endorsed by the Energy Development Board.

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SECTION 5 - ASSISTANCE BY OTHER GOVERNMENT AGENCIES/OFFICES AND CORPORATIONS

All government agencies and instrumentalities including government owned or controlled corporations in addition to being implementors of the comprehensive national energy program when so designated, shall extend whatever assistance that may be required by the Energy Development Board, including but not limited to the detail to the Board of such of their employees, scientists and technical personnel.

SECTION 6 - APPROPRIATIONS

The sum of TEN MILLION PESOS (₱10,000,000.00) is hereby appropriated out of any available funds in the National Treasury not otherwise appropriated as operating funds of the Energy Development Board to fully carry out and implement the functions and objectives provided in this Decree for the period from the effective date of this Decree up to and including the fiscal year ending December 31, 1977. Thereafter, amounts required by the Energy Development Board shall be included annually in the General Appropriation Decree.

SECTION 7 - REPEALING CLAUSE

All laws, decrees, orders, rules and regulations or parts thereof which are inconsistent with any of the provisions of this Decree are hereby repealed or modified accordingly.

SECTION 8 - EFFECTIVITY

This Decree shall take effect immediately.

Done in the City of Manila this 12 day of January in the year of Our Lord, nineteen hundred and seventy-seven.

(SGD) FERDINAND E. MARCOS
President
Republic of the Philippines

Annex G

Department of Energy

BUREAU OF ENERGY DEVELOPMENT

Total Positions: 39

NON-CONVENTIONAL RESOURCES DIVISION

- 1 - Chief
- 1 - Secretary
- 1 - Clerk-typist

TECHNOLOGY DEVELOPMENT & ASSESSMENT SECTION

- 1 - Supervising Dev. Engr.
- 1 - Development Engr.
- 1 - Development Engr. II
- 1 - Development Engr. I
- 1 - Technical Analyst II
- 1 - Technical Analyst I

PROGRAM MANAGEMENT & TECHNICAL ASSISTANCE SECTION

- 1 - Supervising Project Engr.
- 1 - Driver

WIND SYSTEMS BRANCH

- 1 - Sr.Pro. Engr.
- 2 - Proj.Engr.II
- 2 - Proj. Engr. I

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SOLAR ENERGY BRANCH

- 1 - Sr. Proj.Engr.
- 3 - Proj. Engr. II
- 3 - Proj. Engr. I

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BIOCONVERSION SYSTEMS BRANCH

- 1 - Sr. Proj.Engr.
- 3 - Proj. Engr. II
- 3 - Proj. Engr. I

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APPLIED PROJECTS & TEST FACILITIES

- 1 - Supervising Test Engr.

APPLIED PROJECTS

COLLECTOR TEST FACILITY

- 1 - Sr. Test Engr.
- 2 - Test Engr.
- 2 - Technician II
- 2 - Technician I
- 1 - Utility Man

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SOLAR/WIND STATION

Best Available Document

FIGURE 1. OPERATIONAL FLOW SCHEME FOR N W PROJECTS

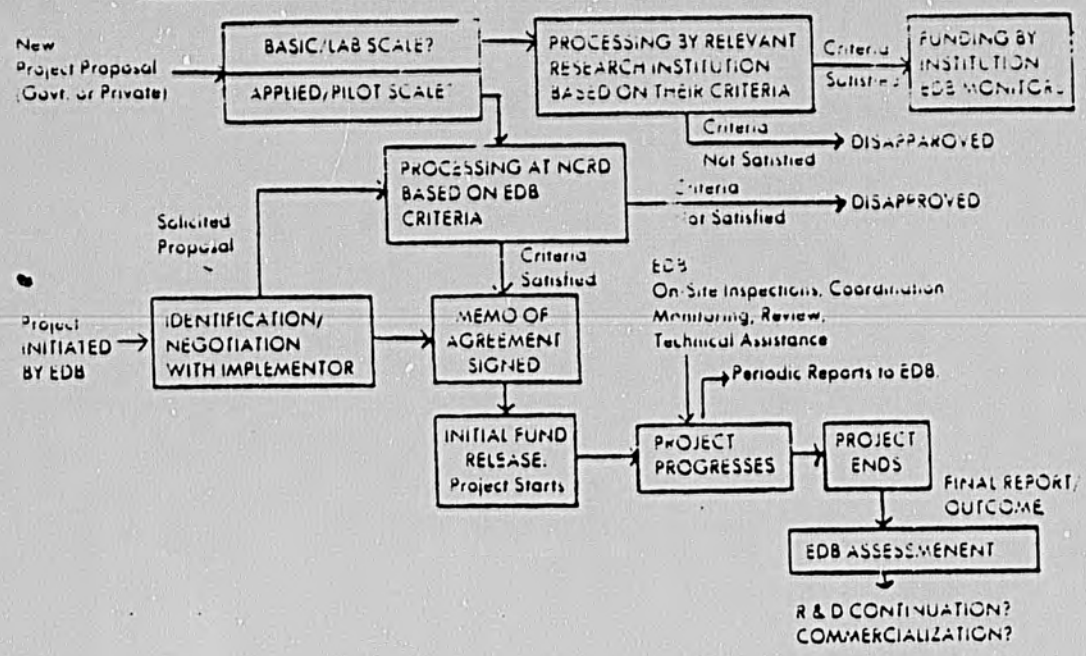
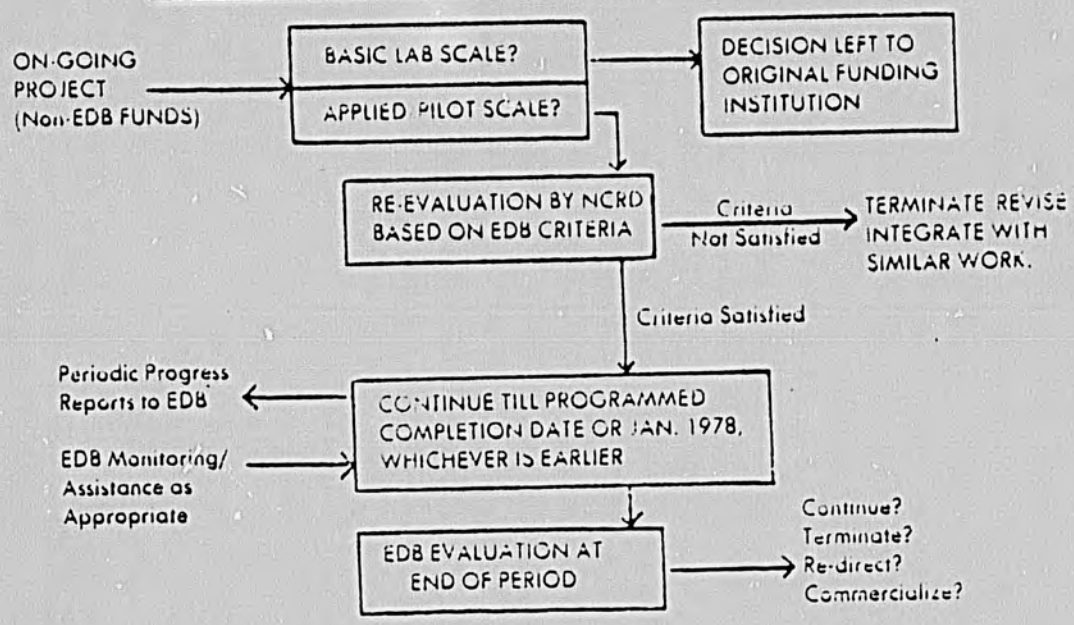


FIGURE 2. DECISION FLOW SCHEME FOR ON-GOING PROJECTS (GOV'T. FUNDS BUT NOW EDB)



ENERGY DEVELOPMENT BOARD
PHILIPPINE NATIONAL PETROLEUM CENTER
M. BRITT ROAD, FORT BONIFACIO
METRO MANILA, PHILIPPINES TEL. NO. 88-38-11

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CIRCULAR # 10

Series of 1977

TO : AGENCIES AND INDIVIDUALS, PUBLIC OR PRIVATE, INTENDING TO SUBMIT PROPOSALS FOR FINANCIAL ASSISTANCE UNDER THE NATIONAL PROGRAM FOR NONCONVENTIONAL ENERGY RESOURCES DEVELOPMENT.

SUBJECT : GUIDELINES FOR THE PREPARATION OF PROJECT PROPOSALS

The attached materials describe relevant operational policies and criteria set by the Board for the consideration and awarding of grants-in-aid to prospective implementors of nonconventional energy projects. It is hoped that these shall encourage well-organized, cost-effective project proposals, the potential outputs of which satisfy important needs within the national program.

Please be guided accordingly.

GERONIMO Z. VELASCO
Chairman

Attach: a/s
5 August 1977

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GUIDELINES FOR THE PREPARATION OF PROJECT PROPOSALS UNDER THE NONCONVENTIONAL ENERGY RESOURCES DEVELOPMENT PROGRAM (NERDP)

(Refer to EDB Form 19 Rev. 8-77)

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1. Nature of the Project

1.1 The project must be a development or demonstration of a nonconventional energy device or system for the purpose of advancing or adapting the technology and for investigating technical and economic feasibility of such system or device under local conditions.

1.2 In general, higher priority shall be accorded to projects which involve the design, fabrication, installation and on-site operation of a nonconventional energy device or system.

1.3 Unless solicited, lower priority shall be given to projects which only involve surveys, paper studies or investigations in which no physical installation results.

1.4 Projects under the NERDP are preferably applied or developmental in nature as contrasted with basic/lab scale/fundamental researches which are primarily the responsibility of other agencies.

1.5 Projects for the expressed purpose of ultimately patenting a device, process or system for the material benefit of the proponent are not eligible for financial assistance under the EDB program.

1.6 A listing of priority project areas and examples of specific project titles are shown in Annex A.

2. Proponent

2.1 The proponent may be an entity or an individual belonging to the public or private sector. For counterpart funding

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purposes, it is preferred that individual proponents obtain official backing from their respective offices. The capabilities, related experience, facilities or techniques of the proponent, including the proposed key personnel, considered critical to the achievement of the project's objectives must be described in the proposal.

3. Cooperating Agencies

3.1 Proponents are encouraged to include other relevant agencies or groups as co-participants in the project. Aside from the possibility for cost and personnel sharing, such alliances simplify inter-agency arrangement often required in the conduct of the project.

4. Project Costs

4.1 Any reasonable amount may be requested as financial assistance. In general, however, the requested funding for any single year must be kept well below ₱150,000.

4.2 The line-item budget must be sufficiently detailed. It must be kept in mind that actual expenditures shall be subject to normal government accounting and auditing rules and should thus be properly documented.

4.3 The number of project personnel must be kept to an effective minimum. The practice of designating the highest ranking personnel of the proponent agency as "Project Director" even though he has no actual role in the project is discouraged. Until further notice, EDB shall adopt currently accepted norms and procedures for granting honoraria, incentives and compensation for key and contractual personnel of a project. Such rates and criteria are given in Annexes B and C.

4.4 The proponent/implementing agency is expected to put up a counterpart fund of at least 15% of the total project costs. All other factors being equal, the chances for approval of a project increases with the amount of a proponent's counterpart fund. Proposals requesting for the financing of materials and equipment only have the greatest chances for approval.

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5. Nature of Counterpart

The following are allowed to be listed as counterpart of the proponent agency:

5.1 Salaries of personnel, computed on "percent of time" basis, who will be involved in the project but are not eligible for honoraria, e.g., technical personnel in excess of allowed number of honoraria recipients.

5.2 Use of agency vehicles and facilities, e.g., shop machines, special instruments and tools, etc. This must be computed based on planned duration and frequency of use and prevailing rates for leasing such equipment or vehicles.

5.3 Infrastructure, office equipment and furniture, provided that these are not yet existing and will be put or purchased as a consequence of the project and primarily for use by the project. In no case shall existing infrastructure be listed as a counterpart even if this shall be used in the project.

5.4 Administrative and clerical support (actually required) miscellaneous supplies, etc., must be presented as an overhead cost component in the counterpart fund.

6. Duration

6.1 Projects in which key findings or visible results are realizable within 6 months or 1 year are preferred.

6.2 The duration limit for any single proposal is two (2) years. This does not preclude renewals or sequel work which builds upon previously completed work by the proponent.

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Annexes

A. Priority Project Areas and Examples of Specific Project Titles.

B. Salary Scale for Contractual Technical Personnel and Criteria for Hiring Thereof.

C. Allowable Rates for Honoraria and Criteria for Granting Thereof.

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I. PRIORITY PROJECT AREAS

1. Evaluation of Potentials

- NONCON RESOURCES SURVEY
- SOLAR/WIND MONITORING NETWORK

2. Available Technologies: Large-Scale Output

- POWER & FUELS FROM AGRO WASTES
- "ALCOGAS" FOR MOTOR FUEL
- ENERGY PLANTATIONS
- INDUSTRIAL SOLAR WATER HEATING

3. Available Technologies: Rural Emphasis

- BIOGAS FROM RURAL & URBAN WASTES
- WINDMILLS FOR WATER PUMPING & LOW-POWER ELECTRICITY
- SOLAR CROP DRYERS
- MARSH GAS UTILIZATION
- SOLAR STILLS

4. Others: More R & D Required

- SOLAR REFRIGERATION
- SOLAR PUMPS
- SOLAR POWER, ETC.

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II. EXAMPLES OF SPECIFIC PROJECT TITLES (not in order of priority)

1. Practical Utilization System for a Specific Marsh Gas Site.

2. Low-Cost Portable Kilns for Charcoal-Making Using Forestry Wastes.

3. Feasibility Study For a Viable Pyrolytic Converter Producing Charcoal, Oil and Gas from Agricultural Wastes.

4. Using Rice Hulls to Make a Rice Mill Self-Sufficient in Power.

5. Low-Power Applications of Hot Springs

6. Low-Cost Crop Dryers Using Agricultural Wastes as Fuel

7. Techno-economic study of a Communal Biogas System Using Human Waste

8. Energy Plantation/Dendro-Thermal Plant System in a Specific Site, etc.

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ANNEX B

SALARY SCALE FOR CONTRACTUAL TECHNICAL PERSONNEL AND CRITERIA FOR HIRING THEREOF

I. SALARY SCALE

Position Level	Class Title	Monthly Salary Min.	Monthly Salary Max.
1	Science Aide I (or Technical I)	₱ 350	₱ 450
2	Science Aide II (or Technican II)	375	500
3	Science Aide III (or Technican III)	400	550
4	Research Asst. I (or Technologist)	500	700
5	Research Asst. II (or Technologist II)	600	800
6	Research Asst. III (or Technologist III)	700	900
7	Research Associate I	850	1,100
8	Research Associate II	950	1,300
9	Research Associate III	1,100	1,500
10	Research Associate IV	1,300	1,700

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II. SCHEDULE OF STEP INCREASES

Position Level	Minimum	1st Step	2nd Step	3rd Step	Maximum
1	₱ 4,200 (350)	₱ 4,500 (375)	₱ 4,300 (400)	₱ 5,100 (425)	5,400 (450)
2	₱ 4,500 (375)	₱ 4,800 (400)	₱ 5,100 (425)	₱ 5,400 (450)	₱ 6,000 (500)
3	₱ 4,800 (400)	₱ 5,100 (425)	₱ 5,400 (450)	₱ 6,000 (500)	₱ 6,600 (550)
4	₱ 6,000 (500)	₱ 6,600 (550)	₱ 7,200 (600)	₱ 7,800 (650)	₱ 8,400 (700)
5	₱ 7,200 (600)	₱ 7,800 (650)	₱ 8,400 (700)	₱ 9,000 (750)	₱ 9,600 (800)
6	₱ 8,400 (700)	₱ 9,000 (750)	₱ 9,600 (800)	₱10,200 (850)	₱10,800 (900)
7	₱10,200 (850)	₱10,800 (900)	₱11,400 (950)	₱12,000 (1,000)	₱13,200 (1,100)
8	₱11,400 (950)	₱12,000 (1,000)	₱13,200 (1,100)	₱14,400 (1,200)	₱15,600 (1,300)
9	₱13,200 (1,100)	₱14,400 (1,200)	₱15,600 (1,300)	₱16,800 (1,400)	₱18,000 (1,500)
10	₱15,600 (1,300)	₱16,800 (1,400)	₱18,000 (1,500)	₱19,200 (1,600)	₱20,400 (1,700)

III. QUALIFICATIONS

1. Science Aides are normally non-degree holders whose experience and training range from minimal (lowest category) to highly experienced (SA III). Clerical workers are not eligible as Science Aides.

2. Research Assistants are technical degree holders whose qualifications range from new graduate, under-board (RA I) to those with at least two (2) years of relevant job experience (RA III).

3. Research Associates are senior technical personnel with at least three (3) years relevant job experience and/or a master's degree (R. Asso. I) to those with over (5) years relevant experience, recognized expertise and/or a PH.D (R. Asso. IV).

   A Research Associate may serve as Project Leader assisting a Project Director or may be the Project Director himself.

IV. CRITERIA FOR HIRING

1. Contractual employees may be hired on a monthly salary basis.

2. The contract shall be made between the personnel and the implementing agency in a format to be prepared by the EDB.

3. Unless laws to the contrary are applicable, the personnel may start at any step in his normal position level depending on his specific qualifications and aptitude as judged by the Project Director.

4. Increases in salary may be made every six (6) months of satisfactory service in accordance with the schedule shown in Sec. II above. The Project Director should allow for such increases in his budget for personnel.

V. ALLOWABLE NUMBER OF CONTRACTUAL PERSONNEL

1. For a "normal" project in which the EDB grant is less than ₱150,000 per year, the maximum allowable contractual personnel are (See also Sec. 3 Annex C):

   1 - Research Associate
   1 - Research Assistant
   1 - Science Aide

   Other personnel requirements are expected to be provided as counterpart by the implementing agency.

2. Any upward departure from this rule must be fully justified in writing by the Project Director and will have to be specifically deliberated upon by the EDB Review Panel.

3. On the other hand, projects in which (a) the Research Associate is also the Project Director, or (b) the Research Associate is not assisted by a Research Assistant, or (c) the Research Associate, Research Assistant and/or the Science Aide are regular agency

personnel requiring only honoraria or incentive pay shall be accorded priority consideration.

4. The personnel schedule for projects costing more than ₱150,000 per annum shall be proposed and considered on a case-to-case basis.

ALLOWABLE RATES FOR HONORARIA AND CRITERIA FOR GRANTING THEREOF

1. Definitions

1.1 Honorarium is a sum awarded to Qualified Project Personnel in appreciation for their participation in the project as a function over and above their normal duties in their parent agencies. "Incentive pay" has essentially a similar meaning but often refers to the case of lower-echelon personnel.

1.2 Qualified Project Personnel refers to those who are not in the particular project as salaried contractual personnel and who possess qualifications and expertise essential to the attainment of the project objectives. They are normally regular technical employees in the implementing agency or agencies. The Project Director is required in all cases to be a regular employee of the implementing agency.

1.3. Project Director (Principal Investigator or Project Leader) is the person who, by virtue of his special knowledge, experience or expertise in the most essential aspects of the project as attested to by publications, present and previously-led researches, past positions, etc. is deemed capable of providing overall technical and managerial direction to the project.

Important: A person who is only administratively concerned with the project by virtue of his high position in the implementing agency is not considered

qualified as Project Director. For example, a Department Head of the proponent agency who has no expertise in say, biogas technology, is not qualified to be the Project Director of a project entitled "Design, Construction and Operation of a Communal Biogas System". For purposes internal to the agency, he may be nominally designated as Project Administrator or Project Manager but will not be entitled to any honorarium from EDB.

2. Maximum Number of Projects

2.1 All of the above-defined project personnel can only be listed in no more than three (3) on-going projects if they are to participate effectively and at the same time discharge their official functions. These three projects include both EDB and non-EDB researches.

3. Allowable Number of Personnel with Honoraria

3.1 For a normal project with annual costs of less than ₱150,000, the maximum allowable total costs for key personnel compensation is for the case (See Sec. V Annex B) where the Project Director (PD) is receiving honorarium and one each Senior Researcher (SR), Research Assistant (RA), and Science Aide (SA) are full-salaried contractuals.

3.2 In the interest of minimizing personnel costs, it is preferred that the PD be also the SR and/or the SR to have no RA. If these are not possible, a second preference is for as many of the allowable project personnel

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to be regular employees of the implementing agency and thus be entitled only to honoraria (lower than full salary). However, it must be assured that such personnel can actually devote ample time to the project.

3.3 In any case, only one (1) SR, a maximum of three (3) RA's and a maximum of 2 SA's are allowed to be recipients of honoraria for the case when no project personnel is a full-salaried contractual employee.

3.4 Although the above rules define allowable limits, it is emphasized that the nature of the specific project should determine the type of personnel complement structure. Each personnel position decided to be included in the project must be fully justified by a detailed description of duties.

3.5 No personnel, whether an honoraria recipient or contractual employee, should be listed for the entire duration of the project when his role is obviously relevant only at a certain phase. For example, a chemist whose only role is to analyze the output of a gas producer should not be listed until the gas producer is in operation. The EDB prefers that such personnel who shall be utilized only at brief instances in the course of the project be provided under the counterpart responsibility of the implementing agency.

4. Consultants

4.1 Consultants are persons specifically solicited by EDB
(a) to help evaluate the soundness of a project plan,
(b) to trouble-shoot or assist in solving a critical

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problem not by a project implemntor, (c) to participate in inter-agency deliberations or preparation of a special paper or study, and (d) for other purposes as may be required.

4.2 No project proposal should include a consultant whose services are planned to be on a regular basis. Such action reflects negatively on the qualifications of the Project Director/Proponent.

In cases where a few unavoidable expert consultations are envisioned due to the nature of the project, this may be included in the budget under Special Purposes. However, the amount will not be released to the proponent and shall be used only through EDB which shall have a say in the selection of the consultant and which shall pay such consultant directly.

5. Interim Rates for Honoraria

5.1 Project Personnel

	Annual Project Cost Less than ₱250,000	Annual Project Cost More than ₱250,000
Project Director	₱ 600 (850)*	₱ 750 (1000)
Senior Researcher	450 (600)	650 (800)
Researcher Assistant, Others	200	250

*The higher rates are for the case when the Project Director is not assisted by a Senior Researcher, and when the Senior Researcher is not assisted by a Research Assistant, respectively.

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5.2 Limitations

The aggregate monthly honoraria or incentive pay received by project personnel from government offices or private organizations shall not exceed 50% of their monthly salaries or such limitations as may be established by subsequent laws, rules or regulations.

(Guide only. Please accomplish using separate sheets).

ENERGY DEVELOPMENT BOARD
NONCONVENTIONAL ENERGY RESOURCES DEVELOPMENT PROGRAM

PROPOSAL FOR FINANCIAL ASSISTANCE

PART I. PROPOSAL SUMMARY

1. PROJECT TITLE: _____

2. PROPONENT: (Agency, Insitution or Company)

PRINCIPAL INVESTIGATOR: (Person who shall actually work on the project as Project Director and principal expert)

3. COOPERATING AGENCIES: (Agencies which are expected to be closely involved in project implementation by way of lending personnel or facilities, etc.)

4. PROJECT COST: TOTAL _____

(a) EDB Financing Requested _____

(b) Proponent's Counterpart _____

(c) Others, if any: _____

5. DURATION OF PROJECT: _____

6. PROJECT SUMMARY:

(A concise description of the project background, methodology and targets as detailed in Part II of this Form).

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PART II. TECHNICAL ASPECTS

7. SIGNIFICANCE OF PROJECT: (The broad rationale for embarking on the project, in relation to declared national development goals).

8. PRESENT STATUS OF PROJECT: (What has been done abroad, locally and by proponent on this or directly related research areas).

9. SPECIFIC OBJECTIVES/TARGETS: (Specific outcomes expected to be realized at end of project).

10. METHODOLOGY: (Brief description of how problem will be approached)

PART III. WORK PLAN

11. SCHEDULE OF ACTIVITIES: (Make Giant Chart showing detailed project phase and time span in weeks)

12. FINANCIAL PLAN SUMMARY: (A detailed Lin-Item Budget must be attached as Annex I)

	Cost	Requested from EDB	Proponent's Counterpart
I. Personnel Services			
II. Equipment & Accessories			
III. Maintenance & Other Operating Expenses			
IV. Capital Outlay			
V. Special Purposes			
TOTALS:			

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13. PERSONNEL REQUIREMENTS

No.	Position/Title	Monthly Salary/Honoraria

14. REFERENCES: (List 3 local persons who can comment authoritatively on subject of this proposal)

15. RELATED ACTIVITIES OF PROPONENT: (List a few other projects of related nature undertaken by proponent/principal investigator which have been completed or are in progress. Attached Curriculum Vitae of Principal Investigator as Annex II).

PREPARED BY:

_____
Principal Investigator

PROJECT PROPOSAL TRANSMITTAL APPROVED:

_____
Head of Institution

ANNEX I: LINE-ITEM BUDGET

PROJECT TITLE: _____

PROPONENT: _____

I. PERSONNEL COSTS: (Number, Position, Total Salary/Honoraria, etc.

II. EQUIPMENT AND ACCESSORIES: (Do not include office equipment)

III. MAINTENANCE AND OTHER OPERATING EXPENSES: (Supplies, materials, Travelling, Sundry, etc.)

IV. CAPITAL OUTLAY: (Land, Buildings, Office Furniture, Office Equipment, etc.)

V. SPECIAL PURPOSES:

NOTES:

1. Tabulate all items and break down into 3 columns:
   (a) Total Cost
   (b) Requested from EDB
   (c) Proponents Counterpart.
2. Specify Foreign Cost Components, if any.
3. Referring to the Work Plan, break down financial requirement by quarters. This is important in scheduling disbursements.

Nonconventional Energy Resources Development Program (NERDP)

NCRD EVALUATION OF PROJECT PROPOSAL

Project Data

Title: _____

_____

Proponent/Principal Investigator: _____

Date Received: _____ Project Duration: _____

Requested EDB Funding: _____

NERDP Project Area: _____ Priority Group _____

- -

I. EVALUATION BY THE PROJECT DEVELOPMENT GROUP (PDG): Technical Overall Quality

Is project category applied pilot/developmental? ___ Yes. ___ No.

If proponent is an individual, is he backed by an institution? ___ Yes. ___ No.

Does institution have required technical facilities? ___ Yes. ___ No.

What are Specific Outputs at completion (briefly)?

_____

_____

_____

Key results/installations realizable ___ within 6 mos. ___ within one year ___ _____

Is technical basis questionable? ___ Yes. ___ No.

Is project mere duplication of ongoing government-funded work? ___ Yes. ___ No.

Is work program (phases, durations) reasonable? ___ Yes. ___ No.

Is intended project site relevant? ___ Yes. ___ No.

Are Project Director and Senior Researcher qualified? ___ Yes. ___ No.

(IF THERE ARE ADVERSE REPLIES TO ANY OF ABOVE QUESTIONS, PLEASE ELABORATE ON SEPARATE SHEET)

PDG RECOMMENDATION _____

_____

_____

_____
PDG Evaluator

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II. EVALUATION BY THE PROJECT MONITORING GROUP (Financial and other Details)

Are listed personnel (number and type) within limits of guidelines?

/__/ Yes. /__/ No.

Are all contractual salaries/honoraria rates in accordance with guidelines? /__/ Yes. /__/ No.

Are Project Director and Senior Researcher currently handling less than three research projects each? /__/ Yes. /__/ No.

Are listed counterpart items/amounts within guidelines? /__/ Yes. /__/ No.

Are consulting fees appearing in costing? /__/ Yes. /__/ No. If so, are these within guidelines? /__/ Yes. /__/ No.

Are there vague or unreasonable budget items? /__/ Yes. /__/ No.

Were all requested materials furnished? /__/ Yes. /__/ No.

(IF THERE ARE ADVERSE REPLIES TO ANY OF ABOVE, PLEASE ELABORATE ON SEPARATE SHEET).

PMG RECOMMENDATION _____

_____

_____

_____
PMG Evaluator

III. RECOMMENDATION BY NCRD MANAGER

Based on above evaluations:

/__/ Proposal has no merit and is hereby rejected.

/__/ Proposal has some remediable defects. Suggest revision by proponent to conform with EDB guidelines.

/__/ Proposal satisfies NCRD criteria and is hereby endorsed to Review Panel.

_____

Draft Project Description

The $7.1 million AID loan will be utilized to finance the foreign exchange costs and a portion of the local currency costs of carrying out nine individual subprojects designed to exploit nonconventional, renewable energy resources. Subprojects will focus on direct and indirect solar conversion and small-scale hydropower. Illustrative subprojects to be undertaken and the estimated U.S. and GOP contributions to each activity are summarized in the table below:

Project Financing
($000)

Subproject	U.S.	GOP	Total	FX
1. Solar Dryers	$ 591	$ 180	$ 771	$ 528
2. Solar Refrigeration	351	67	418	226
3. Photovoltaics	132	68	200	113
4. Waste-Fired Thermal Plant	244	80	324	187
5. Pyrolysis	186	56	242	99
6. Mini-Hydro Power	244	80	324	187
7. Micro-Hydro Power	474	171	645	347
8. Wind Energy	280	93	374	228
9. Dendro-Thermal Plant & Energy Plantation	2,847	1,620	4,380	2,586
Sub-totals	$ 5,647	$ 2,516	$ 8,163	$ 4,786
Contingencies (10%)	565	252	817	479
Cost Escalation (15%)	847	378	1,225	719
Total	$ 7,059	$ 3,146	$ 10,205	$ 5,984

The $1.55 million grant will be utilized to finance: long and short term participant training and technical assistance; procurement of books, basic research equipment, and other research literature; a survey to determine energy use demands and resources in rural areas of the Philippines; and the dissemination of information through seminars, and workshops. Estimated U.S. and GOP contributions to each activity are summarized below:

Project Financing
($000)

Item	AID	GOP	Total	FX
Project Coordinator	202	40	242	170
Short-Term Consultants	336	60	396	280
Participant Training	279	84	363	279
Energy Survey	120	60	180	100
Solar/Wind Monitoring Equipment	140	56	196	110
Public Information/ Seminars	156	60	216	40
Sub-totals	1,233	360	1,593	979
Inflation 15%	191	54	245	168
Contingencies 10%	126	36	162	105
TOTALS	1,550	450	2,000	1,252

The Bureau of Energy Development (BED) of the Department of Energy will be the executing agency for the GOP. BED will select implementing agencies for individual subprojects. These will likely include BED; other Government agencies such as NEA, NPC, and NIA; the University of the Philippines, and other local institutions.

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS

PART II

PHILIPPINES

Nonconventional Energy Development
A.I.D. Project No. 492-0294

Pursuant to Part I, Chapter 1, Sections 106 and 119 of the Foreign Assistance Act of 1961, as amended, I hereby authorize a Loan and Grant to the Government of the Philippines (the "Cooperating Country") of not to exceed Eight Million Six Hundred Fifty Thousand United States (U.S.) Dollars ($8,650,000), (the "Authorized Amount"), to help in financing certain foreign exchange and local currency costs of goods and services required for the Project as described in the following sentence. The Project consists of ten research/demonstration/pilot projects to test the feasibility of exploiting nonconventional energy resources through direct and indirect solar conversion, biomass conversion, and small scale hydroelectric plants; participant training; technical assistance; and other related activities. The results of this research program have the potential of significantly affecting the social and economic development of rural areas in the Philippines by providing low cost, low maintenance energy sources to the rural poor. Of the amount authorized, Seven Million One Hundred Thousand U.S. Dollars ($7,100,000) (the "Loan") shall be in loan funds and One Million Five Hundred Fifty Thousand U.S. Dollars (the "Grant") ($1,550,000) shall be in grant funds. The entire amount of A.I.D. financing herein authorized for the Project will be obligated when the Project Agreement is executed.

I hereby authorize the initiation of negotiation and execution of the Project Agreement by the officer to whom such authority has been delegated in accordance with A.I.D. regulations and Delegations of Authority subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

a. Interest Rate and Terms of Repayment

The Cooperating Country shall repay the Loan to A.I.D. in United States Dollars within twenty (20) years from the date of first disbursement under the Loan, including a grace period of not to exceed ten (10) years. The Cooperating Country shall pay to A.I.D. in United States Dollars interest from the date of first disbursement under the Loan at the rate of (a) two percent (2%) per annum during the first ten (10) years, and (b) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

b. Source and Origin of Goods and Services

Except for ocean shipping, goods and services financed by A.I.D. under the Project shall have their source and origin in countries included in A.I.D. Geographic Code 941 or the Cooperating Country when loan-financed and in the Cooperating Country or the United States when grant-financed, except as A.I.D. may otherwise agree in writing. Ocean shipping financed under the Loan shall be procured in countries included in Code 941 and under the Grant in the United States, except as A.I.D. may otherwise agree in writing.

c. Terms and Conditions

1. Prior to the initial disbursement or the issuance of the initial commitment document under the Project Agreement, the Cooperating Country shall furnish in form and substance satisfactory to A.I.D. an agreed plan for the evaluation of the Project.

2. Prior to the disbursement of funds for construction of or procurement of major equipment for the dendro-thermal sub-project, final feasibility and detailed design of the sub-project shall be approved by A.I.D.

3. The Cooperating Country shall covenant that it will make available to the Bureau of Energy Development on a timely basis peso funds required for the implementation of the Project.

4. The Cooperating Country shall covenant that each participant who undertakes long-term training under the Grant shall execute an agreement with the Cooperating Country to serve the sponsoring agency or institution for a period at least equal to the length of the training period received.

Signature_____

Date_____

Biomass As An Alternative to Fossil Fuels

One of the alternatives available to the Government of the Philippines to relieve the dependence on fossil fuel energy generation is biomass development. Specifically, this method of energy generation would entail the cultivation of wood products, harvesting the timber, burning the wood directly or converting it to char, heating of water to produce steam, and the generation of electricity. In order to consider this alternative, the following data is presented concerning the cost of biomass electrical generation as compared to fossil fuel generation.

A hectare of Ipil-Ipil fuel wood (20 tons) will produce 320 million BTU's of energy (8,000 BTU's per pound). A barrel of #5 or #6 fuel oil (42 gal barrel) will produce 6.3 million BTU's of energy (150,000 BTU's per gallon). Given the efficiency of wood combustion of 65 percent and and the oil efficiency of 80 percent, a hectare of wood could produce steam to be used in electricity generation equal to 41 barrels of oil. (If biomass conversion were used to replace the Philippines 1977 oil consumption of 83.4 million barrels there would have to be 2 million hectares of Ipil-Ipil under cultivation.)

Any discussion relating to the large scale use of biomass conversion must touch on three basic issues:

- -- Availability of land
- -- Economic aspects of fuelwood cultivation
- -- Transportation of raw materials and electricity

In addition to the above considerations one should also discuss the basic practicality of wide-spread utilization of biomass conversion.

Availability of Land

At the present level of land development, commercial forest lands cover sixty percent of the total land mass of the Philippines. Of the 18 million hectares of commercial lands, approximately 8 million hectares are considered exploitable; however, the economics of the forest products industry would preclude the large scale use of exploitable lands for energy plantations. Saw logs would be much more valuable than the chip wood used in energy production; however, there are five million hectares of denuded or marginal commercial forest lands in the Philippines, and the establishment of energy plantations on these lands should be explored. In short, land is available.

Economic Aspects of Fuelwood Cultivation

The major economic aspect of fuelwood cultivation within the private enterprise system is whether or not local cultivators will opt for fuelwood over timber or farmland. At present fuelwood market prices ($41 per ton) there would not be much incentive for a land owner to plant fuelwood unless they had a good deal of unused acreage. A recent World Bank study priced

fuelwood at $44 per ton, however, if a figure of $26 per ton is used (making the fuelwood cost per BTU equal to the equivalent value of fossil fuel) the value per hectare would be about $1,100 per hectare. Considering the lack of labor required other than fencing and initial planting establishment, energy plantations might be an attractive alternative for marginal forest land and if current market prices were used the value would increase to $1,750 per hectare. If investment costs were subtracted from the gross figure and the growing season of four years were taken into account, the value per year would equal about $300 per hectare per year.

Transportation Issues: fuelwood and electricity

The two major transportation questions are: how one gets the product to the generating installation, and how one gets the generated electricity to the consumer. As the source of the fuelwood gets further away from the generating plant, the transportation costs will increase thus reducing profit from the crop. Although the fuelwood could be converted to char thus reducing the weight per BTU by 40% (fuelwood 8,000 BTU vs. char 14,000 BTU per pound) this additional process would increase the cost of the product and reduce the profit to the producer. Therefore, it seems practical that the energy plantation encompass the generating facility thus reducing the transportation costs.

As the biomass conversion generating facility will generate large amounts of electricity, the facility will have to serve large municipal areas, industrial consumers, or be fed into the power grid. The first two alternatives would call for the lease investment in electrical transmission costs although it may be hard to locate a large energy plantation in an area near an urban community due to land use factors.

In conclusion, nonconventional energy planners are faced with some very difficult practical considerations. In all likelihood, an energy plantation will have to be government owned and operated as the incentive for private enterprise development most probably will not be sufficient to encourage investment. In addition, the relatively large amount of land necessary to sustain the operation would make the logistical problems of organizing many small private growers insurmountable. Using fuelwood as an alternative to fossil fuel would be practical only if the government were willing to put forth a major effort to insure that the necessary land were made available, the plantation well managed, and the resultant electricity properly utilized.

Department of State

Annex N

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E.O. 11652: NA
SUBJ: NON-CONVENTIONAL ENERGY DEVELOPMENT PROJECT -- GOP LETTER OF REQUEST

FOLLOWING LETTER RECEIVED FROM NEDA 3/31/78: QUOTE DEAR MR. CODY
I REFER TO THE PROJECT PAPER FOR THE NON-CONVENTIONAL ENERGY DEVELOPMENT PROJECT DESIGNED TO CONDUCT MAJOR RESEARCHES ON ENERGY SOURCES OTHER THAN FOSSIL FUELS. THIS OFFICE JOINS THE SECRETARY OF ENERGY IN ENDORSING IT. I TAKE THIS OCCASION TO FORMALLY REQUEST USAID ASSISTANCE CONSISTING OF A DEVELOPMENT LOAN OF UP TO $7.1 MILLION AND A GRANT OF $1.65 MILLION.

IT IS MY UNDERSTANDING THAT THE BREAKDOWN OF ELEMENTS OF THE PROJECT AND COSTS ARE PLANNING FIGURES AND THAT THESE WILL BE SUBJECT TO REFINEDMENT WHEN A MORE DETAILED CALCULATION OF REQUIREMENTS IS MADE. SINCERELY YOURS, /S/ GERARDO P. SICAT UNQUOTE.
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