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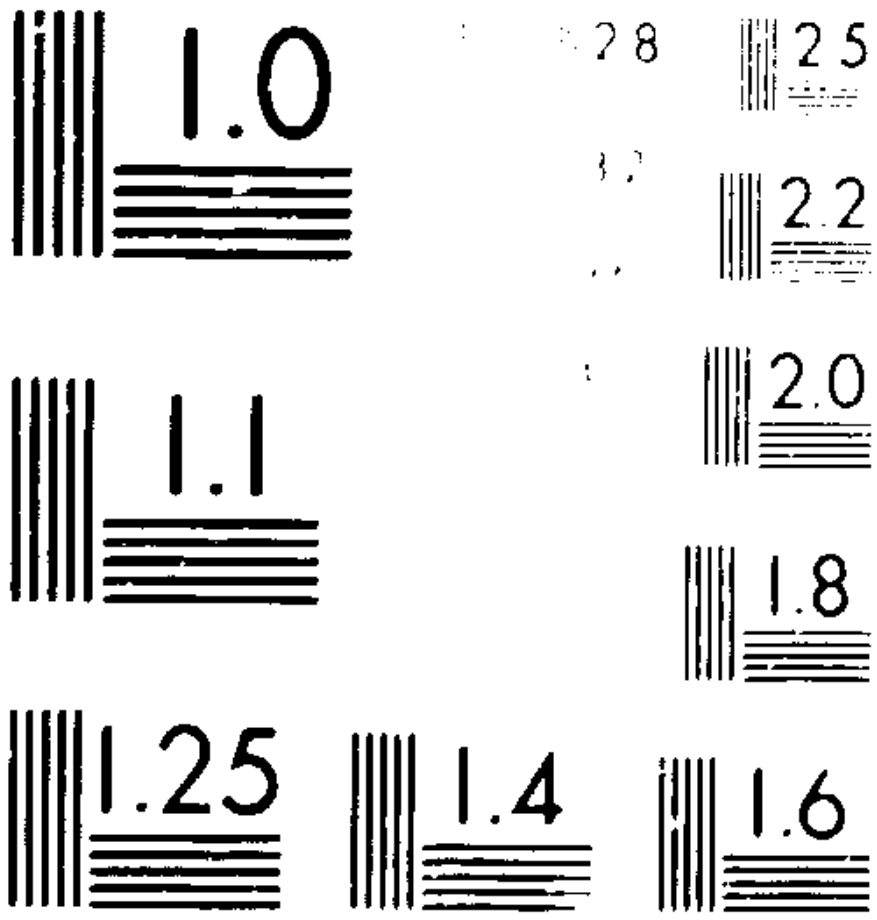
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PROMOTION OF LOCAL DESIGN AND MANUFACTURE OF MINI HYDROELECTRIC EQUIPMENT IN THE REPUBLIC OF THE PHILIPPINES*

by

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I. THE OPPORTUNITY - THE MARKET FOR MINI HYDRO IN THE PHILIPPINES

A. The NEA[1/] Programme

Waterways were used as sources of power in the Philippines as early as 1900s. The earliest known hydroelectric project was a small installation built in 1914 at an American base, Camp John Hay in Baguio, in the northern Philippines. As of 1977, thirty known small hydroelectric projects were in operation.

The development of these hydroelectric projects, however, was slow and sporadic. The devaluation of Philippine currency in 1962 increased the cost of imported equipment and materials for mini hydros. As a result, minor projects (below 1000KW) were considered uneconomical to develop. The government's program in the 1960s and 1970s, then, concentrated in large part on major power projects -- hydroelectric, diesel, thermal and geothermal.

With the advent of the oil crisis and the rapid escalation in the price of oil, policy emphasis was placed on seeking alternative sources of energy that are indigenously abundant and regenerative in form. The economics of power production from streams and rivers were re-examined.

1/ NEA - National Electrification Administration.

In response, the National Electrification Administration (NEA), initiated a program to develop electric generating capacity utilizing indigenous water power resources primarily to lessen the country's dependence on oil and to develop a lower cost source of electrical energy for the rural areas.

The long-range objective of the NEA is to attain the total electrification of the country by 1990 and to provide electrification to all barrios by 1984.

At present, over 4,000 sites have been identified for possible hydro exploitation. Up to 1987, a total of 300 MW in incremental capacity, with a value in terms of equipment alone of ₱1.5 B, is programmed for availability to roughly 3M households. (EXHIBIT 1 projects the development plant for mini hydroelectric projects on a yearly basis up to 1987; EXHIBIT 2 shows the development plan by region).

Although final sites are yet to be selected for the full 300 MW, about 100 sites with an estimated potential of 120 MW have been identified.

Todate, twenty (20) mini hydro projects with aggregate capacity of 25 MW are under construction. Purchase orders have been issued for 76 sites with a total capacity of 95 MW. Equipment have been delivered for 21 sites with capacity of 26 MW. Feasibility studies have been completed for 94 sites with an estimated capacity of 116 MW.

By early 1980, the NEA had equipment loans from France, the PROC, Norway, and the Federal Republic of Germany, in addition to its support from the United Kingdom for the development of mini hydro projects. The NEA identified specific projects with a capacity of 148 MW to be funded under the loan agreements and prepared a map showing the proposed development of sites under the various loan packages.

B. The Private Sector

The private sector market for mini hydro is comprised primarily of large companies, such as mines, sawmills, and food processing firms located in areas not served or adequately provided for by the National Power Corporation. Mini hydro presents a less costly power source alternative since most of these firms generate their own power at relatively high cost with bunker or diesel fueled reciprocating engines.

However, the promotion of mini hydro as a lower cost, alternative source of power in the private sector is limited by the fact that approvals have to be secured from NEA and the National Water Resource Council for the right to develop waterways into electric generating power for private use.

C. The ASEAN Market

During the Third Meeting of the ASEAN Ministers on Energy Cooperation held in Manila on October 6-8, 1981, one of the agreements reached was to promote ASEAN cooperation in the field of micro/mini hydro development.

Among others, this include the supply of equipment or contracting services when required on a preferantial basis among ASEAN member countries. An ASEAN Mini Hydro Information Exchange (MHINEX) program was established which requires the exchange of information among members regarding all tenders or requests for services or supply of equipment scheduled or projected.

II. THE RESPONSE - THE LOCAL MANUFACTURING PROGRAM

A. Rationale of a Local Manufacturing Program

Traditionally, the imported input into power projects comprise a substantial slice of the total project cost, about 60% - 70%. The plans, however, are to make the mini hydro program virtually 100% local input within the medium term. This move has been spurred by the realization that it is possible to ultimately develop the mini hydro program from indigenous resources and still maintain efficiency and low cost.

Within the Philippine context, the characteristics of the mini hydro program which make local participation viable are:

a) the number of power plants programmed for construction presents a large enough potential market for local equipment manufacturers, enabling competitive manufacturing costs.

b) the technology required for the manufacture of mini hydro equipment is relatively simple and within the level of existing engineering expertise and technical capability.

c) there are already a number of local companies in existence with sufficient capability in foundry, metals fabrication, electricals, civil works and structurals. What presently is not available locally is a laboratory testing facility for mini hydro.

d) the costs of individual power plants are low enough to permit the mistakes of learning to take place, without incurring unacceptable losses.

B. Benefits of a Local Manufacturing Program

In addition, a local manufacturing program for the Philippines brings with it major benefits:

a) self-reliance, thereby eliminating dependence on foreign sources for mini hydro technology;

b) conservation of precious foreign exchange required for importing mini hydro equipment.

During the initial six-year, an estimated $150M will be saved in foreign exchange;

c) the development of local engineering and construction expertise;

d) reduced capital costs --- $600/KW for local versus $1,000/KW from western sources;

e) improvement of the utilization of existing plants;

f) creation of indigenous employment;

g) creation of a potential export, dollar earning industry; and

h) development of related supply industries such as electricals.

As local technology and manufacturing capability evolve, it is expected that mini hydro power plant costs will be greatly reduced and thus making it more competitive than other alternative power sources.

C. Existing Local Power Plant Installations

While most of the electro-mechanical equipment already installed were imported, local manufacturers have supplied some equipment to NEA.

Presently, three (3) power plants, namely, BALIGUIAN, COYAO-YAO and DAWARA, with an aggregate capacity of 1 MW, were designed, manufactured and installed using Philippine technology, in very large measure.

These plants were installed and manufactured using Philippine design, except for some electrical components. By late 1984, there should exist in the Philippines a tested capability to manufacture a wide range of mini hydro equipment. (Please refer to EXHIBIT 3 - Details of Philippine designed and installed mini hydro power plants).

D. Transfer of Technology

1. Licensing Agreements

With the encouragement and support of the NEA, the private sector committed itself in support of the mini hydro program.

To develop expertise in the manufacture of mini hydro equipment, several companies entered into technology transfer agreements.

In April 1980, Atlantic, Gulf & Pacific Company of Manila entered into a licensing agreement with the CMEC of People's Republic of China for the transfer of technology in the manufacture of mini hydraulic turbines between 100 KW to 5,000 KW. For turbines over 5,000 KW, AG&P tied up with Escher Wyss of Switzerland.

There are a number of other local companies who have obtained access to foreign know how through cooperative production and licensing agreements.

2. Areas of Consideration for Technology Transfers

Based on Philippine experience, the following areas of consideration should be looked at in choosing the technology source:

a) Product Mix - this basically means that the product offering, in terms of type/model and capacity range should coincide with the requirements of the mini hydro program.

b) Engineering standards - this refers to the compatibility of the licensor's engineering standards to those which are accepted and used internationally (such as ASTM/ASME). AG&P's experience with CMEC of PROC which uses IEC standards relates initial difficulties in translating and adapting the Chinese standards to locally accepted engineering standards.

c) Communication - the spontaneity and ease of communication flow between the giver and recipient of the technology transfer is important. Again, drawing from AG&P's experience with a Chinese licensor, the language barrier problem crops up in instances such as interpretation of technical drawings and brochures, during training and during negotiations.

d) Guarantees - this refers to the licensor's guarantee of the equipment's performance, in terms of efficiency and output; and against manufacturing defects by the licensee.

e) Royalties - technology transfers in the Philippines are closely monitored by the government. Foreign exchange remittances are usually subject to government regulations and therefore, the licensing agreement should take into consideration questions like the amount of royalty, the minimum volume of production required for such royalty, and manner of remittance to licensor.

E. Problem Areas in Implementation

The promotion and implementation of local manufacturing program for mini hydro in the Philippines however,

is not without problems:

1) Financing

The success of the local manufacturing program depends on the availability of long term credit. It has been established that small hydro projects can be viable and generate power below current NPC rates if suitable financing is available. (EXHIBIT 4 - Computed Cost of Power at Various Financing Terms).

As a result, the NEA has relied heavily on imported equipment, primarily because of the concessional financing terms, tied in with the supply of these equipment. (Please refer to EXHIBIT 5 - Foreign Financing Terms to NEA).

To shift from foreign to local sources, the NEA must be able to secure financing for locally sourced equipment competitive with foreign offerings.

Based on NEA's development plan, this means funding of about P153M for equipment purchase with a proposed term of 10-15 years and an interest rate of not exceeding 10%.

As it presently stands, the NEA can only purchase locally what can be covered with the long-term financing it was able to secure so far --- ₱60M or an equivalent 12,000 KW. In terms of number of units, this is approximately equivalent to 24 units at an average of 500KW.

2) Design and Volume Limitations

Because of funding and socio-political considerations, site selection of mini hydroelectric plants is not definite nor sufficiently advanced. Therefore, it is difficult for loca. manufacturers to plan the exact models of equipment to be manufactured. This inability to standardize designs tend to make local manufacture at this stage uneconomic.

Further, for local manufacturing to be viable, the number of mini hydro equipment planned for installation by the NEA should be enough to sustain production. Due to lack of financing, however, NEA's schedule is less than firm. This uncertainty does not allow for planning on the part of local manufacturers and certainly not conducive to commitment of company resources.

III. CONCLUSIONS

The private sector has given its support and commitment to the Philippine mini hydro program through the local manufacturing program. For it to be viable, however, there are some prerequisites needed:

a) Consistent Government Policy

The local manufacturing program needs a market base which must be a) substantial -- for the venture to be economically attractive and feasible, and b) fairly constant -- to allow for long-term planning.

In this connection, there is a need for the government to come up with a definite, clearly drawn out program which will be the basis for the local manufacturers' planning for investment. The local manufacturers' plans and directions would be more positive if based on a national program which is integrated and consistent, and not subject to change in short periods of time.

b) Need for Long-term Credit

The principal constraint in obtaining mini hydro business for local manufacturers is the lack, domestically, of long term, low cost financing.

The NEA has decreed that sales of power for mini hydro plants must be at rates low enough to be competitive with alternative energy sources. Generation cost lower than NPC-supplied power is only possible with financing.

Foreign manufacturers are supported by their respective governments by providing NEA with very liberal terms. For local manufacturers to compete successfully with foreign suppliers and meet the hurdle rates imposed by NEA, government intervention and support is required to make available to these local manufacturers long-term funding.

c) Existence of Local Infrastructure

The success of a local manufacturing program for mini hydro equipment presupposes that local capability in terms of basic technology required for mini hydro equipment manufacture, e.g. casting, welding, machining, testing, etc., is already in existence in one country.

On the assumption that the program for mini hydro development in any country is finite, it will therefore be difficult and economically not feasible to put up a plant solely dedicated to the manufacture of mini

hydro plant. When the mini hydro program has been completed and its objectives accomplished, then it would be easy for the local manufacturing firms to shift its resources to the manufacture of other product lines which will make use of its acquired technology and plant capacity.

IV. RECOMMENDATION

Mini-hydroelectric projects are intended to make a distinct contribution to the energy development program. It promises rural progress and development through a reasonably priced and dependable energy supply.

For the country to maximize the benefits arising out of this program, there is a need to further accelerate the promotion of local design and manufacture of mini hydro equipment and ancillaries.

To be able to do this, the following problem areas need to be looked at and acted on:

1. Long-term low cost financing- to enable local manufacturers to compete with foreign-supplied equipment and to be able to meet the hurdle rates imposed by NEA.

Furthermore, the government should be able to extend an umbrella of incentives to manufacturers to make the local fabrication program financially attractive.

2. Evaluation of economic impact - to justify the promotion of local mini hydro industry, the NEA should monitor the mini hydro program and evaluate the economic impact -- quantitatively and qualitatively --- of local versus imported technology. This way request for government support in terms of funding can easily be supported and justified.

SCHEDULE OF PHYSICAL TARGETS
1981 - 1990 (MW)

EXHIBIT 1

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Total
UK		1	7	3	4	9	3				27
PROC			5	18	21	20	14				78
FRANCE			4	5							9
GERMANY					2						2
JAPAN						4					4
NORWAY					5						5
ADB					4	4					8
LM	1		2	3	4	5	15	18	18	18	84
UNCOMMITTED							10	24	24	25	83
TOTAL	1	1	18	29	40	42	42	42	42	43	300

EXHIBIT 2

SCHEDULE OF PHILIPPINE MINI HYDROELECTRIC PROGRAM DEVELOPMENT BY REGION (In MW)

	Number of Rivers and Streams	1981	1982	1983	1984	1985	1986	1987	TOTAL
LUZON									
Region I	39	3.34	2.30	5.91	9.70	2.67	10.14	16.58	50.64
Region II	26	3.56	5.42	-	7.80	6.90	7.72	20.98	52.27
Region III	24	2.28	2.00	8.70	5.50	7.40	9.22	5.94	41.04
Region IV	19	-	2.50	2.70	3.70	9.35	5.60	3.16	27.01
Region V	16	-	3.54	3.54	4.10	0.80	-	-	11.98
Subtotal	124	9.18	15.76	20.85	30.80	27.12	32.68	46.66	183.95
VISAYAS									
Region VI	24	6.03	1.98	2.50	1.50	3.50	9.06	8.10	32.67
Region VII	18	-	0.50	4.25	2.40	2.80	3.70	3.30	16.95
Region VIII	14	0.94	8.74	7.60	0.75	-	1.70	-	19.73
Subtotal	56	6.97	11.22	14.35	4.65	6.30	14.46	11.40	69.35
MINDANAO									
Region IX	5	-	1.00	-	0.51	-	6.20	-	7.71
Region X	11	-	0.20	1.80	2.80	6.20	-	0.28	11.28
Region XI	14	-	0.80	2.00	2.86	8.99	2.10	3.00	19.75
Region XII	16	-	-	1.00	3.55	6.56	3.88	-	14.99
Subtotal	46	0.00	2.00	4.30	9.72	21.75	12.18	3.28	53.73
TOTAL	226	16.15	28.98	40.00	45.17	55.17	59.32	61.34	306.13

Source: National Electrification Administration

EXHIBIT 3

DETAILS OF PHILIPPINE DESIGNED AND/INSTALLED MINI HYDRO POWER PLANTS

BALIGUIAN RIVER

Location	Presentacion, Camarines Sur
Gross head	28 m
Net Head	27 m_3
Discharge	.6 m^3/sec
Capacity	100 KW
Type of turbine	propeller-type vertical shaft
Type of scheme	run-of-river
Distance from the electric cooperative	Co-op to Tigaon seaport: 12KM Seaport to site (by pump boat, 2 1/2 hours): 20 KM

COYAO-YAO

Location	Bo. Sangay, Tigaon, Camarines Sur
Gross head	51 m
Net Head	40-45 m_3
Discharge	0.85 m^3/sec
Capacity	175 KW
Type of turbine	Francis vertical
Type of scheme	run-of-river
Distance from the electric cooperative	Co-op to site: 21 KM; 30 mins. trip

DAWARA

Location	Bo. Suyo, Tagudin, Ilocos Sur
Gross head	47 m
Net Head	40-45 m_3
Discharge	0.67 m^3/sec. per unit
Capacity	175 KW
Type of turbine	Horizontal Francis type hydraulic
Type of scheme	run-of-river
Distance from the electric cooperative	Co-op to Bitalag Junction: 15 KM Bitalag junction to site: 14 KM

EXHIBIT 4

COMPUTED COST OF POWER AT VARIOUS FINANCING TERMS

Terms	COST OF POWER		
	Easy Site	Average Site	Difficult Site
10%, 20 years	₱.30	₱ .34	₱ .40
12%, 25 years	.32	.36	.42

EXHIBIT 5

FOREIGN FINANCING TERMS TO NEA

Source	Value	Conditions	
		Rate	Term
CHINA	US$30M	7.5%	14 years
FRANCE	US$19M	5.9%	19 years
JAPAN	US$5M	3.5%	25 years
NORWAY	US$5M	grant	
U. K.	US$31M	5.02%	15 years