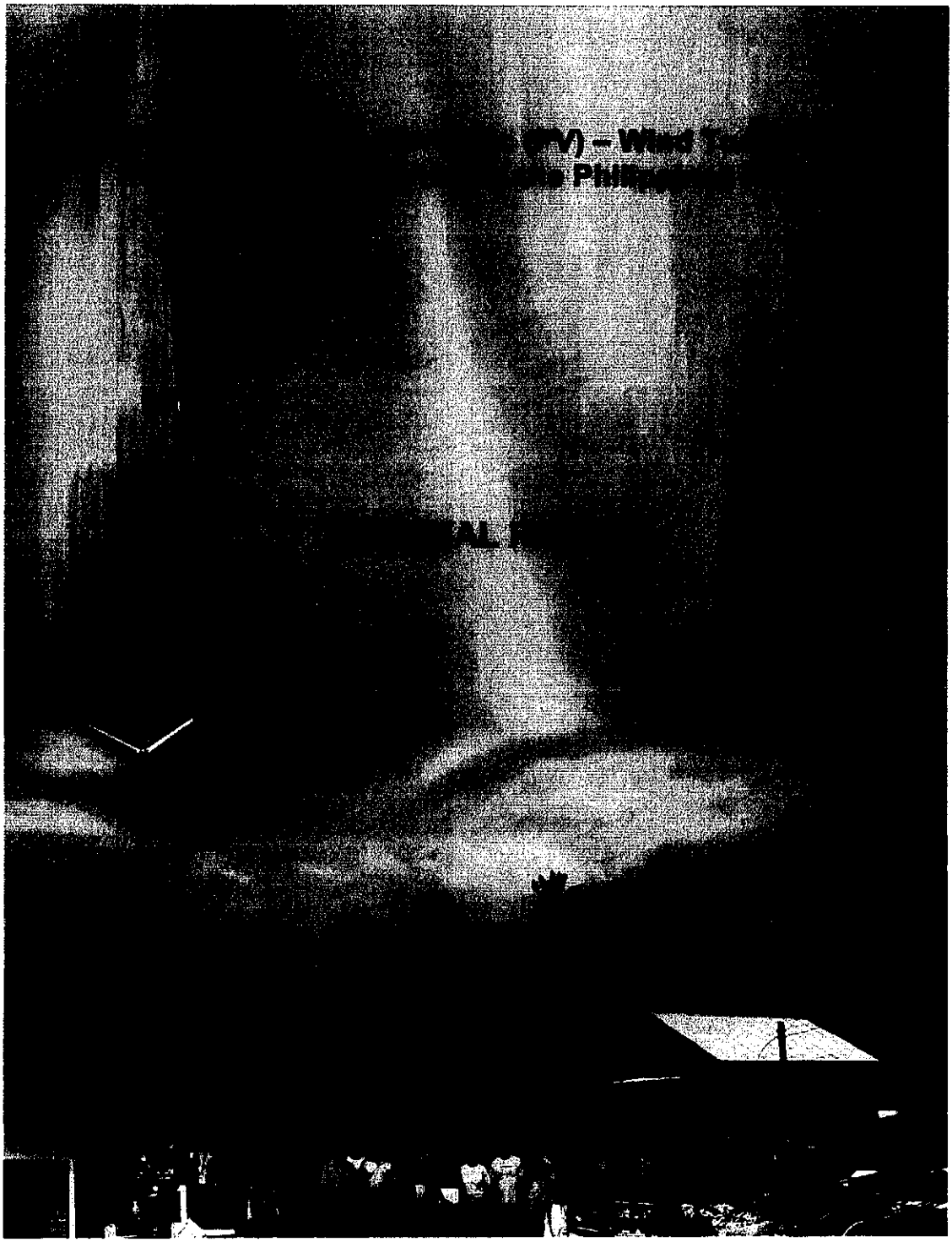


September 2006

Summary

1. The proposed project was envisioned to be a pilot centralized utility-type 5 kWp Photovoltaic (PV)/10 kW Wind Turbine Hybrid System that would provide the electricity needs of 200 household beneficiaries in Sitio Sicud, Brgy. Candawaga, Rizal, Palawan for lighting and operation of small home appliances. Electricity would be distributed via a mini-grid distribution line. The DC output of the PV and Wind Turbine Generator would be converted into a 220-volt AC by passing through a 15 kVA inverter. A 15 kVA diesel generator would be provided to back-up the hybrid system.

2. The Sicud Village Power Association was established to directly manage the operation and maintenance of the system including electricity distribution to consumers, meter reading, billing and collection under the supervision of the State Polytechnic College of Palawan- Affiliated Nonconventional Energy Center (SCPC-ANEC), now known as Western Philippines University-Affiliated Nonconventional Energy Center or WPU-ANEC.

3. A technical monitoring visit was conducted by the Department of Energy from 19-20 April 2006 to observe the performance of the hybrid power system. The team was composed of representatives from JICA, led by Dr. Akio Shiota, DOE, Messrs. Ronnie N. Sargento and Romeo M. Galamgam and PGP Energy Unit Staff, Messr. Roberto Abacial. An equipment inventory and technical report validation was conducted last 16 August 2006 for purposes of project closure.

4. Since this was the first pilot hybrid system to be implemented by the Department of Energy (DOE) and Western Philippines University-Affiliated Non Conventional Energy Center (WPU-ANEC), there were difficulties in the design and implementation of the project. Several adjustments had to be made during the course of implementation with the guidance and supervision of DOE.

5. Delays in the implementation of the project were experienced primarily due to the DOE reorganization in 2003 wherein project staff transferred to other DOE units. No formal turn over of the project was made and the next steps were not identified but with DOE's commitment, the appropriate thing to do was to implement the project immediately.

6. It took less than 2 years to implement the procurement process due to the delayed signing of the tri-partite MOA among DOE, PGP and WPU which resulted to the delayed release of the DOE counterpart for the project amounting to P1.26 million which was used for the distribution line and social preparation.

7. The DOE encountered two (2) failed biddings due to the limited project budget provided for the procurement of equipment. Three pre-qualified suppliers failed to submit their financial and technical proposals on November 21 and December 22, 2003 due to the project's limited budget.

8. Due to the numerous delays encountered and the DOE reorganization, project monitoring and documentation were inadvertently overlooked by the DOE Project Staff and the Implementing Agency, WPU-ANEC.

9. The Sicud Village Power Association (SVPA) composed of household beneficiaries was organized/established on April 11, 2005. SVPA was to be responsible for the management and operation of the project.

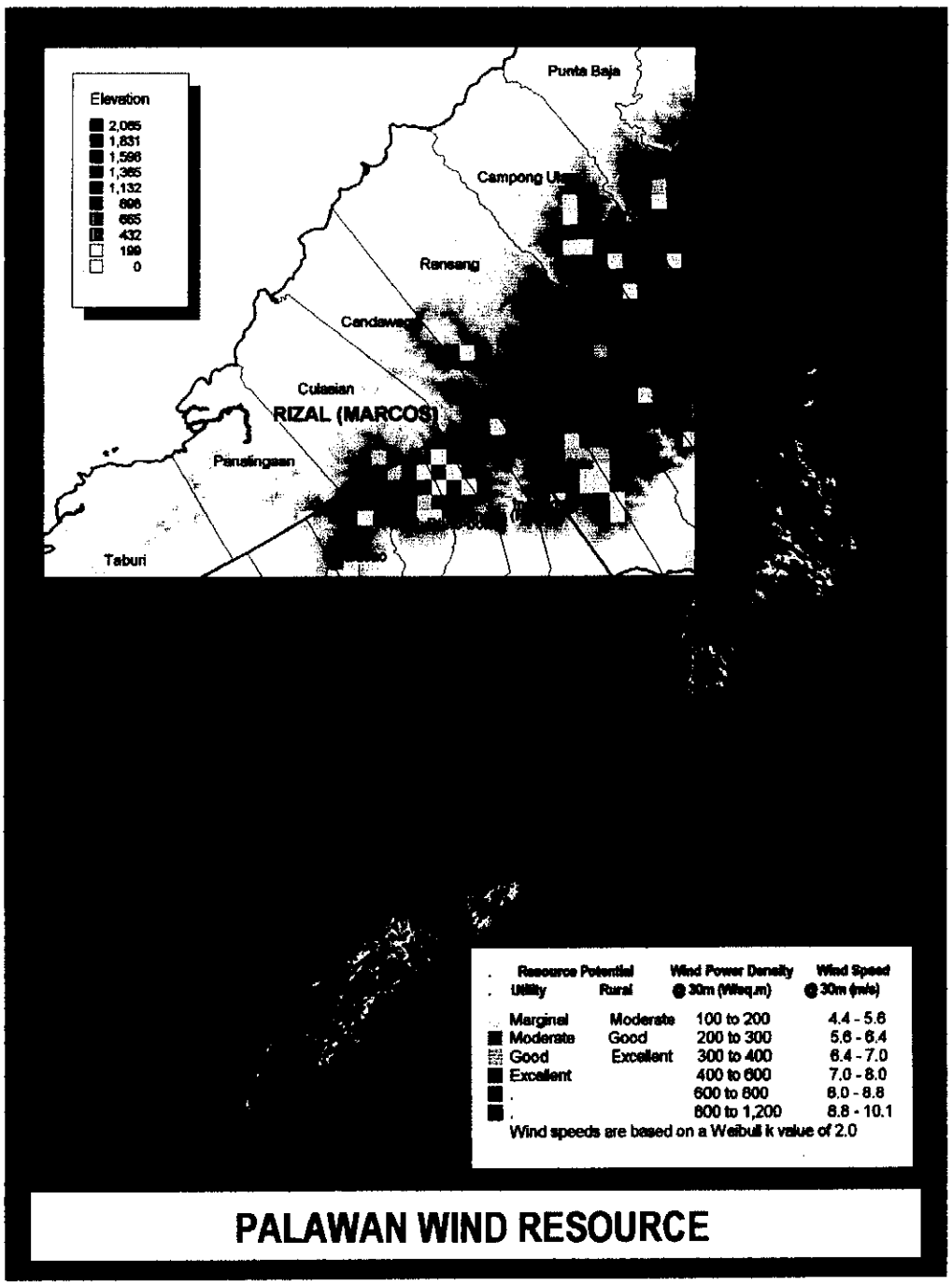
10. The DOE implemented the project, albeit sluggishly, and had the PV-Wind hybrid system installed in Sitio Sicud, Candawaga Rizal on April 2005. The completed project contributed to the promotion of new and renewable energy systems for rural electrification in the area with increased awareness and utilization of PV Solar Home Systems as an alternative means to obtain electricity. It also capacitated the local community in the management and operation of a small-scale power system.

11. Several lessons (technical design, economic and social aspects) were drawn from experiences in implementing the project. These relevant information would provide useful inputs for more successful implementation of rural electrification projects in the future. It must be noted that the household beneficiaries are now enjoying electricity from the project, albeit on a limited capacity, wherein the electricity tariff is still much cheaper compared to the cost of operating small diesel generators.

Context

Project Location

12. The project site, Sitio Sicud is located in Barangay Candawaga, Municipality of Rizal, Palawan. It is located 245 km southwest of Puerto Princesa City. It is bounded on the west by the South China Sea and on the east by rice fields at the foot of Mount Mantalingahan Range.



13. While the province of Palawan has some of the highest wind resource potential, based on the National Renewable Energy Laboratory's Wind Atlas, it was noted that in Barangay Candawaga, Rizal, in particular, has no potential wind resource.

Community Profile

14. At the time of the study, the municipality of Rizal, particularly Sitio Sicud, was a recipient of very limited share of government investments and services. However, the sitio was notably fast developing and growing as indicated by the presence of a public market, several establishments, farm and fishery supplies, post harvest facilities, fish buying stations, transportation terminal and gasoline station. Please see attached photos in Annex "6".

15. Sitio Sicud had a total population of 582 in 2000 when the project was proposed (Feasibility Study, April 2000, ANNEX "3"). It had since increased to about 1200. Of this total, only few had electricity in their homes.

16. The households in Sitio Sicud had an average income which was about twice the province average. With a relatively affluent population indicating a high capacity to pay for electricity services, it was identified as among the target communities for rural electrification.

17. Prior to the start of the project, renewable energy technologies such as solar and wind energy technologies were relatively new. There was lack of information on these technologies in terms of its social, financial, economic and environmental aspects. It was observed that after the conduct of information campaigns through community consultations, the people of Sitio Sicud learned to appreciate the advantages of having solar home systems as an alternative and cheaper way to obtain electricity. To date, there are about 13 households that use SHS for lighting and small appliances.

Partner Implementers:

18. Implementation Structure

    Project Management Board (PMB) – The PMB was established to provide advisory support in the formulation of management guidelines, organizational and operational policies of the project. It was composed of representatives from UNDP, DOE, PGP, WPU-ANEC and other project stakeholders.

19. Department of Energy – The DOE was identified as the lead agency in this project. It was tasked to provide overall management and supervision of the project. Likewise, it had to provide a counterpart funding for the construction of distribution line and social preparation activities. It had to undertake coordination works with the local partners of the Project.

20. Western Philippines University – Affiliated Non Conventional Energy Center – The WPU-ANEC acted as the Implementing Partner of the Project

wherein close collaboration with the DOE had to be established as well as with the local government units, the Municipal Government of Rizal and Barangay Candawaga. It established the Sicud Village Power Association that was capacitated by WPU-ANEC through the conduct of training seminars.

21. Sicud Village Power Association – Composed of household project beneficiaries, SVPA was tasked to oversee the day-to-day operation and management of the project.

22. Provincial Government of Palawan – The PGP during the project conceptualization, had committed to provide counterpart funding for the construction of a multi-purpose building for the project. With the increase in energy demand in Barangay Candawaga including Sitio Sicud, the PGP had committed to provide additional power project using diesel generators that would supply its high energy demand. The corresponding workplan was completed and ready for implementation. It is expected that the electrification of Barangay Candawaga, including Sitio Sicud, will be completed before the yearend.

23. United Nations Development Programme – The UNDP had provided funding support for the procurement of equipment and services relative to the installation of hybrid 5 kWp PV System-10 kW WTG with a back up generator. UNDP was instrumental in the development of the project document in close collaboration with DOE and WPU-ANEC. It also had provided administrative support in the course of project implementation.

24. Palawan Electric Cooperative, Inc – The exclusive right to provide electricity services in the whole province of Palawan was bestowed upon PALECO. Due to economic considerations in extending the local grid to Sitio Sicud, PALECO waived its right to give way to the realization of the project.

25. Japan International Cooperating Agency – As a complementary capacity building project, JICA and DOE had established the Sustainability Improvement of Renewable Energy Development in Village Electrification Project in 2004. Short-term PV Expert Dispatch, Dr. Akio Shiota had provided inputs in project evaluation and assessment of operation of the hybrid power system. Likewise, JICA had conducted a series of technical trainings on PV system and its related components to capacitate the national government, local government, training institutions, renewable energy developers and suppliers.

Project Milestones/Accomplishments

26. The project has three main objectives as stated in the project document. The first is to provide Sitio Sicud with a utility-type 24-hour electricity service for 200 households.

27. The project successfully installed a hybrid power system with the following components:

Wind Turbine

Wind Turbine Manufacturer	:	Westwind
Model	:	
Rated output	:	10kW at 14 m/s 6kW at 10 m/s 2kW at 6 m/s
No. of Wind Turbine	:	1 unit
Hub Height	:	18m

The rated capacity of installed Wind turbine is 10kW at 14 m/s.

PV System

PV Module Manufacturer	:	BP Solar
Model	:	BP375H
Capacity	:	75W
No. of PV modules	:	70 units (10 in series, 7 in Parallel)
Total Capacity	:	5.25kW (75W x 70)

The total capacity of installed PV arrays is 5.25kW.
This complies with the specification of 5.1kW.

Charge Controller/Inverter

Manufacturer	:	PPS Enviro Power
Model	:	SPP-1P-1D-15K-230-60-120-10K
Capacity	:	15kVA
Frequency	:	60 Hz
Voltage	:	230V
Phase	:	1 phase
Bulk Charge	:	2.30V@cell
Float Charge	:	2.35V@cell

Back Up Diesel Generator

Manufacturer	:	Cummins
Model	:	ES35-6
Capacity	:	35kVA at prime
Frequency	:	60 Hz
Voltage:	:	230V
Phase	:	1 phase
Transformer	:	15kVA, 240V to 240V

The total installed capacity of Genset is 35kVA. This complied with the specification of 15kVA.

Battery Bank

Battery Manufacturer	:	Exide
Battery Model	:	Classic EnerSol T460 (2V)
Capacity	:	416Ah at C24
No. of Batteries	:	60pcs in series

The technical specification in the bidding document was 1000Ah (@ C/20) with 48V (1000Ah x 48V = 48.0kWh in total). Since 48V system was not adequate for this size of system, supplier offered 120V system. Therefore, 416Ah (@ C/24) batteries were supplied to meet the total capacity of 49.9kWh (416Ah x 120V = 49.9kWh).

The total capacity of supplied battery bank complied with the specification. However, the capacity of battery bank is too small.

Error Identified[1]	Cause of Error	Remedy / Rectification Measure
1. *The battery capacity is too small:* The total capacity of the battery is 50 kWh (416 Ah @ C24 x 60 units). Minimum capacity requirement of the battery bank should be 458.4 kWh (1910 Ah @ C24 x 120 units)	Initial assumption was that depth of discharge (DOD) of battery was at 50%. It was however, later learned that to prolong the life of the battery, DOD should be maintained at 20% only.	Since the existing capacity of the battery bank can be fully charged by the PV array alone, energy from the WTG can no longer be absorbed by the system. DOE has been capacitated through the experiences learned from the project and through the technical trainings provided by JICA Short-term Expert

[1] Based on Monitoring Report of the DOE-JICA Project: Sustainability Improvement of Renewable Energy Development in Village Electrification

Error Identified	Cause of Error	Remedial Measure Taken
		Dispatch, Dr. Akio Shiota
2. *Wind turbine has not been generating power.*	Wind assessment was not done properly. It was done only in one day instead of one year. During the conceptualization of the project, DOE's and WPU-ANEC's capacity to conduct resource assessment of wind power sites was very limited. Hub height in the TOR was 36m. The contractor installed an 18-meter hub height.	DOE has since beefed up its capacity to conduct assessment of wind power sites. Based on the Wind ATLAS that was developed by National Renewable Energy Laboratory, the area in Sitio Sicud, Candawaga, Rizal has no wind resource. For this particular site, the wind turbine component is being considered for possible relocation to other wind potential sites
3. The output power of PV array was overestimated	The performance ratio of the PV array was estimated at 100%. The actual performance ratio should have been estimated at 50% to consider the available "sunshine-hours"[2] per day	DOE has been capacitated through the experiences learned from the project and through the technical trainings provided by JICA Short-term Expert Dispatch, Dr. Akio Shiota

28. Due to the above-mentioned errors and the increase in the energy demand of the population, the target of 200 households was not met. As of 16 August 2006, about 51 households are connected to the system. The Sicud Village Power Association targets that an additional 10 households will be connected to the system by October 2006.

29. Another factor in not meeting the target of 200 households was the resistance of some households to provide their own counterpart fund for the project. It was agreed during project conceptualization that in order to

[2] Based on Dr. A. Siota's training module on PV Technology Training, the intensity of available solar irradiation per day is only 4 hours but the estimate made for the project was 8 hours per day.

ensure commitment to the project's goals, household beneficiaries were required to provide their own house wiring and kWhr meter. This cost was approximately US$100 per household.

30. The second objective of the project was to develop an approach to ensure project sustainability. It was envisioned that the project would be sustainable if it would be anchored primarily on people's participation and commitment.

31. As a functional organization composed of the local people, the SVPA was established by WPU-ANEC for local project management, monitoring and supervision. It has an initial membership of 32 household beneficiaries and had since grown to 51 households as of August 16, 2006. Most of the members and officers of the association are women, who have been immensely benefited from the realization of the project since they have now more time for routine home management activities as well as entertainment and relaxation.

32. Series of trainings to capacitate SVPA in the management and operation of the hybrid power system, including basic bookkeeping were conducted. A local technician was trained for the operation, repair and maintenance of the hybrid power system. JICA has contributed to the technical training of the technician during one of the monitoring visits that was conducted.

33. The PGP-Energy Unit was trained by JICA Expert Dispatch to supplement the effort of the WPU-ANEC in strengthening the Association's technical knowledge deficiencies.

34. With the intervention of key project stakeholders and JICA, the operation of the hybrid power plant is now well understood and in cases of emergencies or system failures, the SVPA technician is well equipped with the proper information, skill and expertise to restore the normal system operation.

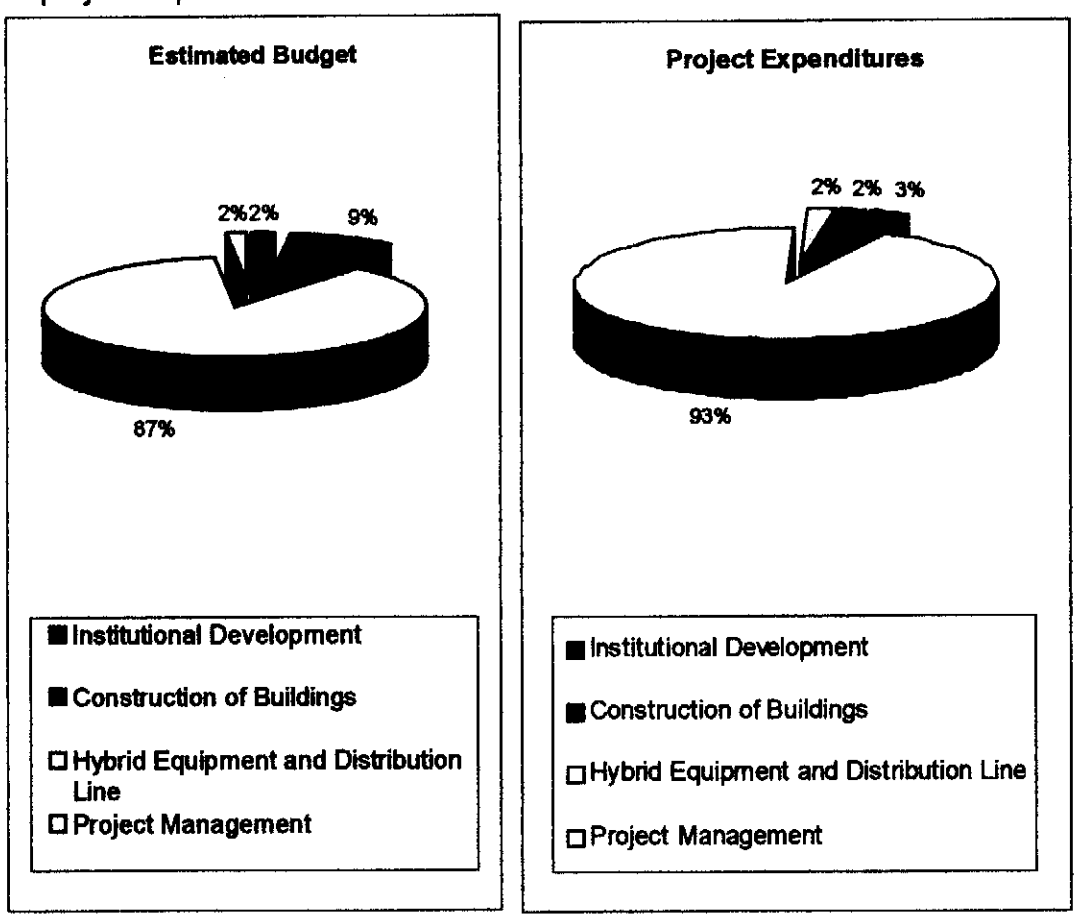
35. The last objective of the project was the development of a framework that will draw out from the valuable technical, economic, social and other relevant experiences that will justify the replication of the system in other areas as well as for policy making in the matter of rural electrification in rural villages.

36. While it is a fact that the project did not completely deliver all the expected outcomes due to a number of miscalculations and misconceptions, valuable lessons learned from the project were drawn which currently are being seriously taken into consideration in the implementation of current and future rural electrification projects.

37. Anchored on the experiences gained on the project, few policies were instituted while the necessary implementing guidelines in the execution of the DOE's rural electrification project have been completed.

Budget Breakdown

38. The pie charts below represents the estimated budget vis a vis the actual project expenditures:



39. Actual expenditures show that most of the budget was spent for the hybrid equipment and distribution line. Budget for the former was provided by UNDP while the DOE on the latter. Only about 2% each was spent for the institutional development and project management. The WPU-ANEC was not able to establish the Project Management Office and hire the necessary staff due to the insufficiency of funds allocated herein.

40. 87% of the budget was allocated for the procurement of hybrid equipment and distribution line. However, a 5% cost overrun was achieved (93% of the total expenditures) due to foreign currency exchange and inflation.

41. One of the keys to project sustainability is a well-organized and completely prepared community to understand the concept of business and manage the day-to-day operation of the hybrid power system. Effective social preparation is necessary coupled with the appropriate allocation of budget to fund the related activities.

Impact on the Promotion of New and Renewable Energy in the Province of Palawan

42. It was identified in the project document the lack of capabilities of the LGUs to implement renewable energy based rural electrification projects due to the innovativeness and complexity of the technology. The national government through the DOE has since espoused the wider use of renewable energy at the national and local level with, among others, the drafting of the Renewable Energy Bill that provides preferential incentives to RE developers and end users.

43. The private sector such as the Shell Renewables Philippines, Inc. has identified the province of Palawan as one of its major market for the 15,100 SHSs. The private sector was motivated to participate in RE rural electrification due to the national government's intervention to minimize risk through the availability of highly subsidized RE systems at the local level and implementation of specific work programs and projects in rural electrification. The project was able to demonstrate the viability of operating a mini-grid system that caters to the electricity needs of the target beneficiaries with a minimal fee.

44. Based on the information provided by the SVPA, during the conceptualization phase of the project, Sitio Sicud had 11 small generators with capacities ranging from 3–7.5 kW. Several other small generators with the same capacity range were operated until the start of project operation. To date, the project has successfully displaced about 13 diesel generators, with capacities ranging from 3–7.5 kW, with a monthly average fuel consumption of about 1,560 liters. However, due to high electricity demand, the project also uses the back up generator with a monthly consumption of 420 liters. This means that the project was able to displace about 1,140 liters of diesel fuel per month. SVPA is now acting as the entrepreneur, making business out of the need for electricity in the sitio. It has an approximate monthly net profit in the amount of P2,000.00 which is being plowed back to the member beneficiaries through better electricity services.

45. With the SVPA's technical and basic financial training on the project, operation procedures and guidelines were developed and implemented. Due to the fluctuating cost of fuel, SVPA officials are now capacitated in the

calculation of the appropriate electricity tariff to be imposed upon member consumers.

Lessons Learned

46. Based on the project expenditures, only about 4% was spent for the institutional development and project management. The insufficiency of funding the activities relative to the institutional development and management of the project resulted to the assumption of the WPU-ANEC as the PMO with a very limited budget and staff, rather than creating a separate PMO with the hiring of dedicated staff for the project. Therefore, in the conceptualization and implementation of future RE for rural electrification projects, substantial increase in budget for social preparation and project management must be seriously considered.

47. As of August 16, 2006, about 51 household beneficiaries have been registered as active members of the SVPA. This is 75% short of the 200 target beneficiaries the project intends to attain. Due to its complexity, there were miscalculations in the design of the system that resulted to the reduction of the total energy generation of the hybrid power system. Valuable lessons were learned in the course of implementation of the project specifically in recognizing the training deficiencies of the DOE on solar PV and Wind Power technologies. In this regard, the DOE engaged the services of JICA Experts in strengthening the capability of not only the DOE, but including the ANECs, local government units and renewable energy developers and suppliers.

48. Electricity needs of the beneficiaries are constantly growing due to the increased economic activity in the area. It is therefore safe to always anticipate a bigger growth forecast.

49. Delays in the implementation of the project were encountered due to inadequate coordination among key project stakeholders. A written agreement on the provision of counterpart funding from the DOE, PGP, and LGU-Rizal must have been secured first prior to the signing of the project document. In the implementation of future RE rural electrification projects, initial social preparation and counterpart funding have to be available prior to the approval of the legal document.

Acronym List

UNDP	-	United Nations Development Programme
DOE	-	Department of Energy
REMD	-	Renewable Energy Management Division
WPU-ANEC	-	Western Philippines University – Affiliated Non Conventional Energy Center
SVPA	-	Sicud Village Power Association
PGP	-	Provincial Govemment of Palawan
JICA	-	Japan International Cooperating Agency
ANECs	-	Affiliated Nonconventional Energy Centers
RESCO	-	Renewable Energy Service Company
LGU	-	Local Government Unit
PMO	-	Project Management Office
PMB	-	Project Management Board
PALECO	-	Palawan Electric Cooperative, Inc.
PV	-	Photovoltaic
WTG	-	Wind Turbine Generator
RE	-	Renewable Energy
kW	-	Kilowatt
kWp	-	Kilowatt-peak
kVA	-	Kilovolt-ampere
AC	-	Alternating Current
DC	-	Direct Current

Report Attachments

- ✓ **Project Document (ANNEX "1")**
- ✓ **Monitoring Report of Dr. Shiota (ANNEX "2")**
- ✓ **Original Feasibility Study (ANNEX "3")**
- ✓ **Barangay Electrification Project Implementation Manual (ANNEX "4")**
- ✓ **Equipment Inventory Report (ANNEX "5")**
- ✓ **Photos in Sitio Sicud (ANNEX "6")**

ANNEX "1"

Project Document

United Nations Development Programme

Sustainable human development

PHL/00/E01
(PROG/2000/A224)

November 16, 2000

Dear Mr. Benito,

PHL/00/E01 Multi Purpose Pilot Photovoltaic (PV) – Wind Turbine System for Rural Electrification in the Philippines

Further to your 10 November 2000 letter, kindly find enclosed the duly signed project document for the above-cited project funded by the Government of Japan through the UNDP Energy Account.

The project is a pilot centralized utility type 5 kWP PV/ 10 KW wind turbine hybrid system that will provide the electricity needs for lighting and operation of small home appliances of 200 households in Sitio Sicud, Barangay Candawaga, Rizal, Palawan.

Total inputs from the Government of Japan through the UNDP Energy Account is US$125,000.

Considering that the UNDP/GOJ contribution of US$125,000 will be used to cover the costs of the equipment and installation of the hybrid system, we have enclosed for easy reference the guidelines on the procurement of goods (Chapter 15 of the Manual for National Execution of UNDP Supported Projects). Please note that UNDP could on an exceptional basis act as a paying agent for the goods purchased for the project provided that the DOE's or the Affiliated Non-conventional Energy Center's (ANEC) ability to make payment is limited by banking or exchange control regulations or where it is more cost effective for the UNDP Country Office to make the payment directly. In this case, the entire procurement process will still be undertaken by the Project Management Office (PMO).

Mr. Francisco A. Benito 11/23
Officer-in-Charge
Energy Utilization Management Bureau
Department of Energy
Merritt Road, Fort Bonifacio
Taguig, Metro Manila

1604

Attention: Mr. Domingo Samuel Baybay

NEDA sa Makati Building, 7/F, 106 Amorsolo Street, Legaspi Village, 1229 Makati City, Philippines
Postal Address: P.O. Box 7285 Domestic Airport Post Office Lock Box, 1300 Domestic Rd., Pasay City, Philippines
Telephone No.: (632) 892-0611 to 25 • Fax (632) 816-4061; (632) 893-9598 • Cable Address: UNDEVPRO Manila
Email:undevpro@i-next.net • undpadm@i-next.net • fo.phi@undp.org (INTERNET)

Finally, we will appreciate it if your office could provide us with the list of signatories and their designations in relation to the project implementation and the corresponding specimen signatures for the authorizing/approving officers to issue reports, request for direct payments (RDP) and advances.

Best regards.

Yours sincerely,

Terence D. Jones
Resident Representative

cc: Mr. Reuben Quejas, Chief, NCED/DOE, Makati City
Mr. Rolando Tungpalan, Director, PIS/NEDA, Pasig City (w/ copy of the prodoc)

UNITED NATIONS DEVELOPMENT PROGRAMME
PROJECT OF THE GOVERNMENT OF PHILIPPINES

PROJECT PHI/00/E01

Title: Multi-Purpose Pilot PV Wind Turbine Hybrid System for Rural Electrification in the Philippines

Short Title: Mulit-Purpose Pilot PV-Wind Turbine Hybrid

Starting Date:	01/12/2000
End Date:	30/11/2001
Executing Agent:	NEX - Department of Energy
Implementing Agent:	NEX - Department of Energy
Project Site:	Sitio Sicud, Bgy. Candawaga, Rizal, Palawan
Beneficiary Countries:	
ACC Sector/Subsector:	NEW AND RENEWABLE SOURCES OF ENERGY - ENERGY
DCAS Sector/Subsector:	Energy - New and renewable sources of energy (includes fuelwood, methane, synthetic, solar, biomass, wind, wave, etc.
Primary areas of focus/sub-focus:	Promoting Environmental and Natural Resources Sustainability - Promotion of sustainable energy and atmospheric quality
Primary Type of Intervention:	Investigation - Pilot and demonstration
Primary Target Beneficiaries:	Target Groups - Disadvantaged groups - disadvantaged groups (in general)

Sumary of UNDP and Cost-Sharing Inputs in US$ as per atached budget(s)

INPUTS	
UNDP:	0
73-UNDP Energy Account	125,000
TOTAL INPUTS	125,000
TOTAL	125,000

LPAC approval date:	/ /
BPAC approval date:	/ /
Programme Officer:	

Brief Description:

The project is a pilot centralized utility type 5Kp PV/-10KW Wind Turbine Hybrid System that will provide electricity needs to 200 households in Sicud, Rizal, Palawan for lighting and operation of small home appliances.

Approved by:	Signature:	Date:	Name/Title:
UNDP:		17 NOV 2000	Terence D. Jones Resident Representative
Executing Agent:			Cyril del Callar Undersecretary, Department of Energy

UNITED NATIONS DEVELOPMENT PROGRAMME
PROJECT OF THE GOVERNMENT OF PHILIPPINES

PROJECT PHI/00/E01

Title: Multi-Purpose Pilot PV Wind Turbine Hybrid System for Rural Electrification in the Philippines

Short Title: Mulit-Purpose Pilot PV-Wind Turbine Hybrid

Starting Date:	01/12/2000
End Date:	30/11/2001
Executing Agent:	NEX - Department of Energy
Implementing Agent:	NEX - Department of Energy
Project Site:	Sitio Sicud, Bgy. Candawaga, Rizal, Palawan
Beneficiary Countries:	
ACC Sector/Subsector:	NEW AND RENEWABLE SOURCES OF ENERGY - ENERGY
DCAS Sector/Subsector:	Energy - New and renewable sources of energy (includes fuelwood, methane, synthetic, solar, biomass, wind, wave, etc.
Primary areas of focus/sub-focus:	Promoting Environmental and Natural Resources Sustainability - Promotion of sustainable energy and atmospheric quality
Primary Type of Intervention:	Investigation - Pilot and demonstration
Primary Target Beneficiaries:	Target Groups - Disadvantaged groups - disadvantaged groups (in general)

Sumary of UNDP and Cost-Sharing Inputs in US$ as per atached budget(s)

INPUTS	
UNDP:	0
73-UNDP Energy Account	125,000
TOTAL INPUTS	125,000
TOTAL	125,000

LPAC approval date:	/ /
BPAC approval date:	/ /
Programme Officer:	

Brief Description:

The project is a pilot centralized utility type 5Kp PV/-10KW Wind Turbine Hybrid System that will provide electricity needs to 200 households in Sicud, Rizal, Palawan for lighting and operation of small home appliances.

Approved by:	Signature:	Date:	Name/Title:
UNDP:		17 NOV 2000	Terence D. Jones Resident Representative
Executing Agent:			Cyril del Callar Undersecretary, Department of Energy

TABLE OF CONTENTS

List of Acronyms

ANEC	Affiliated Non-conventional Energy Center
APR	Annual Progress Report
DOE	Department of Energy
FR	Financial Report
GEF	Global Environmental Facility
GHG	Greenhouse Gas
GOJ	Government of Japan
KW	Kilowatt
LGU	Local Government Unit
MOA	Memorandum of Agreement
MOOE	Maintenance, Operation and Other Operating Expenses
MW	Megawatt
NAPOCOR or NPC	National Power Corporation
NEA	National Electrification Administration
NRE	New and Renewable Energy
NREL	National Renewable Energy Laboratory
PAC	Project Advisory Council
PALECO	Palawan Electric Cooperative
PGP	Provincial Government of Palawan
PMO	Project Management Office
PV	Photovoltaic
QPR	Quarterly Progress Report
RESCO	Renewable Energy Service Company
SBAA	Standard Basic Assistance Agreement
SPCP	State Polytechnic College of Palawan
SVPA	Sicud Village Power Association
UNDP	United Nations Development Programme

A. CONTEXT

1. Development Problems Being Addressed

1.1 Country and Project Site Profile

Palawan is an archipelagic island province isolated from the rest of the Philippine islands. It is composed of eleven (11) mainland municipalities, one component city (Puerto Princesa), and twelve (12) island municipalities. The latter are mostly composed by island barangays. It has a total land area of 14,896.55 sq. km. and 1,700 islands and islets.

The province has a total population of 640,486 in 1995 with a growth rate of 3.67%. These composed the 124,928 households with an average family size of 5.1. Average household income is about $1036.00 per annum ($1.00 : PhP40.00). Its poverty incidence was 52.98% in 1998. The population of the province is projected at 739,813 (1999) equivalent to 145,061 households using the family size at 1995 level.

Palawan is almost 100% dependent on petroleum products to provide electricity supply to households and other consumers. The National Power Corporation (NAPOCOR, a national government agency) and Paragua Power Company (a private power producer in Palawan) generate the electricity in the province with a combined installed power capacity of 24.60 MW. These are distributed by the Palawan Electric Cooperative (PALECO). Electricity, however, is supplied only to households in barangays accessible to the main grid and in town proper.

The municipality of Rizal generates electricity from its own 250 KW diesel electric generator. Electricity is supplied only to consumers in the town proper. However, only 41% (270 out of 652 households) in the town proper are supplied with electricity

The pilot test site of this project is Sitio Sicud in Barangay Candawaga, Rizal, Palawan. The sitio is located 245 km southwest of Puerto Princesa City, the capital of Palawan (Appendix, Figure 1). It is bounded on the west by China Sea, and on the east along the side span of ricefield, by Mount Mantalingahan Range. The number of households in Sicud comprises about 24% (976 HH) of the total project households of the municipality of Rizal (1999 projection: 4124 HH). The median household income is about $2700.00 per year, which is more than twice the province average.

1.2 Rural Electrification Problem

Palawan has 431 barangays with an average size of 290 households inclusive of barangays in Puerto Princesa City. Only 42% of the barangays are electrified, and there are at least 70,000 households that are still without access to electricity.

The Palawan Provincial Government (PGP) has formulated its Provincial Energy Master Plan (2000 – 2010) with the goal of increasing its electricity supply from its current 37 MW to 101 MW in 2010. Under this plan, 154 barangays are targeted to be electrified through new and renewable energy (NRE). The others will be electrified through diesel electric generators and mini-hydro power plant.

The growing dependence of the province in fossil fuels to provide electricity will generate not only a substantial amount of greenhouse gas emission, but is not economically viable as well. Majority of the households in the province are scattered in remote and isolated villages

and barangays in the province. The transport costs of diesel fuel are high, and grid extension is too expensive and loss of economy of scale.

The abundance of NRE sources in the province – solar, wind, hydro and biomass – makes NRE a viable alternative. However, the relative newness of NRE technologies as source of electricity; the lack of information on the social, economic, financial and environmental aspects of the technologies; and the high initial investment requirements have been the barrier to entry of private investor in the NRE bara..gay electrification in the province.

Currently, the provincial and local government units (LGUs) in Palawan are highly committed to developing NRE sources in the province to provide electricity service to households without access to electricity. The provincial government is to receive a substantial amount of revenues from the production and sales of natural gas recently found in the province, and expected to commence in the year 2002. This will increase the provincial budget substantially for power generation.

Hence, it is important to demonstrate the viability and sustainability of PV – Wind Turbine Hybrid System for Rural Electrification in Sitio Sicud, Bgy. Candawaga, Rizal, Palawan. Experiences to be gained from this project are expected to encourage private entrepreneur participation in the NRE rural electrification not only in Palawan but also in other areas in the country.

1.3 Issues to NRE Development in Palawan

1. *Lack of capabilities of the LGUs to implement NRE rural electrification.* Because NRE systems are relatively new in the country , the government should provide great support to the NRE development. The support should not only be in form of financial support but also initiate activities to mobilize the private sector. There is a need to incorporate and stress the relevance of NRE in the national and local level. The government could create a kind of incentives on preferential loans at preferential rates. Policy makers should be motivated to internalize external costs inherent to conventional systems. The project will provide information that will help address this issue.

2. *Lack of interest of private investors to participate in NRE rural electrification due to high risk.* The management of electricity utility and stakeholders is a challenging task in rural electrification by using NRE technologies. Rural electrification is deemed to have exceptional social value and considerable environmental benefits. While these warrants considerable effort to expand rural facilities, and may justify subsidies to accommodate special economic problem of such investments, they are not of themselves sufficient to motivate rural energy entrepreneurs. No less important is that power of the market comes with a price – that is profit for the entrepreneurs. This project will demonstrate the sustainability and financial viability of and a mini-grid NRE hybrid system for rural electrification.

3. *Lack of capability to manage widely spread small independent NRE systems.* To manage and operate an electricity utility conceivable regulatory frameworks and guidelines must be strictly applied in day-to-day business. Regulations must be followed strictly to create a basis of good cooperation between customers and company/cooperative. Tariff structures must be simple and transparent as possible and closely related to real cost and risks.

4. *Social acceptance of NRE.* Public acceptance rises when the local population participates in the projects as investors. Indigenous private sector may have a more important role to play in promoting effective transfer of the technology. A share company structure may be suitable to achieve the intended purpose of electrification since it offers financial stimulus to the partners and permits differential economic activities.

5. *Lack of technical capability in the maintenance and operation of NRE system.* Maintenance is one critical problem of an NRE system. Users are usually located in rural and remote villages. There is a lack of competent technicians to assist users. Another is the absence of necessary power grid distribution network in rural and remote villages. Problem of maintenance is crucial because the installed system will serve as a demonstration project to showcase the viability and reliability of the system.

6. *Lack of appropriate financing scheme for rural electrification.* NRE systems require a high initial investment cost that makes them unaffordable to low-income households. Currently, rural electrification is financed through government subsidies, and privatization is the step taken by the government to remove such subsidies and let market forces determine the power rate that consumers have to pay. This could lead to NRE competitiveness with diesel electric generators.

Due to the above barriers, without this project, more diesel electric generators will be installed to provide electricity for the more than 70,000 unelectrified households in Palawan. The expected revenues of the provincial government from the production and sales of its natural gas will be expended to support the expansion of diesel generators. Emission of GHG to the atmosphere will continue to degrade the local, national and global environment. Thus, NRE will continue to play an insignificant role in the rural electrification in Palawan and in the protection of the environment.

2. Previous Experiences

Most of the rural electrification projects and activities utilizing renewable energy currently being undertaken in the province are small-scale and decentralized. The DOE through its project affiliate in the State Polytechnic College of Palawan has installed several solar energy systems for household lighting in the various remote barangays. The Palawan Electric Cooperative (PALECO) has a solar battery charging station for ten households in Dumaran which was funded by NPC. The Dutch Government has funded a solar eco-tourism project for resorts in El Nido and the Spanish Government funded the Philippine Rural Reconstruction Movement project providing individual solar electricity to 291 households and nine public structures. Recently, the Provincial Government of Palawan intends to install 400 individual solar home systems in the two unelectrified barangays in Puerto Princesa through the Development Bank of the Philippines. In view of the expected royalties of Palawan province from the production and sales of its natural gas, the Shell International Renewables is planning to set up a RESCO in Palawan to provide renewable energy services to remote communities without access to electricity.

Except from the Shell RESCO project, these projects are highly subsidized through government and foreign grants. These projects have not generated much impact inasmuch as private sector and local people participation are involved. End-users fees are not reflective of the true cost of the systems which the private sector hopes to recoup if they would invest in rural electrification projects. This set-up makes project sustainability and replicability always at stake.

3. Development Objective

The Department of Energy has set an ambitious target to increase the electrification ratio of rural areas from the current level of about 77% in terms of electrified barangays (villages) to 100% by 2004 (equivalent to electrify 9648 barangays). Of these, estimated 7,013 barangays can be connected to the grid, and the remainder can be most cost-effectively served with new and renewable energy sources.

The objective that is pursued by the Provincial Government of Palawan (PGP) is to ensure the availability of an affordable and reasonably priced energy supply through a socially and environmentally compatible energy infrastructure projects provincewide. The target is to electrify 62% (154) of the unelectrified barangays by year 2007 through NRE technologies. This is equivalent to 36% electrification by NRE in the province. The rest of the unelectrified barangays will be energized by diesel electric generators by increasing its current electricity capacity of 37 MW to 101 MW. Being committed to developing NRE in Palawan to provide electricity to households without access to electricity, the PGP and LGUs are searching for appropriate technologies, mechanism and strategies to encourage the participation of private investors in the sustainable NRE electrification in the province. The PGP intends to use the expected revenues from natural gas as guarantee. Accomplishing this objective is a support to livelihood improvement with minimum hazard to the local, national, regional and global environment.

This project is contributory to the attainment of the Rural Electrification Program of the present Administration as utility-type electrification through solar and wind energy will be utilized to provide sustainable and affordable electricity services to the rural households. It is expected that this project will encourage greater private sector participation in the rural electrification of Palawan

Specifically, this project seeks to attain the following objectives:

1. To provide a utility-type electricity service to households in the fishing and farming village of So. Sicud;
2. To install sunlight and wind resource-based hybrid renewable energy demonstration project;
3. To develop an approach that will ensure sustainability of hybrid system to encourage private sector involvement in rural electrification
4. To draw valuable technical, economic, social and other relevant information that will justify the replication of the system in other areas as well as for policy-making in the matter of rural electrification in rural villages.
5. To improve the living condition of the village people in So. Sicud through access to electricity; and,
6. To improve the welfare of women by making their regular household chores easier through the easy access to electricity.

This objective is clearly consistent with the goal of the Philippine Government and PGP to electrify rural areas using NRE and support the improvement of the quality of life of the rural households.

4. Strategies to Achieve the Development Objective

The UNDP/GEF Enabling Activity in the Philippines, highlighted the important role the energy sector can play in reducing future GHG emissions in the country, and identified NRE technologies as priority area in the abatement of GHG emissions.

The Philippine Energy Plan for the period of 1999 – 2008 focuses on strategies for achieving 100% electrification of all barangays in the country by the year 2008, including the installation of NRE systems in areas not accessible to the power grid.

The National Electrification Administration (NEA) has already tapped PV energy systems for the electrification of unserved areas but the application of NRE hybrid system is not yet demonstrated. Such a system could ensure the availability of electricity given the load requirement variability and available resources in a specific community. A hybrid system can also increase the power generating capacity of NRE at lesser capital investment cost.

This project will demonstrate the viability of hybrid system through installation of a PV-Wind Turbine in a farming and fishing village in So. Sicud, Bgy. Candawaga, Rizal, Palawan wherein valuable technical, economic, social and other relevant experiences can be drawn to justify replication of the system in other areas. The learnings from the project will also serve as the basis for policy-making in matters of rural electrification in the country. Further, the project will promote environment-friendly energy system for rural electrification. The entry point of the project is the identified immediate need for power, commitment and willingness of the people to make the system sustainable. Social and environmental concerns will also be considered in the project to ensure sustainability.

The project will emphasize local-level participation. The proposed project shall mobilize the local institutions from the provincial government down to the barangay council in planning and implementation. Since NRE technologies require relatively high cost of capital investment, the project will be directly complemented with technical and financial supports from both government agencies (DOE, PGPG, LGU, Barangay Council). With these complementation the cost of electricity from NRE technologies can be reduced to comparable rate as that of unsubsidized power rate of diesel generating sets.

Moreover, beneficiaries of the project will be organized into a village power association – Sicud Village Power Association (SVPA). The association shall operate, maintain and manage the project with supervision of SPCP-ANEC for six years, and thereafter, total management will be by the association.

To promote private sector participation, the project ensure recovery cost of initial investments and replacement of the system after its service life, and payment of personal services and maintenance, operation and other operating expenses (MOOE) from the income that will be derived from the project. The recovered cost of investment will be used to replicate the system in other areas.

To ensure the sustainability of the project, local technicians will be continuously trained by SPCP-ANEC on the operation, repair and maintenance of the systems. Moreover, the SVPA officials will also be trained on basic project management, simple bookkeeping and record keeping to ensure that all transactions are properly recorded and kept.

The roles of various stakeholders will also be delineated for them to know and understand their corresponding responsibilities and obligations to the project. This will eliminate conflict that may arise during the implementation and operation of the project.

5. Beneficiaries

The direct beneficiaries of this project are:

1. *200 farming and fishing households in So. Sicud, Bgy. Candawaga, Rizal, Palawan.* This project will provide 24-hour electricity service to the beneficiaries giving them the convenience and comfort of simply switching light on and off. Most importantly, the 200 households will have access to information through the TV and radio that will be powered by the system.

2. *Palawan Electric Cooperative (PALECO).* As a utility having a franchise right over the whole province of Palawan, PALECO would have increased its capacities to implement rural electrification utilizing renewable energy as an alternative electrification option for its highly remote and isolated villages within its area of coverage.

3. *DOE.* The lessons that will be drawn out from the experiences of this project will be valuable inputs to the refinement of its policies and guidelines on rural electrification. The same lessons will be used in the replication of the project in other unelectrified off-grid communities in the country with similar characteristics as with the project site.

4. *SPCP-ANEC.* The project will strengthen the technical expertise of the ANEC in implementing hybrid systems for rural electrification..

The indirect beneficiaries of the project are:

1. *Women.* Rural women spend a major portion of their life in home occupation. The convenience of power in the house will enable them to make their household chores faster and easier. Women would also have longer hours at night which can be used to engage in other productive activities such as homecrafts, tending the variety store, etc.

2. ***Children.*** Students will have longer hours to study and do their homework. They will benefit also from stronger and better light intensity reading and doing homework. Healthwise, the children will benefit from reduced local fumes and air pollution from burning kerosene and candle for lighting.

6. Regulatory Framework

Several legislative measures had been legislated and/or being legislated to ensure a level playing field inclusive of the NRE sector.

Philippine Agenda 21 identified the need to develop and utilize renewable energy technologies as the country's priority strategy. The National Action Plan on Climate change has proposed the gradual shift from fossil-fuel energy source towards NRE sources.

The Republic Act No. 7638 otherwise known as the DOE Act of 1992 has established the main goal of energy policy in the country, that is, "... *to ensure a continuous, adequate and economical supply of energy with the end in view of ultimately achieving self-reliance in the*

country's energy requirements through the integrated and intensive exploration, production, management and development of indigenous resources." This goal includes the development of NRE sources for power generation.

The Philippine Energy Plan (1999-2008) outlines the energy sector blueprint for supporting the Administration's objective of poverty alleviation. It focuses on strategies to achieve total electrification of all barangays in the country by end of the planning horizon, including the installation of NRE systems in the areas that are inaccessible to electricity grid networks.

The project also works within the framework of the Omnibus Electric Power Bill which seeks to privatize the electricity power industry thereby encouraging greater participation from independent power producers to engage in grid-connected NRE power plants. The Bill has been signified as an Administration Bill which gives it a priority status for passage by Congress. It is foreseen that the Bill will be passed before the year ends. Also pending at Congress is the New and Renewable Energy Bill which will strengthen commercialization of renewable energy by providing greater incentives to private RE developers. This project will supplement the policy studies on the impact of the policy measures essential to ensure proper implementation of NRE electrification.

At the provincial level, the Palawan is committed to environmental protection. It is the only province in the country with a Strategic Environmental Plan (R.A. No. 7611), the goal of which is to preserve the environment of Palawan. Thus, the project is highly compatible with this goal.

The Palawan Provincial Energy Master Plan has espoused the goal of energy adequacy, reliability and affordability under the umbrella of social and environmental acceptability. It has outlined the strategies and policies to ensure the attainment of energy goals, among which is the promotion and adoption of environment-friendly energy system, and encouragement of greater private sector investment and participation in all energy activities in the province.

Distribution and sale of electricity in Palawan province are under the franchise of PALECO and BISELCO. Under the policy of these electric cooperative, distribution and sale of electricity to ten or more households constitute commercial sale of electricity. IPPs who need to operate, distribute and sell electricity in the province need to secure a permit or waiver from the cooperative where appropriate.

SPCP-ANEC has already been granted the franchise waiver by PALECO by virtue of Board Resolution No. 078, Series of 1999 dated 03 September 1999.

7. National Resources

Palawan has abundant NRE resources. The study made by the National Renewable Energy Laboratory (NREL) of the U.S. Department of Energy revealed that Palawan has some of the highest potential wind energy in the Philippines with 3,000 to 5,000 MW of potential wind energy, whereas the total energy demand in the province is 250 MW by year 2021. In addition, Palawan also has abundant solar energy (1000Watt/m^2), hydro and biomass resources.

Palawan has very limited NRE expertise in technical , management, marketing and renewable energy resource assessment capabilities. The financial resources are also limited of rural electrification.

This project will address these issues by demonstrating the viability and sustainability of hybrid system by involving village power association and to provide essential information to promote private sector participation in rural electrification in the province.

A. STRATEGY FOR USE OF UNDP RESOURCES

1. Project Linkage to UNDP Mandate

1.1 Linkage to Sustainable Human Development

UNDP works to build developing countries' capacities for sustainable human development by promoting and supporting efforts to alleviate poverty, and manage natural resources to benefit both people and the environment, improve governance, and create opportunities for people to improve their lives. It puts people at the center of development.

Reliable electricity stimulates rural and social development. It complements and drives the social and economic evaluation of the village society. This project will demonstrate NRE hybrid system as an environmentally sound energy source for such evolution of the village society. It will provide electricity service to improve the living condition of the villagers.

The UNDP mandate also means continuous growth beyond the period of direct donor financial and technical assistance. This embodies the development of capacity within developing country to produce and manage technologies that can support sustainable human development.

1.2 Linkage to Environment

Sustainable human development requires the preservation and enhancement of the local, regional and global environment. The UNDP/GEF supports project with low GHG and low carbon path. UNDP/GEF are searching for opportunities that would enhance national capacities to develop promising and viable renewable energy technology in the country.

The recently concluded UNDP/GEF Project – Asia Least-Cost GHG Abatement Strategy and the preliminary outcomes of the ongoing UNDP/GEF Enabling Activity in the Philippines highlighted the crucial role of the energy sector in reducing GHG emissions in the country. It has identified renewable energy technologies as a priority area in the GHG abatement strategies in the country.

In preparation for a full project, a PDF-B activity was proposed to identify the key barriers, to recommend activities that will remove the barriers and to prepare a full project brief and document that will seek to remove those barriers at the national level. This involves technical assistance, capacity building and demonstration projects for financing under GEF Operational Program 6, "Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs".

Complementary to the PDF-B, a medium-sized project Palawan Alternative Rural Energy and Livelihood Support Project was approved last February 2000. It is intended to demonstrate the viability of a renewable energy service company (RESCO) as a delivery mechanism of off-grid renewable energy systems and economic activities of productive use of renewable energy services for rural communities.

This project will demonstrate the alternative option of using NRE hybrid system instead of placing great emphasis on petroleum-based rural electrification. The project will create high awareness and will facilitate the sustainable utilization of environment friendly NRE system to meet the electricity needs of barangays without access to electricity in Palawan. It will significantly reduced GHG emissions that otherwise will result from burning fossil fuels by diesel generators. It will also reduce the health and environmental hazards from the use of petroleum products.

This project will not cause any pollution or destruction of the environment and/or disturbance of the ecology in the barangay. No flying mammal or bird was observed in the proposed site that will be harmed or disturbed by the project.

The batteries that will store the energy from the sun and wind have the same component as that of the ordinary car battery. No battery solution will be discharged to the nearby river or seacoast. Dead batteries with its solution will be left intact in a well-ventilated storeroom and will be shipped out for trade-in to the manufacturer. For safety purposes from inhalation of minimal emission from the batteries, personnel will be required to wear protective mask when inside the battery room.

Washings of oil spillage and oil-water mixture for the back-up generator will be drained into a stilling pool to be treated with ricehull for several days until the oil have been separated from the water prior to water disposal into the nearby river or sea. Waste-oil will be stored in covered container for re-use as home treatment against pests.

1.3 Linkage to Role of Women

UNDP takes special steps to ensure that women participate in and benefit from the full range of its activities, and assists governments in integrating women in national development programs.

Routine home management activities took-up the time allocation of Philippine rural women. This project will have direct impact on the lives of women in rural communities since they will have of just switch light on and off reducing the hazard of being burn from lighting kerosene lamp or inhaling fumes kerosene. They will have better option to allocate their time for productive activities. Thus, the project will improve household production efficiency in terms of level and quality of output.

1.4 Linkage to Child Development

Better light will encourage children to read in the evening. Children will be able to improve and extend the study period at night. They can be exposed and could learn much from education self-interacting materials from TV/VHS medium to enhance and update learning and fill-in the inadequacy of learning facilities especially in public schools. This project will also have indirect contribution to improve school performance of children in school.

2. Need for UNDP Intervention

Without this project, Palawan will have no option but to rely primarily on diesel electric generators. This will mean that substantial amount of Palawan expected revenue from the

production and sale of its natural gas will be spent to the installation of more diesel generators for rural electrification. This will create more hazards to the environment.

The provincewide adoption of hybrid system in Palawan, where appropriate, will significantly reduce in the consumption and imports of petroleum products, as well as significant reduction in carbon dioxide emissions in the province.

This project will show that the ed capital investment to be provided by UNDP/GOJ can be recovered and can be used to replicate the system to another area by the pricing mechanism that will be adopted in this project. This expected result would encourage bilateral arrangement with private sector to developing NRE sources in the province for electrification of unelectrified barangays.

3. Project Description

The proposed project is a pilot centralized utility-type 5KWp PV/- 10KW Wind Turbine Hybrid System that will provide the electricity needs of 200 households in So. Sicud, Bgy. Candawaga, Rizal, Palawan for lighting and operation of small home appliances. Electricity will be distributed via a mini-grid power network. The DC output of the PV and Wind Turbine will be converted into 220-volt AC by passing through a series of step-up and step-down transformers. A 15 KVA diesel electric generator will be provided to back-up the hybrid system failure due to unsuitable weather condition.

The plant site will be located in a level open area along the coastline of the South China Sea (Annex, Figure 2). The area has already been committed by the owner of the land for donation to the barangay specifically for the project.

This project will have a life span of 20 years. DOE through SPCP-ANEC will closely supervise, monitor and evaluate the project for at least five (5) consecutive years.

The SVPA will directly manage the operation and maintenance of system including electricity distribution to consumers, meter reading and billing collection under supervision of the SPCP-ANEC.

The electricity that will be generated shall be sold to the beneficiaries at an affordable cost. The in-house electrical installations including the light and fixtures shall be provided by the beneficiaries. The operator/technician who shall be employed by the Sicud Village Power Association (SVPA) for the operation, repair and maintenance of the hybrid system will be trained, and in the future, upgraded by SPCP-ANEC.

Since the viability, sustainability and installation of hybrid system is yet to be seen in the country, the lessons that will be learned from the experiences of the project shall provide conclusions for replication of the system in other areas, where appropriate, and for policy-making in the matter of electrification in rural areas.

4. Expected Outcome

The project would be considered successful if the hybrid system generates the expected power most of the year and there occurred a visible transformation in the life and activities of the people and the society in the pilot area. Such results will eventually justify the replication of the project in other areas, where appropriate.

The project will be anchored primarily on people's participation letting them know that project is their own. It will be based on people's commitment to sustain the system.

Specifically, the expected project outcomes are the following:

1. Electrification of 200 households in the fishing and farming village of So. Sicud;
2. Improvement of the living conditions of the rural folks in the Sitio by providing them with electricity. This will be measured in terms of the baseline data established for the Sitio
3. Institutionalization of the Village Power association to manage, operate, repair and maintain the system for project sustainability; and.
4. Transfer of skills on the management, operation and maintenance of hybrid system to the power association.

B. IMMEDIATE OBJECTIVES, OUTPUTS, INDICATORS AND ACTIVITIES

Objective 1:

Provision of a utility-type 24-hour electricity service to 200 households in farming and fishing village in So. Sicud, Candawaga, Rizal, Palawan.

Output:

5 kW solar and 10 kW wind turbine hybrid system installed in the village.

Indicator:

200 households are connected to the system for their lighting and operation of small home appliances.

Activities:

1.1 Design of the hybrid system to include the technical specifications for various parts and accessories of the systems;
1.2 Development of the Terms of Reference or Contract for Supply of equipment parts and other accessories;
1.3 Advertisement, pre-qualification of contractors and bidding;
1.4 Selection and awarding of winning Contractor; and
1.5 Installation and commissioning

Objective 2:

Development of an approach to ensure project sustainability.

Outputs:

2.1 Functional organization for local project management; and,
2.2 Strengthened and skilled manpower to operate and manage the system.

Indicators:

2.1 Established local project management support;
2.2 Formed end-user' organization or barangay power association;
2.3 Trained at least two local technicians for the operation, repair and maintenance of the system; and
2.4 Trained power association officials on project management, monitoring and supervision.

Activity 2.1 Project Management Support

2.1.1 Identification and delineation of roles and responsibilities of local institutions responsible for project management and supervision;
2.1.2 Formulation of the Memorandum of Agreement and Implementation Agreements to guide the relationships among the involved institutions;
2.1.3 Recruitment and hiring of project staff; and
2.1.4 Setting of project management office.

Activity 2.2. Community Organizing and Training of Local People

2.2.1 Community assembly to discuss the formation of the end-users into a village power association;
2.2.2 Training of the village power association on project management, monitoring and supervision;
2.2.3 Selection and hiring of local technician for operation, repair and maintenance of the system;
2.2.4 Training of the local technicians; and
2.2.5 Upgrading of skills and knowledge of the local technicians.

Objective 3:

Development of a framework that will draw out from the valuable technical, economic, social and other relevant experiences that will justify the replication of the system in other areas as well as for policy making in the matter of rural electrification in rural villages.

Output:

Report on the rural electrification framework that will include among others, policies and guidelines on the implementation of hybrid systems for rural electrification.

Activities:

6.1 Formulation of monitoring guidelines;
6.2 Conduct of periodic monitoring and review of technical and social performance of the project; and
6.3 Drafting of relevant policies and implementation arrangements.

C. INPUTS

The project will provide necessary equipment to establish the multi-purpose pilot PV-Wind Turbine hybrid system. The costs will cover (a) institutional development, (b) construction of buildings, (c) equipment and supplies including electricity transmission/distribution lines, and (d) project management coordination/consultation. The total cost of the project is US$176,878.00.

Considering that the relatively high cost of NRE systems may not be entirely recoverable from the users, subsidized power rates and other forms of government support may be required. Technical and financial assistance and joint implementation with foreign donor countries or institutions is a viable consideration.

The breakdown of the inputs to the project is shown in Table 1 below.

Table 1. Estimated Project Cost by Source of Funding (Financial Plan) in Dollar Equivalent

PROJECT COMPONENT	TOTAL COST	UNDP/ GOJ	*TOTAL*	*HOST COUNTRY CONTRIBUTION*				
				DOE	Rizal LGU	PGP	Beneficiary	Total
Institutional Development	3,405				3,405			3,405
Const. Of Buildings	16,428				5,000	8,928	2,500	16,428
Equipment/ Supplies	154,200	125,000	125,000	27,500	1,250		450	29,200
Project Management/ Coordination/ Consultation	2,845				2,845			2,845
TOTAL	**176,878**	**125,000**	**125,000**	**27,500**	**12,500**	**8,928**	**2,950**	**51,878**

General Notes: 1. The above estimated project cost is for year 1 only.
2. Contribution of Beneficiaries/Barangays refers to labor and office tables and chairs including in-house wiring,, electric meter and hybrid system site.
3. Incentive and allowances of LGU assigned personnel , SPCP-ANEC SRS I, expenses for seminar-workshop/trainings, and buildings refer to contributions of LGU and PGP.
4. Conversion rate used : $1.00 = PhP40.00

1. Government Inputs:

1.1 Department of Energy (DOE) Contributions

The DOE shall provide substantial amount to support the installation of the hybrid system. Specifically, its contribution amounting to US$27,500.00 shall be used to purchase some parts of the systems. Other non-cash contribution will be in the form of technical support, project supervision and monitoring.

1.2 PGP and Rizal LGU Contributions

The Provincial Government of Palawan (PGP) and the Rizal Local Government are fully supportive of the project. Funding from the two LGUs have already been committed to the project. In particular, the PGP contribution is US$8,928.00 which shall be used for the

construction of the multi-purpose building for the project. On the Other hand, the Rizal LGU financial support is US$12,500.00. This amount shall cover the institutional cost of the project such as the training of local technicians and end-users, the project management coordination/consultation and the allowances of the assigned LGU and SPCP-ANEC personnel who will be directly involved with the project.

1.3 SPCP-ANEC Contributions

The contributions of SPCP-ANEC are in the form of technical assistance and management support to the project, SVPA and barangay. The in-kind contributions will be the salaries and allowances of SPCP-ANEC personnel who will supervise and monitor the project.

2. Contributions of Beneficiaries/Barangay

The beneficiaries/barangay contribution shall be in the form of labor, construction materials and land for the power plant. The in-house wiring and lighting fixtures shall be shouldered by the beneficiaries-end-users. The contribution is valued at US$2,950.00.

3. PALECO

PALECO will provide the following in-kind contributions:

- Franchise waiver for the project inasmuch as the project is a commercial mini-grid system.
- Kilowatt-hour meter to be provided to the beneficiaries upon payment of deposit.
- Technical assistance during the installation of electricity transmission/distribution lines.
- Technical assistance to training to be conducted for the beneficiaries, SVPA and barangay officials.

4. UNDP/GOJ Contribution

The UNDP/GOJ contribution is US$125,000.00. This amount will be used to cover the costs of the equipment of the hybrid system.

D. RISKS AND PRIOR OBLIGATIONS

1. Risks and Steps to be Taken to Minimize Them

1.1 Technical Viability

The project is to demonstrate the technical viability of hybrid system. In the absence of long term wind speed data for So. Sicud, the data gathered for a short period of observations including the information gathered from the people of Sicud were assumed prevailing in the site. The average daily sun insulation is enough for the PV generator. The energy storage batteries have reserve capacity for five (5) days. In addition, to ensure that there will be no power interruption when wind speed will be below the cut-in speed, a 15KVA diesel electric generator back-up will be provided.

The project will help develop in-country technical capacity to install and maintain the PV-Wind Turbine Hybrid System. It will strengthen DOE's'capacity in the formulation of policies using renewable energy for rural electrification. The project will also help create sustainable demand for solar/wind technologies. It will also provide information that will remove barriers-to-entry of private sector involvement in NRE rural electrification.

The technical risk is considered small.

1.2 Financial Viability

From the financial standpoint, the project will charge power tariff rate affordable to the beneficiaries. At the tariff arrived at in the feasibility study of the project (Annex), personal services, replacement costs and MOOE can be paid from the income of the project with provision for replacement of the system after its service life. The payback period of the project is about 9 years indicating that it will be possible to fully recover capital investment. This will ensure the financial sustainability of the project.

With UNDP/GOJ and Philippine Government (through DOE, PGP and Rizal LGU) financial supports, the project will be able to encourage private participation in the NRE rural electrification.

Financial risk is, therefore, considered moderate.

1.3 Institutional Risks

The PGP and Rizal LGU are very supportive of the project. The risk is very minimal that the next provincial and LGU heads will not continue their supports to the project as the present government does. The potential governor and mayor hopefuls are also quite supportive the renewable energy development in Palawan especially considering R.A. 7611 – The Strategic Environmental Plan for Palawan. A countercheck is the project will provide the expressed basic need of the community.

The project also provide institutional capability building to ensure the institutional sustainability of the power facility. The management, operation and maintenance capacity of the SVPA will be developed, and as the need arises will be upgraded. This will also require a lifelong education of the beneficiaries. Moreover, SPCP-ANEC with collaboration of SPCP administration will provide livelihood enhancement training to the beneficiaries. A tight cooperation between SVPA officers and members will be developed so that the people will understand that the power facility is "their own", and after the phase out of the assistance sustainability will be maintained. Thus, the risk is considered small.

2. Prior Obligations or Conditions

There are no prior obligations under the project. The project, however, requires the following:

- The heads of the agencies concerned will support the assignment or use of their qualified personnel to support the project activities.

- Contribution sources must be secured.

- The Project Advisory Council (PAC), Project Management Office (PMO) and SVPA will be established after approval of the project documents.

- Commitment of DOE to maintain its support to SPCP-ANEC for at least five years more.

- The hybrid system equipment including transmission/distribution lines shall be owned by the DOE/SPCP-ANEC. During the first five (5) years of its implementation, the management , operation and maintenance/repair of the system shall be with supervision and guidance of SPCP-ANEC/DOE, thereafter, management, operation and maintenance/repair shall be turnover to the SVPA.

- The service vehicle shall belong to the SPCP-ANEC for its used in the evaluation and monitoring of the project and for use by the DOE and UNDP/DOJ.

E. MANAGEMENT

1. Institutions Involved in the Project

The stakeholders to the project include DOE, SPCP/SPCP-ANEC, PGP, Rizal LGU, barangay government, and SVPA. The strong commitment of the stakeholders is very significant to the success of this project. In this regard, a Memorandum of Agreement (MOA) that will define and delineate the roles and responsibilities of the stakeholders will be entered into. The roles and responsibilities of the project stakeholders are described below.

DOE: The DOE is the lead agency in this project. As the lead agency, it will provide the overall supervision and management of the project. It will also provide coordination work with the local implementor and the UNDP.

SPCP-ANEC: SPCP-ANEC will be the implementing institution of the project. It will assist the DOE in the overall management of the project. It shall provide coordination with the institutions involved at the local level. It shall provide technical assistance to the project as well as to the beneficiaries and SVPA. It shall assign personnel to supervise the operation of the hybrid system. It shall also conduct seminars/training that will redound to the sustainability of the project. In addition, SPCP-ANEC will conduct the periodic evaluation and monitoring of the project during the entire life of the project.

PGP: The governor of Palawan will represent PGP in the PAC for the project. PGP will provide counterpart funds for the construction of the project's multi-purpose building.

Rizal LGU: The mayor of Rizal will represent the Rizal LGU in the PAC for the project. The Rizal LGU will provide counterpart funds for institutional development, construction of multi-purpose building, incentive and allowances of assigned SPCP-ANEC and LGU personnel, and project management coordination/consultation. It shall assign qualified personnel to the project.

SPCP: The President of SPCP will represent SPCP in the PAC. It shall provide technical assistance for the conduct of livelihood enhancement seminar/training and of gender

empowerment including environmental protection seminar. It shall organize the SVPA and assist the SPV in the formulation of electricity service policy. It shall hire also the personnel of the hybrid system.

Barangay Government: It shall assist the SVPA in management, operation and maintenance of the project. It shall provide the land for the use of the project and electric posts.

SVPA/Beneficiaries: The SVPA shall manage, operate and maintain the project with the assistance and guidance of SPCP-ANEC. It shall provide the labor for the construction of building and perimeter fence, cutting and erection of electric posts, and office tables and chairs. The beneficiaries shall provide the labor and electrical supplies and materials for the in-house electrical wiring. It shall be responsible for the payment of salaries, incentives, allowances and other benefits of the personnel of the hybrid system; MOOE; and provide financial support to livelihood and gender empower enhancement activities for the development of the beneficiaries and the community.

PALECO: Either the President or the Manager of PALECO will represent the local electric cooperative in the PAC. It shall grant to the project a franchise waiver to operate a commercial mini-grid electric distribution system. It shall also provide the KWH meter to the SVPA with corresponding deposit. It shall assist the project by providing technical assistance to the project particularly in the take-off phase of the project.

2. Project Implementation Arrangement

A project Advisory Council (PAC) shall be established and to be composed by the DOE, PGP, SPCP and PALECO (Annex: Chart B). This council shall be the advisory support in the formulation of management guidelines, organizational and operation policies for the successful implementation of the project. The compliance to such guidelines and policies shall be coordinated by SPCP-ANEC.

The Project Management Office (PMO) shall also be established and to be composed by the Mayor of Rizal, SPCP-ANEC Project Leader and the Barangay Captain of Candawaga (Annex: Chart C). The PMO shall provide the coordinative support to the lead agency. It shall work closely with the lead agency and the PAC. It shall have direct supervision of the SVPA with regards to the management, operation and maintenance of the hybrid system. It shall also provide coordinative and advisory function to the SVPA.

The SPCP-ANEC shall organize the SVPA. It shall provide the necessary training and seminar to the beneficiaries. Some of the topics proposed are management of cooperative, functions, duties and responsibilities of cooperative committees and members, basic accounting, billing and collection, and basic auditing.

SPCP-ANEC shall also train the technicians/operators of the hybrid system in coordination with the contractor/supplier of the equipment in the project. In coordination with PALECO, it shall conduct training of barangay electricians, personnel and officers of SVPA on meter reading and meter installation, house wiring, maintenance of transmission/distribution lines, and operation of power transformers.

The SVPA shall employ the hybrid system operator/technician. It shall have direct control and supervision of hybrid system personnel. The SVPA shall perform the meter reading,

billing and collection of fees. The municipal treasurer of Rizal LGU shall collect the revenue collected, issue corresponding receipt therefore, and deposit the same in a special trust fund that will be created by the Rizal LGU. This fund shall be used solely for repair and maintenance, expansion of the capacity of the system, replication of the system in other areas, payment of personnel services, allowances and other incentives/benefits of the hybrid personnel, and for MOOE. As incentive to the SVPA, 10 % of the gross income of the project shall accrue to the SVPA to carry out projects that will contribute to the general development and, enhancement or generation of livelihood opportunities i. the barangay including gender empowerment.

G. MONITORING AND EVALUATION

The project will be monitored and evaluated in accordance with the UNDP rules and procedures. This will include at least one Tri-partite Review meeting annually, annual preparation of the Annual Project Review and annual completion of the Project Implementation Review. Quarterly reports will be prepared by SPCP-ANEC through the SVPA and PMO to be submitted to the UNDP(Manila) through the DOE. Working meetings will be held either in Puerto Princesa City or in the project site to discuss reports and identify specific recommendation to improve project impact and implementation.

It is proposed that UNDP local representative will monitor also the project at least during the period of its support to the project. This will include verification of accomplishment reports submitted by the SPCP-ANEC.

Schedule of project activities are presented in Charts E and F for monitoring and evaluation purposes (please refer to Annex: Feasibility Study).

SPCP-ANEC will monitor the system for six (6) years, thereafter, annual monitoring will be conducted by SPCP-ANEC.

H. LEGAL CONTEXT

This project document shall be the instrument envisaged in the Supplemental Provisions to the Project Document, attached hereto, between the Republic of the Philippines and the UNDP, to be signed by the parties. The lead agency (DOE) shall be, for the purpose of the agreement, refer to the Government cooperating agency.

The following types of revisions may be made to this project document with the signature of the UNDP Resident Representative only, provided he or she is assured that the other signatories of the project documents have no objections to the proposed changes:

- Revision in, or addition of, any attachments of the project;
- Revisions which do not involve significant changes in the immediate objectives, outputs, or activities of the project, caused by the rearrangements of inputs already agreed to or by cost increases due to inflation; and

- Mandatory annual revisions which rephrase the delivery of the agreed project outputs, or reflect increased experts or other costs due to inflation, or take into account agency expenditures flexibility.

Chart F. Activity Work Plan for 12 Months

Objective	Output	Activities	12 Months Work Plan Months 1	2	3	4	5	6	7	8	9	10	11	12
1. Management Support	1. Memorandum of Agreement (MOA)	1. Draft of MOA	XX											
		2. Provide copy of draft MOA UNDP, DOE, Rizal LGU, PALECO,SPCP, Bgy. Council of Candawaga, & Palawan Provincial Government for review.		XX										
		3. Revision of MOA		X										
		4. Provide each concerned agencies or units with revised and final draft.		X										
		5. Coordinate and establish venue and date of signing of MOA.		X										
		6. Formal signing of MOA.		X										
		Responsibility: DOE/SPCP-ANEC												
	2. Project Advisory Council (PAC)	1. Identification and designation of PAC members.		X										
		2. Send invitation or appointment for acceptance and confirmation.			X									
		3. Elect/choose chairman, vice chair-man.			X									
		4. Designate secretary of PAC.			X									
		5. Hold first meeting of PAC.			X									
		Responsibility: DOE/SPCP-ANEC												
		6. Hold regularquarterly meetings. Formulate policies and guidelines.				X			X			X		
		7. Submit quarterly and annual reports to DOE and UNDP.					X			X			X	
		Responsibility: PAC												
	3. Project Management Office (PMO)	1. Designate and appoint members of PMO. Members should elect the chairman & vice chairman.		X										
		Responsibility: DOE/SPCP-ANEC												
		2. Supervise the management and												

I. WORKPLAN

		operation of power plant.				XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX		
		3. Develop systems and procedures of hybrid system operation, repair and maintenance.			XXX												
		4.Monitor the hybrid system and including impact to beneficiaries.				x	x	x	x	x	x	x	x	x	x		
		5. Submit to DOE/UNDP and PAC quarterly reports with documentations.					x	x	x	x	x	x	x	x	x		
2. Institution Building	4. SVPA	1. Organize the SVPA	x														
		a. Initiate meetings of beneficiaries															
		b. Conduct meeting															
		c. Establish date of seminar															
		d. Conduct seminar															
		e. Elect officers															
		f. Draft, review and finalize constitution and by-laws	xx														
		Responsibility: SPCP-ANEC															
		2. Conduct meeting of SVPA for approval and adoption of consitution and by-laws.	x														
		3. Establish regulatory policies of the operation of hybrid system.		x													
		4. SVPA Board subject policies to the approval of the SVPA assembly.			x												
		5. Operation, maintenance and repair of hybrid system and its facilities.			xx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx		
		6. Conduct quarterly meeting with SVPA members				x			x			x			x		
		7. Conduct monthly meetings of the SVPA Board of Directors.				x	x	x	x	x	x	x	x	x	x		
		8. Provide PMO and SPCP-ANEC a copy of Quarterly and Annual Reports					x				x				x		
		Responsibility: SVPA															

Continuation ... 12-month activity

Objective	Output	Activities	12 Months Work Plan											
			Months											
			1	2	3	4	5	6	7	8	9	10	11	12
2. Institution Building	5. Seminars/trainings of	1. Prepare seminar/training design:	xxxx											
	beneficiaries	a. Cooperative												
		b. Operation. Maintenance and												
		Repair of Power Plant Facilities												
		c. Operation and Maintenance of												
		power transmission lines												
		2. Coordinate with SPCP, PALECO, LGU	x											
		Barangay, and DOE.												
		3. Identify and invite resource persons,												
		facilitators and trainors.	xxx											
		4. Establish venue and date of seminar	x											
		and trainings.												
		5. Conduct and document seminar and		x	x	x								
		trainings.												
		Responsibility: SPCP-ANEC												
	6. Hybrid Sys. Personnel	1. Establish criteria/qualifications												
		in coordination with DOE/SPCP-ANEC		x										
		2. Hire personnel			xxx									
		Responsibility: SVPA												
		3. Orientation of personnel on duties												
		and responsibilities.				xx								
		4. Supervised operation of hybrid sys.				xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
		Responsibility: SPCP-ANEC												
3. Physical structures and	7. Multipurpose	1. Prepare A & E including technical												
equipment supports	Building Construction	specifications & draft contract.	x											
	including fencing	2. Advertisement, prequalification of												
		contractors and bidding	xxx											
		3. Evaluation of bids & Awarding		x										
		4. Signing of construction contract		x										
		5. Construction of building		xx	xxx									
		6. Inspection and acceptance of			x									
		building.												

		Responsibility: SPCP- ANEC/LGU													
	8.Hybrid System	1. Prepare technical specifications	x												
	equipment, transmission	2. Prepare tender documents	xx												
	lines including erection	3. Advertisement in two newspaper													
	and commissioning	of general circulation in accordance to	xx												
		the IRR of P.D. 1594 as Amended 1992													
		Responsibility: DOE/SPCP-ANEC													
		4. Prequalification of contractors		xx											
		5. Send notices to prequalified and pre-		xx											
		disqualified contractors													
		6. Issuance of tender documents			xx										
		7. Submission and opening of bids			xx										
		8. Evaluation of bids				xx									
		9. Awarding to winning bidders				x									
		10. Signing of Contract Agreement				x									
		11. Send Notice To Proceed													
		Responsibility: SPCP-PBAC													
		12. Supply, delivery and installation of													
		equipment, instrumentation, etc.				x	xxxx								
		13. Commissioning						xxxx							
		14. Inspection and acceptance						x							
		Responsibility: DOE/SPCP-ANEC													

Main Source of Funds: 73 - UNDP Energy Account
Executing Agency: DOE - Department of Energy

Sbln	Description	Implementing	Funding	Total		2000	2001
20	SUBCONTRACTS						
21	Subcontract A						
2101	Equipment for and Installation of Hybrid System	SPCP-ANEC		Net Amount	125,000	125,000	
				Total	125,000	125,000	
2199	Line Total	----------		Net Amount	125,000	125,000	
				Total	125,000	125,000	
29	SUBCONTRACTS TOTAL	----------		Net Amount	125,000	125,000	
				Total	125,000	125,000	
99	BUDGET TOTAL	----------		Net Amount	125,000	125,000	0
				Total	125,000	125,000	0

Philippine Government Counterpart

Source of Fund: Department of Energy

Sbln	Description	Implementing	Funding	Total		2000	2001
300	Capital Outlay						
36	Equipment for Hybrid System	SPCP-ANEC		Net Amount	27,500	27,500	
				Total	27,500	27,500	
36	Line Total	----------		Net Amount	27,500	27,500	
				Total	27,500	27,500	
99	BUDGET TOTAL	----------		Net Amount	27,500	27,500	0
				Total	27,500	27,500	0

ANNEX "2"

Dr. Akio Shiota's Monitoring Report

ANNEX "2"

DOE-JICA Project

Sustainability Improvement of Renewable Energy Development in Village Electrification

Monitoring Report on

Sicud PV-Wind-Diesel Power Project in Rizal (UNDP Project)

1. Project description

Title:	Multi-Purpose Pilot PV-Wind Turbine Hybrid
Project site:	Sitio Sicud, Bgy. Candawaga, Rizal, Palawan
Objective:	Provision of 24-hour electricity service to 200 households
Project cost :	USD 176,878 USD 125,000 from Government of Japan USD 51,878 from host country contribution
Lead Agency	DOE
PMO :	WPU-ANEC responsible for system design, operator training
Contractor :	Bidding by DOE : MATEC (System), Dumalag (Distribution lines), Bidding by PGP : Local contractor (Power house)
Operation :	Sicud Village Power Association (SVPA)
Installed :	December 2005

2. Summary

The monitoring was conducted on April 19 and 20, 2006. The users are 14 households. The system is operated mainly genset (3 hours genset and 1 hour RE). There are three critical errors in the system:

a) The battery capacity is too small.
The total capacity of battery bank is merely 50kWh. Minimum 440kWh is necessary for the estimated power demand (88kWh/day in the project document). <u>This is a critical error in system design.</u>
Since the capacity of battery bank is very small, 5kW PV array has enough power generation to charge battery. The excess power from wind turbine has been dumped into dummy load.

b) Wind turbine has not been generating power.
Wind assessment was not done properly. It was done only in one day instead of one year.
According to the chairman of BAPA, there is no wind for half of year, from December to May. The site may not be suitable for wind power generation. <u>This is</u>

a critical error in validation of site. Therefore, the increase of tower height will not give additional power.
Even there was good wind potential, wind energy can not be utilized due to small battery capacity.

c) The output power of PV array was over estimated.
The output power of PV array was estimated as 20kWh per day in the project document. However, it will be 10kWh per day due to general loss. This is a critical error in understanding PV system.

The improvement of system such as increase of wind tower height, replacement by larger batteries will cost a lot and may not bring good results.
The only solution to utilize the system, proposed by PGP, is to supply electricity for public use such as street lights and school instead of households.

Table 1. Comparison of Plan and Actual

Equipment	Plan	Actual	Correct Design
Estimated Power demand	88kWh/day 200 households	20kWh/day (6:30pm – 10:30pm) 14 households	80kWh/day 120 households
PV array	5.1kW	5.25kW	40kW
Power generation	Approx. 20kWh/day *(Impossible to get 20kWh/day from 5kW PV array. I would be 10kWh/day.)*	Approx. 10kWh/day	(Approx. 80kWh/day)
Wind (Power generation)	10kW at 14m/s (Approx. 72kWh/day) *Without proper assessment. Over estimated. It should be 54kWh/day*	10kW at 14m/s (None, Dumped into dummy load)	Not necessary (Wind potential is low)
Battery bank	48.0kWh (1000Ah@C20 x 24units)	49.9kWh (416Ah@C24 x 60units)	458.4kWh (1910Ah @C24 x 120units)
Inverter	15kVA	15kVA	20kVA
System Voltage (DC)	48V *not recommended*	120V	120V
Genset	15kVA	35kVA	25kVA
Transformer (Genset to Inverter)	none	15kVA (240V to 240V)	Not necessary

Electricity Supply	24-hour supply by RE *This was not possible due to small capacity of battery bank and over estimated power generation.*	3-hour supply by Genset 1-hour supply by RE	24-hour supply by RE
SVPA (BAPA)	To be trained well by WPU-ANEC / MATEC	Not Trained well	To be trained well

3. Wind Turbine

a) Specification

Wind Turbine Manufacturer: Westwind
Model:
Rated output : 10kW at 14m/s
6kW at 10m/s
2kW at 6m/s
No. of Wind Turbine : 1 unit
Hub Height : 18m

The rated capacity of installed Wind turbine is 10kW at 14m/s.
This complies with the specification.

b) Expected Output power

As a nature of wind energy, power generation depends on wind speed. The output of 10kW is obtained only at typhoon season. Normally, average wind speed is around 4m/s to 6m/s. The output power at 4m/s and 6m/s is as follows.

Wind speed	4m/s	6m/s
Output power (Fig. 1-1)	0.7kW	2kW
Estimated power generation per day (Fig. 1-2)	18kWh/day	50kWh/day

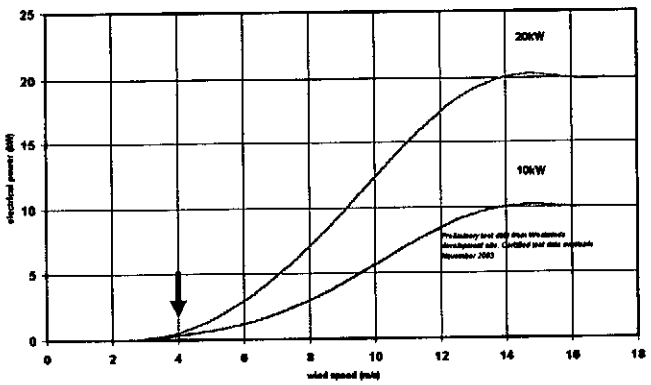


Fig. 1-1 Output power v.s. Wind speed

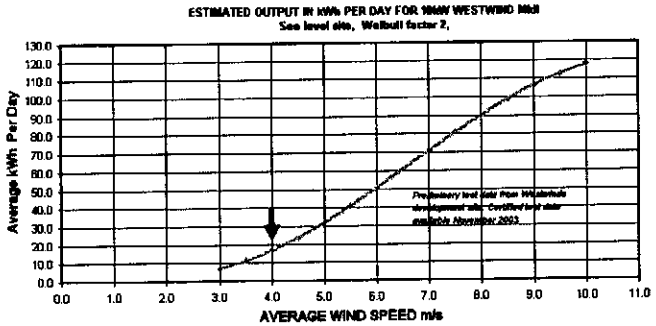
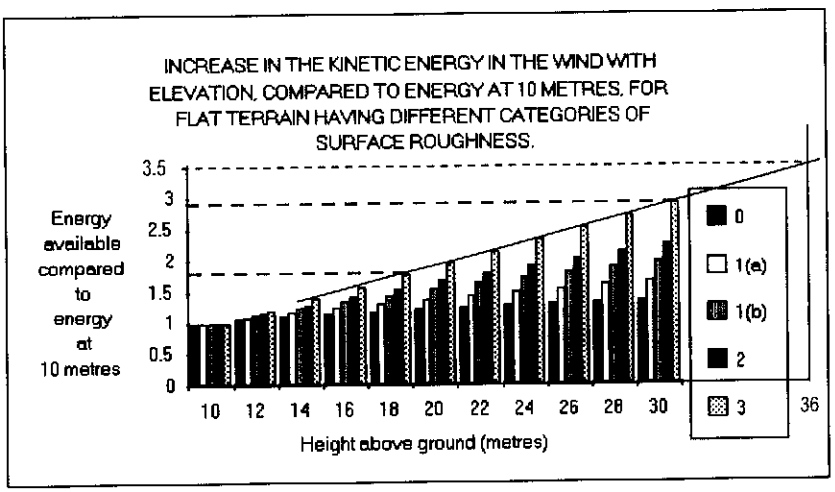


Fig. 1-2 Average power generation v.s. Average wind speed

c) Effect of height increase

According to the data from Westwind (Fig. 1-3), it will get around 61% (2.9 / 1.8 = 1.6) more wind energy (17% more wind speed) when height is increased from 18m to 30m. This means, if the wind speed is 2.5m at 18m, the wind speed may reach 2.9m/s. If the wind speed is 3m/s at 18m, the wind speed may reach around 3.5m/s. If we assume 36m height by extending the graph, it will get around 94% (3.5 / 1.8 = 1.94) more wind energy (25% more wind speed) when height is increased from 18m to 30m. This means, if the wind speed is 2.5m at 18, the wind speed may reach 3.1m/s at 36m. If the wind speed is 3m/s at 18m, the wind speed may reach around 3.8m/s at 36m.

<u>This calculation indicates that there is not much expectation of wind energy by increase of height from 18m to 36m.</u> In addition, 36m tower is not available from Westwind (Table. 1-1). It is necessary to design and construct a new tower for 36m.



Roughness Category

0 Open water areas.

1(a) Open grassland within 1km of the coast.

1(b) Open grassland inland (wheatfields).

2 Low vegetation 0.5 to 2 metres high.

3 Suburban areas, High vegetation > 2metres.

< 3 is used for calculation of height effect >

Fig. 1-3 Average power generation v.s. Average wind speed

Table. 1-1 Available tower height

Turbine Sizes (kW)	Tower heights available
3	18m & 24m
5	24m
10	18m, 24m, 30m
20	30m

d) Actual output power

When we were at the site, there was no wind so that we were not able to measure output power. According to barangay chairman, there is wind between June and December. Since the system was installed in December, the wind turbine never worked. Even the blades were rotating, generated power was dumped into dummy load indicated by the wind controller.

There is a possibility that the site has no wind potential.

4. PV Array

a) Specification

PV Module Manufacturer:	BP Solar
Model:	BP375H
Capacity :	75W
No. of PV modules :	70 units (10 in series, 7 in Parallel)
Total Capacity	5.25kW (75W x 70)

The total capacity of installed PV arrays is 5.25kW.
This complies with the specification of 5.1kW.

b) Expected Output power

The daily available power of 5.25kW PV system (available power after inverter):
In case recommended peak sun hour (4h) is used,
5.25kW x 4h (peak sun hours) x 0.5 (performance ratio) = 10.5kWh

In case average peak sun hour (4.9h) at Puerto Princesa (Year 2003) is used,
5.25kW x 4.9h (peak sun hours) x 0.5 (performance ratio) = 12.8kWh

3. Battery Bank

a) Specification

Battery Manufacturer:	Exide
Battery Model:	Classic EnerSol T460 (2V)
Capacity :	416Ah at C24
No. of Batteries :	60pcs in series

The technical specification in the bidding document was 1000Ah (@ C/20) with 48V (1000Ah x 48V = 48.0kWh in total). Since 48V system is not adequate for this size of

system, supplier offered 120V system. Therefore, 416Ah (@ C/24) batteries were supplied to meet the total capacity of 49.9kWh (416Ah x 120V = 49.9kWh).

The total capacity of supplied battery bank complies with the specification.
However, the capacity of battery bank is too small.

b) Available power per day

The available power per day is limited by power generation (PV & Wind) and DOD (depth of discharge) of battery. To prolong the cycle life of battery, DOD needs to be below 20%. Assume there is enough power generation by PV & Wind, then available power limited by DOD of battery is;

49.9kWh x 20% = 10.0kWh

If inverter efficiency is 90%, available power after inverter per day is;

10.0kWh x 90% = 9.0kWh (at power factor 1.0), 6.3kWh (at power factor 0.7)

6.3kWh per day is enough for 16 households

6.3kWh/day / 380Wh/day(per household at Pangan-an island) = 16 households

According to the project document, estimated power demand is 88kWh/day. In this case, battery capacity needs to 440kWh/day (5 times larger than power demand).

5. Charge Controller/Inverter

a) Specification

Manufacturer:	PPS Enviro Power
Model:	SPP-1P-1D-15K-230-60-120-10K
Capacity :	15kVA
Frequency :	60 Hz
Voltage	230V
Phase	1 phase
Bulk Charge	2.30V@cell
Float Charge	2.35V@cell

Set point voltage of Bulk and Float charge is too low. They should be 2.40V and 2.45V respectively.
There is a setting to bypass the control charging. We observed, therefore, battery voltage was 2.5V that has being over charged.

5. Genset

a) Specification

Manufacturer:	Cummins
Model:	ES35-6
Capacity :	35kVA at prime
Frequency :	60 Hz

Voltage	230V
Phase	1 phase
Transformer	15kVA, 240V to 240V

The total installed capacity of Genset is 35kVA.
This complies with the specification of 15kVA.

A transformer is used. According to the operator, this was installed to insulate genset side (line to line) from Inverter & Distribution side (line to ground). However, we confirmed that both outputs are line to ground. There is unknown reason why this transformer was installed (not listed in the bidding equipment). The same type of genset and inverter are used in New Ibajay, and there is no transformer. This transformer needs to be removed since it produces a loss and its capacity is smaller than genset.

b) Expected Power Supplies

The capacity is big enough to supply electricity for around 390 households.
(35kVA x 0.7PF x 0.8margin) / (50W peak per hh) = 392 hh

c) Operation

Genset is operated from 6:30 to 9:30, then switched to Inverter(battery bank) for one hour. RE system is used to save fuels. However, when numbers of users are increased, usage time of RE system has to be reduced by half or less than half.

6. Conclusion

- The bottleneck of the system is the capacity of battery bank.
  The capacity of battery bank is too small for the system size.
  Electricity supply is already exceeding the limitation of DOD.
- The PV array has enough power generation to charge the battery bank.
  Additional power generation is not necessary for this size of battery bank.
- Wind power will not be utilized to charge battery.
  The battery bank is too small to utilize wind power. The operator already noticed that generated electricity by wind turbine has been dumped into dummy load since the batteries are already fully charged by PV array.
- It is not necessary to increase the height of tower from 18m to 36m. There is not much expectation of wind energy at 36m. Wind power is not expected between January and May. Even there was good wind, the wind power is not able to be utilized because of limited capacity of battery bank.
- PGP proposed the system to be utilized for 24-hour public service such as street lights and PCs at school, etc. Then genset is utilized for household electrification. This will be the best option to utilize this system, though this is one of the most expensive street light systems in the world.

This plan requires independent distribution lines (genset has to be removed from RE system).
Total power consumption for RE system needs to be below 6kWh/day. The system will become PV only system.
Unfortunately, the BAPA refused this proposal.

- PGP has a plan to install a large genset to cover whole barangay, however, existing 35kVA Genset has enough capacity to cover sitio Sicud.

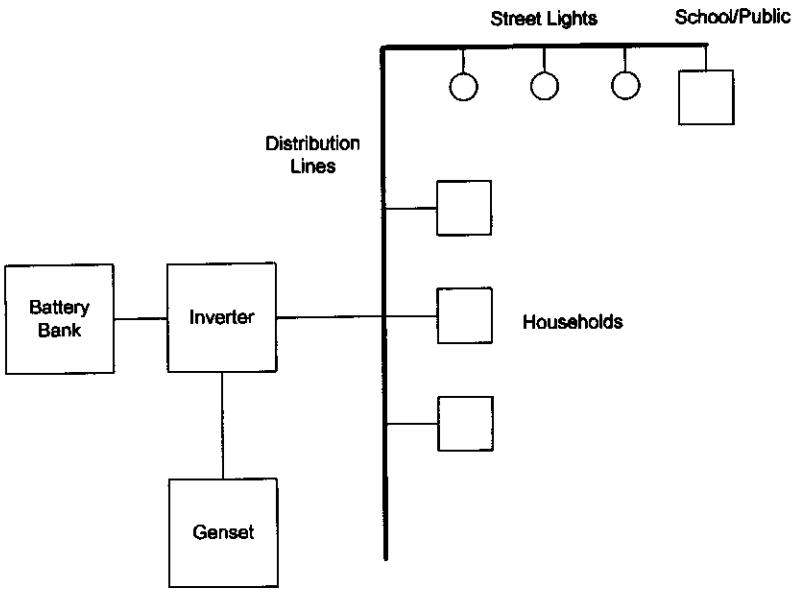


Fig. 5-1 Existing Power Distribution

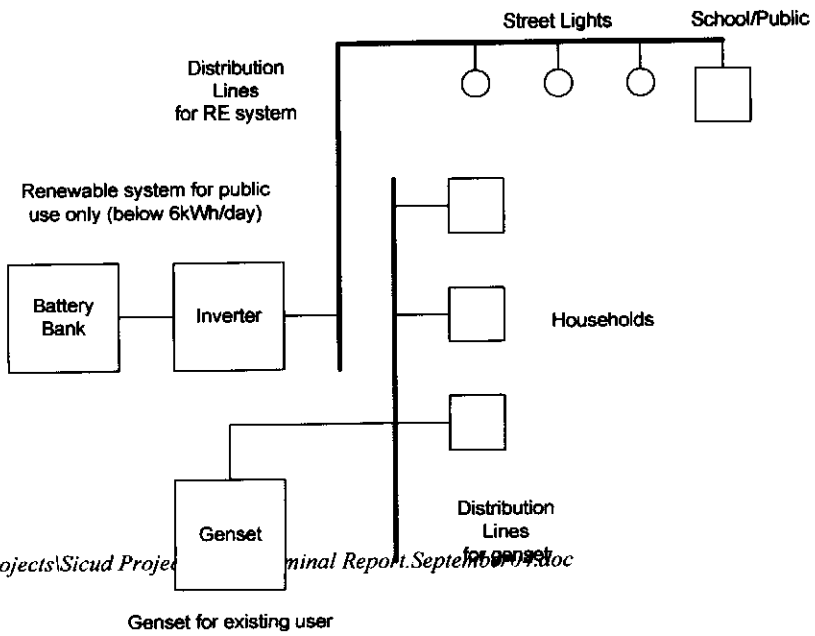


Fig. 5-2 Recommended Power Distribution
RE system is for public use only (independent distribution lines).
Existing genset can supply around 390 households.

Photo 1. View of the system

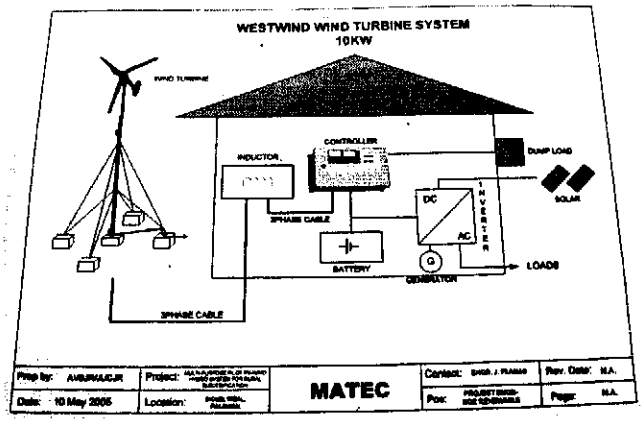


Photo 2. Diagram of the system

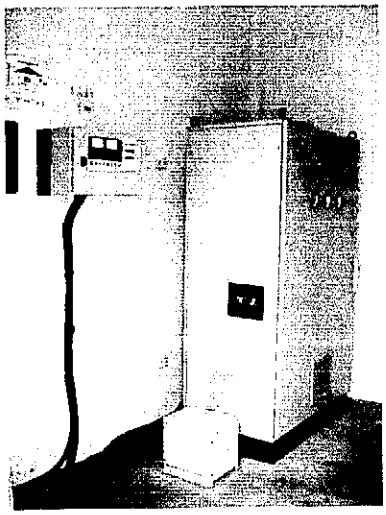


Photo 3. Inverter (right) and wind turbine controller (left)

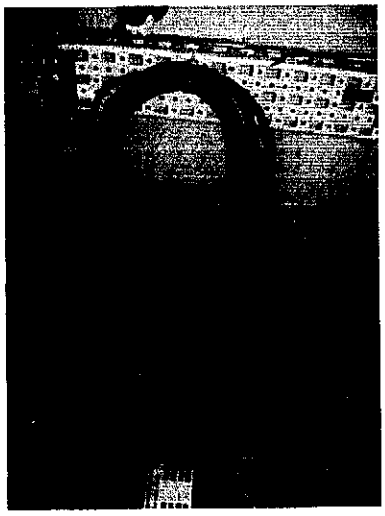


Photo 4. Battery temperature sensor was left inside in the inverter

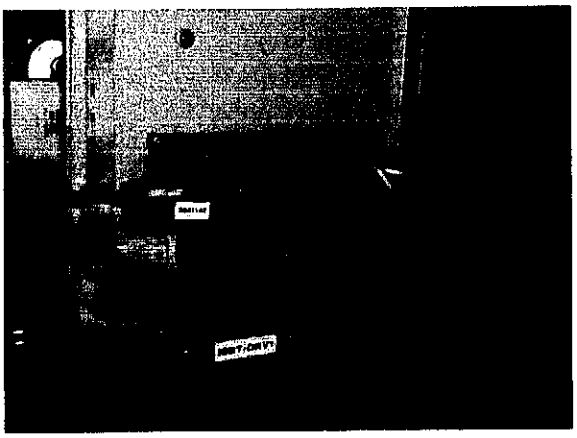


Photo 5. The circuit board has loose contact so that the board was tightened by a cord.

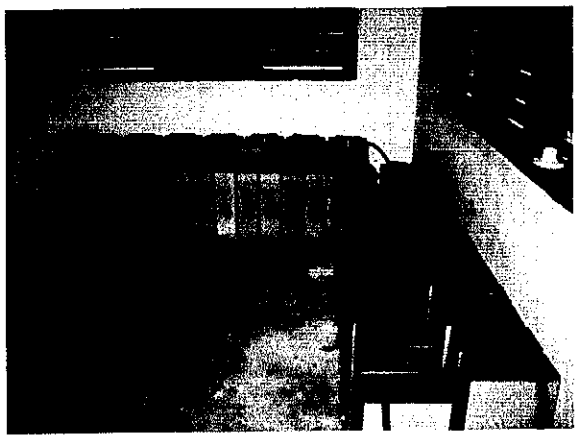


Photo 6. Battery bank. The capacity is too small.

ANNEX "3"

Feasibility Study

ANNEX A

FEASIBILITY STUDY:

A MULTI-PURPOSE PILOT PV AND WIND TURBINE HYBRID SYSTEM FOR RURAL ELECTRIFICATION

Prepared by:

Department of Energy
State Polytechnic College of Palawan

April 25, 2000

PROJECT FEASIBILITY STUDY

PROJECT TITLE: MULTI - PURPOSE PILOT PV - WIND TURBINE HYBRID SYSTEM FOR RURAL ELECTRIFICATION

LOCATION : Sitio Sicud, Barangay Candawaga, Rizal, Palawan, Philippines

I. BACKGROUND

At Philippine household level, about 37% are still unelectrified at present (NEA 1998). The National Electrification Administration (NEA) tasked by the government to spearhead the country's Rural Electrification Program has targeted that all households shall be provided with electricity by year 2018. However, the Philippines has hundreds of remote islands and inaccessible hinterland barangays characterized by low density of demand, low economies of scale, low affordability level, and ever - rising fuel and transportation costs. These conditions make the islands and remote villages unprofitable ventures to private investors in energy development. Further, fossil - derived fuel fed electric generating sets are not viable options for rural electrification in far-flung villages.

Palawan, an archipelagic island province in the Philippines, is composed of eleven (11) mainland municipalities, one component city (Puerto Princesa), and twelve (12) island municipalities. The latter are mostly composed by island barangays . As of 1998, only 47% of the province or 431 barangays were connected to the main power grid, and 128 barangays were identified by the Palawan Electric Cooperative (PALECO) as potential for electrification only through NRE system.

The proposed project is thus, envisioned to demonstrate the use of NRE sources as viable option for rural electrification especially of remote and island barangays and far-flung villages that are inaccessible to power grid. The project will demonstrate the viability and reliability of a hybrid Solar - Wind Turbine system to energize unelectrified areas. It has given priority to fishing and farming village since these are the primary occupation of families in rural areas.

Sitio Sicud in Barangay Candawaga, Rizal, Palawan has been selected as the pilot test area for the proposed project. The sitio is located 245 kilometers southwest of Puerto Princesa , the capital of Palawan. It is bounded on the west by the South China Sea, and on the east along the wide span of ricefield, by the Mount Mantalingahan Range.

The lessons that will be learned from the project shall provide insight for the replication of the project in other areas with similar characteristics as So. Sicud.

Relation to UNDP/GOJ and DOE(GOP) Priorities. The UNDP/GOJ, DOE, the local government unit (LGU) of Rizal, the Provincial Government of Palawan (PGP), and PALECO place high priority on the implementation of the proposed project viewing the project as a vital component for the full electrification of Palawan province.

To facilitate in carrying out the objective effectively of the project, DOE through the, State Polytechnic College of Palawan - Affiliated Non-Conventional Energy Center (SPCP-ANEC) has requested PALECO for technical assistance during implementation and a franchise - waiver since the system will be a mini-grid. Local counterparts were also committed by the Barangay Council of Candawaga, Rizal LGU and the PGP.

II. SCOPE OF THE PROJECT

The proposed project will be implemented in So. Sicud, Brgy. Candawaga, Rizal, Palawan, some 245 kilometers southwest of Puerto Princesa City and 28 kilometers from Rizal town proper (Figure 1). The number of households in Sicud comprise about 24% (976 HH) of the total households (1999 projection: 4124 HH) of Rizal.

The succeeding tables present the socio-economic profile and the energy situation of the village as gathered in the interview with the 101 households taken in September 1999

Socio-Economic Profile.

1. The population of So. Sicud is a very young in which 53% belong to 0-19 years old. The average age is 23.45 years old.

Table 1. Age Distribution of Household Members, n = 101

Age Category	Frequency	Percent (%)
0 – 9	135	23.19
10 – 19	176	30.24
20 – 29	89	15.29
30 – 39	67	11.51
40 – 49	57	9.81
50 – 59	37	6.36
60 – 69	13	2.23
70 – 79	7	1.20
80 – 89	1	0.17
TOTAL	**582**	**100.00**

2. There are about 309 females as against 273 males in the village.

Table 2. Sex Distribution, n = 101

Sex	Frequency	Percent (%)
Male	273	46.91
Female	309	53.09
TOTAL	**582**	**100.00**

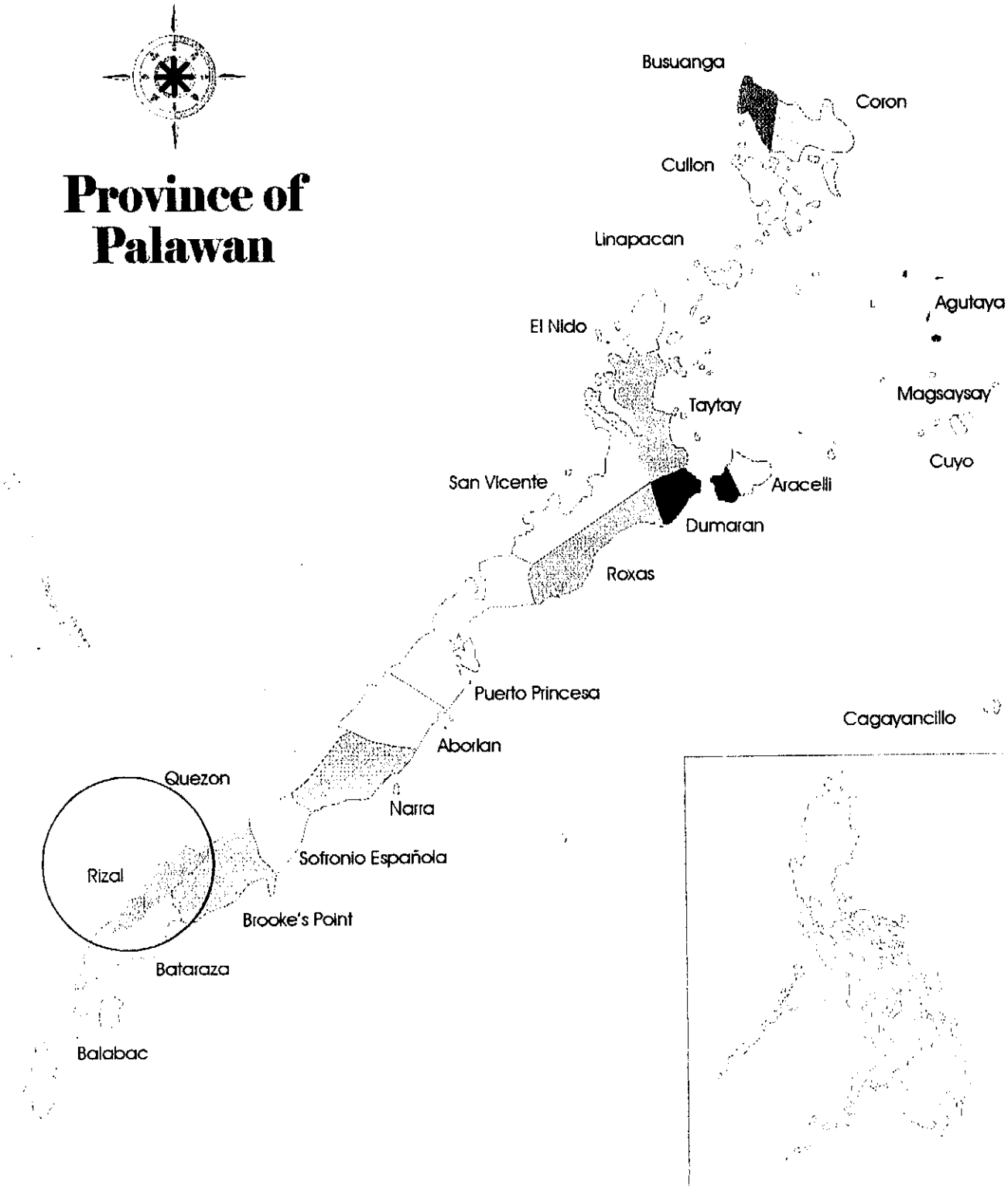


FIGURE 1. PROJECT LOCATION MAP

3. The average family size is 5.72. Most of the families or forty-eight percent (48%) are having only one child to three (3) children.

Table 3. Distribution of Family Size, n = 101

Family Size	Frequency	Percent (%)
0 - 2	9	8.91
3 to 5	48	47.53
6 to 8	22	21.78
9 to 11	21	20.79
12 to 14	1	0.99
TOTAL	**101**	**100.00**
Average Family Size = 5.72		

4. Majority of the population (64%) has attended or has graduated high school and/or elementary school. Only 14% have either attended college or graduated with a baccalaureate degree. The barangay high school is located in the sitio.

Table 4. Educational Attainment of Household Members, n= 101

Educational Level	Frequency	Percent (%)
Below Grade 1	125	21.62
Elementary	185	32.01
High School	189	32.70
College	59	10.21
College Graduate	20	3.46
TOTAL	**578**	**100.00**

5. Majority of the houses is made of wood (86%) with nipa roofing (61%) while the rest are made of concrete hollow block with galvanized iron roofing.

Table 5. Distribution of Dwelling Characteristics, n = 101

Type of Dwelling	Frequency	Percent %
Wood Construction	87	86.14
Concrete Construction	9	8.91
Bamboo/Sawali/Nipa/Cogon	0	0.00
Half Concrete /Brick/Stone & half-wood	5	4.95
TOTAL	**101**	**100.00**

6. Potable water is taken from tubed/piped well with installed jetmatic handpump.

Table 6. Source of Potable Water

Source	Frequency	Percent (%)
Spring/River/Lake	0	0.00
Dug Well	4	3.96
Tubed/Piped Well	84	83.17
Others	13	12.87
TOTAL	**101**	**100.00**

7. Farming and fishing supplemented with secondary gainful activities during off-farm and off-fishing activities, respectively, are the main economic activities of the families in Sicud, with a few engaged in business enterprise and employment.

Table 7. Distribution Matrix of Household Sources of Income

Secondary Main	Fishing	Farming	Business	Employment	Carpentry	Tricycle Operator	Laborer	Others	TOTAL
Fishing	11	2	2				1		16
Farming	5	33	4	2	1	4	7	1	57
Business	1	3	8						12
Employment				3		1			4
Carpentry		1			2				3
Tricycle Optr./Driver		1						1	2
Laborer									
Others	1		1	1				4	7
TOTAL	**18**	**40**	**15**	**6**	**3**	**5**	**8**	**6**	**101**

8. Out of the 101 households interviewed, eleven (11) households depend on fishing as the main source of livelihood. The fish catch per day ranges from 15 kgs. to 260 kgs. and earning between PhP120,000 to PhP432,000 annually. Majority of the household (68%) however, have an annual gross income between PhP100,000 - 200,000. Household median income is PhP107,870 indicating a high capability to pay for electricity.

Table 8. Gross Income of Households, n = 1

Income Level	Frequency	%
100,000 - 200,000	69	68
200,001 - 300,000	23	23
300,001 - 400,000	3	3
400,001 - 500,000	5	5
500,001 - 600,000	1	1
TOTAL	**101**	**100**

9. There are 26 sari-sari stores, 4 eateries, 1 bakery, 1 furniture manufacturing, 4 rice mills, 2 vulcanizing/welding shop, 1 farm supply and 1 fishery supply. A gasoline station is also under construction. Sicud is also the terminal of the Puerto Princesa - Rizal/Sicud route.

10. The municipality of Rizal is a recipient of a very limited share of government investments and services, particularly So. Sicud. However, the sitio is notably fast developing and growing as indicated by the presence of public market, several establishments, farm and fishery supplies, post-harvest facilities, fish buying stations, transportation terminal, construction of a gasoline station, and the observed high influx of migrants from other towns of the province and from other provinces of the country. Politically, the sitio has strong voice in the Sangguniang Bayan of Rizal because two of the members of the Sanggunian are from the sitio including the ex-mayor of the municipality.

Energy Situation of So. Sicud

11. While there are eleven (11) privately-owned diesel electric generating sets of up to 10kVA each installed in the Sitio, only about 6 % of the households are served with electricity from 6:00 P.M. to 11:00 P.M. These are mostly relatives of the owners of the generators and the monthly charged is PhP50 for a 20W bulb. Electricity supply is erratic as it depends on the willingness of the owners to run the generator. Findings also showed that availability of electricity is only 50% due to high cost of fuel, oil, spare parts and maintenance.

12. Kerosene wick lamps are the commonly used source of lighting including those connected to generators. The latter use wick lamps as back-up. A few of the households use kerosene pressure lamp (Petromax) and LPG "Superkalan.".

Table 9. Distribution Matrix of Lighting Devices used in Households, n = 101

	Wick lamp		Petromax		Fluorescent Light		LPG		Total	
Device	No.	%	No.	%	No.	%	No.	%	No.	%
Wick lamp	42	41.58	8	7.92	5	4.95			55	54.45
Petromax							1	0.99	1	0.99
Fl. Light					44	43.57	1	0.99	45	44.56
Total	**42**	**41.56**	**8**	**7.92**	**49**	**48.58**	**2**	**1.98**	**101**	**100**

13. Monthly lighting consumption of the responding households were PhP78.00 for those using wick lamps, PhP203.00 for kerosene pressure lamp (Petromax/Coleman) and PhP245.00 for a 20W fluorescent lamp powered by electricity supplied from the generator set.

Table 10. Households lighting consumption, n=101

1. All households median annual expenses for lighting including	
Those connected to privately-owned electric generators	P1,636.00
2. DEVICE: WICK LAMP	
Number of HHs	55
Number of wick lamps (service life = 1 yr)	151
Average number of wick lamp/HH	3
Cost per unit of wick lamp	P15.00
Average monthly kerosene consumption/HH, bottles of 350ml.	P15.60
Cost per bottle of 350ml of kerosene	P5.00
Monthly expenses for kerosene/HH	P78.00
Annual expenses with wick lamp lighting	P981.00
3. DEVICE: KEROSENE PRESSURE LAMP (PETROMAX)	
Number of HH	9
Number of petromax	9
Average cost of 1 unit Petromax (service life = 7 years)	P1,750.00
Annualized cost of Petromax	P250.00
Annual kerosene consumption/HH, 0.15lph x 4h/nioght @P10.00/liter	P2,190.00
Annual expenses for lighting/HH using Petromax	P2,440.00

4. DEVICE: 20W FLUORESCENT LIGHT	
Number of HH	49
Total number of fluorescent light	131
Average number of fluorescent per HH	3
Cost per set of fluorescent lamp	P240.00
Annual electrical energy consumption, 4h/night, all HH	3863 kWh
Total cost of energy for all HH	P173,388.00 (1)
Estimated cost/kWh based on fixed charge of P50.00 per 20W bulb	P45.33
Assuming 100% availability of electricity and based on fixed charge, annual cost	P79,380.00
Cost per kWh @100% availability and fixed charge of P50.00 per 20W bulb	P20.55
Monthly electrical energy consumption @100% availability	6.57 kWh
Annual expenses per HH for electricity including device	P2,940.00
(1) includes expenses for electricity used by refrigerators of some small establishments.	

14. About 93% of the households leave lighting on throughout the night for security purposes.

Table 11. Extent of Lighting Utilization for Household Activities, n = 101.

Activities	Always		Sometimes		Never		Total	
	Number	%	Number	%	Number	%	Number	%
The household leaves the Light throughout the Night for security purposes	48	47.53	46	45.54	7	6.93	101	100
The household leaves the Light throughout the Night for livestock	2	2.18	68	73.91	22	23.91	92*	100
The household used any Form of lighting for Household work	3	2.97	74	73.27	24	23.76	101	100

*Nine (9) household respondents have no livestock.

III. DETAILED PROJECT DESCRIPTION

The Project.

The proposed project is a pilot centralized utility-type 5KWp PV / 10KW Wind Turbine Hybrid System that will provide the power needs of 200 households in So. Sicud for lighting and operation of small home appliances.

The site of the Hybrid System will be located in a level open area along the coastline of the South China Sea (Figure 2). The area has already been committed by the owner of the land for donation to the barangay specifically for the project.

The power that will be generated shall be sold to the beneficiaries at an affordable cost. The in-house electrical installations including the light and fixtures shall be provided by the beneficiaries. The operator/technician who shall be employed by the Sicud Village Power

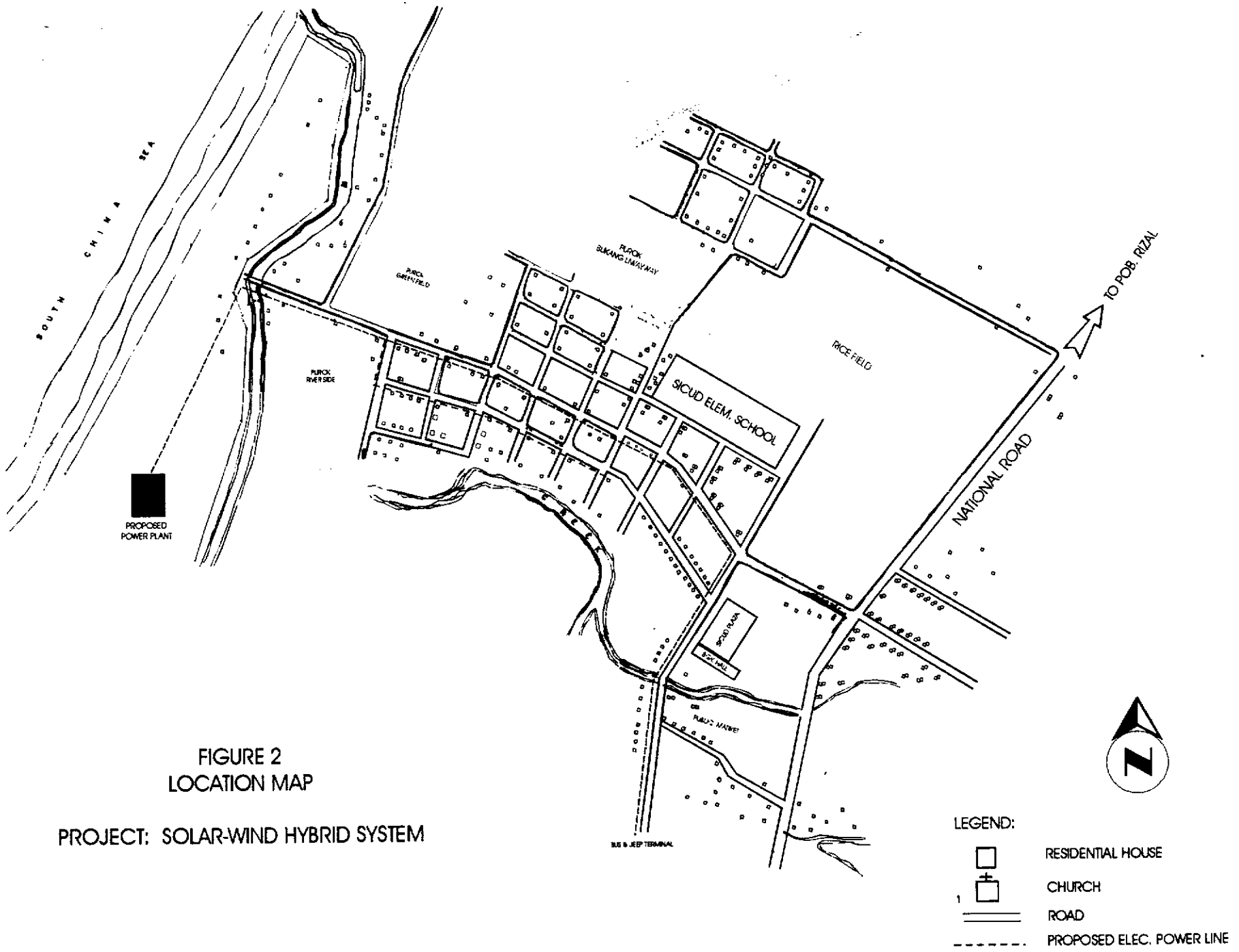


FIGURE 2
LOCATION MAP

PROJECT: SOLAR-WIND HYBRID SYSTEM

Association (SVPA) for the operation, repair and maintenance of the of the Hybrid System shall be regularly trained by the SPCP-ANEC.

Since the installation of hybrid system is yet to be seen in the country, the lessons that will be learned from the experience of the project shall provide conclusions for replication of the system in other areas with similar characteristics as So. Sicud, and for policy making in the matter of rural electrification in the rural areas.

Site Selection

So. Sicud was selected as the pilot site of the project for the following reasons:

1. Acceptability of NRE system, particularly PV and Wind Turbine to the members of Barangay Candawaga.
2. Commitment exhibited by the LGU of Rizal, Barangay Council and the members of the barangay.
3. The prevailing wind and sunshine brightness duration in So. Sicud. The Sitio is bounded on the west by South China Sea and by a wide range of ricefield in the east. The prevailing wind speed is relatively high with bright sunshine almost throughout the year .
4. The Sitio is a remote farming and fishing village, 245 kilometers southwest of Puerto Princesa City. Only the town proper of Rizal is provided with electricity from the grid from a 250kVA diesel electric generator of the LGU.
5. Sicud is accessible for immediate response to problems that may occur in the system for evaluation and monitoring purposes.
6. The Sitio represents a typical farming and fishing village in Palawan.
7. The responsible commitment on the maintenance and operation of NRE system shown by the village on the 225W PV Battery Charging Station (BCS) demonstration unit installed by SPCP-ANEC.
8. Sicud is a fast developing and growing farming and fishing village as indicated by the presence of the barangay public market, a gasoline station under construction, several small establishment (sari-sari store, eateries, fishery and farm supply, etc.), post harvest facilities, fish buying stations, high influx of migrants from other Palawan municipalities and from other provinces in the country.
9. The willingness and high capability to pay for electrical service. The median monthly net income of farming household is PhP3,163.00 and of fishing household is PhP4,949.00 as found in the socio-economic research survey conducted by SPCP-ANEC.

Goal of the Project.

To demonstrate the viability of NRE hybrid system in remote, off-grid unelectrified barangay thereby improving the living conditions of the rural people.

General Objective of the Project.

The project is designed to provide sustainable supply of power to a remote, off-grid unelectrified village through the installation of a PV - Wind Turbine Hybrid System for rural electrification. The achievement of this objective will contribute to the ERAP Barangay Electrification Program of the DOE.

The conditions that will indicate that the objective has been achieved are as follows:

1. 200 households are fully electrified;
2. presence of entertainment medium in the households;
3. reduced household cost of energy that will indicate energy conservation;
4. convenience provided by the project to the household members;
5. sense of improve security of the households;
6. longer night period of study and reading time of family members;
7. extent of reliability and availability of power from the system;
8. study/observation tour made to the system; and,
9. impact of the project on the routinary household chores of wives and other women members of the household including the children and the aged.

To measure all these indications, an evaluation survey instrument will be designed to determine every quarter the changes in the living conditions of the beneficiaries of the project. Problems encountered by the beneficiaries and the Hybrid System will also be documented.

Specific Objectives.

The following are the specific objectives of the project:

1. To provide a utility-type electricity service to households in the fishing and farming village of So. Sicud;
2. To install sunlight and wind resource-based hybrid renewable energy demonstration project;
3. To develop an approach that will ensure the sustainability of the project;
4. To draw valuable technical, economic, social and other relevant experiences that will justify the replication of the system in other areas as well as for policy making in the matter of rural electrification in rural villages;
5. To improve living condition of the village people in So. Sicud through access to electricity; and,
6. To improve the welfare of women by making their regular household chores easier through the easy access to electricity.

Project Inputs.

A total cost input of $176,878 (PhP7,075,120) is required during the first year of implementation of the project to achieve the desired outputs. These shall be sourced out from various institutions.

Table 13. Funding Sources

Source of Fund	Contribution		Percent (%) Share
	In US $	In Phil. Pesos	
UNDP/GOJ	125,000	5,000,000	70.67
GOP – DOE	27,500	1,100,000	15.54
Rizal Local Government Unit (LGU)	12,500	500,000	7.07
Provincial Government of Palawan	8,928	357,120	5.05
Beneficiaries/Village	2,950	118,000	1.67
Total	**176,878**	**7,075,120**	**100**

Note: Conversion rate - $1.00 = PhP40.00

Expected Project Outputs.

1. Electrification of 200 households in the fishing and farming village of So. Sicud;
2. Improvement of the living conditions of the rural folks in the Sitio by providing them with electricity services;
3. Institutionalization of the Village Power Association to manage, operate, repair and maintain the system for project sustainability; and,
4. Transfer of skills on the management, operation and maintenance of hybrid system to the power association.

IV. TECHNICAL FEASIBILITY

Potential of Sitio Sicud for Wind Turbine

During several one-day monitoring of the PV-BCS in Sicud by SPCP – ANEC, wind speed was observed to be relatively high during the later part of the morning to early afternoon (between 10:00 a.m. and 3:00 p.m.). By the used of a handheld anemometer, windspeed was observed near the coastline of South China Sea to vary between 4.5 m/s to 6.5 m/s measured at about 1.50 meters above from ground surface.

A recorded observation of the windspeed was made on September 6, 1999 by SPCP-ANEC during the conduct of the detailed socio-economic survey of Sicud. The results are as follows:

Date of Observation	:	September 6, 1999
Weather	:	Partly cloudy
Prevailing Wind	:	Southwest
Height at Measurement	:	1.80 meters above ground surface
Location of Observation	:	Proposed Site
Instrument Used	:	Anemometer

Table 14. Wind Monitoring Data, September, 1999.

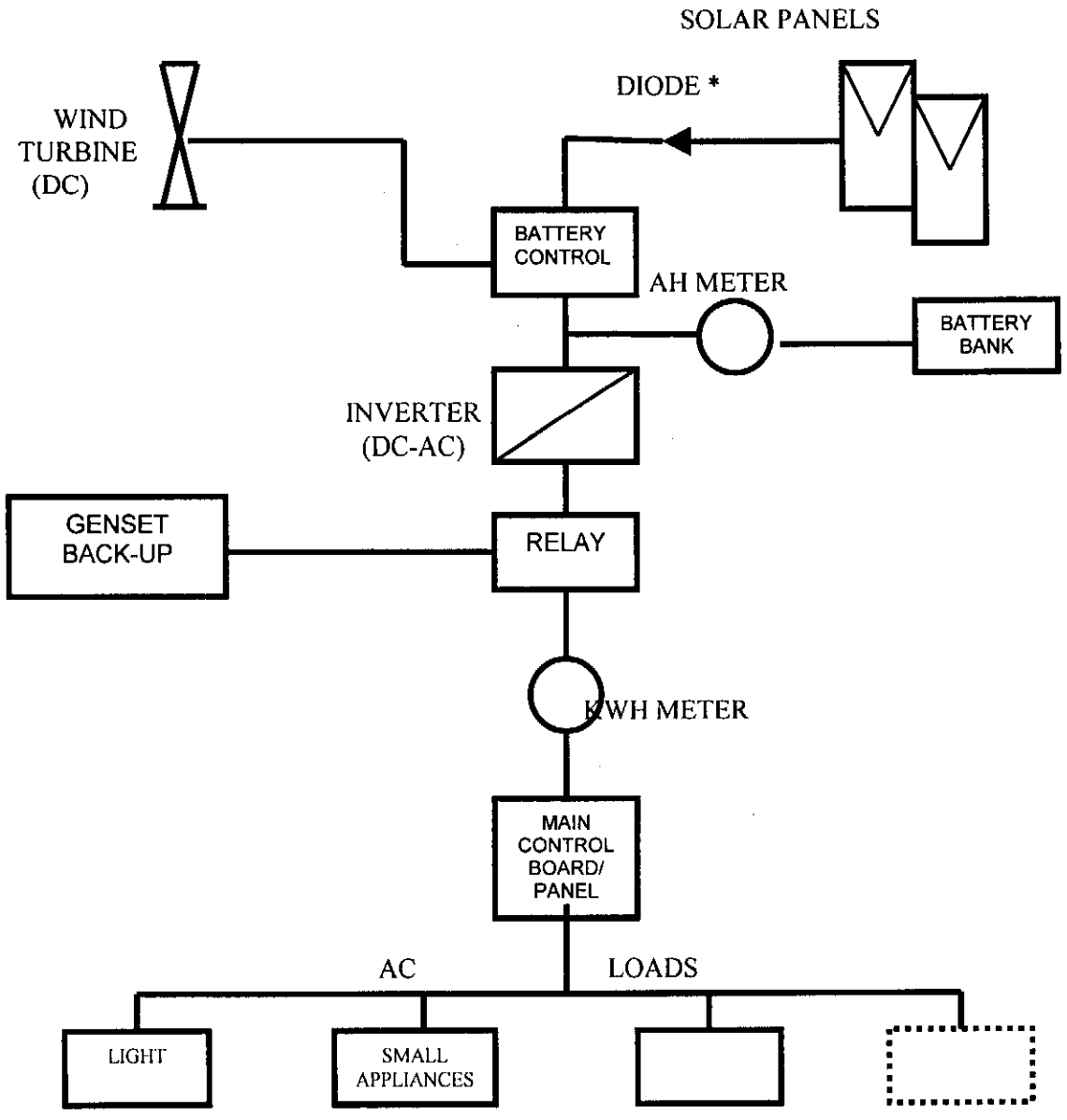
Time	Windspeed (m/s)	
	Low	High
9:37 am - 10:02 am	4.0	5.0
10:02 am - 11:17 am	4.8	6.5
11:17 am - 12:28 pm	5.0	7.2
12:28 pm - 1:50 pm	6.5	9.2
1:50 pm - 2:20 pm	5.0	6.5
2:20 pm - 2:54 pm	5.0	5.6
2:54 pm - 3:31 pm	3.8	4.9
Average	***4.64***	***6.18***

The wind speed at higher elevation is expected to be higher than the observed measurements which make the site a potential for wind energy system.

System Operation

Electricity will be supplied by a 5-kWp PV array and a 10-kW Wind Turbine Hybrid System. The direct current output of the system will be converted into a 220VAC before electricity is distributed to the beneficiaries. A 20kVA main transformer and 3-5kVA distribution transformer will also be installed to minimize system losses. A complete instrumentation for measurement of the efficiency and power control of the system will also be installed. The electricity will be distributed by a 2500 meter transmission line from the hybrid system to the beneficiaries. A 15-kVA back-up diesel generator will also be provided in case there will be failure of the system or in case the weather will not permit running the system into its maximum capacity. The system will be operated 24 hours daily.

Chart A
SCHEMATIC DIAGRAM OF HYBRID SYSTEM



A blocking diode is needed to prevent the battery from discharging into the modules. At night time, the voltage potential of the battery bank is greater than the PV modules hence, the battery will and can discharge through the PV modules. The provision of diode is required by the Philippine Electrical Code.

The hybrid system will have one personnel – an operator/technician. The hybrid system will be under the supervision of a SPCP-ANEC live-in Science Research Specialist to ensure the proper operation and maintenance of the system. SPCP-ANEC shall provide technical support during installation of the hybrid system. It shall also assist in organizing the households into power cooperative and train local villagers in meter reading, billing, collection, basic accounting as well as in undertaking unspecialized maintenance.

Design of the System

A. PV-Wind System

1. Number of household (HH) beneficiaries: 200

2. Assumed energy demand :

2.1 175 HHs with light only

Load 1: 1 – 9 W CFL x 6 hours/day	=	9,450 Wh
Load 2: 1 – 9 W CFL x 10 hours/day	=	15,750 Wh
Load 3: 1 – 11W CFL x 6 hours/day	=	11,550 Wh
Load 3: 1 - 12 W radio/cassette x 6 hours/day	=	12,600 Wh
		49,350 Wh

2.2 25 HHs with light + TV/VHS

Load 1: 2 - 13W CFL x 6 hours/day	=	3,900 Wh
Load 2: 1 - 13 W CFL x 10 hours/day	=	3,250 Wh
Load 3: 1 - 120W Color TV/VHS x 5 hours/day	=	15,000 Wh
Load 4: 1 – 170W radio/cassette x 4 hours/day	=	17,000 Wh
		39,150 Wh

Total Daily Energy Demand = **88,500 Wh/day**

3. Total Energy Supply

PV	:	Module rating (total)	=	5 kWp
		Solar Insolation	=	4
		E_{PV} (5 kW) 5	=	20 kWh
Wind	:	Rated Power	=	10 kW
		Capacity Factor	=	30%
		E_{WTG} (10 kW) (0.3) (24)	=	72kWh

Total Energy Supply (daily) = $E_{PV} + E_{WTG}$
= 20 kWh + 72 kWh
= **92 kWh/day**

B. Use : 5 - kWp PV : 68 – 75 Wp PV Panels
1 – 10kW Wind Turbine
24 – 2 Vdc/Cell, 1000Ah battery
1 – 15 kVA Inverter, Quasi – sine
1 - 120A Battery Control Unit, 48VDC/230VAC

Since the project is aimed for replication, the reliability of the hybrid system has to be monitored. The presence of the eleven (11) privately owned generating sets in Sicud can provide a good mode of comparison. These generating sets were noted by the UNDP/GOJ Mission Team during its rapid site assessment of the potential of Sicud for a hybrid system.

Table 15. Summary of Technical Data

ECONOMIC PARAMETERS					
Period of Analysis	N	20	Years		
Interest Rate(discount rate)	I	12	%		
DEMAND DATA					
No. of households without TV and VHS	Hh	175			
Load 1: 1 x 9W Compact Fluorescent Lamp x 6 hrs/day	Ed1	9,450			
Load 2: 1 x 9W Compact Fluorescent Lamp x 10 hrs/day	Ed2	15,750			
Load 3: 1 x 11W Compact Fluorescent Lamp x 6 hrs/day	Ed3	11,550			
Load 4: 1 x 12W Radio/Cassette x 6 hrs/day	Ed4	12,600			
Total Daily Energy Demand/day	Eda	49,350			
No. of households with TV and VHS	Hh	25			
Load 1: 2 x 13W Compact Fluorescent Lamp x 6 hrs/day	EdL1	3,900			
Load 2: 1 x 13W Compact Fluorescent Lamp x 10 hrs/day	EdL2	3,250			
Load 3: 1 x 120W Color TV and VHS x 5 hrs/day	EdL3	15,000			
Load 4: 1 x 170W Radio/Cassette x 4 hrs/day	EdL4	17,000			
Total Daily Energy Demand/day	Edb	39,150			
Daily Energy Demand	Ed	88,500	Wh/day	88500	Wh/day
Max Power Demand	P	14,661	W	14661	W
Annual Energy Demand	Ea	32,303	KWh/year	32302.5	kWh/year
TECHNICAL DATA					
		Rating	Unit	Quantity	Total No.
PV Modules, 75Wp		75	Wp	68	68
Batteries, 2V/cell, 1000 Ah		1000	Ah	24	24
Battery Accessories & Storage		1	Lot	1	1
Controllers/Electronics		120	A	1	1
Inverter, 15kVA, 48VDC-230VAC		15,000	W	1	1
10 Kw Wind-Turbine Generator		10	KW	1	1
Step-Up Distribution Transformer		20	KVA	1	1

Step-down Distribution Transformer		5	KVA	3	3
15 kVA diesel generator set		15	KVA	1	1
Transmission/Distribution Lines		2.5	Kms.	1	1
COST DATA					
Unit Cost		Unit Price	Total Price	Lifetime	
Modules		20,000	1,360,000	25	years
Batteries		18,000	432,000	7	years
Battery Accessories & Storage		45,000	45,000	20	years
Battery Charge Controllers/Electronics		105,000	105,000	10	years
Inverter, 15kVA, 48VDC-230VAC		548,000	548,000	10	years
Wind Turbine Generator, 10 kW including controls and inverter/charger		1,048,000	1,048,000	20	years
Step-Up Distribution Transformer, 20 kVA		80,000	80,000	20	years
Step-Down Distribution Transformer, 5 kVA		20,000	60,000	20	years
Solar Array Support Structure		102,000	102,000	20	years
Transmission and distribution line, 2.5 kms.		260,000	650,000	20	years
15kVA diesel genset (back-up)		75,000	75,000		
Service Vehicle		480,000	480,000		
Sub-Total			4,985,000		
Installation Cost			623,125		
SubTotal			5,608,125		
Capital Cost		5,608,125			
Annual O&M Cost		273,989			
O&M (PW)		2,046,545			
Replacement Cost (PW)					
Controller, 120A		33,807			
Battery, 1000 Ah, 2V/cell		253,402			
Inverter		176,441			
Subtotal		463,651			

LIFE CYCLE COST (PW) 8,118,321

ANNUALIZED LCC 1,086,871

LEVELIZED ENERGY COST **33.64685 Per kWh**

The formula used to compute for the levelized energy cost is presented below:

Present Worth, $PW = Cr \times \{(1+i) / (1 + d)\}^{y}$

Where y = year the cost was incurred

Cr = single future cost

i = excess inflation rate, that is, the rate of price increase of the component above the general inflation of the country. Components like structural, operating cost, etc. are increasing, while the cost of PV modules, inverters,

controllers, batteries are decreasing. For safe assumption and ease, i = 0, i.e., PV system price increases with the same rate as the inflation.

d = discount rate (in this FS, d = 12%)

If the same amount of cost occurs annually (Ca) for a period of n years, instead of calculating the present worth of each cost a single equation is used to compute the present worth of the sum of the annual future cost as follows:

$$PW = Ca \times \{A(1-A^n)/(1-A)\}$$

Where $A = (1+i)/(1+d)$

n = life of the project in years

Life-Cycle Cost, LCC = Ccap + Cop + Cfl + Crep – Csal

Where: Ccap = total initial cost of buying and installing the system

Cop = operation and maintenance cost spent per year in keeping the system operational including personnel costs

Cfl = annual bill of fuel (in this FS, distilled water is included in the Cop)

Crep = replacement cost of component at the end of its lifetime

Csal = discounted salvage value or resale (in this FS, Csal = 0)

Annualized Life-Cycle Cost, $ALCC = LCC /\{A(1-A^n)/(1-A)\}$

Levelized Energy Cost , LEC = ALCC / (Electricity supplied per year)

G. Construction and Installation

All labor shall be provided by Brgy. Candawaga for the construction of buildings and other facilities including labor for the installation of the hybrid system.

PALECO shall provide technical assistance in the installation of transmission and distribution lines. PALECO is interested in the system to enable it to energize the whole Palawan province by year 2004.

H. Licensing

Distribution of electricity in the mainland Palawan is under the franchise of PALECO. The project has the strong favorable support of PALECO. Since the project shall be a mini-grid system, a franchise waiver for the project has been requested by SPCP-ANEC from PALECO.

The SPCP-ANEC was reliably informed by a Board Member of PALECO that the request has been approved by the Board of the PALECO.

I. Training of Plant Personnel, Barangay Electricians and Villagers.

The following seminar-workshops and trainings shall be conducted by SPCP-ANEC/DOE-NCED in collaboration with the LGU of Rizal, PALECO and SPCP.

1. Organization and Management of Cooperative;
2. Management, Operation, Repair and Maintenance of Hybrid System including billing and collection; and
3. Operation and Maintenance of Transmission and Distribution Lines including house wiring , meter installation and meter reading.

V. ECONOMIC FEASIBILITY

Benefit - Cost Analysis.

The economic analysis includes total investment cost, all expenditures, income, and generated savings by the beneficiary households with the project. In determining the power rate to be charged to the beneficiaries, the levelized energy cost (LEC) which is PhP33.65/kWh (Table 15) and a power rate of PhP20.00/kWh increased annually by 10% until Year 10 were used. Both power rates cover the capital investment cost of all equipment and components including the day-to-day maintenance and operations costs of the system including repair, personnel cost (i.e., salaries and wages of the local technician as well as the incentive allowance of the project management office), and replacement cost of components.

Using the LEC as the power rate, the proposed project is expected to generate a 20-year total benefit of PhP111,552,655.00 with a present value of PhP41,661,813.00 with a total project investment cost of PhP5,976,125.00 and a 20-year total expenditures of PhP7,597,980.00 with a present value of PhP2,957,425.00 (Table 16). Total net benefit was PhP97,728,263.00 with a present value of PhP32,728,263.00.

Using as power rate PhP20.00/kWh increased annually by 10% until Year 10, the proposed project is expected to generate a 20-year total benefits of PhP115,345,189.00 with a present value of PhP41,640,982.00 (Table 16A). Total net benefit was PhP101,771,084.00 with a present value of PhP32,707,432.00.

Benefit to Cost Ratio of both power rates is 4.7 to 1.00 at graduated power rate, that is, for every PhP1.00 that will be imputed to the project, PhP4.70 will be returned to the Philippine society. Hence, the project is economically viable.

The Benefit - Cost analysis is shown in Tables 16A and 16B for both power rate, which attempts to estimate some of the real economic benefits the rural Philippine society will derive from this project. The present values of project - related initial and on-going costs over a 20 - year period are compared with those of quantifiable project benefits over the same period, the latter estimated for the following:

a. Income derived from the sale of electrical energy to beneficiaries.
b. The subsidy to be provided to reduce cost of electricity to make the cost of electricity affordable to the beneficiaries.
d. The savings generated to households from replacement of the current lighting devices used by the households.
e. Savings generated to households from replacement of kerosene by clean and environment-friendly sources of energy - sunlight and wind.
f. Increase in income of farmers due to information derived from availability and accessibility of sources of production information, that is, TV-VHS medium.
g. Benefits returned to education derived from extended studying and self-interacting educational materials that can be shown in TV-VHS medium.

Table 16A. Economic Benefit - Cost Analysis at PhP33.64665/kWh.

	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Total Investment Cost	5,976,125										
Total Benefits		5,577,633	5,577,633	5,577,633	5,577,633	5,577,633	5,577,633	5,577,633	5,577,633	5,577,633	5,577,633
- Collection Fee		1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888
- Savings Generated		4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745
- PV @ 12%		4,980,029	4,446,455	3,970,049	3,544,686	3,164,899	2,825,802	2,523,038	2,252,712	2,011,350	1,795,848
Total Expenditures		524,789	388,589	388,589	334,589	334,589	273,989	273,989	705,989	273,989	273,989
- Personal Services		225,589	225,589	225,589	171,589	171,589	137,989	137,989	137,989	137,989	137,989
- Operations and Maintenance		299,200	163,000	163,000	163,000	163,000	136,000	136,000	136,000	136,000	136,000
- Replacement									432,000		
- PV @ 12%		468,562	309,781	276,590	212,637	189,855	138,811	123,939	285,137	98,803	88,217
Net Benefits	-5,976,125	5,052,844	5,189,044	5,189,044	5,243,044	5,243,044	5,303,644	5,303,644	4,871,644	5,303,644	5,303,644
- PV @ 12%	-5,976,125	4,511,468	4,136,674	3,693,459	3,332,049	2,975,044	2,686,991	2,399,099	1,967,575	1,912,547	1,707,631
NPV @ 12%	32,728,263										
BENEFIT : COST RATIO	4.7										

Table 16A. Economic Benefit - Cost Analysis at PhP33.64665/kWh. (Continued)

	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	TOTAL
Total Investment Cost											
Total Benefits	5,577,633	5,577,633	5,577,633	5,577,633	5,577,633	5,577,633	5,577,633	5,577,633	5,577,633	5,577,633	111,552,655
- Collection Fee	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	21,737,755
- Savings Generated	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	89,814,900
- PV @ 12%	1,603,436	1,431,639	1,278,249	1,141,294	1,019,013	909,833	812,351	725,313	647,601	578,215	41,661,813
Total Expenditures	926,989	273,989	273,989	273,989	705,989	273,989	273,989	273,989	273,989	273,989	7,597,980
- Personal Services	137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989	3,089,780
- Operations and Maintenance	136,000	136,000	136,000	136,000	136,000	136,000	136,000	136,000	136,000	136,000	2,991,200
- Replacement	653,000				432,000						1,517,000
- PV @ 12%	266,487	70,326	62,791	56,064	128,982	44,694	39,905	35,629	31,812	28,404	2,957,425
Net Benefits	4,650,644	5,303,644	5,303,644	5,303,644	4,871,644	5,303,644	5,303,644	5,303,644	5,303,644	5,303,644	97,978,550
- PV @ 12%	1,336,949	1,361,313	1,215,458	1,085,231	890,031	865,139	772,446	689,684	615,789	549,812	32,728,263
NPV @ 12%											
BENEFIT : COST RATIO											

Table 16B. Economic Benefit - Cost Analysis at PhP20.00/kWh Increased by 10% Annually until Year 10

	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Total Investment Cost	5,976,125										
Total Benefits		5,136,805	5,201,411	5,272,478	5,350,651	5,436,641	5,531,231	5,635,280	5,749,733	5,875,632	6,014,121
- Collection Fee		646,060	710,666	781,733	859,906	945,896	1,040,486	1,144,535	1,258,988	1,384,887	1,523,376
- Savings Generated		4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745
- PV @ 12%		4,586,433	4,146,533	3,752,845	3,400,435	3,084,896	2,802,294	2,549,114	2,322,221	2,118,812	1,936,386
Total Expenditures		524,789	388,589	388,589	334,589	334,589	273,989	273,989	705,989	273,989	273,989
- Personal Services		225,589	225,589	225,589	171,589	171,589	137,989	137,989	137,989	137,989	137,989
- Operations and Maintenance		299,200	163,000	163,000	163,000	163,000	136,000	136,000	136,000	136,000	136,000
- Replacement									432,000		
- PV @ 12%		468,562	309,781	276,590	212,637	189,855	138,811	123,939	285,137	98,803	88,217
Net Benefits	-5,976,125	4,612,016	4,812,822	4,883,889	5,016,062	5,102,052	5,257,242	5,361,291	5,043,744	5,601,643	5,740,132
- PV @ 12%	-5,976,125	4,117,871	3,836,752	3,476,255	3,187,798	2,895,042	2,663,482	2,425,176	2,037,084	2,020,009	1,848,169
NPV @ 12%	32,707,432										
BENEFIT : COST RATIO	4.7										

Table 16B. Economic Benefit - Cost Analysis at PhP20.00/kWh Increased by 10% Annually until Year 10 (Continued)

	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	TOTAL
Total Investment Cost											
Total Benefits	6,014,121	6,014,121	6,014,121	6,014,121	6,014,121	6,014,121	6,014,121	6,014,121	6,014,121	6,014,121	115,345,189
- Collection Fee	1,523,376	1,523,376	1,523,376	1,523,376	1,523,376	1,523,376	1,523,376	1,523,376	1,523,376	1,523,376	25,530,289
- Savings Generated	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	4,490,745	89,814,900
- PV @ 12%	1,728,916	1,543,675	1,378,281	1,230,608	1,098,757	981,033	875,923	782,074	698,280	623,464	41,640,982
Total Expenditures	926,989	273,989	273,989	273,989	705,989	273,989	273,989	273,989	273,989	273,989	7,597,980
- Personal Services	137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989	3,089,780
- Operations and Maintenance	136,000	136,000	136,000	136,000	136,000	136,000	136,000	136,000	136,000	136,000	2,991,200
- Replacement	653,000				432,000						1,517,000
- PV @ 12%	266,487	70,326	62,791	56,064	128,982	44,694	39,905	35,629	31,812	28,404	2,957,425
Net Benefits	5,087,132	5,740,132	5,740,132	5,740,132	5,308,132	5,740,132	5,740,132	5,740,132	5,740,132	5,740,132	101,771,084
- PV @ 12%	1,462,429	1,473,349	1,315,490	1,174,545	969,776	936,340	836,018	746,444	666,468	595,061	32,707,432
NPV @ 12%											
BENEFIT : COST RATIO											

Table 17 explains the production cost and the benefits as bases in determining the economic feasibility of the project.

Table 17. Production Cost and Benefits

A.	**Production Cost**		
1.	Number of beneficiary HH		200
2.	Assumptions: a) 175 HH will have lights and radio-cassette		
	b) 25 HH willhave lights and TV/VHS		
3.	Daily electricity consumption: Assumption a	Wh	49,350
	Assumption b	Wh	39,150
4.	Monthly electricity consumption/HH: Assumption a	Wh	1,501,063
	Assumption b	Wh	1,190,813
5.	Direct Production Cost (Operation and Maintenance):		
	Annual	P	171,289
	Administrative Overhead Cost	P	163,000
	Total Production Cost	***P***	***334,289***
B.	**Benefits**		
1.	Option: Cost of energy saved with fixed allocation		P14,683.15
2.	Savings on entertainment: P5.00/show/head		45,625.00
3.	Return to education at 10% due to availability of		
	Education self-interacting medium (TV/VHS)		34,960.00
4.	Assuming a 15% increase in income of farming HH		
	Due to new production technology and information		
	Learned from TV/VHS program		P16,180/HH
5.	Assuming a 25% increase in income of fishing HH due		
	to information and technology to improve fish catch,		
	Fish processing and fishing method		P74,888/HH
	Total Benefits for 200 HHs		***P4,490,745***

VI. FINANCIAL FEASIBILITY

Financial Plan and Project Budget

A tabular summary of project funded components is presented in Table 18. Of the total project cost of $176,878 (P7,075,120), 60.28% shall be UNDP/GOJ grant for the major equipment components. The host country represented by the LGU, DOE and PGP shall provide the counterpart fund of 27.65% for personnel, other capital investments and institutional development. The barangay/beneficiaries shall provide the equivalent of 1.68% of self-help labor and material support.

Table 18. Estimated Project Cost by Source of Funding (Financial Plan) in Dollar Equivalent

PROJECT COMPONENT	TOTAL COST	UNDP/ GOJ	*TOTAL*	*HOST COUNTRY CONTRIBUTION*				
				DOE	Rizal LGU	PGP	Beneficiary	Total
Institutional Development	3,405				3,405			3,405
Const. Of Buildings	16,428				5,000	8,928	2,500	16,428
Equipment/ Supplies	154,200	125,000	125,000	27,500	1,250	8,928	450	29,200
Project Management/ Coordination/ Consultation	2,845				2,845			2,845
TOTAL	**176,878**	**125,000**	**125,000**	**27,500**	**12,500**	**8,928**	**2,950**	**51,878**

General Notes:
1. The above estimated project cost is for year 1 only.
2. Contribution of Beneficiaries/Barangays refers to labor and office tables and chairs, land, electrical posts, fencing, and in-house wiring and fixtures.
3. LGU and PGP contributions will be used for the incentive and allowances of the assigned LGU and SPCP-ANEC personnel, seminar-workshop, training and building construction.
4. Conversion rate used : $1.00 = PhP40.00

The attempt to mobilize local resources to accomplish project outputs represent an important and basic concept in the design of this project, and its success will ensure its financial replicability in the country to provide electricity services. 92% of the project cost is appropriated for the hybrid system, 4% for physical construction, 2% for institutional development and 2% for project management and operation. All equipment for the hybrid system shall be provided by UNDP/GOJ grant, DOE and the rest from host country participants.

Financial Sustainability and Viability

In determining the financial sustainability and viability of the project, the two (2) power rates used in the Economic Analysis were also considered The first one (Table 19A) uses the LEC and the second (Table 19B) uses PhP20.00/kWh annually increased by 10% until Year 10. The former has an internal rate of return (IRR) of 12.09% and a payback period of 7.65 years. The latter has an IRR of 12.01% and a payback period of 8.80 years. Both power rates showed the project to be financially sustainable, viable, can be replicated and can replaced the hybrid system after its service life including expansion of electricity service as indicated by their NPVs. The latter power rate (i.e., PhP20.00/kWh increased annually by 10%) will be adopted for the proposed project. This is comparable with the existing power rate at P20.55/kWh being charged by private owners of generator sets in Sicud. From year 11 onwards, the power rate will be at year 10 level which is P47.16/kWh.

At PhP20.00/kWh annually increased by 10% until Year 10, beneficiary households have more than enough capacity to pay this power rate as shown by their average monthly net income: PhP3,163.00 for farming HHs and PhP4,949.00 for fishing HHs. This power rate is more attractive and acceptable to the households. This would also mean that a larger amount of the disposable income of the households will be used for other more important needs of the households such as food.

The viability question is whether the LGU/Village Power Association will be able to provide funding after the official sponsorship of the project. It is more important to the ultimate success of the project design as a model for nationwide replication, to consider whether LGU will be able to counterpart required for the project. The LGU of Rizal has committed to provide counterpart funding to the project. It has stressed this willingness and commitment during several meetings held in Rizal with the LGU officials.

As for the second question, whether the beneficiaries can afford the low level of cash outlay expected from them as support of the project activities directly benefiting them, the beneficiaries have the capability to fulfill its commitment. The barangay council has programmed a portion of its internal revenue allotment (IRA) to provide for the real cash outlay of the project in addition to the land donation, material support and labor that the barangay shall provide. There is great willingness among the beneficiaries to provide their share to sustain the project.

Table 19A. Projected Cash Flow @ LEC of PhP33.64665

	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Investment Cost	5,608,125										
Income/Revenue											
Collection Fee		1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888
Total Income		1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888
PV @ 12% Discount Rate		970,435	866,460	773,625	690,737	616,729	550,651	491,653	438,976	391,943	349,949
Expenditures											
Salaries and Wages		137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989
O & M		136,000	136,000	136,000	136,000	136,000	136,000	136,000	136,000	136,000	136,000
Replacement Cost									432,000		
Total Expenditures		273,989	273,989	273,989	273,989	273,989	273,989	273,989	705,989	273,989	273,989
PV @ 10% Discount Rate		244,633	218,422	195,020	174,125	155,469	138,811	123,939	285,137	98,803	88,217
Net Income (Loss)	(5,608,125)	812,899	812,899	812,899	812,899	812,899	812,899	812,899	380,899	812,899	812,899

Net Present Value @ 12% 11,792

Internal Rate of Return (IRR), 12.09%

Payback Period, years 7.65

Assumptions:

Income: PhP33.64665/kWh x annual energy demand

Expenditures:

1. Salaries and Wages include:

1.1 Salaries and Wages = 1 operator/technician @P8,605/mo inclusive of all benefits

2. Operations & Maintenance

2.1 Distilled water @P110000/yr

2.2 Repair and maintenance @P15,000/yr

2.3 Replacement cost

2.4 General operations include office supplies, communications and consultation/coordination meetings

Tabla 19A. Projected Cash Flow @ LEC of PhP33.64665

	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	TOTAL
Investment Cost											
Income/Revenue											
Collection Fee	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	1,086,888	21,737,755
Total Income	**1,086,888**	**1,086,888**	**1,086,888**	**1,086,888**	**1,086,888**	**1,086,888**	**1,086,888**	**1,086,888**	**1,086,888**	**1,086,888**	**21,737,755**
PV @ 12% Discount Rate	**312,454**	**278,977**	**249,087**	**222,399**	**198,570**	**177,295**	**158,299**	**141,338**	**126,195**	**112,674**	**8,118,447**
Expenditures											
Salaries and Wages	137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989	2,759,780
O & M	136,000	136,000	136,000	136,000	136,000	136,000	136,000	163,000	163,000	163,000	2,801,000
Replacement Cost	653,000				432,000						1,517,000
Total Expenditures	**926,989**	**273,989**	**273,989**	**273,989**	**705,989**	**273,989**	**273,989**	**300,989**	**300,989**	**300,989**	**7,077,780**
PV @ 10% Discount Rate	**266,487**	**70,326**	**62,791**	**56,064**	**128,982**	**44,694**	**39,905**	**39,140**	**34,947**	**31,203**	**2,497,115**
Net Income (Loss)	**159,899**	**812,899**	**812,899**	**812,899**	**380,899**	**812,899**	**812,899**	**785,899**	**785,899**	**785,899**	**9,051,850**

Table 19B. Projected Cash Flow @PhP20.00/kWh Increased Annually by 10% until Year 10.

	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Investment Cost	**5,608,125**										
Income/Revenue											
Collection Fee		646,060	710,666	781,733	859,906	945,896	1,040,486	1,144,535	1,258,988	1,384,887	1,523,376
Total Income		**646,060**	**710,666**	**781,733**	**859,906**	**945,896**	**1,040,486**	**1,144,535**	**1,258,988**	**1,384,887**	**1,523,376**
PV @ 12% Discount Rate		**576,839**	**566,539**	**556,422**	**546,486**	**536,727**	**527,143**	**517,729**	**508,484**	**499,404**	**490,486**
Expenditures											
Salaries and Wages		137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989
O & M		136,000	136,000	136,000	136,000	136,000	136,000	136,000	136,000	136,000	136,000
Replacement Cost									432,000		
Total Expenditures		**273,989**	**273,989**	**273,989**	**273,989**	**273,989**	**273,989**	**273,989**	**705,989**	**273,989**	**273,989**
PV @ 12% Discount Rate		**244,633**	**218,422**	**195,020**	**174,125**	**155,469**	**138,811**	**123,939**	**285,137**	**98,803**	**88,217**
Net Income (Loss)	**(5,608,125)**	**372,071**	**436,677**	**507,744**	**585,917**	**671,907**	**766,497**	**870,546**	**552,999**	**1,110,898**	**1,249,387**

Net Present Value @ 12% **1,626**

Internal Rate of Return (IRR) **12.01%**

Payback Period **8.80**

Assumptions:

Income: PhP20.00/kWh increased annually by 10% until Year 10

Expenditures:

1. Salaries and Wages include:

1.1 Salaries and Wages = 1 operator/technician @P8,605/mo inclusive of all benefits

2. Operations & Maintenance

2.1 Distilled water @P110000/yr

2.2 Repair and maintenance @P15,000/yr

2.3 Replacement cost

2.4 General operations include office supplies, communications and consultation/coordination meetings

Table 19B. Projected Cash Flow @PhP20.00/kWh Increased Annually by 10% until Year 10.

	Y11	Y12	Y13	Y14	Y15	Y16	Y17	Y18	Y19	Y20	TOTAL
Investment Cost											
Income/Revenue											
Collection Fee	1,523,376	1,523,376	1,523,376	1,523,376	1,523,376	1,523,376	1,523,376	1,523,376	1,523,376	1,523,376	25,530,289
Total Income	**1,523,376**	**1,523,376**	**1,523,376**	**1,523,376**	**1,523,376**	**1,523,376**	**1,523,376**	**1,523,376**	**1,523,376**	**1,523,376**	**25,530,289**
PV @ 12% Discount Rate	**437,934**	**391,013**	**349,118**	**311,713**	**278,315**	**248,496**	**221,871**	**198,099**	**176,874**	**157,923**	**8,097,615**
Expenditures											
Salaries and Wages	137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989	137,989	2,759,780
O & M	136,000	136,000	136,000	136,000	136,000	136,000	136,000	136,000	136,000	136,000	2,720,000
Replacement Cost	653,000				432,000						1,517,000
Total Expenditures	**926,989**	**273,989**	**273,989**	**273,989**	**705,989**	**273,989**	**273,989**	**273,989**	**273,989**	**273,989**	**6,996,780**
PV @ 12% Discount Rate	**266,487**	**70,326**	**62,791**	**56,064**	**128,982**	**44,694**	**39,905**	**35,629**	**31,812**	**28,404**	**2,487,670**
Net Income (Loss)	**596,387**	**1,249,387**	**1,249,387**	**1,249,387**	**817,387**	**1,249,387**	**1,249,387**	**1,249,387**	**1,249,387**	**1,249,387**	**12,925,384**

VII. SOCIAL SOUNDNESS ANALYSIS

Determination of the social soundness of the project is based upon the analysis of results of the evaluation of the UNDP/GOJ Mission and DOE on July 20 – 21, 1999 including meetings with Rizal LGU, provincial government of Palawan and PALECO, and the results of the research surveys conducted by SPCP-ANEC and DOE-NCED of So. Sicud on September 1-7, 1999.

The UNDP/GOJ Mission Team meeting with Rizal LGU on July 21, 1999, and with the provincial government of Palawan and PALECO on July 22, 1999 got strong positive endorsement of the proposed project. Follow-up by SPCP-ANEC got commitment from Rizal LGU, PGP and PALECO to provide counterparts to the project. PALECO will provide technical assistance in the construction of transmission and distribution lines, Rizal LGU and PGP with counterpart funding for the project. Barangay Candawaga through the Barangay Council also committed to provide the site, labor, and electric post. SPCP-ANEC Project Leader was already reliably informed by a PALECO Board member that the request for a franchise waiver from PALECO has been approved by its the Board of Directors. The DOE is also providing counterpart funding to the project.

Indicators of Acceptance of the Project.

Survey findings that more than 90% acceptance of NRE project is an indication of receptivity to the project. It is very encouraging to find that all is accepting PV and wind energy with 89% and 85%, respectively, highly accepting such sources of energy.

Table 20. Acceptance of Energy - Related Projects, n = 101.

Item	Highly Accepted		Moderately Accepted		Rejected	
	Number	%	Number	%	Number	%
Solar/Photovoltaic	89	88.12	12	11.88	0	0
Biomass	61	60.39	31	30.69	9	8.91
Micro-hydro	69	68.32	27	26.73	5	4.95
Wind	85	84.16	16	15.84	0	0
Other NRES	27	26.73	55	54.45	19	18.81

The fact that only 56% of the respondents including those connected to generators is happy with their current fuel implied that the respondents need other source of energy that will provide them with clean and better lighting and reliable power source. All the respondents agree that watching TV will provide them great source of news and information, and entertainment. Eighty-seven percent (87%) agree that kerosene and diesel fuel can cause health problems.

The survey findings indicated no condition suggesting any resistance to the project. Even those with generating sets have expressed willingness to connect their households to the system. Further, the fact that the LGU of Rizal, PGP and the Barangay have committed to provide counterparts and with PALECO waiving its franchise for the barangay for the purpose of the implementing the project are social indicators of not receptivity but of high acceptability of the project.

Table 21. Attitude of Respondent Households on Energy-Related Matters

ITEM	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
My family is happy with the light we get from our current fuel	39	38.60	17	16.81	3	2.97	8	7.92	34	33.7
In my house, it is easy to read in the evening	40	39.60	21	20.79	1	1.00	6	5.94	33	32.67
Watching TV is a great source of news and information	74	73.26	26	25.74	0	0.00	1	1.00	0	0.00
Watching TV provides my family with great entertainment	75	74.25	25	24.75	0	0.00	1	1.00	0	0.00
Lighting with kerosene can cause health problems	59	58.42	29	28.71	10	9.90	3	2.97	0	0.00
Lighting with diesel can cause health problems	61	60.40	27	26.73	10	9.90	3	2.97	0	0.00
Car batteries are good source of electricity for lighting	31	30.70	27	26.73	9	8.91	6	5.94	28	27.72
Electricity in the household is important for children's education	67	66.34	32	31.68	0	0.00	0	0.00	2	1.98
Children would study more at night if there is good light	76	75.25	25	24.75	0	0.00	0	0.00	0	0.00
The family will feel very secure at night if there is electricity	73	72.28	28	27.72	0	0.00	0	0.00	0	0.00
Reading is easier with electric lamps compared to kerosene lamps	66	65.35	29	28.71	4	3.96	2	1.98	0	0.00
We often receive guests in the evening	36	35.64	39	38.62	24	23.76	2	1.98	0	0.00
Electricity is important for local water supply	36	35.64	47	46.54	16	15.84	2	1.98	0	0.00

Gender Participation.

Philippine rural women spend a major portion of their life in home management activities. Routine household chores took-up their time allocation such as child care, cooking, laundry, homecrafts, small scale retailing, etc. The convenience of just switching on and off the light will ease them in their night household chores. And with TV/VHS will give the rural wife and other members of the family relaxation and entertainment after a whole day work in the household and in the field.

In general, the project is expected to modify the allocation of time of household members. The provision of electricity in the homes will allow the performance of household chores at night in order to have the daytime hours for other productive activities. Thus, the project will improve household production efficiency in terms of level of output and quality of output.

Education.

Better light will encourage children and other members of the household to read in the evening. Children will be able to improve and extend their study period. They can now be exposed and could learn much from education self-interacting materials from TV/VHS medium to enhance and update learning and fill the inadequacy of learning facilities especially in public schools in the barangay. The availability of electricity in the homes is expected to improve the school performance of students and teachers alike by giving them more time to study at night.

According to ILO, the average economic rate of return to educational expenditures in the Philippines has been estimated as around 5%. The same paper, based on the University of the Philippines School of Economics study, has assumed a 10 % increase in returns to education resulting from improved health and nutrition. This assumption is also being adopted in the analysis of the project.

Environmental Concern.

The project is environment-friendly and will not cause any pollution or destruction of the environment and/or disturbance of the ecology in the barangay. Literature on efficiently designed wind turbine showed noise level below 90 db to even as low as 45 db. This is just like the whistling of the leaves during a sea breeze. No flying mammal, bird or insect was observed in the proposed site that will be disturbed by the project.

The battery to store the energy from the sun and the wind has the same component as the ordinary car battery but of bigger capacity (1000 Ah). No battery solution will be discharged to the nearby river or seacoast. Dead batteries with its solution will left intact in a well-ventilated storeroom and will be shipped out for trade to manufacturers during the period of scheduled replacement. For safety purposes from inhalation of minimal evaporation from the battery solution, Hybrid System personnel will be required to wear protective mask when entering the battery room.

Washings of oil spillage and oil-water mixture of the back-up generator will be drained into a stilling pool to be treated with ricehull kept for several days until the oil have been separated from the water prior to water disposal into the nearby river. Waste oil will be stored in covered container for re-use as home treatment against termite.

VIII. ADMINISTRATIVE FEASIBILITY

The lead implementing agency for the project is the DOE. The organization charts of the project (Charts B and C) illustrates the flow of administrative direction and coordination focusing upon the integration of the project activities with direct supervision of the Project Management Office (PMO). The Project Management Office shall develop a system and procedures manual for project operation indicating line of administrative and fiscal responsibilities.

While integration and coordination of services imply the participation of several organizations or agencies with varying degree of input to the project, it is essential to the success

of the project that clear lines of direction of project activities be established and the authority defined, and schedule of project activities preserved.

The general procedure for fund flow at LGU level is for the LGU head to include in its budget request for the succeeding year the amount required in the project's financial plan. This is to be submitted to the Sangguniang Bayan (SB) for deliberation and proper action through SB resolution. After this, the LGU will sign his approval. This process starts within the fourth quarter of each year. By designating its line item request for this project, the LGU head notifies the LGU budget and accounting departments for the project that the amount requested is the peso counterpart of a foreign- assisted project, thus, giving it priority status for budgetary releases and protecting it against reductions.

Organizational Machinery for Implementation

A Project Advisory Council (PAC) shall be established and to be composed by the DOE, Provincial Government of Palawan, PALECO and College President of SPCP. This council shall be the advisory support in the formulation of management guidelines and organizational policies for the successful implementation of the project. It shall meet quarterly and as the need arises to thresh out coordination problems in agency participation. The compliance to the established guidelines and policies shall be coordinated by SPCP-ANEC.

The Project Management Office (PMO) shall also be established and to be composed by the Mayor of Rizal, SPCP-ANEC Project Leader and Barangay Captain of Candawaga. The PMO shall provide coordinative support to the lead implementing agency (DOE). It shall work closely with the lead agency and the advisory council. It shall have direct supervision of the Sicud Village Power Association (SVPA) with regards to the management, operation, maintenance and repair of the Hybrid System. It shall also provide coordinative and advisory functions to the SVPA.

The SPCP-ANEC shall organize the SVPA. It shall provide the necessary training and seminar to the beneficiaries prior to organizing them into an association. Some of the topics proposed to be covered in the training/seminar management of cooperative; requirements in the organizing into a cooperative; functions, duties and responsibilities of cooperative committees, basic project planning and analysis; basic accounting, billing and collection, and basic auditing.

SPCP-ANEC shall train the operator and technician of the Hybrid System in coordination with the contractor/supplier of the equipment in the project. SPCP-ANEC in coordination with PALECO shall also conduct training of barangay electricians, system personnel and officers of the SVPA on meter reading and basic trouble shooting of the hybrid system. For close and proper operation and management, and close monitoring and evaluation of the Hybrid System, SPCP-ANEC shall assign a live-in Science Research Specialist in the project site.

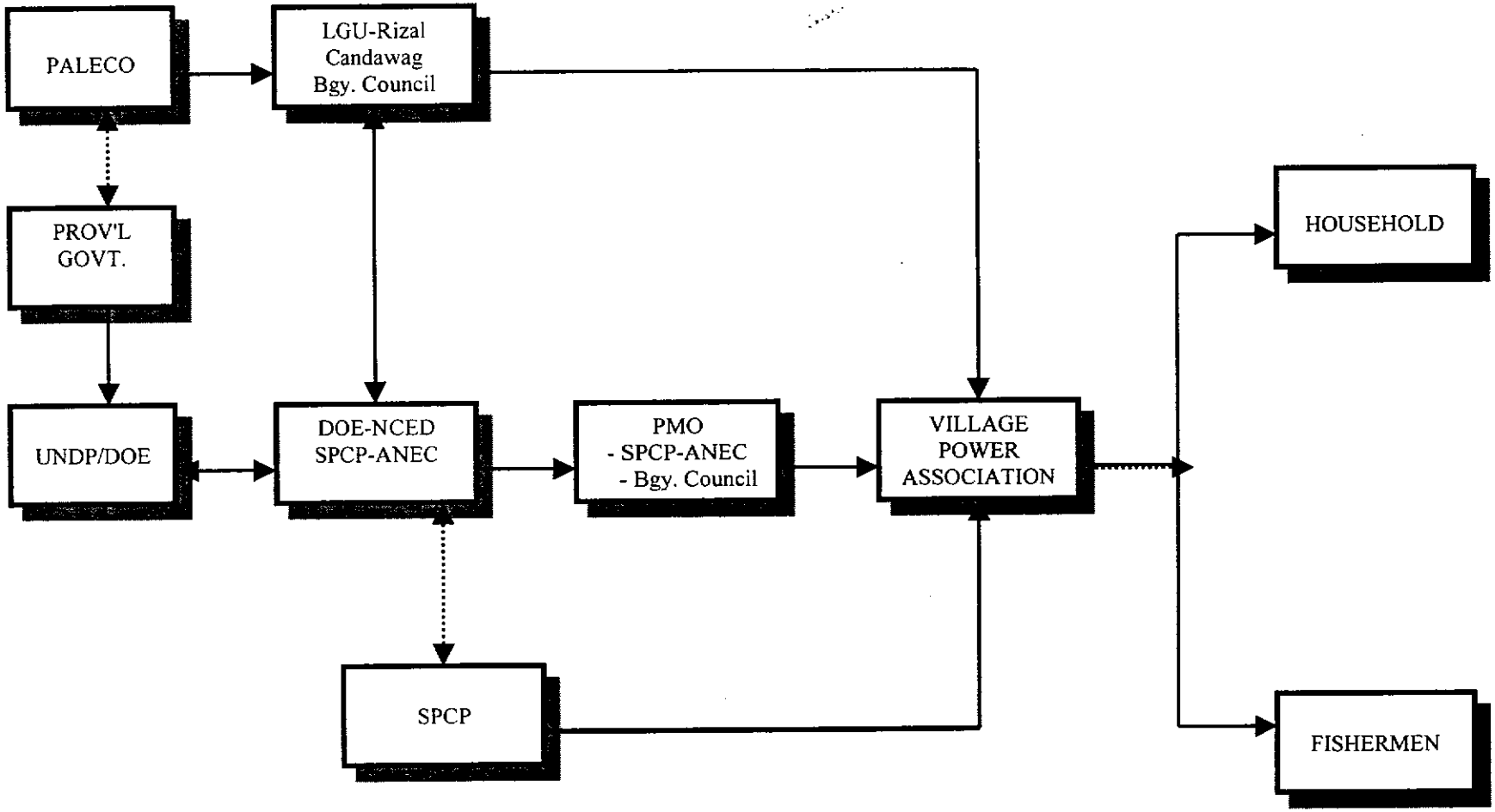
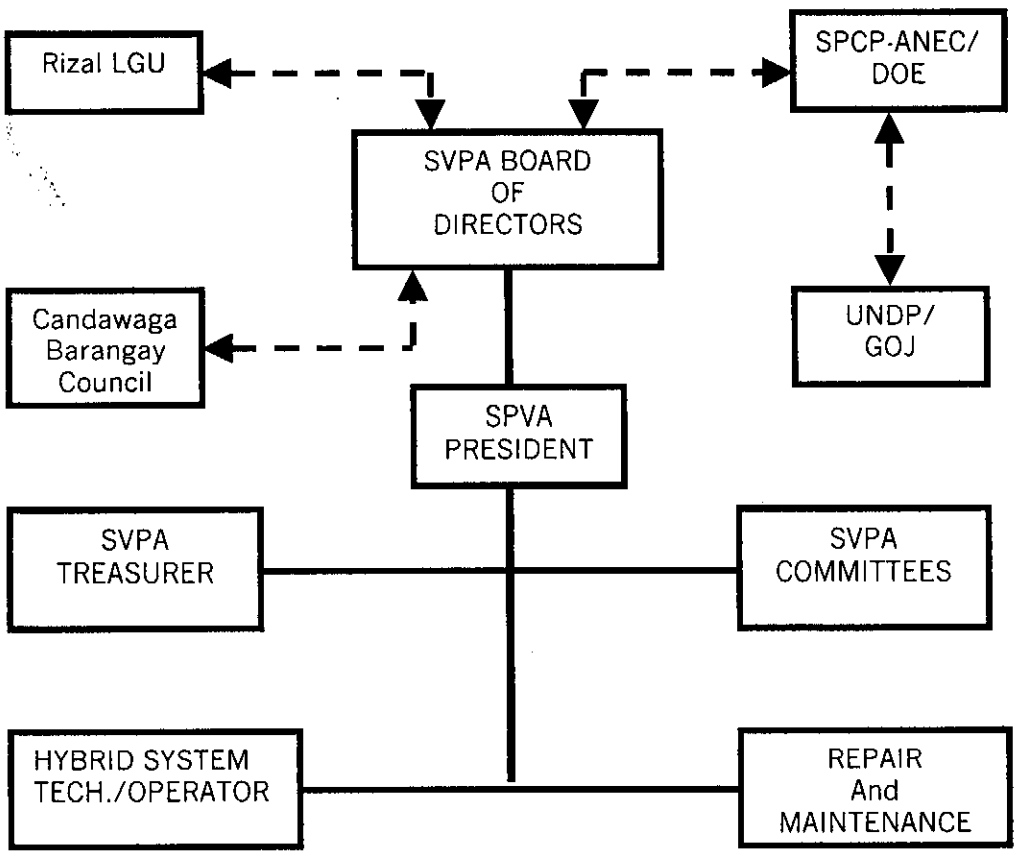


Chart B Schematic Framework

The SVPA shall employ the Hybrid System operator/ technician. It shall have direct control and supervision of Hybrid System personnel. The SVPA shall perform the meter reading, billing and collection of payment. The Municipal Treasurer shall collect the revenue collected, issue corresponding receipt therefor, and deposit the same as trust fund of the project. This fund shall be used for repair and maintenance, expansion of the capacity of the Hybrid System, and more importantly, replication of the system in areas with similar characteristics as So. Sicud. The SVPA shall also be directly accountable to the PMO. As incentive to the SVPA, the balance of the twenty percent (20%) of the net revenue that will be derived from the project shall accrue to the SVPA to establish and implement projects that will contribute to the general development in the barangay.

Chart C. Proposed Organizational Chart of The Village Power Association



Procurement of Equipment and Installation of Hybrid System

A *Terms of Reference (TOR)* shall be drafted by DOE for the conduct of bidding for this particular activity including fiscal administration systems and procedures. The tasks of the contractor shall include but not limited to the following: preparation of detailed technical design

data and plans for the systems, provision of the necessary equipment, laying works of these equipment and execution of civil works related to the supply, assembling and start-up of the complete hybrid system. The contractor. in coordination with DOE/SPCP-ANEC, shall also be responsible in the provision of training to the SVPA in the proper system operation, maintenance, and basic troubleshooting procedures. A one-month commissioning period shall be required of the contractor. During the first three years of project operation, the contractor shall assist the SVPA through the SPCP-ANEC to ensure that the Hybrid System is maintained in optimal working conditions and its load pattern utilization are optimized. The contractor shall also ensure an after-sales-service support mechanism and items, which are under warranty, should be properly defined. A provision on spares shall be provided for by the Contractor.

Fiscal Administration

In general terms, the project fiscal administration system and procedures will follows the Philippine government fiscal administration principles.

A *Memorandum of Agreement (MOA)* shall be signed between the UNDP/GOJ, DOE/SPCP-ANEC, SPCP, Rizal LGU, Provincial Government of Palawan, and Barangay Candawaga to formalize, among others, the fiscal administration systems and procedures to be followed in the implementation of the project. A service connection memorandum of agreement shall also be made between the individual beneficiary, SVPA and SPCP-ANEC.

Chart D presents the flow of funding for the project.

A. Fund for tendering of equipment and building, construction/installation, and training and seminars:

Under the agreement participating agencies shall transfer the funds each has appropriated to the project to the SPCP-ANEC for equipment, buildings, and training and seminars. The College had the sufficient experience in handling similar funds having been the recipient of several foreign-and national-assisted projects. These funds will be under the administration of SPCP-ANEC through the accounting and auditing offices of the College. Funds shall be withdrawn exclusively for the project expenditures with the approval of SPCP-ANEC/DOE and the College.

B. Fund for salaries and wages, operation and maintenance, and deposit of revenue collected

All revenues derived from the project shall be deposited to the Rizal LGU treasury. The Rizal LGU shall establish a Special Trust Fund for this purpose. This Trust Fund shall serve as the depository of funds exclusively for the salaries and wages of Hybrid System personnel, operation, maintenance and repair, maintenance of the system, and for expansion of the project and/or replication of the project in other areas with similar characteristics as So. Sicud.

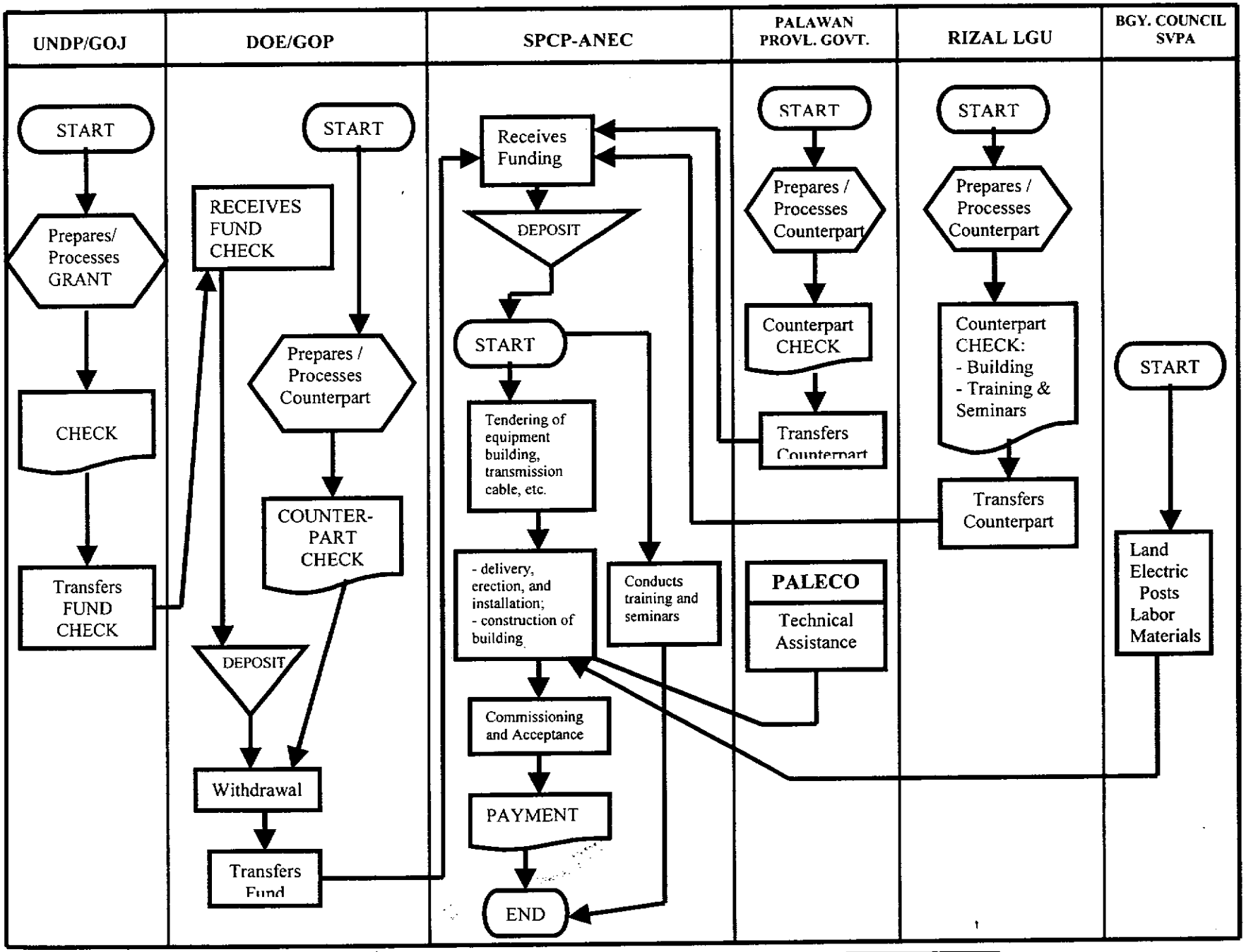


Chart D. PRE – OPERATION PERIOD

Continuation ... Chart D. Fund Flow

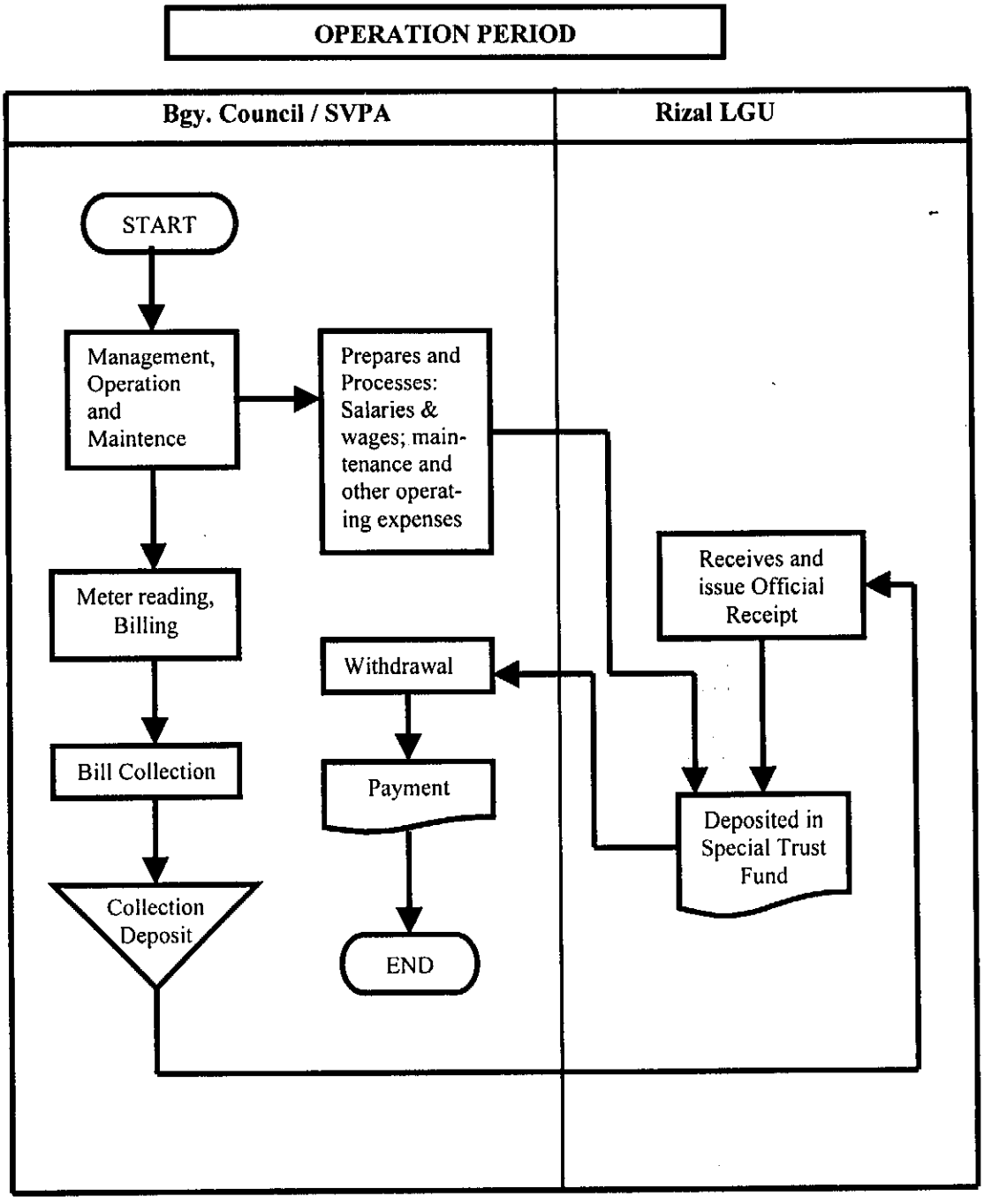


Chart E. Monitoring Indicators of Management and Personnel Organization including Transfer of Funds

Objectives and Outputs	Monitoring Indicators Year 1	Year 2	Year 3	Year 4	Year 5
Objective 1: Management Support		→	→	→	→
Output: 1. Operator & technician hired	1- Optr.				
2. Mun. treasurer, accountant and buyer assigned part time to the project	1- mun. treasurer 1- accountant 1- buyer	→	→	→	→
3. SPCP-ANEC SRS I hired and detailed full time in the project	1 - SRS I	→	→	→	→
4. Project Management Office organized	Proj. Mgt. Team - Mun. Mayor - SPCP-ANEC Proj. Leader - Bgy. Captain	→	→		
5. Project Advisory Council organized	PAC - Provl. Governor - DOE - SPCP President - PALECO G.M.	→	→	→	→
6. Franchise waiver granted by PALECO	Franchise waiver	→	→	→	→
Objective 2: Project Support	Amount required provided by LGU	→	→	→	→
Output: 1. Travelling/Transportation	Fund transfer to SPCP-ANEC	→	→	→	→
2. Organization and seminars	Fund transfer to SPCP-ANEC	→	→	→	→
3. Consultation meeting	provided by LGU	→	→	→	→
4. Office supplies	Provided by SVPA	→	→	→	→
5. HYBRID SYSTEM supplies	Provided by SVPA	→	→	→	→
6. Repair and maintenance	Provided by SVPA	→	→	→	→

Project Turnover to the SVPA

After the project has been made operational and its operation sustained, project implementation will now be the main concern of the SVPA. The SVPA or Cooperative shall have the responsibility of collecting payments as well as maintenance and operation of the system.

The project will be turned-over to the SVPA at the end of Year 5. Starting Year 6, the project will be solely managed, operated and maintained by SVPA. DOE/SPCP-ANEC will still be monitoring the project during this period.

VIII. PROJECT MONITORING AND FOLLOW-UP

It is proposed that UNDP local representative will monitor the project during its life for at least two times a year. This will include verification of accomplishment reports that will be submitted by the PMO and SPCP-ANEC through DOE-NCED to the UNDP office.

Charts E presents the schedule of project activities indicative of the accomplishment of the objectives. Chart F presents the 12-month time frame of completion of project activities.

For six (6) years SPCP-ANEC will provide an on-site Science Research Specialist to oversee and, provide assistance and guidance in the implementation of the project. He will also conduct a daily monitoring of the performance of the system.

A quarterly accomplishment report shall be provided for and submitted by the SPCP-ANEC and PMO to the DOE on the technical, social and financial aspect of the system.

Documentation

All reports of all the processes undertaken shall be supported with documentation, highlighting on the experiences and lessons learned in the project, including policy recommendations in the matter of rural electrification. This documentation shall serve as a guide for future replication of similar undertaking in other areas of the country. A Case Study may also be prepared by SPCP-ANEC on the project.

:ontinuation ... Chart E

Objectives and Outputs	Year 1	Monitoring Indicators Year 2	Year 3	Year 4	Year 5
)utput: 7. Incentive Allowance to SVPA - 10% of gross revenue	Turnover to SVPA	→	→	→	→
)bjective 3: Equipment Support					
)utput: Equipment installed on site commissioned and accepted by SPCP-ANEC/DOE & SVPA	5 kw PV 10 kw Wind turbine 24 - 1000Ah /2vdc per cell battery 1 lot complete instrumentation 10 kva Back-up diesel genset 15 kva step-up transformer 2-5kva step-down transformer 50 pcs electric posts 2500-m transmission line 1-multipurpose hybrid system building constructed 1000 s.m. Plant site donated 1-unit PC computer w/ printer 4-units Office tables & chairs				
Vehicle delivered to SPCP-ANEC	1-unit 4x4 vehicle				
Perimeter fence	Hybrid system enclosed with fence				

Chart E... Continuation

Objectives and Outputs	Monitoring Indicators	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6 to 20
Objective 2: Project Management Support							
Output: 1. Institutional Development A. SVPA	1. Conduct one seminar/training on cooperative for 200 beneficiaries. 2. Approved and adopted SVPA Constitution and By-Laws. 3.Elected and installed officers of SVPA. 4. Prepared regulatory policies for SVPA hybrid system operation, maintenance, repair, collection, connection, etc. 5. Hired personnel of hybrid system. 6. Conducted quarterly & annual assembly meetings.		→		→		every 2 years annual
B. Technical Capability Building	1. Conducted one training on management, operation repair and maintenance of hybrid system including billing and collection to the beneficiaries. 2. Conducted one seminar/training on operation and maintenance of transmission lines including house wiring, meter installation and reading.		→				
Output: 2. Project Facilities Development							
C. Physical facilities and structures	1. Prepare A & E designs of power plant building including technical specifications and draft contract. 2. Tendering of construction. 3. Construction of building. 4. Acceptance of building.						
D. Hybrid System equipment and supplies.	1. Prepare technical specifications and tender documents. 2. Tendering of equipment including supply, delivery and installation on site. 3. Supply, delivery and installation. 4. Inspection and commissioning of hybrid system 5. Acceptance of hybrid system.						
E. Energization of 200 HH	1. Housewiring of 200 HH including service drop connection.		→				
F. Collection of fees	3. Meter reading and billing collection.		95% collection rate	→	→	→	until year 20

Continuation ... 12-month activity

Objective	Output	Activities	12 Months Work Plan											
			Months											
			1	2	3	4	5	6	7	8	9	10	11	12
	8.Hybrid System	1. Prepare technical specifications	x											
	equipment, transmission	2. Prepare tender documents	xx											
	lines including erection	3. Advertisement in two newspaper												
	and commissioning	of general circulation in accordance to	xx											
		the IRR of P.D. 1594 as Amended 1992												
		Responsibility: DOE/SPCP-ANEC												
		4. Prequalification of contractors		xx										
		5. Send notices to prequalified and pre-		xx										
		disqualified contractors												
		6. Issuance of tender documents			xx									
		7. Submission and opening of bids			xx									
		8. Evaluation of bids				xx								
		9. Awarding to winning bidders				x								
		10. Signing of Contract Agreement				x								
		11. Send Notice To Proceed												
		Responsibility: SPCP-PBAC												
		12. Supply, delivery and installation of												
		equipment, instrumentation, etc.				x	xxxx							
		13. Commissioning						xxxx						
		14. Inspection and acceptance						x						
		Responsibility: DOE/SPCP-ANEC												

Continuation ... 12-month activity

Objective	Output	Activities	12 Months Work Plan Months											
			1	2	3	4	5	6	7	8	9	10	11	12
2. Institution Building	5. Seminars/trainings of beneficiaries	1. Prepare seminar/training design:	xxxx											
		a. Cooperative												
		b. Operation. Maintenance and Repair of Power Plant Facilities												
		c. Operation and Maintenance of power transmission lines												
		2. Coordinate with SPCP, PALECO, LGU	x											
		Barangay, and DOE.												
		3. Identify and invite resource persons,												
		facilitators and trainors.	xxx											
		4. Establish venue and date of seminar	x											
		and trainings.												
		5. Conduct and document seminar and		x	x	x								
		trainings.												
		Responsibility: SPCP-ANEC												
	6. Hybrid Sys. Personnel	1. Establish criteria/qualifications												
		in coordination with DOE/SPCP-ANEC		x										
		2. Hire personnel			xxx									
		Responsibility: SVPA												
		3. Orientation of personnel on duties												
		and responsibilities.				xx								
		4. Supervised operation of hybrid sys.				xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
		Responsibility: SPCP-ANEC												
3. Physical structures and equipment supports	7. Multipurpose Building Construction including fencing	1. Prepare A & E including technical												
		specifications & draft contract.	x											
		2. Advertisement, prequalification of												
		contractors and bidding	xxx											
		3. Evaluation of bids & Awarding		x										
		4. Signing of construction contract		x										
		5. Construction of building		xx	xxx									
		6. Inspection and acceptance of			x									
		building.							1					
		Responsibility: SPCP- ANEC/LGU												

Chart F. Activity Work Plan for 12 Months

Objective	Output	Activities	12 Months Work Plan Months 1	2	3	4	5	6	7	8	9	10	11	12
2. Institution Building	4. SVPA	1. Organize the SVPA	x											
		a. Initiate meetings of beneficiaries												
		b. Conduct meeting												
		c. Establish date of seminar												
		d. Conduct seminar												
		e. Elect officers												
		f. Draft, review and finalize	xx											
		constitution and by-laws												
		Responsibility: SPCP-ANEC												
		2. Conduct meeting of SVPA for												
		approval and adoption of consitution	x											
		and by-laws.												
		3. Establish regulatory policies of the	x											
		operation of hybrid system.												
		4. SVPA Board subject policies to the		x										
		approval of the SVPA assembly.												
		5. Operation, maintenance and repair												
		of hybrid system and its facilities.		xx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
		6. Conduct quarterly meeting with												
		SVPA members			x			x			x			x
		7. Conduct monthly meetings of the												
		SVPA Board of Directors.			x	x	x	x	x	x	x	x	x	x
		8. Provide PMO and SPCP-ANEC a												
		copy of Quarterly and Annual Reports				x				x				x
		Responsibility: SVPA												

Chart F. Activity Work Plan for 12 Months

Objective	Output	Activities	12 Months Work Plan Months 1	2	3	4	5	6	7	8	9	10	11	12
1. Management Support	1. Memorandum of	1. Draft of MOA	XX											
	Agreement (MOA)	2. Provide copy of draft MOA UNDP,	XX											
		DOE, Rizal LGU, PALECO,SPCP, Bgy.												
		Council of Candawaga, & Palawan												
		Provincial Government for review.												
		3. Revision of MOA		X										
		4. Provide each concerned agencies												
		or units with revised and final draft.		X										
		5. Coordinate and establish venue and												
		date of signing of MOA.		X										
		6. Formal signing of MOA.		X										
		Responsibility: DOE/SPCP-ANEC												
	2. Project Advisory	1. Identification and designation of												
	Council (PAC)	PAC members.		X										
		2. Send invitation or appointment for												
		acceptance and confirmation.			X									
		3. Elect/choose chairman, vice chair-												
		man.			X									
		4. Designate secretary of PAC.			X									
		5. Hold first meeting of PAC.			X									
		Responsibility: DOE/SPCP-ANEC												
		6. Hold regularquarterly meetings.			X			X			X			X
		Formulate policies and guidelines.												
		7. Submit quarterly and annual reports												
		to DOE and UNDP.				X			X			X		X
		Responsibility: PAC												
	3. Project Management	1. Designate and appoint members		X										
	Office (PMO)	of PMO. Members should elect the												
		chairman & vice chairman.												
		Responsibility: DOE/SPCP-ANEC												
		2. Supervise the management and												
		operation of power plant.			XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
		3. Develop systems and procedures												
		of hybrid system operation, repair		XXX										
		and maintenance.												
		4.Monitor the hybrid system and												
		including impact to beneficiaries.			X	X	X	X	X	X	X	X	X	X
		5. Submit to DOE/UNDP and PAC												
		quarterly reports with documentations.				X	X	X	X	X	X	X	X	X

ANNEX "4"

BEP Implementation Manual

ANNEX "4"

DEPARTMENT OF ENERGY
ENERGY UTILIZATION MANAGEMENT BUREAU

DOE-FUNDED BARANGAY ELECTRIFICATION PROJECT

PROJECT IMPLEMENTATION MANUAL

January 2004

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LIST OF ANNEXES

1.0 INTRODUCTION

1.1 PROGRAM DESCRIPTION

In 1960, the Government of the Philippines first enunciated total electrification as a national policy objective. The Government adopted the area coverage basis for attaining total electrification. Consistent with this strategy, the Government has already achieved 100% municipality level electrification.

Recognizing the contribution of electrification to rural development, the energy sector through the Department of Energy (DOE) launched the O'Ilaw Program in 1998 to accelerate barangay level electrification. The O'Ilaw Program aims to achieve 100% barangay level electrification by the year 2006. At the end of November, 2003 barangay level electrification had reached 89.93% and about 5,200 barangays are still to be energized. A large number of these un-energized barangays are located in remote, rural and sparsely populated areas in which Renewable Energy (RE) based electrification could prove to be the least cost electrification option.

One of the main components of the O' Ilaw Program is the DOE-Funded Barangay Electrification Project (BEP). The BEP targets the electrification of barangays wherein RE systems are found to be feasible. Among the technologies to be installed are solar home systems, solar battery charging stations, micro-hydro systems, wind energy and RE hybrid systems

DOE's past experiences on village electrification projects using RE systems include, among others, those in Burias Island, Isla Verde Tingloy Island and Belance. The organization and the manner of implementation of these projects were based on the particular conditions in the areas as well as on the availability of appropriate institutions or groups to collaborate in the project. The DOE's barangay electrification projects to be undertaken under the BEP need for streamlining related activities to fast-track the implementation of the project towards the attainment of DOE's electrification targets. Hence, this **Project Implementation Manual** aims to establish and streamline procedures for the implementation of the DOE-Funded Barangay Electrification Project.

1.2 OBJECTIVE OF THE MANUAL

*This **Project Implementation Manual** has been developed to provide harmonized procedures for off-grid RE electrification projects to be implemented by DOE. Specifically, it aims to expedite the formulation of **Memorandum of Agreement, Contract of Services and Other Project Agreements** for each projects which shall define the terms and conditions to be followed in the implementation of each barangay electrification project. It is expected, however, that the actual implementation arrangements for a specific barangay electrification project shall be attuned to the actual*

conditions in the target areas as well as in the presence of necessary infrastructure and local manpower support needed in project implementation.

The Approved Project Document, Memorandum of Agreement, Contract for Services and other Project Agreements shall serve as the main instruments in resolving issues and concerns regarding the implementation of the project.

1.3 INTENDED USERS

The intended users of this Project Implementation Manual are the following:

- *Department of Energy;*
- *Project Management Staff (REMD);*
- *Project Implementor (LGUs)*
- *Affiliated Non-Conventional Energy Centers (ANECs);*
    - *Barangay Power Associations;*
    - *Private Companies/Suppliers;*
    - *Project Consultants; and*
    - *Other stakeholders*

2.0 PROJECT PREPARATION

2.1 IDENTIFICATION OF TARGET BARANGAYS

The DOE Barangay Electrification Program shall prioritize the electrification of barangays listed under the Missionary Electrification Development Plan (MEDP) for RE electrification. The minimum criteria in the finalization of the list of BEP target barangays are the following:

- Approval of the sites by the DOE-EPIMB
- Capacity of the Project Implementor (Municipal LGU), Barangay LGU and household beneficiaries to provide their minimum counterpart to the Project
- RE system is the least cost option (has the lowest net present cost) in the electrification of the site

2.2 MUNICIPAL ENTRY

This activity includes a DOE meeting with the concerned municipal, barangay and REC officials with the following agenda, among others:

1. DOE Barangay Electrification Program
2. Required minimum counterparts of the LGUs and beneficiaries
3. REC supports to the project

4. Potentials of RE systems for Rural Electrification
5. Conduct of RRA
6. Primary and secondary data to be gathered

2.3 BARANGAY ENTRY

This activity includes a DOE meeting with the barangay beneficiaries, Sangguniang Barangay officials and REC & municipal representatives. Among others, the agenda of the meeting are:

1. DOE Barangay Electrification Program
2. Potentials of RE systems for Rural Electrification
3. Required counterparts of the LGUs and beneficiaries
4. REC supports to the project
5. Conduct of RRA
6. Primary and secondary data to be gathered

2.4 CONDUCT OF RAPID RURAL APPRAISAL (RRA)

The purpose of RRA is to assess the socio-economic conditions and to identify the available indigenous energy resources and appropriate energy technologies in the area. The basic information to be derived from this activity shall be used to determine the most suitable financing, repayment and implementation schemes. The RRA questionnaire forms for barangay and households surveys are provided in **Annex 1A** and **1B**, respectively. For the household survey, a minimum of ten (10) households in each target barangays shall be required as a sample. The results of said surveys shall be encoded in the database which will be made specifically for this purpose for analysis and easy access in the future.

This activity is generally the first visit to the community. It is expected that during this stage, the interests and preliminary approval of the LGUs and the barangay folks regarding the off-grid RE electrification have already been established. This activity shall also serve as a venue for negotiation to get the necessary counterpart funding for the project from the LGUs, project beneficiaries and other potential fund sources. It will be assumed that the RRA report will indicate that the off-grid RE electrification project is feasible in the barangay.

In case the minimum counterpart is not available during the current year, the Municipal LGU shall issue an official communication to the DOE citing that it can not presently provide the required minimum counterpart therefore it is amenable that the project will only be prioritized by the DOE once it has the capacity to provide the said counterpart.

2.5 PROJECT DESIGN AND PROPOSAL DEVELOPMENT

This activity shall take-off from the results of the RRA conducted in the target area. Energy demand, willingness and capacity to pay of the targeted beneficiaries and the availability of indigenous energy resources shall be the primary considerations in the design of appropriate technology and implementation scheme which will be proposed for a particular area. To ensure that the needs and requirements of the benefiting community are met, active participation of the community shall be maximized. The Project Implementor and the project beneficiaries must therefore display strong coordination during this stage of project preparation. The Project Implementor will develop a project proposal with assistance from Affiliated Non-Conventional Energy Center (ANEC) and shall be submitted to DOE for review, evaluation and approval. The suggested outline of the Project Proposal is provided in **Annex 2.**

2.6 PROPOSAL EVALUATION AND APPROVAL

The DOE will designate Renewable Energy Management Division – Technical Development Support Section as the Barangay Electrification Projects – Technical Working Group (BEP-TWG) to conduct technical review and evaluation of the proposed barangay electrification project. **Annex 3** provides the composition of the BEP-TWG. **Annex 4**, on the other hand, shows the process flow for DOE's evaluation and approval of project proposals.

2.7 PROJECT AGREEMENTS

The Project Agreements are legal documents which specify the respective obligations of each contracting parties. These agreements shall specify, among others, the following:

- Roles and responsibilities of each contracting party;
- Project funds – itemized as to funds source;
- Scope of the Project;
- Duration and schedule of activities;
- Effectivity of the Project Agreement;
- Ownership of the RE systems, and;
- Other provisions necessary for the Project.

The Project Agreements are the following:

- **Contract for Services (CFS).** This contract shall be undertaken by and between the winning bidder/supplier of the required goods and services and the DOE. The model CFS is provided in **Annex 5**.

- **Memorandum of Agreement (MOA).** This document shall be undertaken by and between the DOE and Project Implementor (Municipal LGU). The model MOA is provided in **Annex 6**.

On the issue of ownership, the following provision may be applied:

- For full-cost recovery schemes, the Project Beneficiaries shall own the RE systems upon the full recovery of the cost. For Partial cost recovery scheme and Full Subsidy Recovery Scheme, the Project Beneficiaries shall own the RE systems only when the DOE or the Project Implementor issues a "Deed of Donation" (see **Annex 7**) to effect the said transfer of ownership.

- In effect, all physical components of the RE system acquired using DOE funds shall remain the property of the DOE except when DOE deems the said transfer for some valid conditions. Transfer of ownership on the RE systems to the Project Implementor (Municipal LGU) shall be made upon the acceptance by the DOE of the RE systems from the Supplier/Contractor.

- DOE shall designate the Project Implementor as the caretaker of the facilities during project implementation phase.

- Transfer of the system or a part of it shall be subject to the approval of the Department of Energy. This shall be spelled-out in the Deed of Donation for the RE systems.

As a support to the achievement of the overall barangay electrification targets of the energy sector, the project duration, whenever possible, should be limited only to one (1) year to be reckoned from the date of the signing of the Agreement and in accordance with the approved Project Workplan. In the said period, the conduct of Community Organizing, Establishment of BAPA, Mobilization of Fee Collector and Local Technician, Installation of RE Systems, Conduct of Trainings should have been accomplished.

2.8. ALLOCATION OF PROJECT FUNDS

The DOE process for fund allocation for each approved Project under BEP is provided in **Annex 8**. After approval of the project by the BEP-TWG, the DOE will provide minimum amount to the project implementor for the conduct of community organizing and other related trainings. Also, it shall consolidate all approved project proposal and if it already come-up to at least ten (10) barangays it will develop the Terms of Reference for the bidding of equipments and installation of the systems. The Financial Management Services (Budget Division and Accounting Division) shall be requested to earmark/allocate fund for the said bidding. The Budget Division and Accounting Division shall then

issue Allotment and Obligations Slips (ALOBS) and Certificate of Availability of Fund (CAF), respectively.

3.0 PROJECT IMPLEMENTATION

3.1 PROJECT IMPLEMENTATION STRUCTURE

The following are the suggested organizational structure and the specific functions of the key actors in the implementation of the barangay electrification projects.

3.1.1 ORGANIZATIONAL STRUCTURE

DOE shall oversee the overall management of the project. The Project Implementor will be responsible for the implementation of all its mandated project activities at the local area. Close coordination between DOE and the Project Implementor will be instituted to monitor the progress of the project implementation, as well as to discuss and resolve project-related issues and concerns. On the other hand, a Barangay Power Association (BAPA) representing the project beneficiaries will be identified or established by the Project Implementor. The said BAPA shall manage the operationalization of the electrification scheme. The Project Implementor shall assist in the effective operation of the BAPA involved in the project. The DOE shall tap its concerned Affiliated Non-Conventional Energy Center (ANEC) to provide technical assistance to the Project Implementor and the BAPA. BAPA operators and technicians shall be fully trained to operate and maintain the NRE system.

3.1.2 SPECIFIC FUNCTIONS OF KEY PROJECT PLAYERS

The DOE and Project Implementor shall be responsible for the well-coordinated implementation of the project. Below are the general functions and tasks of the stakeholders of the project:

3.1.2.1 Department of Energy

a) To Identify project site and conduct rapid rural appraisal on the identified sites;
b) Designates the concerned Municipal LGU to be the Project Implementor;
c) Provides technical expertise to Project Implementor in project proposal preparation with the assistance of Affiliated Non-Conventional Energy Center (ANEC);
d) Evaluate and forward the finalize project proposal to the Office of the Secretary for Secretary's approval;

e) Execute Memorandum of Agreement between DOE and Project Implementor;
f) Request funding from Financial Management Services to be provided to the Project Implementor for the conduct of community organizing and other related training for the BAPA officers;
g) Consolidate all approved project proposal and prepare Terms of Reference and request funding from the Financial Management Services;
h) Requested Bids and Award Committee for bidding of the approved Terms of Reference for all BEP projects;
i) Awards the project to the winning bidder and conduct technical supervision on the installation of the systems; and
j) Conducts regular monitoring of the project in coordination with the Project Implementor.

3.1.2.2 Project Implementor

a) To provide assistance to DOE in the conduct of Rural Rapid Appraisal;
b) Develop project proposal in coordination with concerned ANEC and DOE personnel;
c) Provide its minimum counterpart to the Project;
d) Ensure the timely delivery of the required Barangay LGU and/or beneficiaries counterparts (cash and non-cash);
e) Manage and coordinate the implementation of the Project at the local level;
f) Regularly submit to the DOE the required Project Status Report during its implementation and evaluation phases;
g) Identify or establish the Barangay Power Association (BAPA) that shall manage the sustainable operationalization of the RE scheme;
h) Establish a Municipal Project Management Office (MPMO) which will manage the implementation of the Project at the local level and assist in the sustainable operationalization of the Project. Suggested organizational setup of the MPMO is shown in **Annex 9**; and
i) Designate a permanent municipal staff who will be trained as Municipal RE Technician.

3.1.2.3 Barangay Power Association.

a) Ensure the timely delivery of the beneficiaries' counterparts (cash and non-cash);
b) Designate at least two BAPA members who will be trained as BAPA Operator and Technician;
c) Manage the sustainable operation of the NRE scheme;
d) Manage the collection of fees and its disbursements.

3.1.2.4 RE Supplier/Contractor

a) Supply and installation of the RE system/s of the Project;
b) Undertake the commissioning of the RE systems; and
c) Provide required trainings to Project Beneficiaries, LGUs and Local Technicians on the operation, repair and maintenance of the RE systems.

3.1.2.5 Affiliated Non-Conventional Energy Center

a) Provide extension and technical assistance during the project development, implementation and operationalization of the Project; and
b) Monitor the performance of the RE scheme.

3.1.2.6 Project Beneficiaries

a) Provide the required counterpart to the Project;
b) Dutifully abide the rules and regulations of the BAPA; and
c) Regularly pay the appropriate fees for the services provided by the RE system.

3.2 IMPLEMENTATION GUIDELINES

3.2.1 MODE OF IMPLEMENTATION

The DOE shall institute the **Contracted-Out Services Approach** as the mode of implementation for ***turnkey*** DOE Funded Barangay Electrification Project. The following section discusses the general procedures and guidelines for the implementation of the Barangay Electrification Project under the said approach:

3.2.1.1 Contracted-Out Services

Under this approach, DOE shall employ the services of the supplier/contractor through a public bidding for the supply of the required goods and services for the Project. These goods and services may include, among others:

- RE equipment,
- Installation services, and
- Other project related services, i.e., conduct of the required technical training.

The procedures for the procurement of the services of a supplier/contractor shall be governed by the GAAM rules and regulation (GAAM Volume 1, Title 7, pages 248 to 304)

A Contract for Services shall be executed by and between the DOE and the winning supplier/contractor. A **Performance Bond** and/or **Surety Bond** shall be posted by the winning supplier/contractor and shall be released upon completion of the project to guarantee for failure of the project or any other damages.

As much as possible, the DOE requires the winning supplier/contractor to locally sourced out his manpower requirement during the construction and installation of the RE systems.

DOE will tap the services of the concerned municipal LGU to act as the Project Implementor for the conduct of other project related activities such as community organizing and other social preparation activities, on-site project monitoring and project management at the local level. The MOA provided in Annex 5 shall be executed between the DOE and Project Implementor to define the roles and responsibilities of each project player. Under this scenario, the counterpart funding from LGUs, congressional districts, barangay, beneficiaries and other counterpart agencies shall be deposited into a trust account for the project and will be used for the conduct of the said activities.

3.2.2 ARRANGEMENTS FOR THE PROJECT FUNDS

The term "Project Funds" refers to the financial amounts to be contributed by the project participants as indicated in the approved Project Proposal. These shall be classified into as follows:

a) **DOE Funds.** This refers to the amount allocated by the DOE for the project. In the absence of a subsidy policy on rural

electrification using RE systems (DOE will issue a Circular on Subsidy Policy for RE Systems), the said amount will be used for the payment of the contractor/supplier who shall supply and install the required RE systems and conduct the required technical training. Also, it will provide minimum amount to the Project Implementor to be used for the conduct of community organizing and other related trainings. At all possible means, this shall be kept at the minimum.

b) **LGU Counterpart (Cash and Non-Cash).** Cash counterpart refers to the financial supports committed by the LGUs, Congressional District, target beneficiaries, and other agencies, organization and individuals which will be used for the conduct of community organizing and training of BAPA's and in transporting the RE systems from the municipality to the beneficiary barangays, procurement and installation of a security fence for the RE systems, right of way, among others. Non-cash counterpart shall be in the form of labor for manual hauling, construction of security fence of the RE system, etc. The municipal LGU shall ensure the provision of the non-cash counterpart by the project beneficiaries.

3.2.3 INSTALLATION OF RE SYSTEMS

During the Project Implementation Phase, the Project Beneficiaries shall be required to provide local manpower and logistics support especially on the hauling of materials and equipment, construction of fences and foundations and in the actual installation of the RE system.

Prior to the installation activities, the Barangay and Municipal LGUs shall facilitate the settling and securing of the site (e.g., for micro-hydro projects), right-of-way (in case when distribution lines are needed) and provide other necessary interventions in support of the project.

The following are the minimum requirement for the installation of the required RE systems:

1. BAPA is already established (i.e. officers have already been elected and assumed their duties and responsibilities, household beneficiaries have already been completely selected and paid their membership fees, there is an existing Bank Account of the BAPA and registration of the BAPA to the SEC has already been filed); and

2. The following trainings have already been accomplished:

a) Basic management principles and practices
b) Basic accounting and auditing procedures
c) Bookkeeping

The Project Implementor shall assist the DOE in ensuring the timely installation of the RE systems, the systems meet the required Technical Specifications and manuals for the operation and maintenance of systems are provided to the users and technicians. It must regularly update DOE on the progress of the installation activities.

3.2.4. SOCIAL PREPARATION AND COMMUNITY ORGANIZING

3.2.4.1 Scope of Social Preparation. This activity shall commence on the first visit to the community for the conduct of RRA. During this initial stage of project preparation, the community organizing activities shall focus on the presentation of the more detailed project package to the LGUs (municipal entry) and barangay folks (barangay entry) to seek their consent and participation.

3.2.4.2 LGU's Participation. The Municipal LGU will be designated as the project implementor. A municipal ordinance or resolution must be executed indicating the expression of interest and support of the LGU to the Project. A sample LGU resolution is provided in **Annex 10**. Aside from its financial counterpart, the following are the involvement of the LGU in the conduct of the Project:

a) Coordination with the officials of the barangays on various scheduled visits and community activities pertaining to the project; and
b) Security for the personnel and technical staff involved in the Project in the performance of their duties at the community levels.

3.2.4.3 Barangay/Community Participation. Meeting with Barangay Council (Barangay Entry) must be set to orient the barangay officials on the details of the Projects and to get their support to its implementation. A Barangay Resolution endorsing the conduct of the Project in the area should be executed, a sample Barangay Resolution is provided in **Annex 11**. A general assembly must also be conducted to introduce the Project with the entire community. A simple presentation (in layman's

terms) of salient features of RE systems for electrification should be explained by DOE vis-à-vis other alternatives.

Among others, the responsibility of the barangay officials during this stage of social preparation are as follows:

a) To facilitate the conduct of community assembly to introduce and discuss the Project with potential beneficiaries;
b) To assist in the selection of project beneficiaries;
c) To ensure the safety of DOE field teams; and
d) To provide accommodation to the DOE team at the barangay as the need arises.

3.2.4.4 Establishment of Barangay Power Association. The Project Implementor shall establish a "Barangay Power Association" (BAPA) comprising the project beneficiaries. The BAPA, whose concept is borrowed from that of ECS, shall be responsible for the management of the sustainable operationalization of the RE scheme. **Annex 12** provides guidelines for the formation and establishment of a BAPA.

3.2.4.5 Selection of Project Beneficiaries. The Project Implementor oversees the selection of beneficiaries. On the other hand, it may delegate the said task to the newly created Barangay Power Association or any appointed existing group in the barangay. The criteria for the selection of beneficiaries are as follows:

a) Willingness to pay the membership fee which will be established by the BAPA (selection of beneficiaries shall be based on the payment of this fee, i.e. on a first-come-first-served basis)
b) Capacity and willingness to pay for the energy services to be rendered by the Project (for all repayment schemes)
c) Capacity and Willingness to pay for the capital cost of the RE systems (in case of either full- or partial-cost recovery schemes)

3.2.5 TRAININGS AND SKILLS ENHANCEMENT ACTIVITIES

3.2.5.1 Scope of Skills Enhancement Program. The Project Implementor and Contractor/Supplier shall be responsible in the conduct of the required trainings. They may employ the services of a private group to undertake formal training

workshops. Assistance of DOE and its ANECs shall be extended to the management of such training activities. The program should cover the following:

Trainings for BAPA officers and members. The training should cover the following as a minimum:

d) Basic management principles and practices
e) Basic accounting and auditing procedures
f) Bookkeeping
g) Technical Reporting
h) Operation and maintenance of the household component of the RE system
i) Load management
j) Safety precautions on the use of the RE system

Trainings for BAPA Operator & Technician and Municipal & Local Technicians. The training shall cover the following as minimum:

a) Basics of electricity
b) Basics of RE technology used by the Project
c) Operation and Maintenance Principles and Practices
d) Troubleshooting
e) Technical Reporting
f) Repair and Maintenance Procedures
g) Performance test
h) Load management
i) Warranties
j) Safety precautions on the use of the RE system
k) Procedures in the acquisition of technical assistance on repair and maintenance.

3.2.6 FEE RATES AND COLLECTION

In consultation with the Project Beneficiaries, the fee rates to be collected shall be established by the Project Implementor then submit it to for review and approval by the DOE. In consultation with the project stakeholders, DOE shall finalize the fee rates and endorse it for approval by the ERC. Among others, the components of the said payment are the following:

1. Cost recovery, if applicable;
2. Replacement cost (household components of the system, example: for PV-BCS-the minimum is the cost of battery and regulator); and

3. Maintenance and operating costs for the sustainable operationalization of the RE scheme.

3.2.6.1 Types of Repayment Schemes. In the absence of a rationalized subsidy for rural electrification using RE systems, there will be three (3) types of repayment schemes that may be employed in the Project depending on the socio-economic conditions of the barangay to be electrified and capability to pay by the target beneficiaries. These are the full-cost recovery, partial-cost recovery and full-subsidy schemes.

a) **Full Cost Recovery Scheme**. This type of repayment scheme shall be determined based on the full cost recovery of the RE systems and accessories as well as sustainability cost of the project. This scheme shall be applied to those barangays with well-off beneficiaries. The fee shall be determined based on the total cost of the RE systems and accessories as well as the repair, maintenance, operating and replacement cost of the project.

b) **Partial Cost Recovery Scheme**. This type of repayment scheme shall be based on the partial recovery of the cost of the RE systems and accessories as well as sustainability cost of the project. This scheme shall be applied to those barangays whose beneficiaries belong to the middle-class. The fee shall cover the cost for the replacements of consumable parts such as lighting fixtures, storage battery, etc.

*c) **Full Subsidy Scheme**. This type of repayment scheme shall be determined based only on the cost of the sustainability of the project. This scheme shall only be applied to those barangays whose beneficiaries are very poor.*

3.2.6.2 Rate Making. The Capability-To-Pay, which is established during the RRA activities, at the target barangay shall be compared to the designed tariff rate to determine the appropriate repayment scheme. It must be noted that the designed repayment scheme should not be higher than the paying capacity of the beneficiary. After selection, the specifications of the fee rates shall be prepared and shall be presented to DOE for review and approval. In case of the partial-cost recovery scheme, it is suggested that the specification of fee rate must include the percent project cost which shall be subsidized.

3.2.6.3 **Collection of Fees.** The Project Implementor shall assist the BAPA in the adoption of guidelines on the collection, safekeeping, disbursement and liquidation of the said payments (see **Annex 13**).

3.2.7 PROJECT COORDINATION

3.2.7.1 **Overall Coordination**. The DOE shall supervise the implementation of the project starting from project preparation up to evaluation phase. The Project Implementor shall submit to DOE an Accomplishment Report highlighting the major achievements as well as other pertinent matters on the project. The frequency of report must be made clear to both DOE and the Project Implementor. It is suggested that from the signing of the MOA up to the completion of the commissioning of the RE system, a monthly report should be submitted to the DOE. The operation of the RE systems and the management of the Barangay Power Association shall continue to be monitored by the Project Implementor for a period of 3 years after the commissioning of the RE system. At the post commissioning period, reporting shall be done on a quarterly basis.

3.2.7.2 **Reporting.** The report must be as simple as possible. A memo style is advisable. Among others, the DOE shall require the following reports:

a) Monthly Status Report from MOA signing up to the completion of project installation.
b) Quarterly Operational Status Report after commissioning.

The report should include, among others, the operational conditions of the RE system/s as well as the status of collection and disbursement of fees. Said report should also highlight the major management issues encountered by the Barangay Power Association regarding the Project.

3.2.7.3 **Local Coordination**. The Project Implementor shall be responsible in coordinating the required assistance of the Barangay Power Association. The Project Implementor shall require BAPA to submit reports containing, among others, the status of the following:

a) Technical Report detailing the physical status of the RE system, issues and concerns, among others; and
b) Financial Report duly audited by a registered CPA

3.2.7.4 **Coordination on Maintenance and Repair.** The suggested coordination on the mobilization of the trained Technicians is as follows:

a) The beneficiary or BAPA Operator shall report to the BAPA Technician any problems encountered related to the usage of the RE system;
b) The BAPA Technician shall institute troubleshooting procedures and provide the required solution to the problem the soonest possible time.
c) In case the BAPA Technician is not capable to undertake the required solution to the problem, he will endorse it to the Municipal Technician for his appropriate action.
d) In case the Municipal Technician is not capable to undertake the required solution to the problem, he will endorse it to the Local Technician, if any, or to the ANEC.
e) In case the ANEC is not capable to undertake the required solution to the problem, he will report it to the DOE.
f) The DOE shall coordinate to proper authorities on the immediate provision of the required solution to the problem.

3.2.8 PROJECT EVALUATION

3.2.8.1 Scope of Evaluation. The DOE shall evaluate the following aspects of the Project using accepted evaluation models or approaches at the end of the 3rd year of operation of the RE system (i. e. reckoned on the commissioning date of the system).

1. Technical aspect
2. Organizational aspect
3. Management aspect
4. Socio-cultural and institutional aspect
5. External and internal interventions aspect
6. Environmental aspect
7. Political aspect
8. Financial aspect

3.2.8.2 Consultation Meetings. Results of the said evaluation shall be presented in a meeting/workshop with the project stakeholders.

3.2.8.3 Evaluation Report. *DOE shall prepare the evaluation report. Main findings on the Project must be compiled and integrated with those of*

the other projects for the preparation of the overall evaluation report on the Barangay Electrification Program.

3.2.9 PROJECT DOCUMENTATION

DOE is responsible in the generation and maintenance of the database of the project.

ANNEX "5"

Equipment Inventory Report

Equipment Inventory Form							
Project Reference Number: PHI/00/E01	**Project ID: 00014473, Multi Purpose Pilot PV-Wind Turbine System for Rural Electrification in the Philippines Project**						
Item Description	**Serial Number**	**Inventory Number**	**Date of Acquisition**	**Acquisition Cost (Php)**	**Present Condition**	**Present Location**	**Recommendation/ Other remarks**
Solar Photovoltaic Module, 75 Wp-70 units			April 2005	**1,326,000.00**	Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109694	00014473-001	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109742	00014473-002	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388930	00014473-003	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109649	00014473-004	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388926	00014473-005	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109693	00014473-006	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109707	00014473-007	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388925	00014473-008	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109739	00014473-009	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109706	00014473-010	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109711	00014473-011	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109692	00014473-012	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109689	00014473-013	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109745	00014473-014	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388901	00014473-015	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109737	00014473-016	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109748	00014473-017	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109687	00014473-018	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109740	00014473-019	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388910	00014473-020	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109688	00014473-021	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253108937	00014473-022	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109691	00014473-023	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109714	00014473-024	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388902	00014473-025	April 2005		Good Working Condition	Rizal, Palawan	

Item Description	Serial Number	Inventory Number	Date of Acquisition	Acquisition Cost (Php)	Present Condition	Present Location	Recommendation/ Other remarks
BP Solar Photovoltaic Module, 75 Wp	AA0407223388899	00014473-026	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388905	00014473-027	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253115987	00014473-028	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388933	00014473-029	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109648	00014473-030	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388920	00014473-031	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109655	00014473-032	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388893	00014473-033	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388913	00014473-034	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109682	00014473-035	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109713	00014473-036	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388929	00014473-037	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388903	00014473-038	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109699	00014473-039	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388907	00014473-040	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109736	00014473-041	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388924	00014473-042	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109647	00014473-043	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109702	00014473-044	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388894	00014473-045	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109715	00014473-046	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388904	00014473-047	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109709	00014473-048	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388890	00014473-049	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388934	00014473-050	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388900	00014473-051	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109683	00014473-052	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388908	00014473-053	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253108883	00014473-054	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109710	00014473-055	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109651	00014473-056	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388916	00014473-057	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388919	00014473-058	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109650	00014473-059	April 2005		Good Working Condition	Rizal, Palawan	

Item Description	Serial Number	Inventory Number	Date of Acquisition	Acquisition Cost (Php)	Present Condition	Present Location	Recommendation/ Other remarks
BP Solar Photovoltaic Module, 75 Wp	AA0310253109690	00014473-060	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109701	00014473-061	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109744	00014473-062	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109738	00014473-063	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388922	00014473-064	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388928	00014473-065	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388891	00014473-066	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109646	00014473-067	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388897	00014473-068	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0407223388921	00014473-069	April 2005		Good Working Condition	Rizal, Palawan	
BP Solar Photovoltaic Module, 75 Wp	AA0310253109645	00014473-070	April 2005		Good Working Condition	Rizal, Palawan	
Storage Batteries, 2 vdc, 460 AH - 60 units			April 2005	**343,750.00**	Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	01	00014473-071	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	02	00014473-072	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	03	00014473-073	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	04	00014473-074	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	05	00014473-075	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	06	00014473-076	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	07	00014473-077	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	08	00014473-078	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	09	00014473-079	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	10	00014473-080	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	11	00014473-081	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	12	00014473-082	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	13	00014473-083	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	14	00014473-084	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	15	00014473-085	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	16	00014473-086	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	17	00014473-087	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	18	00014473-088	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	19	00014473-089	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	20	00014473-090	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	21	00014473-091	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	22	00014473-092	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	23	00014473-093	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	24	00014473-094	April 2005		Good Working Condition	Rizal, Palawan	

Item Description	Serial Number	Inventory Number	Date of Acquisition	Acquisition Cost (Php)	Present Condition	Present Location	Recommendation/ Other remarks
Classic Enersol Batteries, 2 vdc, 460 AH	25	00014473-095	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	26	00014473-096	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	27	00014473-097	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	28	00014473-098	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	29	00014473-099	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	30	00014473-100	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	31	00014473-101	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	32	00014473-102	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	33	00014473-103	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	34	00014473-104	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	35	00014473-105	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	36	00014473-106	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	37	00014473-107	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	38	00014473-108	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	39	00014473-109	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	40	00014473-110	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	41	00014473-111	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	42	00014473-112	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	43	00014473-113	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	44	00014473-114	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	45	00014473-115	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	46	00014473-116	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	47	00014473-117	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	48	00014473-118	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	49	00014473-119	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	50	00014473-120	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	51	00014473-121	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	52	00014473-122	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	53	00014473-123	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	54	00014473-124	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	55	00014473-125	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	56	00014473-126	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	57	00014473-127	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	58	00014473-128	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	59	00014473-129	April 2005		Good Working Condition	Rizal, Palawan	
Classic Enersol Batteries, 2 vdc, 460 AH	60	00014473-130	April 2005		Good Working Condition	Rizal, Palawan	

Item Description	Serial Number	Inventory Number	Date of Acquisition	Acquisition Cost (Php)	Present Condition	Present Location	Recommendation/ Other remarks
Westwind Wind Turbine Generator, 10 kW	MAT1004	00014473-131	April 2005	**2,079,000.00**	Runs only during prevalence of high wind speed, e.g. typhoon	Rizal, Palawan	
Cummins Diesel Generator, 18 kW	400907	00014473-132	April 2005	**437,500.00**	Good Working Condition	Rizal, Palawan	
AES Single Phase Inverter, 15 kVA	119	00014473-133	April 2005	**1,615,000.00**	Good Working Condition	Rizal, Palawan	
Technician's Tools	N/A	-	April 2005	**28,000.00**	Good Working Condition	Rizal, Palawan	
• 6-pc Screw Drivers (various sizes)	N/A	-	April 2005		Good Working Condition	Rizal, Palawan	
• 15-pc ½ Drive Socket Set	N/A	-	April 2005		Good Working Condition	Rizal, Palawan	
• 8" Diagonal Plier	N/A	-	April 2005		Good Working Condition	Rizal, Palawan	
• 8" Combination Plier	N/A	-	April 2005		Good Working Condition	Rizal, Palawan	
• 8" Long Nose Plier	N/A	-	April 2005		Good Working Condition	Rizal, Palawan	
• 10" Locking Plier	N/A	-	April 2005		Good Working Condition	Rizal, Palawan	
• Butane Pencil Torch	N/A	-	April 2005		Good Working Condition	Rizal, Palawan	
• 14-pc Combination Wrench	N/A	-	April 2005		Good Working Condition	Rizal, Palawan	
• TEK DCM 300 Digital Clamp Meter	123538	00014473-134	April 2005		Good Working Condition	Rizal, Palawan	
• DT 9205A Digital Multi Meter	5384	00014473-135	April 2005		Good Working Condition	Rizal, Palawan	
	We certify that all information provided are accurate and may be used as reference for the future actions of UNDP.						
Prepared by:	Approved by:			Asset Information Validated by:			
J. B. Planas / A. M. Cudia / G.A.O. Galano	**Dir. M. C. Marasigan**			**Sharon Gil**			
DOE-REMD/DOE-Actg.Div./DOE-GSD	DOE-EUMB			UNDP-Manila		Program Assistant	
Date:	Date: 10/13/06			Date:		Date:	

ANNEX "6"

Photos in Sitio Sicud, Brgy. Candawaga, Rizal, Palawan

Outside view of the Hybrid PV-Wind Turbine System

Sicud Village Power Association with UNDP, DOE, WPU-ANEC and PGP Staff

Barangay Officials and Barangay Health Workers with UNDP and DOE Staff

Community Hall in Sitio Sicud

Farm Supply

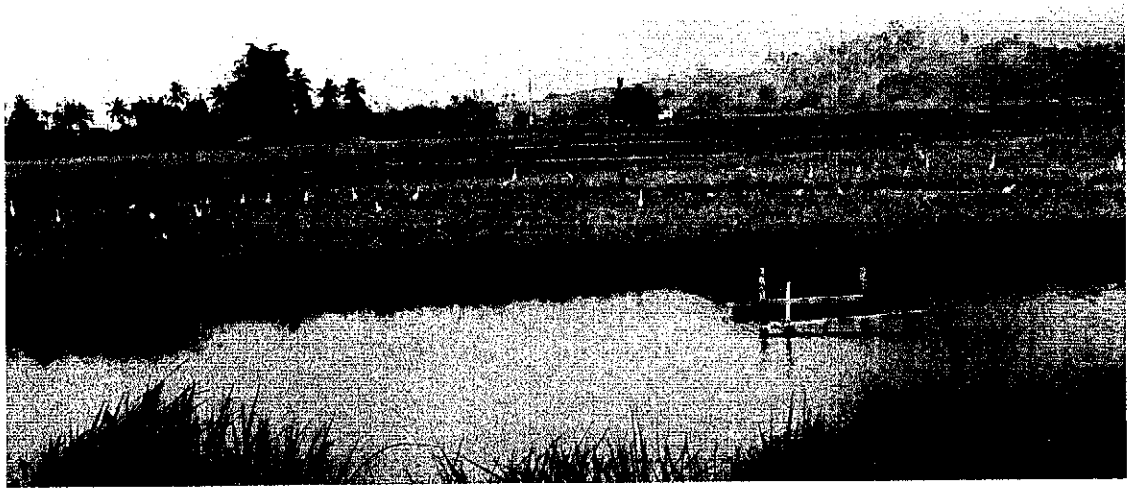
Fishing Village in Sitio Sicud

Fish Vendors

A mobile fish vendor

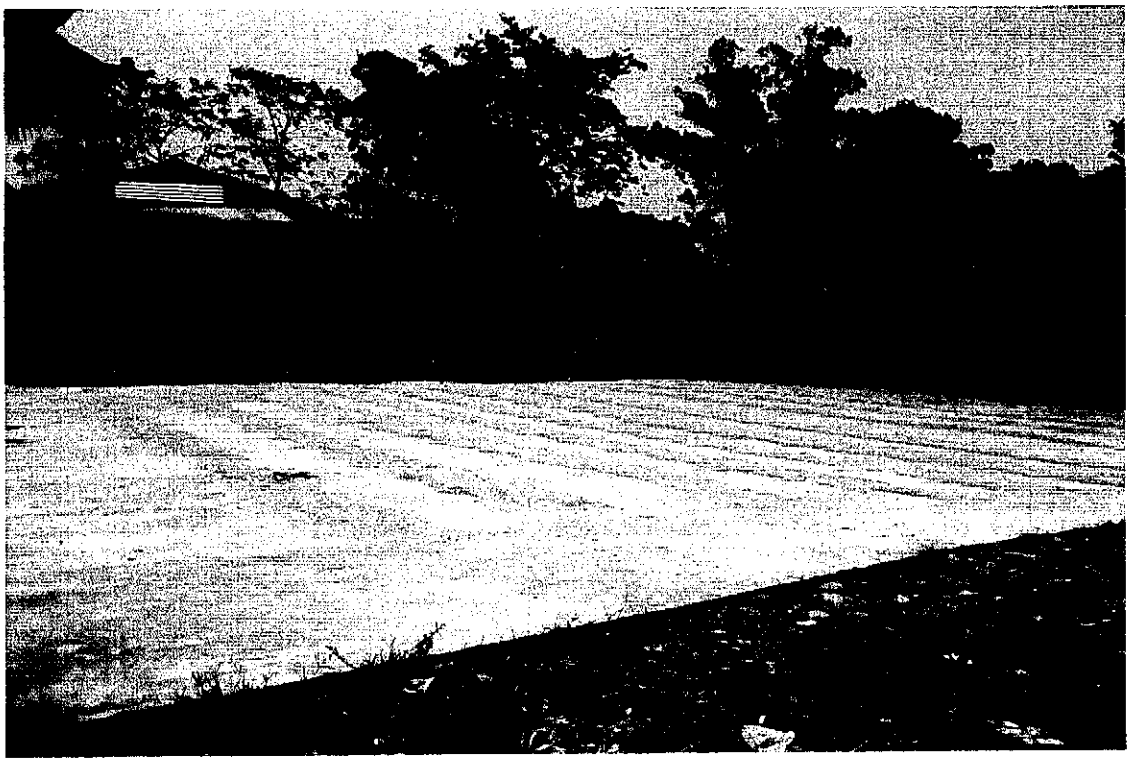
SVPA Member with a Sari sari Store

Fish drying station

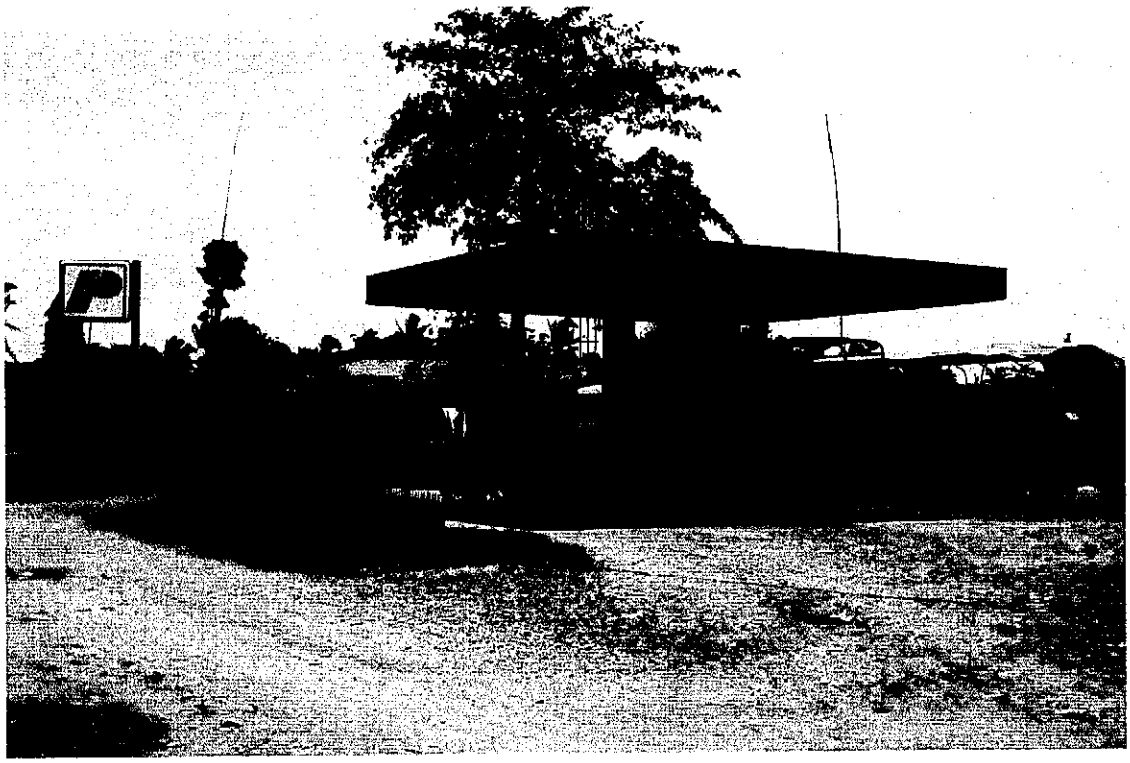


Farm land in Candawaga, Rizal

Sicud Hardware Store



Sicud Palay Drying Area



Petron Gas Station in Sitio Sicud