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RENEWABLE SOURCES OF ENERGY FOR RURAL DEVELOPMENT

**Report of a Joint Project on
The Feasibility of Harnessing Renewable Sources
of Energy in The Philippines**

September 1982

RENEWABLE SOURCES OF ENERGY FOR RURAL DEVELOPMENT

CONTENTS

PREFACE

The 1970s brought into focus the general realization that fossil fuel resources, especially oil and natural gas, are finite in nature and that countries should explore the possibilities of using other sources of energy as well, establishing thereby an appropriate energy "mix" to meet their demands for development. The pressing need to develop alternative sources of energy is most marked in the developing countries, especially in rural areas. It is here that hundreds of millions of people live far from the mainstream of development activities, and in conditions of abject poverty, which cause degradation of the quality of life and hence of the social dimension of the human environment. The provision of an adequate supply of energy to rural areas will not only promote rural development and hence improve the quality of life in such areas, but will also reduce the rural - urban migration that has exacerbated the already dire urban problems.

The Governing Council of the United Nations Environment Programme has fully recognized this problem and at its 3rd session in 1975, requested the Executive Director of UNEP to accord high priority to the establishment in some rural areas of developing countries of a few demonstration (experimental) centres which will harness, individually or in combination, locally available renewable sources of energy. At its 4th session, in 1976, the Governing Council requested the Executive Director to accelerate an active programme involving the rational utilization of renewable resources for energy generation which will have a positive impact on rural development, consistent with environmentally-sound practices, and at its 7th session, in 1979, the Executive Director was urged to promote more activities related to the development of renewable sources of energy, energy conservation measures and the development of efficient technologies for the production and use of energy.

The present report describes the results of a project undertaken jointly by UNEP and the Ministry of Human Settlements of the Philippines to harness indigenous renewable sources of energy in remote rural areas with the target of promoting development of new and renewable sources of energy and improving the quality of life in these areas.

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Chairman, Energy Task Force
United Nations Environment Programme

Nairobi, September, 1982

I. INTRODUCTION

The Philippines is highly dependent on crude oil for its commercial energy requirements. Oil has accounted for at least 93 to 95 per cent of the annual commercial energy consumption. By the mid-1960's the Philippines commercial energy consumption was averaging 36.5 million barrels of oil equivalent per year for a population of 36 million, or slightly more than one barrel of oil per person. By 1979, the Philippines population had grown to about 47 million while commercial energy consumption had risen to 91.9 million barrels of oil equivalent per year, or about 2 barrels per person. On the basis of historical trends, future energy projections result in consumption figures reaching 135 million barrels of oil equivalent by 1984 and 185 million barrels by 1989.

Before 1973, oil imports had never amounted to more than 13 per cent of the Philippines' total import bill, but by 1979, oil imports accounted for 27.7 per cent of the total. In 1973 approximately 10 per cent of the Philippines' export income was allocated to pay for oil imports, but by 1979, about 36 per cent of total export revenues were required to pay for imported oil. The Philippines Ministry of Energy has estimated that oil imports have accounted for 71 per cent of the national trade imbalance since 1974. In 1979, the Philippines had a trade imbalance of US$1640 million, 97 per cent of which is directly attributable to oil imports. In 1979, 23 per cent of the oil consumed in the Philippines was used to generate electricity. Within the power sector itself 73 per cent of present generating capacity is oil-fired.

In order to reduce the dependence on imported oil, the energy policy strategy of the Philippines* focuses on the following:

1. Accelerated diversification to alternative sources of energy and the consequent reduction of dependence on oil as the primary source of energy while continuing efforts to discover and produce indigenous petroleum.

2. The accelerated development of indigenously abundant energy resources and a concomitant shift from depletable to renewable resources.

3. Application of non-conventional (renewable) resources for isolated consumption areas.

4. Development of more efficient technologies for production and use of energy.

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* For details see: Ten-year Energy Program, 1980-1989; Ministry of Energy, The Philippines.

5. Adoption of conservation measures.

6. Emphasis on adaptive energy research and development and demonstration programmes towards assimilation of appropriate technologies.

The Philippines has recently recognized the importance of harnessing renewable sources of energy; official government recognition of the significant contributory potential of such sources is highlighted by Presidential Decree No.1068 (12 Jan.1977), which directed the "acceleration of research, development, demonstration and utilization of non-conventional sources of energy".

Although new and renewable sources of energy (excluding hydropower and geothermal energy), in terms of barrels of oil equivalent, contributed only a small share to energy requirements in the early 1980s (about 279,000 barrels), it is estimated that this share will increase to about 15 million barrels in 1988 or about 8.0 per cent of the total energy requirements in the Philippines in that year (Table 1).

Table 1. Contribution of Renewable Energy Systems (in thousands of barrels of oil equivalent)

Energy Technologies	1980	1982	1984	1986	1988
1. Marsh Gas	1.0	1.5	2.2	2.9	3.7
2. Biogas	5.0	5.1	5.4	5.8	6.2
3. Wind Energy	0.2	0.3	0.5	0.8	1.3
4. Hot Springs	0.1	0.3	1.0	3.4	13.2
5. Direct Solar	1.1	2.2	4.7	9.5	19.4
6. Producer Gas	0.3	0.7	1.8	3.6	5.4
7. Dendro Thermal	-	868.9	1,890.4	2,913.9	3,424.0
8. Alcogas					
Alcohol Production*	138.4	905.7	2,515.7	4,339.6	5,817.6
Bagasse					
- Used for Alcohol Production	75.5	495.6	1,376.6	2,374.6	3,183.3
- Excess	57.3	375.3	1,042.6	1,798.5	2,411.0
Total	279.1	2,655.6	6,840.9	11,452.6	14,885.1

* Represents alcohol barrels. On heat content basis, an alcohol barrel is equivalent to only 0.6 barrel of oil.

Source: Ten-year Energy Program 1980-1989, Ministry of Energy, Manila.

It should be noted that these figures do not include the "non-commercial" renewable sources of energy (e.g. agricultural residues, etc.). It has been estimated that the amount of these resources consumed in 1977 was equivalent to about 16 million barrels of oil, and that it is expected to account for the equivalent of 23 million barrels in 1989.

Although some work was carried out in a number of institutions in the Philippines to develop locally-available renewable sources of energy, it was not until the mid-1970s that the potential of such resources has been realized. Since its inception in 1977, the Non-conventional Energy Programme under the Ministry of Energy, has administered a total of 68 projects, with 18 already completed, 27 still in the works, and 23 others in the initiation phase. Broadly, the projects may be divided into large- and small-scale categories. Large-scale technologies are those that have the highest potential for substituting for or supplementing highly consumed conventional fuels, such as oil and electricity, and could have industrial application in the near term. Small-scale technologies are those that have uses ranging from household utilization to village electrification and will find their place mostly in rural markets due to availability of resources and site-specificity of the technologies.

The present project, partly sponsored by the United Nations Environment Programme, was carried out with the aim of harnessing locally-available renewable sources of energy in some remote areas of the Philippines, with the target of promoting rural development and improving the quality of life in such areas. The project was implemented by the Ministry of Human Settlements in co-operation with other local agencies and institutions. Emphasis was made on using indigenous technologies and local skills and on public participation. The latter is a principal component of the "Bagong Lipunan Sites and Services" Project (BLISS), launched by the Ministry of Human Settlements in 1979 to raise the socio-economic conditions of depressed areas in the Philippines. There is no doubt that the provision of adequate energy supplies to meet the increasing needs of the population in such areas will lead to accelerated development, improvement of the quality of life, and also to environmental protection.

II. SITE SELECTION

Several criteria were taken into consideration while selecting the site for the implementation of the present project, the most important of which are:

1. The site should be a typical "depressed" area far from urban centres and from the main power grids.

2. The site should be a rural area aspiring for accelerated development.

3. The project should contribute to the satisfaction of the basic energy needs of the population at the site.

4. The Provincial, Municipal and Barangay (Village) authorities should be willing to take part in the implementation of the project.

5. Availability of strong public commitment at the site to participate from the beginning in the project, to ensure the future management and maintenance of the energy systems to be installed.

After reviewing a number of potential candidate sites, the Ministry of Human Settlements decided to select two sites (Fig.1) for the implementation of the project: Higatangan Island (Naval Municipality, Leyte Province) and Dagohoy (Bilar Municipality, Bohol Province).

III. HARNESSING RENEWABLE SOURCES OF ENERGY AT HIGATANGAN

Higatangan is an island in the Visayan Sea, central Philippines, about 150 km south of Manila. The Island is located about five kilometres off the northern tip of the mainland of Leyte Province, and about 15 km west of the municipality of Naval in the Island of Biliran, where is belongs from the administrative political point of view (Fig.2).

Higatangan Island has a total land area of 385 hectares. Its topography is gently rolling with a maximum elevation of 48 m above sea level. Coastal areas are generally flat except for the northern and north-western sections which are rocky and featuring cliffs from 10 to 20 m high. Bushes and low forests cover some parts of Higatangan, especially the northwestern parts and coconut plantations are spread along different parts of the coastal areas.

Socio-economic conditions at Higatangan

The Island has two Barangays (Filipino name for village): Mabini and Libertad; both are located at the eastern side and are connected to each other with a 1 km long Barangay road.

There are 235 houses in Higatangan Island, 130 of which are located in Barangay Mabini and the rest (105) in Barangay Libertad. About 15 per cent of the total houses are made of wood and cement with galvanized iron roofings; 40 per cent are made of wood with nipa roofings and the rest are nipa huts made of bamboo with nipa roofing.

The Island has a total population of 1,600 (900 in Mabini and 700 in Libertad). About 58 per cent of the total population (with ages between 10 and 60 years) represents the economically productive part of the population. The people of the Island are considerably literate. About 50 per cent finished their primary education, 36 per cent finished intermediate grades and the rest finished secondary education (some are still college students). Most of the population are farmers (53 per cent); some own and cultivate their farms, but the majority are tenants. The

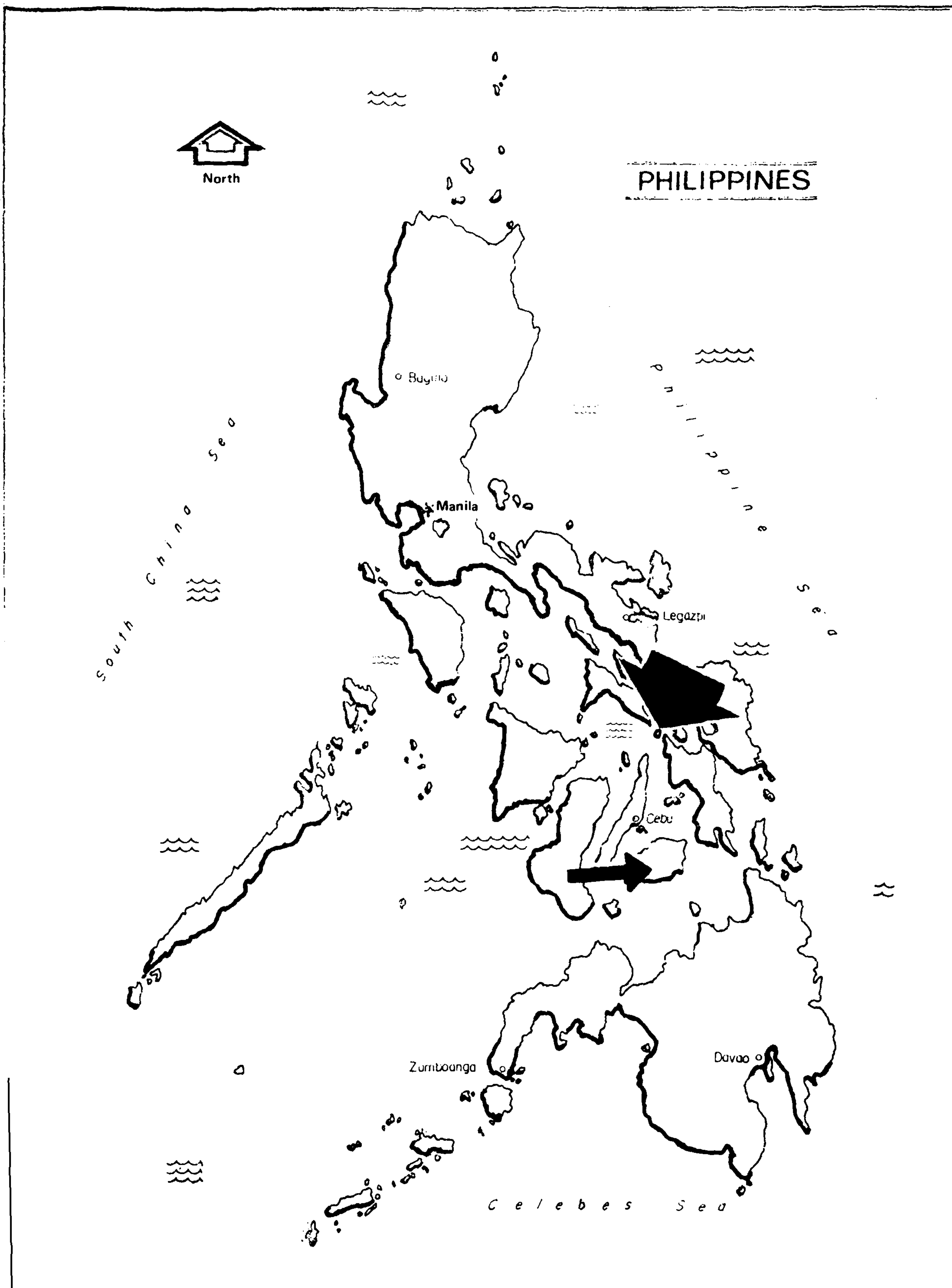


Fig. 1. Sites Selected for Implementation of Project

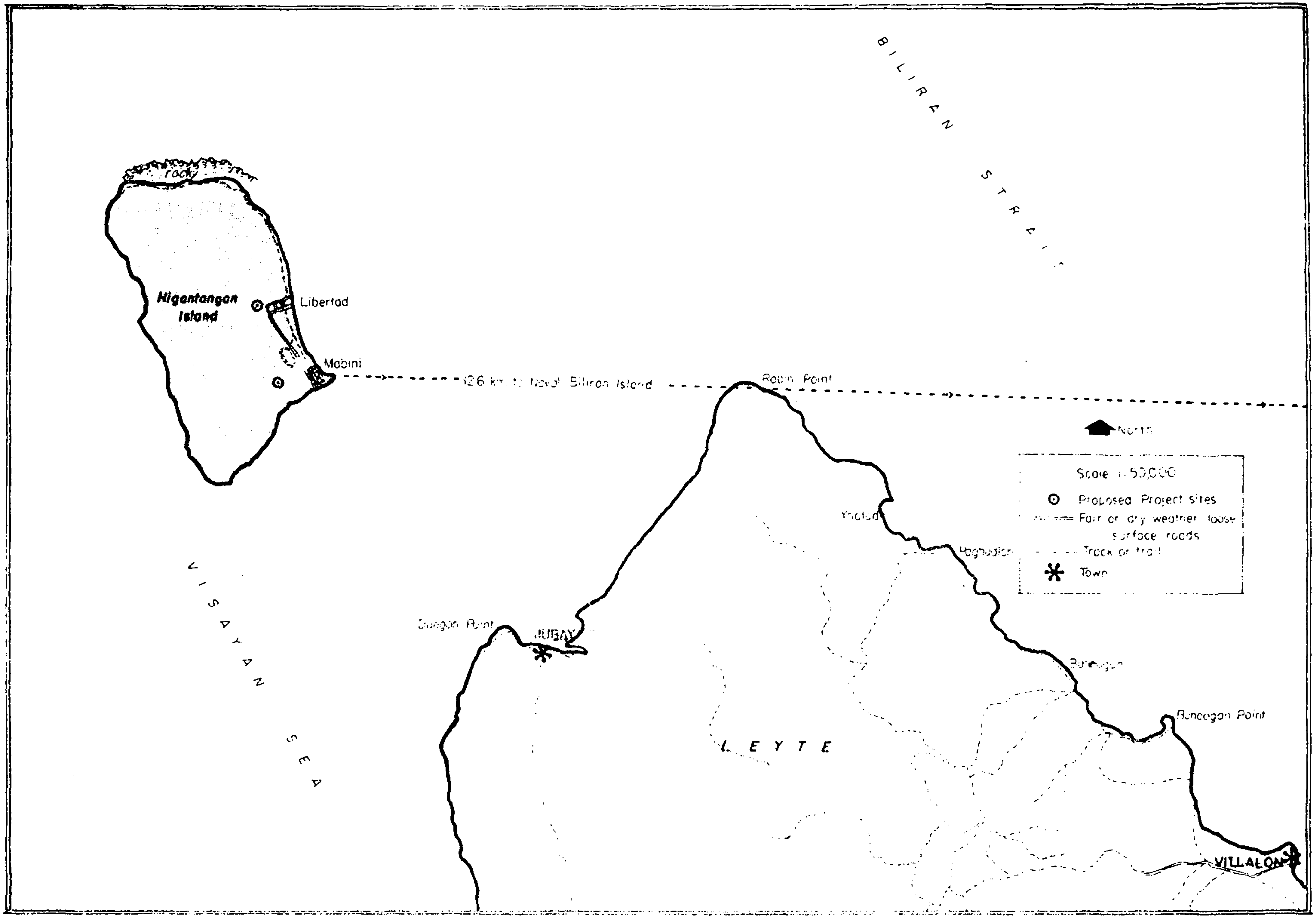

BILIRAN STRAIT
rocky
Higantangan Island
Libertad
Mabini
12.6 km. to Naval, Biliran Island
Robin Point
North
Scale 1:50,000
Proposed Project sites
Fair or dry weather loose surface roads
Track or trail
Town
VISAYAN SEA
JUBAY
LEYTE
VILLALON

Fig. 2

major crops include coconut, corn, cassava, peanuts, camote and mango. Of these, only coconut and mango are sold to market outlets outside the Island, mainly at Naval. Fishing is another main occupation at Higatangan. About 21 per cent of the population are engaged in fishing. There are more fishermen engaged in sustenance fishing (77 per cent) than in commercial fishing (23 per cent). The main cottage industries in the Island are mat-weaving and "tuba-making". About 50 per cent of the housewives and their children are engaged in these cottage industries. Income from these industries usually augment insufficient income derived by the head of the family from either agricultural or fishing activities. About 37 per cent of the households in Mabini and Libertad are raising backyard livestock/poultry, such as chicken, cattle, pigs, etc. These are raised either for consumption, sale or both.

Energy Requirements at Higatangan

Nearly all (99 per cent) households at Higatangan are dependent on kerosene for lighting. About 65 per cent of the households use wick lamps (lamparilla) and 34 per cent use pressure lanterns (Petromax). One per cent of the population use a diesel electric generator. Wood is the main source of fuel used for cooking (used by 96 per cent of the population). Three per cent of the population use bottled liquified petroleum gas and one per cent use kerosene.

Urgent Needs of the Communities

Field surveys in Higatangan led to the identification of the following needs for community development:

1. Provision for safe drinking water.

2. Construction of a suitable road around the Island.

3. A community clinic.

4. Electrification for lighting and for development of cottage industries.

5. Installation of a lighthouse.

6. Modernization of fishing boats.

7. Establishment of fish and marine resources reserves.

There was near concensus among the population of Barangays Mabini and Libertad that the most urgent need is the provision of safe drinking water.

About 80 per cent of the people obtained their drinking water supply from two privately owned water pumps situated in Barangay Libertad, which were the only source of drinking water in the Island. People who drew water from these wells were charged 20¢* (0.025 US$) per can of water (about 5 gallons or 18 litres); water carriers charged an additional 50¢ (0.625 US$) per can of water carried between Libertad and Mabini (i.e. for a distance of about 1.5 km). About 13 per cent of the population obtained water from some 20 open wells in the Island. But this water is generally salty and was used mainly for washing clothes and dishes. About 3 per cent of the people obtained their drinking water from Naval (transported in plastic containers by boats).

Wind Power for Domestic Water Supply

Wind power has been used for many years in many countries to pump water for irrigation and/or for domestic applications. Assuming that a suitable wind regime and a groundwater reservoir are available in an area, there is no technical reason why the water should not be exploited using wind power.

According to meteorological data available for Higatangan, the average wind speed is about 16 km/h. Such wind speed is suitable for a low-speed, high torque, multi-bladed windmill.

Although there are no systematic hydrologic data available for Higatangan, the occurrence of some 20 shallow wells in the Island is a clear indication of the abundance of groundwater at shallow depths. Analyses of the water from the open wells indicated that three of them yield water that is suitable for drinking and for domestic purposes when compared with the Philippines Drinking Water Standards. The location of these wells served as a guide for further exploratory drilling.

The domestic water requirements of the population at Higatangan have been estimated at 40 litres per day per capita; the total requirements of the 1,600 inhabitants of the Island would be about 65,000 litres per day. Of these, the two privately-owned wells supply about 20,000 litres. To provide for the balance (45,000 litres), it was found necessary to drill four new wells, two in each Barangay, and to use four windmills to pump the water from the wells into two storage tanks, each with a capacity of about 30,000 litres. Water would then be transmitted by pipes and distributed through suitably located outlets in the two Barangays.

A suitable site about 800 m NW of Barangay Mabini was selected for drilling two wells. The two wells, 60 m apart yielded fresh water from an aquifer about 9 m deep. After testing the wells, the installation of casings and cleaning operations were carried out. A concrete water tank was built between the two wells (Fig.3, Fig.4). The tank measuring 3.25m x 3.25m x 2.80m has a capacity of about 30,000 litres. Two windmills manufactured locally were constructed, one on each well to pump the water which is then transferred into the storage tank by a suitable pipe. Each windmill has the following specifications:

Number of blades	:	24
Windwheel diameter	:	3 m
Tower height	:	18 m

* 1 Pesos ₱ = 100 Centavos ¢; 1 US$ = 8.0 Pesos

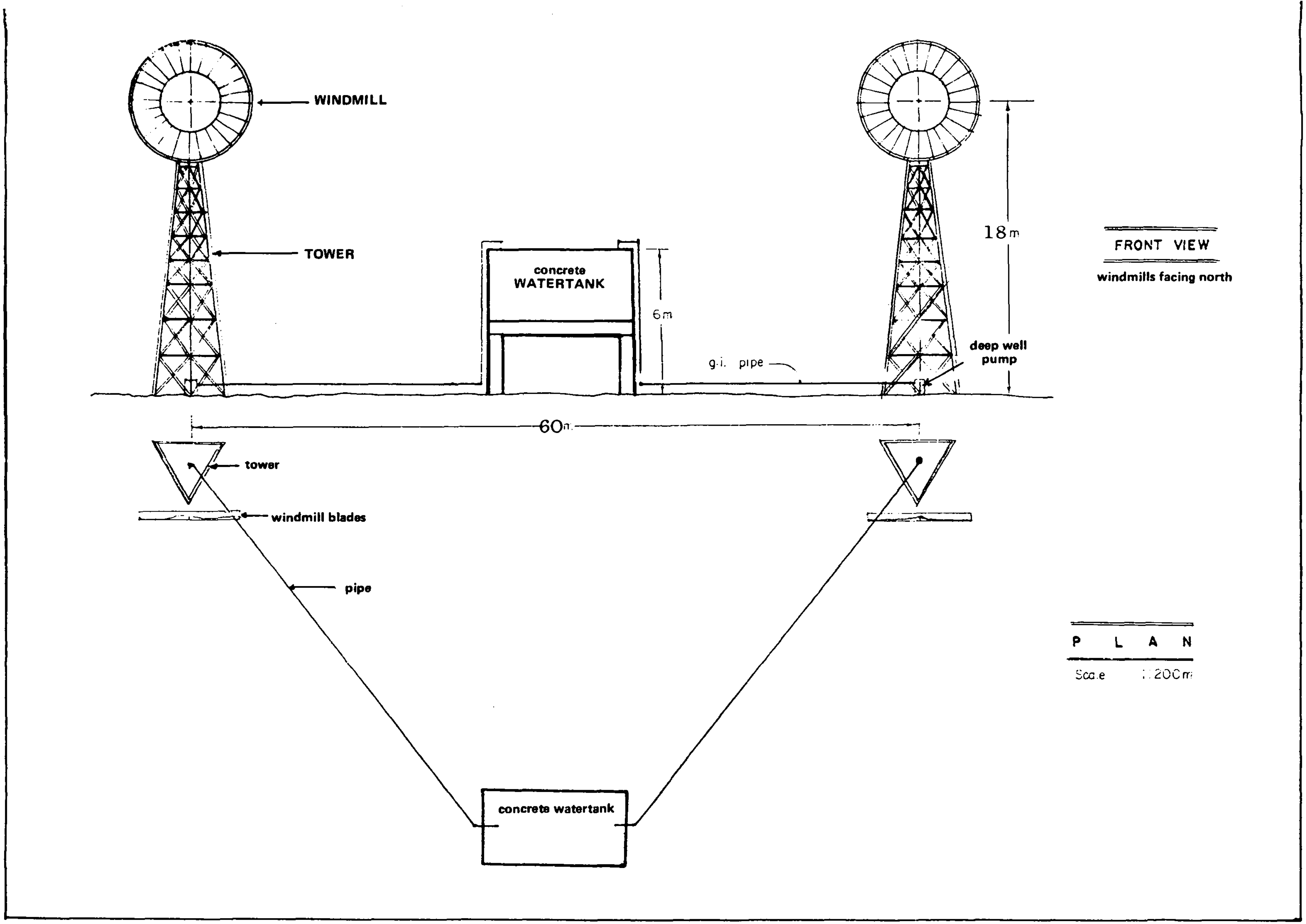
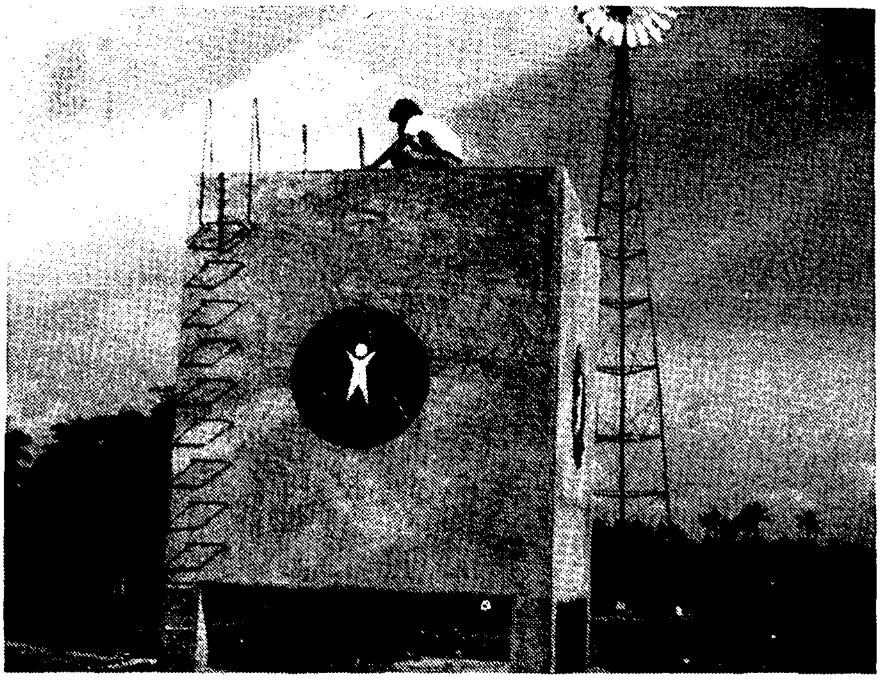

WINDMILL
TOWER
concrete
WATERTANK
6m
18m
FRONT VIEW
windmills facing north
g.i. pipe
deep well
pump
60m
tower
windmill blades
pipe
concrete watertank
P L A N
Scale 1:200m

Fig. 3

(A)



(B)

Fig. 4. A. Inspection of Windmill Tower
B. Concrete Water Tank

The windmills were made of steel and designed to withstand stresses and torque actions induced by excessive wind forces of storms and typhoons and also to resist natural deterioration due to exposure to atmosphere. The pumps that the windmills drive are of the drop-cylinder type. Each windmill has a punping capacity of about 10 litres per minute, and operates at an average of about 18 hours a day. In other words, each windmill has a pumping capacity of about 11,000 litres per day. The water from the storage tank is delivered to a suitable outlet near Mabini by a pipeline.

At Barangay Libertad, two wells were drilled about 300 m to the west of Barangay and a windmill water pumping system similar to that of Barangay Mabini was constructed.

Cost/benefit Analysis of the Windmill Water Pumping System

The total fixed capital investment in the windmill water pumping system of Barangays Mabini and Libertad is as follows:

	₱		
Windmills (4 units)	62,400		
Water Tanks (2 units)	24,700		
Distribution Pipes, etc.	20,000		
Transport costs and handling	10,000		
Contractors	14,075		
Labour	33,645		
Miscellaneous	17,636		
Total	182,456	=	22,807 US$

Assuming 10 years of amortization, an interest rate of 10% per year and operational and maintenance costs of 10% of the capital per year, the annual costs of the system are as follows:

	Capital Cost (₱)	Annual Cost (₱)
Windmill Water Pumping System	182,456	18,246
10% interest per year on capital		1,825
10% operation and maintenance		1,825
Total		21,896

The systems at both Barangays produce an annual average of 14 million litres of water. In other words, the cost of 1 litre of water is about 0.0016 ₱ (or about 0.16 Centavos which is much less than the 1.1 Centavos/litre charged by the privately-owned wells). Even if the cost of operation and maintenance increases annually by 2-3%, the cost of the water will reach a maximum of 0.3 Centavos/litre.

This analysis shows that the windmill water pumping systems established at the two Barangays are economically feasible. Undoubtedly, they are also socially and environmentally beneficial. To provide water suitable for drinking and for domestic applications is to provide for one of the most important basic human needs. This will not only contribute to the improvement of health conditions of the population but will also open several avenues for development. Such important benefits cannot be easily quantified.

IV. HARNESSING HYDRO-POWER AT DAGOHOY

Barangay Dagohoy is a small village about 7 km from Bilar, a municipal town in the Island of Bohol, central Philippines (Fig.5). Bilar is about 42 km from Tagbilaran which could be reached by air from Manila, with a connecting trip from Cebu.

Socio-economic conditions at Dagohoy

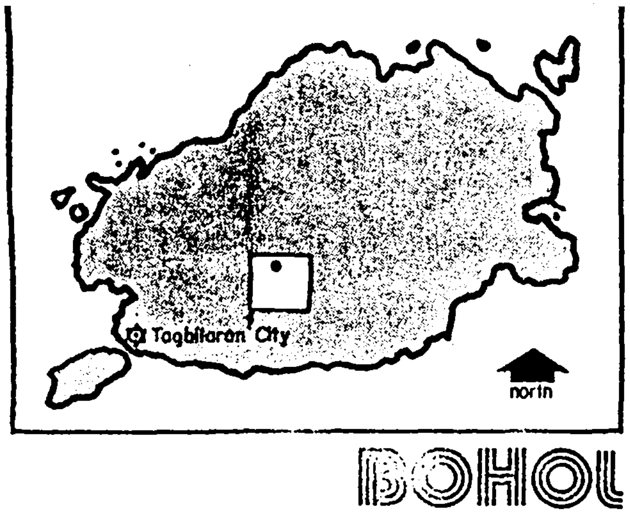
Barangay Dagohoy has 179 households with a total population of 1,036. Sixty-two per cent of the population are between 10 and 60 years old. Most of the population is engaged in agriculture and in cottage industries. The raw materials used include buri, nito, lumber, rattan, bamboo, coconut,etc. which are locally available. The most common finished products are hats, mats, baskets, furniture, etc. which are marketed locally and in neighbouring towns.

Energy Requirements at Dagohoy

The households of Barangay Dagohoy are mostly dependent on kereosene for lighting. Traders procure kerosene from Tagbilaran city which is the centre of trading activities in Bohol. The average annual expenditure on kerosene (for lighting only) per household is about ₱ 60 (or 7.5 US$). Fuelwood is used by all households for cooking. The average annual expenditure on fuelwood per household is about ₱ 192 (or 24 US$).

Surveys at Dagohoy showed that the most urgent need of the population has been the provision of electricity for lighting and for developing the cottage and village industries. The electricity requirements of the whole community have been estimated as follows:

179 households lighting (3 lamps for each household, 40 watts each for 6 hours daily)	47,000 kWh/year
Cottage industries	40,000 kWh/year
Appliances	20,000 kWh/year
Street lighting (30 lamps, 100 watts each for 10 hours daily)	10,000 kWh/year
Total	117,000 kWh/year



A map of Bohol indicating project site.

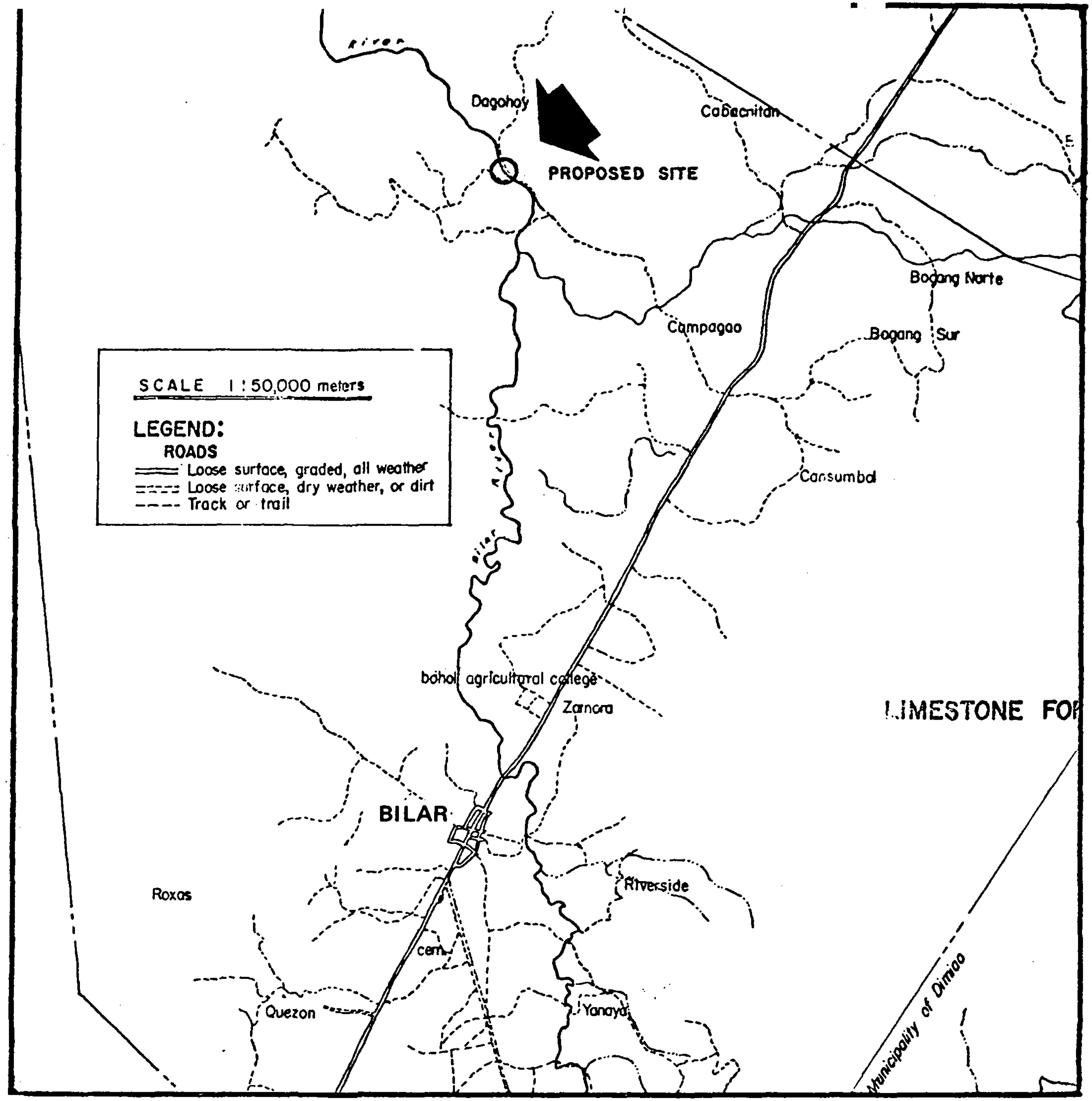


Fig. 5

13

Since Dagohoy is close to Bilar river and the Mag-Aso falls, it was decided to undertake detailed field studies to explore the possibilities of harnessing hydro-power in the area.

Hydrological Survey

The area of Dagohoy has a moderate topography and consists mainly of marly and corralline limestones. The average annual rainfall at Dagohoy is 140 cm; most of the rains occur in the months of June to January.

The source of the Mag-Aso falls is the Bilar River. Streamflow records since 1959 show an average annual discharge at the gauging station (located upstream of the falls) of 186.5 m^3/second. The drainage area at the gauging station is about 92 km^2 and at the Mago-Aso falls it is about 167.5 km^2. The average annual discharge at the Falls is estimated to be 339.5 m^3/second.

A flow duration curve was prepared for the Mag-Aso Falls (Fig.6), from which the amount of flow for any per cent of time can be read. The U.S. Geological survey adopted the flows available 50 and 90 per cent of the time as the standard of flow for water power statistics. The higher percentage is a measure of the prime power potential and the lower value is an index of the power potential with adequate storage facilities. For 90 per cent of time the available discharge is about 3.5 m^3/second. A 4.5 m of head may be developed at the falls. The maximum power that could be produced is:

$$P = 9.8\ Q\ H\ e$$

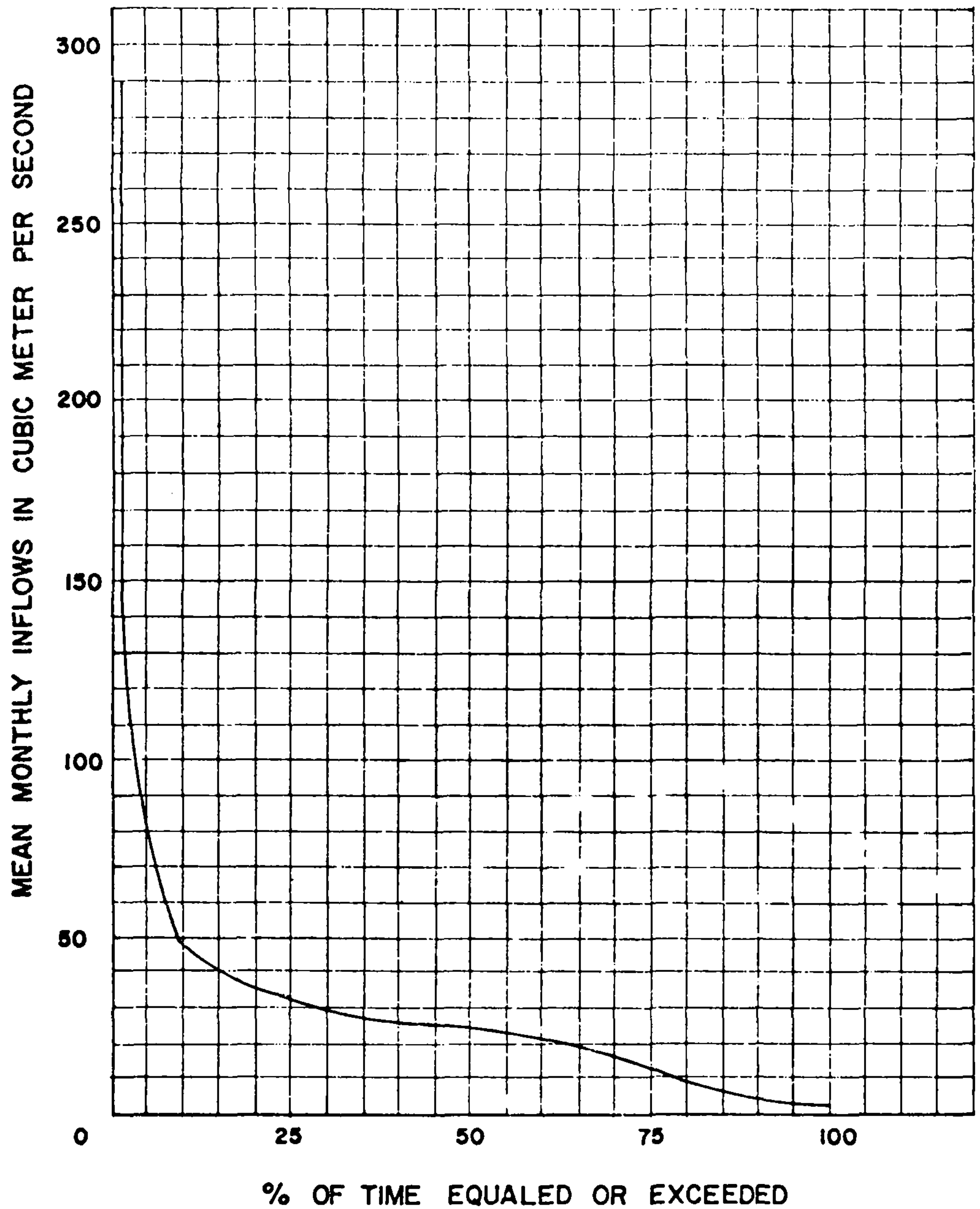
where P : available power in kilowatt
Q : discharge in cubic metres per second
H : available head in metres
e : efficiency of the system

Assuming 75% plant efficiency

$$P = 9.8 \times 3.5 \times 4.5 \times 0.75 = 116 \text{ kW}$$

Measurements of the volumetric flow and practical water head at Mag-Aso falls gave 3.5 m^3/second and 2.4 m respectively. Assuming that 50 per cent of the total flow will be utilized, then the power that could be produced equals:

$$P = 9.8 \times 3.5 \times 2.4 \times 0.75 \times 0.5 = 31 \text{ kW}$$



FLOW DURATION CURVE AT MAG-ASO FALLS, BGY. DAGOHOY, BILAR, BOHOL

Fig. 6

The Mini-hydro Power Plant

A low head mini-hydro electric power plant (manufactured in the Philippines) has been installed at the Mag-Aso Falls (Nagler fixed-blade propeller turbine; Figs.7, 8, 9). It operates on a net head of 2.4 m and a water flow of 1.41 m^3/s. Of the gross power that can be tapped from the falls about 20 kW is being produced. At certain times of the year, particularly during the dry season of February to May, the volumetric flow of Mag-Aso Falls is considerably lower than during rainy days. This situation is further aggravated by the practice of the farmers in the area who utilize portions of the Bilar River upstream for irrigation purposes during the January-February period. These farmers divert the normal flow of water at various points upstream. However, these situations do not pose a serious technical problem to the project. Damming as originally planned for the project was changed for it would only flood and submerge the small rice farms upstream. The alternative has been to divert a portion of the riverflow via a channel to the power house.

Although it was originally designed to provide 20 kW output, the generating capacity of the mini-hydro power plant has been increased to about 40 kW due to additional technical improvements, the most important of which are:

1) A new dike was constructed about 400 metres from the main water impounding area. The dike considerably improved the water supply needed for maintaining the required water head to drive the turbine.

2) The water intake opening of the turbine tube was reduced by 0.1 metre and this increased the efficiency of the rudder control in regulating the turbine speed.

3) The generator pulley was reduced from 15 cm to 10 cm in diameter.

4) The generator automatic voltage regulator was converted into the reactance type through the installation of current transformers and rheostats. These components will protect the generator from damages arising from abrupt changes in turbine speed when in operation.

Of the total generating capacity of the power plant, a maximum load of 32 kW (about 80 per cent of the total capacity) will be delivered to end users based on the recommended safety standard for the generator set matched by a 100 A fuse cutout device. On the average, the plant can produce 250,000 kWh per year which is nearly twice the present requirements at Dagohoy.

The transmission line extends to the service area and is composed of three-phase bare aluminium wires with one neutral line for earth (Figs.10, 11). Transmission voltage was set at 440 V line-to-line to have a smaller voltage drop and a 237 V line-to-line neutral distribution voltage. Street lighting systems were installed for the Barangay road, each fitted with a 50 watt mercury lamp with automatic photo switch.

Fig. 7. Turbine-Runner Assembly

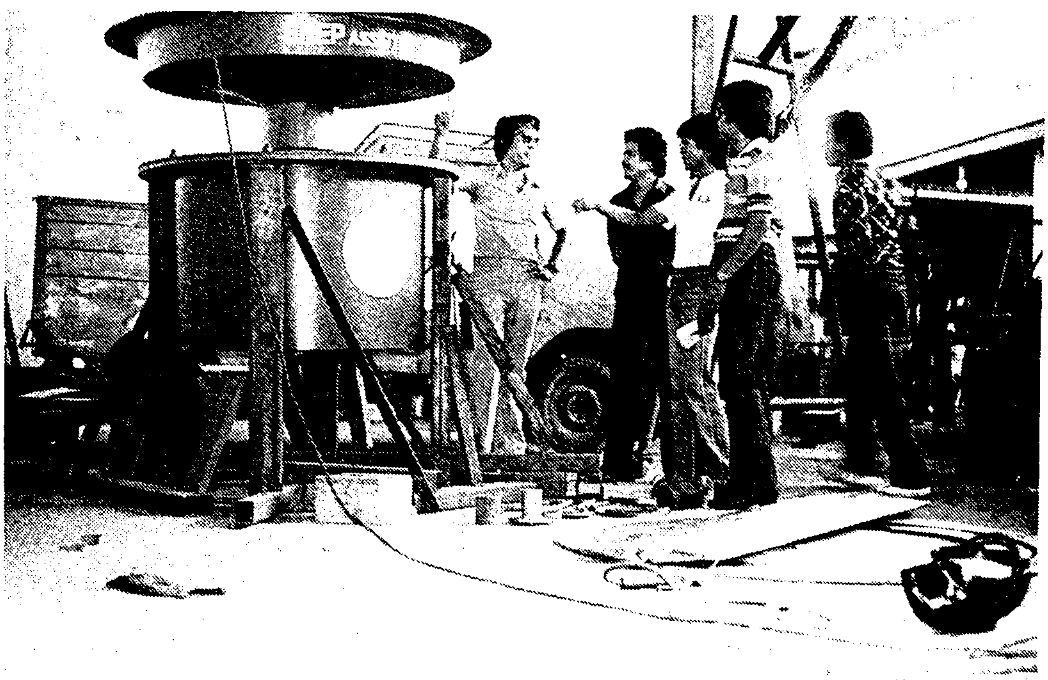


Fig. 8. Inspection of Turbine-Runner

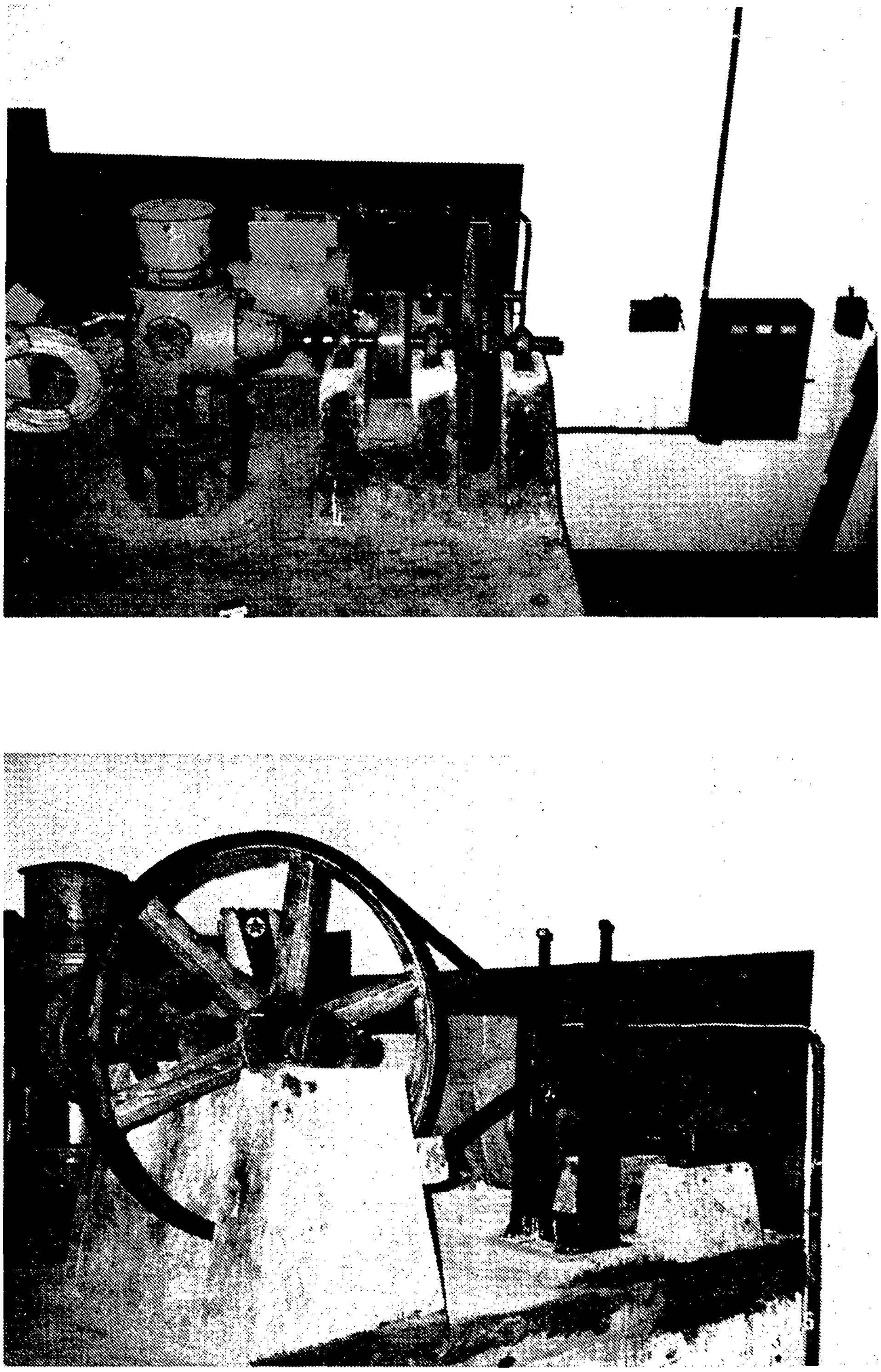


Fig. 9. The Electric Generator

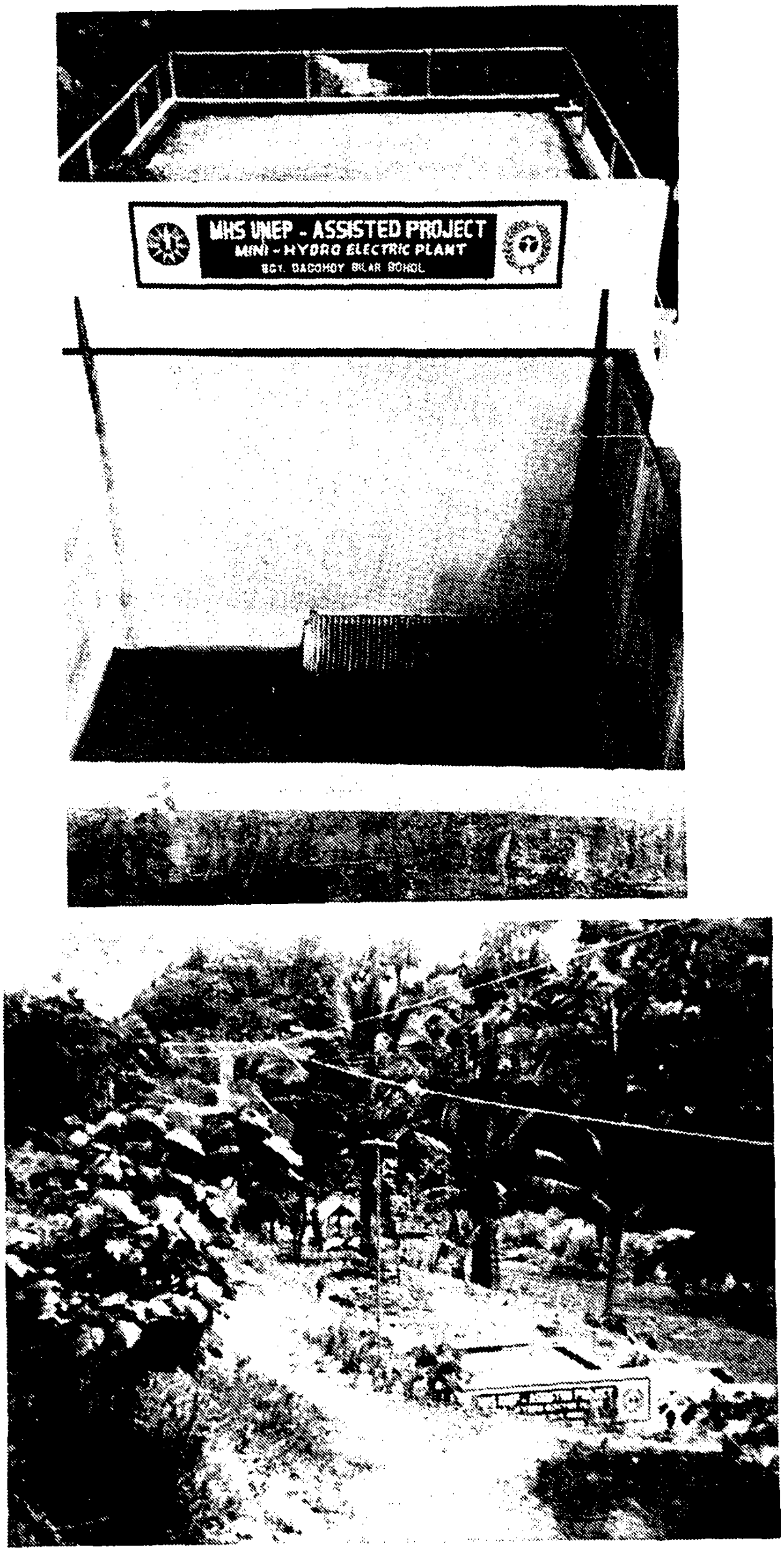


Fig. 10. The main water reservoir and power-house

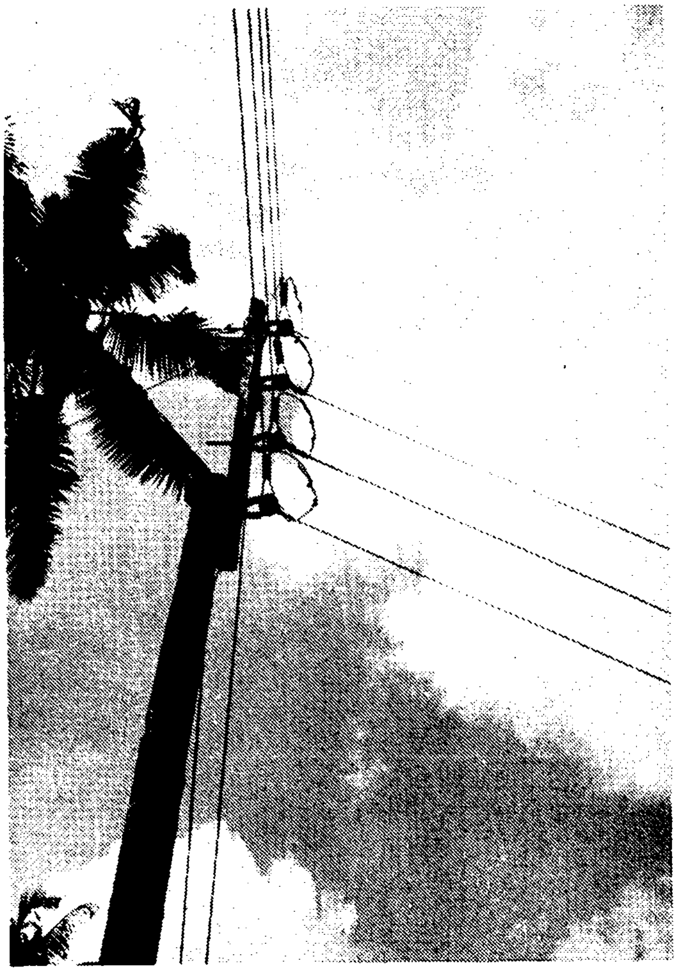


Fig. 11. The Transmission Lines at Dagohoy

Cost/Benefit Analysis of the Mini-Hydro Power Plant

Assuming 10 years of amortization, an interest rate of 10% per year and operational and maintenance costs of 10% of the capital per year, the annual costs of the mini-hydro power plant are as follows:

	Capital cost (₱)	Annual Cost (₱)
40 kW Mini-hydro power plant	908,000	90,800
10% interest rate per year on capital		9,080
10% operation and maintenance		9,080
Total		108,960

In other words, the cost per kWh is about 0.44 ₱ or 0.055 US$ (on the basis of 250,000 kWh/year produced by the plant). This figure is very competitive with the cost of the kWh produced using diesel generators (about 11 US cents) or small thermal power stations.

The Mini-hydro Project is expected to create long range development potential in the area (Figs.12, 13). By providing power to drive a rice and corn mill, the mini-hydro installation will be servicing a vital need of the population in the area. It will also provide power for small machineries and other types of equipment that would open various opportunities for the seasonally inactive farm workers to engage in various types of cottage, home, and other small-scale industries to further boost their income and thereby attain economic self-sufficiency.

V. CONCLUSIONS

The present project illustrates the use of indigenous renewable sources of energy to meet the urgent needs of two rural communities in remote areas of the Philippines. It also illustrates the application of environmentally-feasible and environmentally-sound appropriate technologies for rural development. The technologies are economically feasible, environmentally benign and socially acceptable.

Among the important features of this project are the facts that the technologies are indigenous and that public participation was ensured from the onset. The latter is an important component of the BLISS project (Bagong Lipunan Sites and Services) launched by the Ministry of Human Settlements to improve the quality of life in rural areas. With every BLISS site, the concept of "Bagong Lipunan Community Association (BLCA)" has been introduced to ensure public participation and to achieve self-reliance among the BLISS residents.

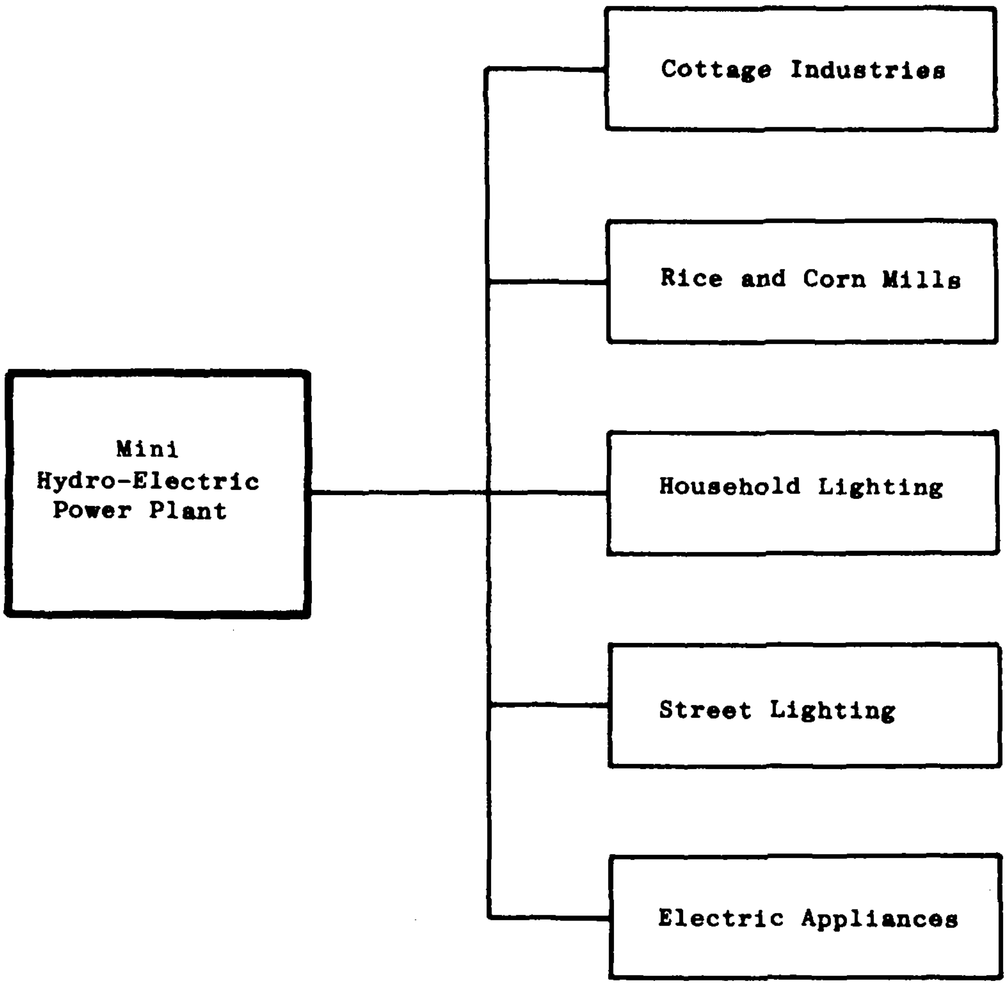


Fig. 12 Immediate Applications of Electricity From the Mini-Hydroelectric Power Plant

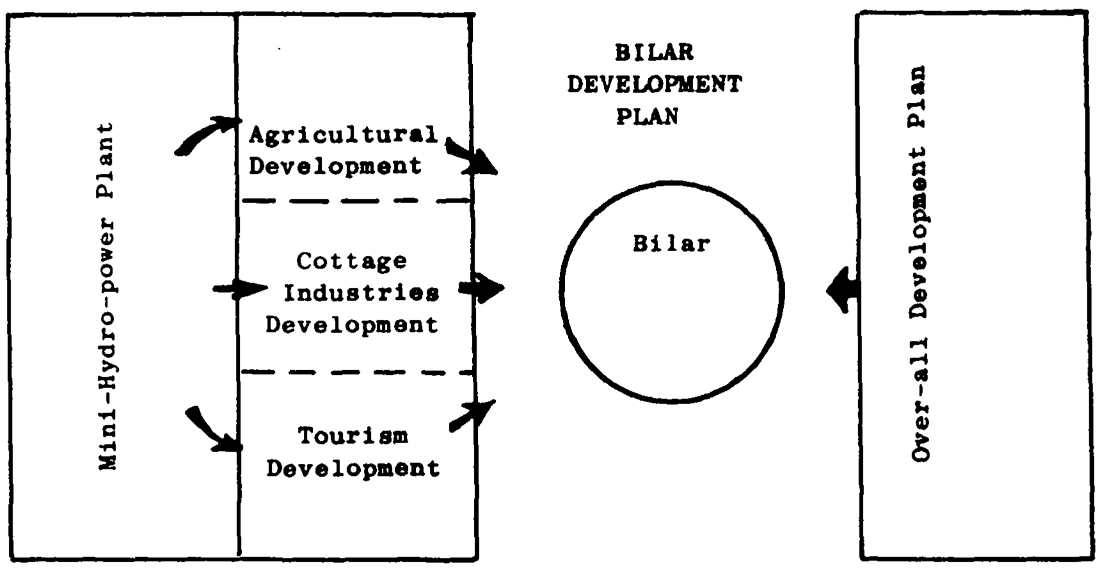


Fig.13 Long-Range Development of Bilar

In the implementation of the project inter-government linkages were established to enable the local government agencies to participate in the implementation. The experience of the local government agencies contributed a lot in solving the different problems encountered.

As an entry point, the local governments concerned and the Ministry of Human Settlements entered into agreement stipulating therein the role and responsibilities of each agency. One of the significant features of this arrangement is the commitment of the local government concerned to undertake the interim management during the initial operation of the project. During this period, the recipient BLCA is offered the opportunity to undergo the required skills and management training, and develop their capacity to operate and manage these projects.

Most of the training designs are on the job activities. They learn the system of operation through the assistance of the assigned technical personnel from the local governments concerned. The BLCA in turn is being closely monitored by the Ministry of Human Settlements to determine its capability to assume full responsibility over the management and ownership of the facility/ies.

The BLCA works in co-ordination with the existing Barangay Council headed by a Barangay Captain. This set-up was established since the BLCA is considered a social unit with administrative function over a small geographical confinement which in turn is a part of the community. These BLCAs were organized in each of the project sites.

Long Range Implications of the Project

The installation and operation of the Wind-Powered Water Supply System in the Island of Higatangan is expected to benefit the two concerned communities in many ways. By harnessing the energy of the wind, the project would practically solve one of the major problems of the Island, that of lack of sufficient water supply. With a ready and adequate supply of water, livestock development will be given impetus not only because of the potential earnings that it could generate but also its utility in community-wide biogas operations.

Concomitant projects will include tree plantations which intend to promote the culture of such "energy trees" as the ipil-ipil and mangrove plants. Under the tree planting project, the leaves and seeds of ipil-ipil trees can be utilized for animal feed needed in livestock development. The wood can be directly used either as cooking fuel or for fueling a producer gas electric generating plant. Hence, the project can further serve the future and proposed establishment of a dendrothermal plant, another potential source of large scale supply of power and of additional income.

The mini hydro-power plant at Dagohoy is expected to create long range implications on the development potentials of the area. The greater area is an agricultural one. By providing power to drive a rice and corn mill, the mini hydro installation will be servicing a vital need of the population. In addition, it will also provide power for small machineries and other types of equipment that would open various opportunities for the seasonally inactive farm workers to engage in various types of cottage, home and other small-scale industries to further boost their income and thereby attain economic self-sufficiency.

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