資料３－２　追加T/R

ADDITIONAL TERMS OF REFERENCE
(PROPOSED FOR INCLUSION IN THE PROPOSAL FOR THE TMPROVEMENT OF O & M IN PUMPING IRRIGATION SYSTEM)

1. OBJECTIVES

a. To undertake study for the repair, rehabilitation and replacement of pump systems.

b. To identify probable project components in conjunction with the Agency's programs for the improvement and accleleration of the institutional development works on pumping irrigation systems.

c. To examine the technical and economic feasibility of implementing the identified project components.

2. BACXGROUND INFORMATION

During the 1960's - 1970's, small-scale (4"Φ to 10"Φ) pumps were acquired by NIA through loans and bilateral arrangements and distributed to farmers, irrigations'associations and corporations hrough lease or rental. As these have been in operation for quite a time and the inability of the recipients to properly maintain them, a number have broken down and out of commission. The wear and tear on the equipment make the operation expensive. The lack of spare parts, maintenance personnel and institutional support contributed to the deterioration of the existing pump irrigation systems.

This situation brings adverse effects such as loss of production opportunity with regards to food and loss of income with regards to farmers who belong to the poorer sector of the economy.

3. NEED FOR IMPROVING O & M IN PUMP IRRIGATION SYSTEMS

In order to solve the problems mentioned and help improve the financial viability of farmers, NIA envisions to undertake repairs, rehabilitation and replacement of small scale pump irrigation systems. In this way, the pump could be operated economically and efficiently and the steady innearer in the non-operational pumps would be arrested. To maximize the efficiency under this type of irrigation system, an integrated institutional development program would be launched by

NIA among farmers' operators, beneficiaries, and irrigators' association members. The institutional supporting services would include training of the farmers in the effective operation and maintenance of pump systems as well as on the modern agricultural practices.

4. SCOPE OF THE STUDY

a. Review all available data and information and prepare detailed program for additional collection of data, surveys and investigations required.

b. Investigate and evaluate the current status of pump irrigation systems throughout the country.

c. Carry out studies and formulate practical programs for the repair, rehabilitation and replacement of existing pump irrigation systems.

d. Carry out studies on probable components centered on the institutional development activities in pumping irrigation systems with emphasis on maintaining sustaining a more viable operation.

e. Undertake economic and financial analyses of the components.

f. Prepare a schedule and program of implementation of the above activities.

5. SCHEDULE OF STUDY

It is proposed that this additional study shall be completed within the 18-month period alloted for the main study.

説明資料 1

REHABILITATION AND DEVELOPMENT PROGRAM OF PUMP IRRIGATION SYSTEMS NATIONAL IRRIGATION ADMINISTRATION

1.0 BACKGROUND

There are three major irrigation systems in the Philippines: (1) National Irrigation Systems, (2) Communal Irrigation Systems and (3) Pump Irrigation Systems.

The nationwide service area covered by pump irrigation systems is about 170,000 hectares. Mostly surface water rather than groundwater sources are tapped to irrigate these areas with pumps of various sizes and capacities.

The increase in service area covered by pumps was made possible through the pump distribution program made by the defunct Irrigation Service Unit and later by the National Irrigation Administration (NIA). NIA pump dispersal program (Annex 1) was deferred. NIA also maintains and operate a limited number of National pump irigation systems covering an area of 22,493 has. (Annex 2)

In 1969, the Philippine Government realizing the need of groundwater to supplement surface water sources specially during the dry season, requested the United National Development Programme (UNDP) for assistance in improving irrigation facilities through groundwater development. The Food and Agriculture Organization (FAO) of the United Nation was assigned as the executing Agency with NIA as the government cooperating agency. The NIA-UNDP/FAO Groundwater Irrigation Project became operational

from 1971 to 1975. Several tubewells were installed in the Diezmo Irrigation System in Laguna for conjunctive use of surface and groundwater and Guimba, Nueva Ecija for purely groundwater irrigation source. In addition, exploratory wells convertible to production well were installed in Laguna and Nueva Ecija.

Another groundwater project, the Central Luzon Groundwater Irrigation Project (CLGIP) was undertaken by NIA from 1976 to 1981. CLGIP was funded by 129 M pesos loan from the Overseas Economic Cooperation Fund (OECF) of Japan and 217 million pesos local fund. Two hundred fourty (240) deepwells to irrigate 12,000 hectares was programmed in the provinces of Pangasinan, Nueva Ecija, Tarlac, Pampanga and Bataan.

In 1981, CLGIP completed 90 pumping stations out of the 240 deepwells due to frequent repair and rehabilitation of completed stations, slow institutional development and inadequate release of funds.

Presently, most of tubewells (ANNEX3) installed by NIA-UNDP/ FAO groundwater irrigation project and CLGIP are not operational due to the increase in power rates resulting in a corresponding increase in irrigation fees. From ₱0.220/Kwh in 1978 to ₱0.448/kwh in 1981, O & M cost increased from 16.7 to 31.7 cavans per hectare annually. Farmers objection to increased irrigation fees caused the pumps to shut down.

With these background and experience, there is a need to develope a consolidated pump irrigation system rehabilitation and development program.

2.0 OBJECTIVES

The general objective of the program is to make the pump irrigation systems viable in order to increase the irrigated area.

The specific objectives are program development for both operational and non-operational pump irrigation systems. Program development for the Improvement of operation and maintenance of Pump Irrigation Systems will primarily be concentrated on the following programs:

1. Pump Rehabilitation Program
2. Surface and Groundwater Conjuctive Use Program
3. Small Pumps Replacement and Dispersal Program
4. Institutional development of Irrigators Association to reduce operation and maintenance cost.

3.0 COMPONENT PROGRAMS

3.1 Pump Irrigation Rehabilitation Program

Tubewells and surface water pumping systems that have been partly or entirely affected by time due to wear and tear, misuse and unuse should be rehabilitated to gain or regain its maximum utilization for diversified crop production.

Operating and non-operating pumps, tubewells, peripheral accessories, power transmission lines, and control devices, etc. or anything that affects the efficient

operation of the pump irrigation system should be monitored and evaluated for repair and/or replacement.

Overall inventory of available and necessary unavailable equipment and material is a necessary step towards a pump irrigation rehabilitation program.

The following component programs may be linked to the pump irrigation rehabilitation/development program:

1. Repair and Maintenance Program
2. Replacement and dispensal Program
3. Power Generation Program (Mini hydro power generation program)
4. Institutional Rehabilitation and Development Program
5. Crop Diversification Program
6. NIA-IA Turn-over Program
7. Canal Network Rehabilitation and Development Program
8. Turbine Pump Program
9. Others

3.2 Surface and Groundwater Conjunctive Use Program

All irrigation systems suffers a reduction in water supply from wet to dry season. This is true in both surface and groundwater irrigation systems. For surface water irrigation systems this is manifested in terms of reduction in irrigated area from wet to dry season due to reduction in the surface water flow. Likewise, in

groundwater irrigation systems, water yield also decreases in the dry season due to the lowering of the water table caused by the eduction in water recharge to the water bearing aquifers.

To eliminate or minimize the reduction in irrigated area from wet to dry season, surface and groundwater conjunctive use irrigation system may be necessary.

A case in point is the Central Luzon area covering the provinces of Bulacan, Nueva Ecija, Pampanga, Tarlac and Pangasinan. With the major dams of Pantabangan and Angat-Maasim, water supply in the dry season is deficient. The proposed Balog-Balog dam in Tarlac, even if constructed, will not fully solve the problem of water deficiency during the dry season. Other dams may be constructed in the Sierra Madre and Zambales mountain ranges but this will not fully solve the dry season water deficiency.

3.3 Small Pump Replacement and Dispersal Program

The National Irrigation Administration had a pump dispersal program. Annex 1 shows the pumps dispersed by NIA nationwide. The area irrigated by these pumps is sizeable. The program was deferred from one reason or another. The primary reason for deferring the pump dispersal program could be the lack of supply of pump. Monitoring, servicing and farmers attitude affected the low amortization collection.

At present, most of these pumps are not serviceable anymore due to breakdown and lack of spare parts. Numerous pumps are missing and the owner could not be located (See Annex 1). Consequently, the irrigated area reported in 1983 is definitely reducted to a great extent.

Reviving and increasing the pump service area would definitely need repair and maintenance, replacement and dispersal program. Local manufacture of these pumps is necessary to ensure spare part availability.

4.0 COMMON COMPONENT PROGRAMS

Common component programs should support the Pump Rehabilitation and Development Program. The following are the component programs.

4.1 Repair and Maintenance Program

Repair and maintenance support program is necessary for continuous and efficient operation of pump irrigation systems. Periodic monitoring, repair, servicing and maintenance should be institutionalized. Spare parts should be made readily available through a unit in the NIA who will sell spare parts at cost. Sapre parts availability would be enhanced with the manufacture of pumps and spare parts locally. Local manufacturer has the capacity to fabricate and manufacture pumps and spare parts.

NIA should coordinate with the manufacturer and farmer-users regarding back up spare parts demands and supply.

Other devices, such as lifting device for repair, power control devices etc., should be made available.

4.2 Replacement Program

Complimentary with the Repair and Maintenance Program, a replacement program is necessary when the pump set up is beyond repair or when it is more costly to repair than replace a pump system. The primary consideration would be economics of repair or replacement.

Replacement Program would ensure continuous operation as consequently continuous irrigation for a pump irrigation area.

4.3 Power Generation Program (Mini hydro power generation program).

Most deepwell pump are idle due to high power cost that farmer are not agreeable to pay higher irrigation fees.

Alternative power sources may be generated to lower the high energy cost.

4.3.1 Mini Hydro (from nearby watershed areas)

Identification of possible sites and mini hydro construction outside the service area of the system for electric power generation. Generated electricity may be channeled thru the existing power grid and retrieved where the electric power is needed. Special arrangements with the power company like NPC should be negotiated.

4.3.2 Mini Hydro (from existing drop or available head in irrigation systems)

Survey, identification, and location of existing drop in irrigation systems may be used for

power generation using a mini hydro. Similarly, to reduce the cost of power transmission, the generated power should be channeled to an existing transmission line and retrieved where needed.

The Baligatan mini hydro has this kind of arrangement with the NPC. Some kind of power, exchange or barter works wherein the power generated in the mini hydro is channeled to the NPC grid and NIA uses power at other locations.

4.3.2 Dendro Thermal Power

The use of timber for steam generation and conversion to electric energy may be tapped. This requires a steady supply of timber e.g. ipil-ipil to make the steam boilwrs work continuously. Development of forest in the watershed may take time.

4.4 Institutional Rehabilitation and Development Program

Irrigators' Associations were established in pump systems that were operated. However, when the pump irrigation system ceased its operation, the irrigator association became inactive. This require rejuvination and rehabilitation.

In areas where tubewells were not operated for irrigation, there is a need to develop and organize a viable irrigators' association who will assist or operate and maintain the pump irrigation system.

4.5 Crop Diversification Program

Pump irrigation system are relatively costly than surface water irrigation system. Higher O & M cost, in pump systems may be justified by higher income generated thru diversified crop production.

Soil analysis and crop suitability analysis has to be made the determine the marketable crop that will yield the highest farm income.

4.6 NIA-IA Pump Turnover Program

NIA objective is to create a viable pump irrigation system which will later be operated and maintained by the farmers thru the irrigators' association.

After NIA has demonstrated the viability of the pump irrigation system to the farmers irrigators' association for a number of seasons, turnover of the pump system to the IA should follow. NIA has to monitor the O & M, supply support services and spare parts, and collects amortization/ irrigation fees. This will make O & M less costly, simplify NIA work and make the farmers run their own irrigation system.

4.7 Pump Irrigation Canal Network Rehab and Development Program

Pump irrigation systems that stopped operation may have deteriorated canal network that needs rehabilitation. Pump systems that were not yet operated needs a canal network for water distribution.

Rehabilitation and development of canals should consider the design criteria for diversified crop irrigation.

4.8 Turbine Pump Program

Areas not feasible for gravity irrigation may be irrigated without power cost due to diesel fuel or electicity by a water turbine pump. The irrigable area of a turbine pump varies with the available head and size of the turbine pump. It may range from a few hundred to a thousand hectares.

5.0 PROGRAM IMPLEMENTATION STRATEGY

The task of rehabilitation and development of pump irrigation systems may be started by the following recommended steps.

5.1 Creation of NIA pump Irrigation Projects.

Initially an officer incharge may be designated to coordinates the task under the PDS SOEM. Needed staff will be detailed to the projects as the need arises. Detailed program development will be the responsibility of the project.

5.2 Project Proposal Development

Any of the above program may be proposed for technical assistance, grant and aid to receptive funding institutions.

5.3 Action Research Development

Action research proposal in cooperation with research institutions who have interest in pump irrigation should be undertaken. Joint funding arrangements should be incorporated in the proposal.

5.4 Project Fundings

NIA should allocate seed fund to start the above programs. Other government funding institutions may be encourage thru cooperative ventures.

The private sector e.g. fertilizer companies, manufacturing firm etc. may be tapped for cooperative research and development.

1-5 STATUS OF NIN PUMP IRRIGATION DISPPENSAL

(SMALL PUMPS)

As of Dec. 31, 1983

Region	Operational	Non-Operational	Missing	Grand Total
I	1,224	275	66	1,565
II	3,433	322	62	3,817
III	3,974	565	228	4,767
IV	2,898	526	162	3,586
V	1,303	319	55	1,677
VI	1,741	71	55	1,867
VII	335	30	13	378
VIII	293	93	3	389
IX	331	9	1	341
X	282	142	10	434
XI	825	56	15	896
XII	692	57	21	770
Total	17,331	2,465	691	20,487

1985 Statistical Data on National Pump Irrigation System in Operation

National Pump Irrigation System	Location	Pump Service Area(ha.)	Horse-power Range	Irrigated Area	
				Wet	Dru
Bonga Pump II 1	Sarrat, Ilocos Norte	298	125	125	117
Bonga Pump II 2	San Nicolas I. Norte	674	200-300	493	233
Bonga Pump II 3	Tangid, Laoag City	202	75-100	136	77
CIADP-IC	Cagayan	3,125	120-1050	1,656	1,651
Solana	Cagayan	1,320	500	907	928
UPPIIS-District IV	Nueva Ecija	530	100	398	362
Angat-Maasim	Bulacan	2,153	75-350	1,942	1,849
Cabuyas East	Laguna	982	350-500	564	537
Diezmo	Sta. Rasa, Laguna	911	60-100	768	335
Libmanan-Cabusas	Camarines Sur	3,427	200	589	482
Mabitac	Sta. Maria, Laguna	481	100-400	-	480
MARIIS	Isabela	8,390	350-550	-	-
	Total	22,493		7,578	7,051

LIST OF EXISTING PUMPING STATIONS

REGION I

NATIONAL PUMP IRRIGATION SYSTEM	LOCATION	QTY.	HP	CAPACITY (M^3/MIN.)	PUMP SERVICE AREA(HAS.)
Laoag Vintar RIS	San Antonio Sarrat, Ilocos Norte	1	125	37.85	420
-do-	-do-	1	125	37.85	420
Ilocos Norte Irrigation Service	San Nicolas	1	200	56.78	630
-do-	-do-	1	200	56.78	630
-do-	-do-	1	300	94.62	1,051
-do-	Tangid, Laoag City	1	75	34.07	378
-do-	-do-	1	75	34.07	378
-do-	Sta. Barbara Pangasinan	1	15	30.0	333
-do-	-do-	1	15	30.0	333
-do-	Totonoquen, Rosales Pangasinan	1	100	45.42	504
-do-	-do-	1	100	45.42	504
-do-	Santiago, Binalonan Pangasinan	1	100	4.92	54
CLGIP	Sumabnit, Binalonan Pangasinan	1	75	4.92	54
-do-	Luebeg, Laoac Pangasinan	1	75	4.92	54
-do-	Anoyao, Laoac Pangasinan	1	75	7.0	77
-do-	Casampagaan, Laoac Pangasinan	1	100	7.97	88
-do-	Linmansangan, Binalonan Pangasinan	1	75	7.0	77
-do-	Capaitan, Laoac Pangasinan	1	75	7.0	77
-do-	Santiago, Binalonan Pangasinan	1	75	7.0	77
-do-	Anis, Laoac Pangasinan	1	75	7.0	77
-do-	Caringayan, Pangasinan	1	75	7.0	77
-do-	Cabilaoan, Pangasinan	1	75	7.0	77
-do-	Cabilaoan West Pangasinan	1	75	7.0	77
-do-	Sumabnit, Binalonan Pangasinan	1	75	7.0	77
-do-	Botique, Laoac Pangasinan	1	75	7.0	77
-do-	Dumayat, Binalonan Pangasinan	1	75	7.0	77
-do-	Aramal, San Fabian Pangasinan	1	40	4.92	54
-do-	Amanaoac, Mapandan Pangasinan	1	75	7.0	77

LIST OF EXISTING PUMPING STATIONS

REGION I (cont'd)

NATIONAL PUMP IRRIGATION SYSTEM	LOCATION	QTY.	HP	CAPACITY (M3/MIN)	PUMP SERVICE AREA (HAS)
CLGIP	Matic-Matic Sta.Barbara, Pangasinan	1	70	75.0	833
-do-	Angia, San Fabian Pangasinan	1	40	4.92	54
-do-	Cabaruan, San Fabian Pangasinan	1	40	4.92	54
-do-	Cabaoangan, San Fabian Pangasinan	1	40	4.92	54
-do-	Lambayan, Hapandan Pangasinan	1	75	7.0	77
-do-	Banzal, Sta. Barbara Pangasinan	1	75	7.0	77
-do-	Dumayat, Binalonan Pangasinan	1	75	7.0	77
-do-	Erfe, Hapandan Pangasinan	1	75	7.0	77
-do-	Leet, Sta.Barbara Pangasinan	1	75	7.0	77
-do-	-do-	1	75	7.0	77
-do-	-do-	1	75	7.0	77
-do-	San Roque, Guimba Nueva, Ecija	1	60	5.67	63
-do-	Bantug, Guimba Nueva Ecija	1	75	5.67	63
-do-	Cawayan, Bugtong Guimba, Nueva Ecija	1	75	5.67	63
-do-	Tampac, L, Guimba Nueva Ecija	1	75	7.0	77
-do-	Banitan, Buimba Nueva Ecija	1	75	7.0	77
-do-	Sta, Maria San.Jacinto Pangasinan	1	40	4.92	54
-do-	Queoel, San Jacinto Pangasinan	1	40	4.92	54
-do-	Botac, Sta.Barbara Pangasinan	1	75	7.0	77

LIST OF EXISTING PUMPING STATIONS

REGION I (cont'd)

NATIONAL PUMP IRRIGATION SYSTEM	LOCATION	QTY.	HP	CAPACITY (M^3/MIN)	PUMP SERVICE AREA (HAS)
CLGIP	San Joaquin, Balungao Pangasinan	1	75	7.0	77
-do-	San Raymundo, Balungao Pangasinan	1	75	7.0	77
-do-	San Aurelio, Balungao Pangasinan	1	75	7.0	77
-do-	Capuluan, Balungao Pangasinan	1	75	7.0	77
-do-	San Joaquin, Balungao Pangasinan	1	75	7.0	77
-do-	Bibiclat, Cuyapo Nueva Ecija	1	75	7.0	77
-do-	Bibiclat, Cuyapo Nueva Ecija	1	75	7.0	77
-do-	Palina,West Urdaneta Pangasinan	1	75	7.0	77
-do-	-do-	1	75	7.0	77
-do-	Buenlag,Urdaneta Pangasinan	1	75	7.0	77
-do-	Cabaruan,Urdaneta Pangasinan	1	75	7.0	77
-do-	Tampac I., Guimba Nueva Ecija	1	75	7.0	77
-do-	Cabauangan,Nampicuan Nueva Ecija	1	75	7.0	77
-do-	Pindangan, Alcala Pangasinan	1	75	7.0	77
-do-	Caput, Orion Bataan	1	75	7.0	77
-do-	Caput, Orion Bataan	1	75	7.0	77
-do-	Sto. Domingo Bataan	1	75	7.0	77
-do-	Tuyo,Balanga Bataan	1	75	7.0	77
	Total	65			

NOTE: PUMP SERVICE AREA WAS COMPUTED BASED ON 1.5 LITERS PER SECOND PER HECTARE WATER REQUIREMENT.

LIST OF EXISTING PUMPING STATIONS

REGION II

NATIONAL PUMP IRRIGATION SYSTEM	LOCATION	QTY.	HP	CAPACITY M^3/MIN.	PUMP SERVICE AREA (HAS.)
	Tuguegaras, Cagayan	1	150	39.74	441
-do-	Tuguegaras, Cagayan	1	150	39.74	441
-do-	Solana, Cagayan	1	500	102.20	1135
-do-	-do-	1	500	102.20	1135
-do-	-do-	1	500	102.20	1135
-do-	-do-	1	500	120.20	1135
	Piat, Cagayan	1	75	13.86	154
-do-	Piat, Cagayan	1	100	13.86	154
-do-	Piat, Cagayan	1	200	13.86	154
	Pamplona, Cagayan	1	150	51.0	566
-do-	-do-	1	150	51.0	566
JIADP	Iguig P. S.	3	120	37.6	417/1251*
-do-	Alcala-Amulung P.S.	3	315	70.5	783/2349*
-do-	-do-	1	240	80.0	888
-do-	Magapit P.S.	4	1050	340.0	3777
MPMP	Station No.1	3	350	69.0	766/2298*
-do-	Station No.2	5	550	199.2	2213/11065*
-do-	Station No.3	5	400	88.8	986/4930*
	Total	35			

* The first value was computed based on the capacity per pump multiplied by 1.5 liter per second per hectare water requirement. The second value was computed by multiplying the first value by the quantity of pump sets.

LIST OF EXISTING PUMPING STATIONS

REGION III

NATIONAL PUMP IRRIGATION SYSTEM	LOCATION	QTY.	HP	CAPACITY (M^3/MIN)	PUMP SERVICE AREA (HAS)
ARMIS	Tibagin, Bustos, Bulacan	1	250	35.20	391
-do-	-do-	1	250	35.20	391
-do-	-do-	1	350	70.40	782
-do-	-do-	1	350	70.40	782
-do-	Malamig, Pandi Bulacan	1	150	60.56	672
-do-	-do-	1	150	60.56	672
-do-	San Rafael, Bulacan	1	75	28.0	311
-do-	-do-	1	75	28.0	311
TISIP	San Manuel, GW, Pilot Project	1	60	5.68	63
-do-	-do-	1	60	5.68	63
-do-	-do-	1	60	5.68	63
-do-	-do-	1	60	5.68	63
-do-	-do-	1	60	5.68	63
-do-	Buenavista, Pura Tarlac	1	150	7.95	88
-do-	Nilazin, Pura Tarlac	1	100	8.70	96
-do-	Matindeg, Pura Tarlac	1	100	5.11	56
-do-	Balbaloto, Victoria, Tarlac	1	125	6.8	75
-do-	Buenavista,Pura Tarlac	1	150	9.84	109
-do-	Polores, Capas Tarlac	1	40	2.27	25
-do-	-do-	1	40	2.27	25
-do-	-do-	1	40	2.27	25
-do-	San Juan,Concepcion, Tarlac	1	75	4.54	50
-do-	Marga, Capas Tarlac	1	40	2.27	25
-do-	Villa, Bacolor	1	60	5.68	63

LIST OF EXISTING PUMPING STATIONS

REGION III (cont'd)

NATIONAL PUMP IRRIGATION SYSTEM	LOCATION	QTY.	HP	CAPACITY (M^3/MIN)	PUMP SERVICE AREA (HAS)
TISIP	Salapungan, Gerona, Tarlac	1	60	5.67	63
-do-	Baculomo,Victoria Tarlac	1	75	6.8	75
-do-	Sta. Cruz,Tarlac Tarlac	1	40	3.02	33
-do-	San Jose, Tarlac Tarlac	1	75	4.92	54
-do-	Tariji, Tarlac Tarlac	1	60	5.29	58
-do-	San Andres, Victoria, Tarlac	1	40	5.67	63
-do-	Naya, Pura Tarlac	1	50	4.54	50
-do-	Talaga, Capas Tarlac	1	79	5.67	63
-do-	San Juan, Concepcion, Tarlac	1	40	3.41	37
-do-	Dolores, Capas Tarlac	1	85	5.30	58
-do-	Matayum-Tayum, Lapaz, Tarlac	1	60	5.67	63
-do-	Lawang-Cupang, Lapaz, Tarlac	1	59	4.54	50
-do-	Sta. Cruz, Concepcion, Tarlac	1	100	9.08	100
-do-	Tarlac, Tarlac				
APIP	Penaranda, Nueva Ecija	1	100	27	300
-do-	-do-	1	100	27	300
	TOTAL	39			

NOTE: Pump service area was computed based on 1.5 liters per second per hectare water requirement.

LIST OF EXISTING PUMPING STATIONS

REGION IV

NATIONAL PUMP IRRIGATION SYSTEM	LOCATION	QTY.	HP	CAPACITY (M^3/MIN)	PUMP SERVICE AREA (HAS
LBDP-IC	Sta. Rosa, Laguna	1	100	13.25	147
-do-	-do -	1	100	10.22	113
-do-	-do-	1	60	4.57	50
-do-	-do-	1	60	5.67	63
-do-	-do-	1	35	9.82	109
-do-	-do-	1	60	13.33	148
-do-	-do-	1	60	6.75	75
-do-	Cabuyao, Bast	1	350	63	700
-do-	-do-	1	350	63	700
-do-	-do-	1	350	61	677
-do-	-do-	1	350	61	677
-do-	-do-	1	350	61	677
-do-	-do-	1	350	61	677
-do-	-do-	1	350	61	677
-do-	-do-	1	500	71	788
-do-	-do-	1	500	71	788
LBDP-IC	Mabitac	1	400	63	700
-do-	-do-	1	400	63	700
-do-	-do-	1	400	63	700
-do-	-do-	1	100	39	433
	Mindoro	1	160	62.5	694
PRDP	Mindoro	1	85	20.8	231
-do-	-do-	1	85	20.8	231
	Total	23			

NOTE: Pump service area was computed based on 1.5 liters per second per hectare water requirement.

説明資料 2

PUMP IRRIGATION SYSTEMS REHABILITATION/IMPROVEMENT PROGRAM

SITUATION:

1. 14% of NIA service area covered by pump irrigation systems

2. Most of tubewells installed are currently non-operational due to either of the following reasons:

   a) high cost of operations which NIA has to shoulder in the light of farmers' objection to increased irrigation service fees.

   b) in need of repair and others, directly needing replacement.

CHANGES NEEDED:

1. Beneficiaries of pump systems be organized into IA's to lease, acquire and/or pay amortization for pump units servicing their areas.

2. Pump Operators to be pooled either at provincial or regional level to train IA's and provide maintenance/ repair services to IA's for pumps' effective operations.

3. Reduce cost of pump systems operations.

4. Institutionalization of periodic monitoring, repair, servicing, and maintenance of pump systems.

PROGRAM STRATEGIES:

1. Pump Repair and Maintenance Program

2. Replacement Program

3. Management Systems for Pump Installation, Monitoring, and Control

1985 Statistical Data on National Pump Irrigation System in Operation

National Pump Irrigation System	Location	Pump Service Area (Ha.)	Horse-power Range	Irrigated Area	
				Wet	Dry
Bonga Pump II 1	Sarrat, Ilocos Norte	298	125	125	117
Bonga Pump II 2	San Nicolas I. Norte	674	200-300	493	233
Bonga Pump II 3	Tangid, Laoag City	202	75-100	136	77
CIADP-IC	Cagayan	3,125	120-1050	1,656	1,651
Solana	Cagayan	1,320	500	907	928
UPRIIS-District IV	Nueva Ecija	530	100	398	362
Angat-Maasim	Bulacan	2,153	75-350	1,942	1,849
Cabuyao East	Laguna	982	350-500	564	537
Diezmo	Sta. Rosa, Laguna	911	60-100	768	335
Libmanan-Cabusao	Camarines Sur	3,427	200	589	482
Mabitac	Sta. Maria, Laguna	481	100-400	-	480
MARIIS	Isabela	8,390	350-550	-	-
	Total	22,493		7,578	7,051

STATUS OF NIA PUMP IRRIGATION PROJECT

(SMALL PUMPS)

As of Dec. 31, 1983

Region	Operational	Non-Operational	Missing	Grand Total
I	1,224	275	66	1,565
II	3,433	322	62	3,817
III	3,974	565	228	4,767
IV	2,898	526	162	3,586
V	1,303	319	55	1,677
VI	1,741	71	55	1,867
VII	335	30	13	378
VIII	293	93	3	389
IX	331	9	1	341
X	282	142	10	434
XI	825	56	15	896
XII	692	57	21	770
Total	17,331	2,465	691	20,487

JENY-017

November 18, 1985

Mr. Jose B. del Rosario, Jr.
Assistant Administrator

Accelerated National Pumping Irrigation Systems Operation Project.
(Tentative tille)

Dear Sir,

It is my great pleasure to submit to you a report on this matter. I believe it is an excellent idea for NIA to own power stations for irrigation systems.

I enjoyed and was excited to formulate this project in spite of my shallow knowledge in this field. This would bring a new dimension on future irrigation projects.

As I mentioned in the report, it is recommendable that this project is divided in phases at the feasibility study stage, and a part of the project will be proper for grant aid program.

I hope for the early implementation of this project and that this report contributes to its success.

Your hearty attention to this matter is appreciated.

Truly yours,

NARUMI YAMADA
JICA Consultant

cc: Mr. Avelino S. Rivera
Director, Project Development Department

Mr. Sebastian I. Julian
Director, System Management Department

Dr. Lino P. Aldovino
Director, Design & Specifications Department

Accelerated National Pumping Irrigation System Operation Project

I Background

Since the so-called oil shock or energy crisis in 1973 and in 1978, the power rate has been rapidly escalating because of the increasing price of oil. It is general knowledge that the National Power Corporation depends mainly on oil to operate electricity. Other alternative energy sources such as geothermal power, hydropower, nuclear power, and solar energy are being developed. But, at present their use still seems in significant. This is due to (1) some need very expensive initial cost, (2) some are still in the experimental stage and (3) some are useful only for small scale application.

With this background, it is significant to utilize energy immanent in irrigation facilities such as dams, drops, etc. In the case of mini hydropower stations on irrigation facilities, the cost of civil works is saved comparing to other hydropower stations since most of the civil works serve both as irrigation facilities and mini hydropower stations.

On the other hand, the critical economic situation in the Philippines compels curtailment of expenditure. With this condition, projects which put existing facilities to practical use effectively are the most important, and should get the highest priority. One of the exisiting irrigation facilities which can not fulfill its function is the pump.

Existing national pumping irrigation systems are shown in Table-1, and Fig-1. The total of existing national pumping irrigation service area is about 42,000 ha. The total service area of Bonga, Solana-Tuguegarao, UPRIIS-Dist. IV, Angat-Masim, Libmanan-Cabusao and Cabuyao-East. which have been operated for years is 9967 Has, and their actual irrigated area in 1984 was 6453 Has. during the wet season and 5649 Has during the dry season. The irrigated area in 1984 was only 65% during the wet season and 57% during the dry season. According to the report of CLGIP, there are only two reasons why the pumps stopped their operation in the early stage of operation way back in 1981. Of the 30 shutdown pumps,28 were shutdown due to non-payment of irrigation service fee while the other two were due to pump breakdown. According to the report of ground water pilot areas in TISIP, the main reason for suspension of pumping operation was the increasing cost of electric power-consumption. During the operation of the pumps, the cost of electric power increased to about 555% from 1976 to 1982 but the price support of palay increased only by 54% over the same period. (Table 2) Based on the pumping operation of the pilot areas, the energy cost constituted nearly 60% of the total O & M cost and followed by the cost of supervision and repair and maintenance. (Table 3). In case of Limanan-Cabusao PIS, the condition of power cost is same.(Table 4).

In the case of Cabuyao East Pumping Irrigation System

in Laguna, the most important problem is that in a part of the service area private pumps have been installed by farmerselves, and they do not agree to join to the national pumping irrigation system. Considering existing power rate system, power rate increase depend on consumption of power. The power rate per KWH are more expensive if pumps consume more volume of power. That is, pump stations are the smaller scale the lower cost in the operation. Therefore, a large scale of pumping station is disadvantageous in the operation cost, it is natural that farmers who installed their peivate pumps do not agree to join to large scale pumping stations. If NIA can apply power with low cost, that inconsistency and the problem of the pumping irrigation system will be solved.

NIA is planning to operate mini hydropower stations constructed on the irrigation facilities in order to supply power to pumping irrigation irrigation systems. The generated power will be transmitted through NPC grid for which NPC will charge NIA about 10% of the power rate as transmission charge. NIA will operate 24 hours, but pumping station consume the power except peak hours, (pumping stations ordinarily operate from 10:00 p.m. to 5:00 p.m.) This will contribute to domestic electric consumption.

NIA's operation of mini hydropower stations using existing irrigation facilities will contribute to lower energy cost. This means lower irrigation fee for the farmers and subsequently an increase in their income. Moreover, this will pave the way for the development of upland crops irrigation.

II Project

1) Expected Power Consumption

Existing national pumping irrigation systems are shown in Table-1. The total service area is 41,957 Has, and their total maximum power is about 22,000 KW.

2) Power Supply

As all national pumping irrigation systems are located in Luzon Island, only mini-hydropower stations in Luzon Island were studied.

The irrigation facilities suitable for mini-hydropower stations are diversion dams and drops on irrigation canals. Such irrigation facilities are listed on Table-5 and Table-6.

Generated power is estimated as follows;

$$P = 9.8 \cdot n_t \cdot n_g \cdot Q \cdot H \cdot h \cdot f \quad (KW)$$

Here, P: Maximum generated power

n_t: Water wheel efficiency

n_g: Generator efficiency

Q: Discharge (m^3/s)

H: Height (m)

h: Loss head efficiency

t: Transmission efficiency

Assuming that $n_t = 0.82$, $n_g = 0.91$, $h = 0.9$, and $t = 0.9$,

$$P = 5.9\ QH \quad (KW)$$

In order to make preliminary estimation of maximum generated power at the proposed power stations, it is assumed that 80% of the maximum discharge, a half of dams' height, and 100% of the drops' height are used. The maximum generated power is estimated as follows.

Chico Dam	203	KW
Maris Dam	6356	
Rizal Dam	892	
Bongabon Dam	555	
Peñaranda Dam	135	
Agno Dam		
Bustos Dam	248	
Agno RIS Drops	6479	
Camiling RIS Drops	4561	
Ambayoan RIS Drops	114	
Depalo RIS Drops	259	
Magat RIS Drops	1333	
Tumawini RIS Drops	639	
Angat RIS Drops	344	
Sto. Tomas RIS Drops	446	
Dumacaa RIS Drops	195	
San-Miguel-Odonnel RIS Drops	298	
Tarlac RIS Drops	231	
Total	23388	KW

3) Project Formulation

According to the above estimation, the supply of power can cover the demand of power. However, for project formulation, many conditions should be taken in consideration, that is, (1) generally speaking, the cost of generators is cheaper in case of small discharge and high water drop than in a contrary case, (2) reliability of the discharge, (3) sediment problem, (4) distance from NPC grid, (5) demand in the near future such as Second Laguna De Bay Project, and so on.

Accordingly it is recommendable that other proper mini-hydropower station sites, even if they are of very small scale, which are located in or near the pumping irrigation systems are studied when the feasibility study is conducted and that the project be divided in phases depending on the necessity and economic profitability.

4) Construction Cost

The equipment cost of Baligatan Hydro-Electric Plant which generate six MKW was about 24 million pesos. The unit equipment cost is 4,000 pesos per KW. The unit construction cost would be about 6,000 pesos per KW including administration and civil work cost. In case of the Hayatsukigawa mini-hydropower station project which was completed in 1980 in Japan and which

generate six MKW, the unit construction cost was about 19,000 pesos per KW. As the scale of each power station of the proposed project is very small and height of water drop is small, the unit construction cost would be much higher than the above cases. If the average construction cost of each power station at the drop site is 15 million pesos, and that at the diversion dam site is 30 million pesos including engineering and administration cost, the project cost is 6S X 15 MP + 7 X 30 MP = 1,185 MP.

Assuming that operation and maintenance cost is 10% of the project cost, it will amount to 118.5 MP per year. And assuming that daily operation hours is 20 hours and that annual operation days is 300 days, the generated power will be 22,000 KW X 20 X 300 = 132 MKWH, and the cost of generation will be 118.5 MP /.132 MKWH = 0.90 P/KWH.

5) Benefit

The project benefit primarily accrues from the increased crop production due to stable pump operation and from the decreased pump operation cost.. Net return per hectare is estimated using the results of the Feasibility Study, Report on the Gumain River Irrigation Project which was estimated by the price level in December, 1984. In the estimation, irrigation cost with project is estimated as 46% of irrigation cost without project. The unit yield is the same in both

cases of with project and without project, Net return per hectare is shown in Table-7.

In case of without project, the irrigated area is estimated as 65% during wet season and 57% during dry season.

Benefit is estimated as follows:

Without Project	Wet Season	Dry Season	Total
Irrigated Paddy			
Area (Has)	27272	23915	
Net Return (₱/Has)	10791	12163	
Total Value (10^6₱)	294.29	290.88	585.17
Rainfed Paddy			
Area (Has)	14685		
Net Return (₱/Has)	3375		
Total Value (10^6₱)	49.56		49.56
With Project			
Irrigated Paddy			
Area (Has)	41957	41597	
Net Return (₱/Has)	11390	12951	
Total Value (10^6₱)	477.89	543.39	1021.28
Benefit (10^6₱)			388.55

From the above data, IRR is estimated as 17.8%.

	Cost		Benefit	Incr.	16%		18%		%	
r	Constr.	O & M		Benefit	D.F.	Value	D.F.	Value	D.F.	Value
	118.5			118.5	0.862	102.15	0.847	100.37		
	237			237	0.743	176.09	0.719	107.40		
	474	11.85	38.86	446.99	0.641	286.52	0.608	271.77		
	355.5	59.25	155.42	259.33	0.552	143.75	0.516	133.81		
		118.5	233.13	114.63	0.476	54.56	0.437	50.09		
		118.5	310.84	192.34	0.411	79.05	0.371	71.36		
		118.5	388.55	270.05	2.492	672.96	2.019	545.23		
al						98.67		9.67		

III Recommendation

This project is very timely from the point of utilizing irrigation facilities not to mention getting big benefit at a minimum expense. What success of this project brings is inestimable. It will give a new idea to projects which will be carried out in future. If mini-hydropower stations and irrigation facilities are constructed at the same time, the construction cost would be saved, and it would be easy to extend irrigable areas. And the development of diversified crops and upland crops irrigation will make rapid progress not only in area but also in technique and irrigation methods.

According to the above preliminary study, this project is feasible. But there are many problems which should be

solved in the feasibility study stage such as reliable discharge, sedimentation, distance from NPC grid to the proposed station sites, other proper station sites in or near the pumping irrigation systems, and so on. Accordingly it may be necessary for the feasibility study to be divided into phases in order to make implementation of this project smooth and effective.

It is very recommendable to carry out this project by foreign funds because it is expected that a considerable portion of the project cost will be of foreign currency.

Fig – 1 NATIONAL IRRIGATION SYSTEMS IN 1984

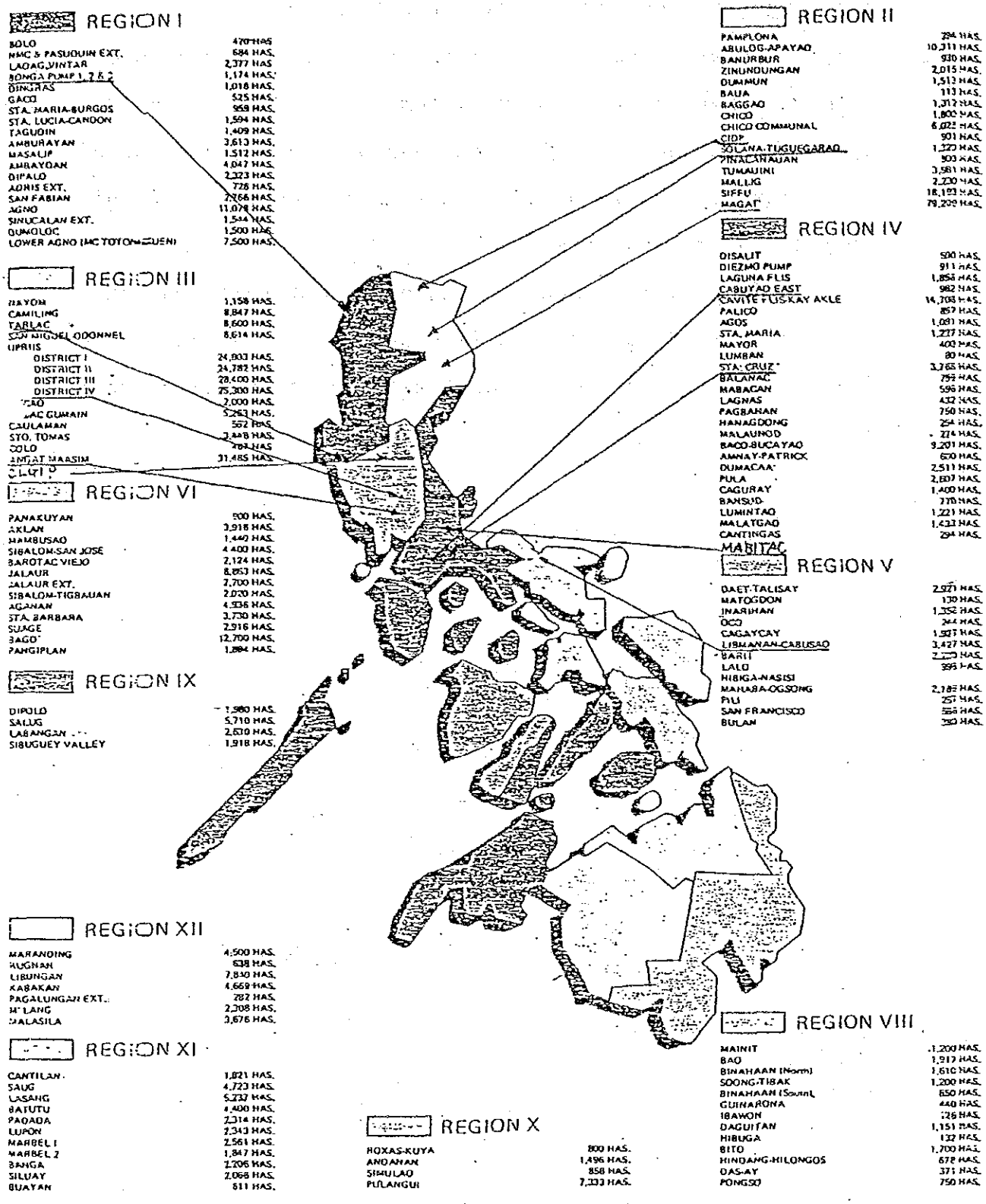

Table - 1 Existing National Pumping Irrigation System

National Pump Irrigation System	Service Area (Has)	Pump Irrigation Area (Has)	Location Province	Pumping Irrigated Area (Has) 1982 W	1982 D	1983 W	1983 D	1984 W	1984 D	Irrigation Fee (cav) W	Irrigation Fee (cav) D	Pumps limits and power
Bonga # 1	684	684	Ilocos Norte	0	165	122	91	640	410	8	12	2 X 125 HP
# 2	298	298	-do-	166	111	0	88	140	93	8	12	1 X 300 HP
# 3	674	674	-do-	509	323	150	92	523	216	8	12	2 X 750 HP
CIADP	13200	13200	Cagayan	0	0	63	519	907	631	7.5	9.5	
Magapit												4 X 1050 KW
Alcala-Amulong												3 X 315 KW; 1 X 240 KW
Iguigu												3 X 120 KW
Iguigu Booster												3 X 15 KW
Solana-Tuguegarao	1320	1320	-do-	724	807	1033	933	907	928	8	12	4 X 500 HP
UPRIIS-Dist. IV	25300	530	Nueva Ecejà	381	381	392	373	398	362	3.5	5.5	2 X 36", 2 X 30", 2 X 24" 2 X 16"
Angat-Masim	31485	2152	Bulacan	1912	1812	1899	1785	1942	1849			17 X (Total) 1210 HP
TISIP	8600	833	Tarrac									
Libmanan-Cabusao	3327	3327	Camarines Su	2151	1291	1582	1858	1331	1256	6	6	4 X 200 HP
Cabuyao-East	982	982	Laguna	568	519	540	334	572	535	6	8	3 X 100 HP
Mabitac	1667	1667	-do-							6	10	3 X 400 HP
Sta. Cruz	3790	3790	-do-					3100	2400			5 X 355 HP, 2 X 310 HP, 2 X 380 HP
Magat	97400	8000	Isabela									5 X 410 KW, 5 X 320 KW, 3 X 260 KW
CLGIP	4500	4500	Nueva Eceja Pangasinan									
Total		41597										

Table – 2 ELECTRIC ENERGY RATS

DURATION	ENERGY CHARGE	DEMAND CHARGE	% INCREASE*
976-1977	0.050/kwh(over 500kw) 0.070/kwh(351-499 kw) 0.085/kwh(0-350 kw)	223.80 per pump per season	0
1978-Aug.1979	0.22/kwh	no demand charge	222
Sep.1979-Jan.1982	0.3848/kwh	no demand charge	463
Feb.1982	0.4807/kwh 0.4457/kwh 0.4157/kwh	18.00/kw (0-1000 kw) 19.00/kw (1001-9000 kw) 20.00/kwh(9001-Over kw)	555

*Excluding demand charge

SUPPORT PRICE OF PALAY

DURATION	PALAY PRICE* (P/kg)	% INCREASE
1976 - 1978	1.10	0
1979 - Oct. 20, 1980	1.30	18
Oct. 21, 1980 - Jan. 16, 1981	1.45	32
June 17, 1981 - May 21, 1982	1.55	41
May 22, 1982	1.70	54

* NFA Price

Table 3 OPERATION RESULTS OF THE TARLAC GROUND WATER PILOT AREAS

PARTICULARS		1976	1977		1978		1979		1980		1981
		WET	DRY	WET	DRY	WET	DRY	WET	DRY	WET	DRY
SAN MANUEL PILOT AREA											
Area Planted	(ha)	304	286	297	252	285	290	306	240	294	293
Average Yield	(t/ha)	3.0	2.0	3.9	1.6	2.8	3.4	3.7	2.5	3.9	3.4
Operation Costs:	(P/ha)										
Energy Cost		21.34	252.26	117.16	261.17	106.93	312.67	423.09	774.46	356.09	735.48
Repair & Maintenance		17.11	23.74	37.82	42.06	6.49	274.15	22.55	141.48	47.20	694.62
Labor Cost		74.99	101.53	84.32	116.98	89.31	105.56	120.24	159.05	128.25	197.49
TOTAL COST	(P/ha)	113.44	377.53	239.30	420.21	202.73	692.38	565.88	1,074.99	531.54	1,627.59
	(cav/ha)	2.1	6.9	4.4	6.5	3.1	10.6	8.7	14.9	7.4	22.4
ISF Collection	(%)	28	5	12	3	13	12	30	8	25	15
PURA PILOT AREA											
Area Planted	(ha)				45	69	98	114	120	128	68
Average Yield	(t/ha)				4.2	2.8	4.4	3.3	2.8	4.0	3.4
Operation Costs:	(P/ha)										
Energy Cost					989.90	59.13	594.42	288.24	1,214.24	764.9	1,275.31
Repair & Maintenance					174.42	2.18	263.20	160.93	157.16	167.40	2,898.34
Labor Cost					578.40	325.53	277.16	254.80	280.60	259.50	756.36
TOTAL COST	(P/ha)				1,742.72	386.84	1,134.78	703.65	1,652.00	1,191.81	4,930.01
	(cav/ha)				31.8	6.0	17.4	25.0	25.0	16.5	51.6
ISF COLLECTION	(%)				0	2	15	53	37	59	24

Table - 4 POWER CONSUMPTION TREND AND SHARE IN TOTAL O & M BUDGET
LIBMANAN/CABUSAO PUMP IRRIGATION SYSTEM
1981 to 1985

MONTH	1981	1982	1983	1984	1985
JANUARY		27,501.52	80,546.82	50,316.80	174.540.80
FEBRUARY		60,456.00	128.565.14	89,984.00	170,009.60
MARCH		115,003.58	129,625.60		193,920.00
APRIL		78,218.24	149,127.16	240,441.60	296,512.00
	62,988.80	105,485.44	159,297.47	114,624.00	
JUNE	63,353.60	124,464.64	147,459.58	146,624.00	
JULY	42,457.60	67,499.52	69,916.80	110,592.00	
AUGUST	79,942.40	59,949.82	41,308.16	185,574.40	
SEPTEMBER	101,420.34	27,245.31	97,086.72	181,491.20	
OCTOBER	10,175.99	6,225.00	-	12,480.00	
NOVEMBER	4,008.70	-	-	-	
DECEMBER	2,672.40	71,875.58	-	42,528.00	
TOTAL	P367,019.83	P743,924.65	P1,031,242.89	P1,304,281.60	P1,661,925.00*
TOTAL APPROVED O&M BUDGET	P685,845.00	P2,000,000.00	P1,874,128.00	P2,243,096.00	P2,636,033.00
SHARE IN O&M BUDGET	53.66%	37.20%	55.03%	58.15%	63.05%

* - Expected total cost of CY 1985

Table 5 Proposed Diversion Dams

	Irrigation System	Location	Type	Height (m)	Intake Discharge (m^3/S)
Chico	Chico RIS	Kalinga Apayao		7.0,3.65,2.50	34.36
Maris	Magat RIS	Isabela		13.50	Left 59.00
					Right 140.50
Rizal	UPRIIS	Nueva Eceja		4.50	84.00
Bongabon	PBRIS	Nueva Eceja		4.20	56.00
Penaranda	UPRIIS	Nueve Eceja		1.50	38.00
Agno	Agno RIS	Pangasinan			
Bustos	AMRIS	Bulacan		2.50	Left 15.32
					Right 26.73

S Y S T E M	PROVINCE	CANAL	STATIONS	Discharge (cu.m./sec.)	Height of Drop (m.)
Region I					
Agno RIS (Discharge fluctuated with the release from Binga)	Pangasinan	Main Canal	2 + 080	38.00	3.00
		-do-	2 + 624	38.00	3.00
		-do-	3 + 800	34.30	3.20
		-do-	4 + 464	34.30	3.80
		-do-	5 + 000	34.30	2.50
		-do-	5 + 600	34.30	2.80
		-do-	6 + 558	33.30	3.00
		-do-	7 + 501	33.30	2.00
		-do-	8 + 096	33.30	6.50
		-do-	9 + 356	33.30	2.00
		-do-	11 + 200	29.00	3.00
		-do-	11 + 720	29.00	2.00
		-do-	14 + 080	23.30	2.50
		-do-	14 + 720	23.30	3.00
Camiling RIS (In dry season flow)	Tarlac	Main Canal	2 + 040	15.50	5.80
		Lateral A	10 + 440	5.58	4.30
		-do-	11 + 720	5.58	4.80
		-do-	13 + 340	4.32	4.60
Ambayon RIS	Pangasinan	Main Canal	7 + 120	10.78	2.25
Depalo RIS	Pangasinan	Main Canal	0 + 963	5.45	5.20
		-do-	1 + 252	5.45	4.90
Region II					
Magat RIS	Isabela	Main Canal	5 + 960	37.10	3.70
		-do-	6 + 700	21.90	3.20
		-do-	10 + 560	7.65	2.20
		Lateral A	7 + 650	7.52	2.20
		Lateral A-1	0 + 160	12.00	2.20
		Lateral C-5	0 + 620	6.05	2.50
Tumawini RIS	Isabela	Main Canal	10 +205	4.36	2.60
		-do-	8 + 120		
			8 + 280	8.19	15.12
Region III					
Angat RIS	Bulacan	Main Canal	1 + 600	15.00	2.7
			6 + 000	13.00	2.5
Sto. Tomas RIS	Zambales	Main Canal	5 + 800	15.00	2.00
		-do-	6 + 400	15.00	2.40
		-do-	7 + 000	9.50	2.20
		Lateral A	3 + 500	3.30	2.30
Dumacaa RIS	Quezon	Main Canal	7 + 151	4.50	4.50
		-do-	8 + 056	4.50	4.70
Camiling RIS	Tarlac	Main Canal	2 + 177	16.162	4.07
		-do-	2 + 472.20	16.162	6.01
		-do-	3 + 491.50	15.302	8.80
		-do-	3 640	15.302	2.81
		-do-	3 + 840	15.302	2.14
		-do-	4 + 040	15.302	2.96
		-do-	4 + 180	15.302	2.75
		-do-	4 + 540	15.302	2.05
		-do-	4 + 720	15.302	2.96
		-do-	5 + 040	15.302	2.11
		-do-	6 + 340	15.302	2.34

POSSIBLE MINI-HYDRO POWER STATIONS IN NIA IRRIGATION SYSTEMS

S Y S T E M	PROVINCE	CANAL	STATIONS	Discharge (cu.m./sec.)	Height of Drop (m.)
		Lateral A	1 + 853	5.94	6.00
		-do-	5 + 446	5.19	2.45
		-do-	10 + 265	4.52	4.65
		-do-	10+612.75	4.52	2.35
		-do-	11 + 265	4.47	2.00
		-do-	11+379.60	4.47	3.75
		-do-	13 + 188	3.73	3.20
		-do-	15 + 287	3.47	2.95
		-do-	15 + 795	3.47	2.70
		-do-	16 + 929	3.13	8.60
		Lateral C	0 + 747	6.91	3.22
		-do-	3+982.17	6.539	2.00
San Miguel-Odonnel RIS	Tarlac	Sn.Miguel M.C.	4 + 653	8.74	2.36
		-do-	9 + 591	6.94	2.20
		-do-	13 + 409	6.94	3.94
Tarlac RIS	Tarlac	Tarlac M.C.	2 + 560	21.68	2.26

Table - 7 Net Return Per Hectare

	Item		Without Project			With Project	
			Irrigated		Rainfed	Wet	Dry
			Wet	Dry			
I	Gross Income						
	Unit Yield (t/ha)		4.5	5.0	1.96	4.5	5.0
	Unit Price (₱/t)		4093	4093	4093	4093	4093
	Gross Income (₱)		18419	20465	8022	18419	20465
II	Production Cost						
	Seed	(₱)	246	246	349	246	246
	Fertilizer	(₱)	1601	1737	677	1601	1737
	Agro-chemicals	(₱)	649	649	343	649	649
	Labor Input	(₱)	2310	2420	1672	2310	2420
	Animal Power	(₱)	639	649	727	639	649
	Mechanical Power	(₱)	763	815	658	763	815
	Irrigation Cost	(₱)	1110	1460	-	511	672
	Miscellaneous	(₱)	310	326	221	310	326
	Total		7628	8302	4647	7029	7514
III	Net Return		10791	12163	3375	11390	12951

資料 6　質問書への回答

SUBJECT: IMPROVEMENT OF O&M IN PUMPING IRRIGATION SYSTEMS

ANSWERS TO QUESTIONNAIRE

1. Background Information

1) Background of the request

NIA operates and maintains a number of pump irrigation systems (PIS) throughout the country including pumps distributed to individuals or agencies. These pumps can be classified as large surface water pumps, tubewells and small scale pumps with diameter from 4"Ø to 10"Ø. The PIS is supplying water to about 170,000 ha nationwide or about 15 percent of the total irrigated area of the nation. Most of these pumps are powered either by diesel, gasoline and electrical engines. The sharp increase in the cost of energy in the 1970's adversely affected the operation of the PIS. Since then, there has been a marked decrease in the numbers of PIS in operation and pump projects for development. Considering the contribution of this type of irrigation system in the gov't efforts to increase rice production, the NIA is looking for measures to improve the O&M in PIS either through more economical sources of energy or increased farm incomes. Potential schemes are tapping nearby streamflows and discharges along irrigation canals with available head for mini-hydro development and an effective agricultural development plan including institutional development. Hence, this request for the study.

2) Related Policy of the Government of the Philippines

Under the present government, the state shall provide a just and dynamic social order that will free the people from poverty through policies that will provide adequate social services promote full development, a rising standard of living and an improved quality of life for all. To pursue these the gov't is given priority to agriculture and energy. Another state policy is the promotion of comprehensive rural development and agrarian reform. Most PIS are located in rural areas and serves small farmers.

3) Relation with National Development Plan and Other Development Plan

Improving the O&M in PIS is in consonance with the objectives of our Public Investment Program (PIP) of giving priority to agriculture and energy development and is in line with the present thrusts of NIA; the rehabilitation and improvement of existing irrigation systems and the strengthening of O&M capability to maximize rice production. The proposal also will contribute to the country's efforts to look for alternate sources of energy and save the country precious foreign exchange.

4) Relation with projects assisted by other countries and/or international organizations.

The proposed project would complement, supplement and improve the operations of the following existing PIS or pump projects now under construction by NIA:

a. Central Luzon Groundwater Irrigation Project (CLGIP)-OECF
b. Cagayan Integrated Agricultural Development Project Irrigation Component (CIADP) on-going - OECF
c. Second Laguna Irrigation Project, on-going - ADB

d. Guimba Groundwater Irrigation Project - UNDP

e. Tarlac Groundwater Irrigation Project - WB

f. Laguna de Bay Development Irrigation Component Project - ADB

g. Libmanan-Cabusao Irrigation Project - USAID

h. Solana-Tuguegarao Irrigation Project - Locally Funded

i. Numerous PIS acquired through bilateral arrangements

2. Confirmation of the Content of the request

1) Title of the Project

Improvement of O&M in Pumping Irrigation Systems

2) Implementing organization

National Irrigation Administration

3) Objectives of the Project

a) To formulate development plan for improvement of O&M of PIS under NIA geared toward increasing production and farm incomes.

b) To examine the technical and economic feasibility of identified projects including their financial viability.

4) Scope and Subjects of the Study

The project study will consist of two stages:

1st Stage - Data collection and field survey on the following:

a) National condition of the PIS as to topography, meteorology, hydrology, geology, soil, etc.

b) PIS as to O&M, water requirement, irrigation fee, service area during dry and wet season, IA, power supply etc.

c) Agricultural aspect - farming practices, land use, land holdings, cropping and yield, agricultural organization.

d) Agro-economy - farmer's increase and productivity marketing and regional economy.

Inventory of PIS based on the above findings, formulate concept of overall improvement plan for O&M. Lastly, select priority systems for detailed feasibility studies.

2nd Stage - Supplementary data collection and detailed feasibility studies and analysis of the selected PIS in order to:

a) formulate an improvement plan of O&M through the possibility of mini-hydro installation, crop diversification, rehab. of existing irrigation facilities and institutional development.

b) prepare feasibility grade design of necessary facilities.

c) estimate cost and benefit of each project plan.

d) conduct economic and financial analysis.

5) Study Area

The study covers national PIS in the country.

6) Development Concept of the Project

The development strategy for the project will involve the following:

a) Lowering the cost of operation of the PIS through the introduction of mini hydro plants along existing irrigation canals and nearby streams to generate cheap energy to power the pumps.

b) Improving and maximizing the efficiency of the PIS through rehabilitation and replacement of the pump equipment and the irrigation facilities.

c) Increasing farmers income through the introduction of

crop diversification, efficient water management and effective institutional development works.

7) Program after the Study

After the study, NIA will evaluate the report and if found meritorious, will incorporate it in its Medium-Term Development Program for possible foreign loan assistance or as grant project.

3. Confirmation Concerning the Implementation of the Study

1) Organization Structure Concerning Implementation of the Study

The study will be implemented by NIA through the Project Development Department (PDD) and the Program Development Staff (PDS) under the Asst. Administrator for Systems Operation and Equipment Management. PDD will be the lead unit.

2) Assignment of Counterpart Personnel

Counterpart personnel will be assigned corresponding with the expertise required and will come from PDD, SMD, IDD and other offices in NIA.

3) Undertaking of GOP

In previous JICA assisted study, NIA provide office space with necessary equipment at C.O. in Quezon City and at the study area and appropriate number of vehicles with driver. However due to our present tight economic situation, NIA request assistance from JICA in the aspects. NIA will also make available to the study necessary data information required and will make necessary arrangement for the security and convenience of the Study Team personnel.

4. Present Condition of Pump Irrigation Systems

1) Name and Location of Systems

Given to Mr. Sakai

2) Detail of Pump facilities of each system

-do-

3) Present Condition of Systems

-do-

4) O&M of the System

a) Administrative Arrangement of Project Cost

In a PIS, project cost are solely shouldered by NIA either through loans or NIA budgetary allocation.

b) Any subsidies to farmers in connection with installation of facilities.

c) Bearer of running and repair cost

NIA is responsible for operating the NPIS and repair of broken down units/parts. However, in NPIS already turn-

b) Availability of following materials concerning above sites

(1) Topography map Scale 1:50,000: Available at the Bureau of Coast & Geodetic Survey.

(2) Aerial Photographs - Some areas are covered by aerial photos but security regulation on access & handling is very strict.

(3) Geological Map - only Scale 1,1:000,000 is available at the Bureau of Mines and Geoscience.

(4) Rainfall and river flow data

Data available for major rivers and streams

(5) Agricultural Aspect

(1) Crop to be promoted in NPIS

See report of Mr. Egashira, NIA-JICA Expert

(2) Planned Cropping Pattern

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資料 7

収 集 資 料 リ ス ト

1. MEDIUM - TERM PHILIPPINE DEVELOPMENT PLAN 1987 - 1992
NATIONAL IRRIGATION ADMINISTRATION
（内容） ＮＩＡの中期開発計画の基本方針，投資計画，修復計画の概要

2. REHABILITATION AND DEVELOPMENT PROGRAM OF PUMP IRRIGATION SYSTEM NIA
（内容） 背景，目的，コンポーネントを説明

3. PUMP IRRIGATION SYSTEMS REHABILITATION/IMPROVEMENT PROGRAM
（内容） プロジェクトのオリジナル・ドキュメント，既存ポンプかんがいシステム概要

4. NIA ANNUAL REPORT 1985

5. INTRODUCTION OF THE AGNO-S, NOCALAN RIVER IRRIGATION SYSTEM
（内容） ＡＧＮＯシステムの歴史，概要

6. STATUS OF PROGRAM IMPLEMENTATION. DECEMBER 31 1985
(NATIONAL ELECTRIFICATION ADMINISTRATION)
（内容） REGION 別の MUNICIPALITIES・BARANGAYS・HOUSE CONNECTIONS 及び GENERAL STATISTICS を示したもの

7. VITAL DOCUMENTS ON THE PHILIPPINE RURAL ELECTRIFICATION PROGRAM
（内容） NATIONAL ELECTRIFICATION ADMINISTRATION 発行の VITAL DOCUMENTS.

8. NATIONAL ELECTRIFICATION ADMINISTRATION
ANNUAL REPORT '85
（内容） NATIONAL ELECTRIFICATION ADOMINISTRATION 発行の業務概要を示したもの）

9. PAMBANSANG PANGASIWAAN PATUBIG PUMPING STATION

（内容） NATIONAL IRRIGATIONポンプシステムの設置位置・ポンプタイプ・口径・馬力・トータルヘッド等を示した資料

10. EXISTING NIA'S PUMP IRRIGATION SYSTEMS FOR LUZON.

（内容） ルソン島におけるNATIONAL IRRIGATION SYSTEMの設置位置図及びSERVICE AREA１９８２年～１９８４年のポンプ用水地区面積等を示した資料

11. INTRODUCTION OF THE AGNO-SONOCALAN IRRIGATION SYSTEM

（内容） AGNO RIVER にかかわるカンガイの概要を示した資料

12. POSSIBLE MIN-HYDRO POWER STATION IN NIA IRRIGATION SYSTEM

（内容） ＮＩＡのカンガイ施設を利用して，小水力発電が可能と考えられる地区概要を示した資料（水量及び落差）

13. REPUBLIC OF THE PHILIPPINS PAMBANSANG PANGASIWAAN NG PATUBIG
NIA OCTOBER 18, 1982 NO82-16

（内容） CENTRAL LUZONGROUNDWATER IRRIGATION PROJECTの状況をまとめた資料

14. NATIONAL IRRIGATION ADMINISTRATION (QUEZON CITY)
AGNO RIVER IRRIGATION SYSTEM.

（内容） ＮＩＡで小水力発電可能と考えている位置を示したもの

15. GENERAL LOYOUY LOCATION OF CLGIP PUMPS.

（内容） GROUND WATER IRRICATION の位置を示したもの

16. NATIONAL IRRIGATION ADMINISTRATION TARLC IRRIG SYSTEMS IMPROVEMENT PROJECT, STRUCTURAL LAYOUT.

（内容） ＮＩＡの施設の中で小水力発電が可能と考えられる位置概要を示したもの

17. CAGAYAN INTEGRATED DEVELOPMENT PROJECT

（内容） NATIONAL IRRIGATION PUMP SYSTEM のポンプ設置位及びポンプ仕様の概要を示したもの

JICA