DEPARTMENT OF STATE

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER

BANGLADESH

RURAL ELECTRIFICATION III

388-0070

PROPOSAL AND RECOMMENDATIONS

FOR REVIEW

JUNE 1986

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE: A (A = Add, C = Change, D = Delete) | Amendment Number: N/A | DOCUMENT CODE: 3

COUNTRY/ENTITY: Bangladesh

3. PROJECT NUMBER: 388-0070

BUREAU/OFFICE: ASIA, NEAR EAST

5. PROJECT TITLE (*maximum 40 characters*): RURAL ELECTRIFICATION III

PROJECT ASSISTANCE COMPLETION DATE (PACD): MM 09 DD 30 YY 91

7. ESTIMATED DATE OF OBLIGATION (*Under "B." below, enter 1, 2, 3, or 4*): A. Initial FY 86 | B. Quarter | C. Final FY 89

8. COSTS ($000 OR EQUIVALENT $1 =)

A. FUNDING SOURCE	FIRST FY 86			LIFE OF PROJECT		
	B. FX	C. L/C	D. Total	E. FX	F. L/C	G. Total
AID Appropriated Total	6,400	100	6,500	57,600	2,400	60,000
(Grant)	(6,400)	(100)	(6,500)	(57,600)	(2,400)	(60,000)
(Loan)	(- 0 -)	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country					19,300	19,300
Other Donor(s)						
TOTALS	6,400	100	6,500	57,600	21,700	79,300

9. SCHEDULE OF AID FUNDING ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE 1. Grant	C. PRIMARY TECH. CODE 2. Loan	D. OBLIGATIONS TO DATE 1. Grant	D. OBLIGATIONS TO DATE 2. Loan	E. AMOUNT APPROVED THIS ACTION 1. Grant	E. AMOUNT APPROVED THIS ACTION 2. Loan	F. LIFE OF PROJECT 1. Grant	F. LIFE OF PROJECT 2. Loan
(1) FN	263	062				60,000		60,000	
(2)									
(3)									
(4)									
TOTALS						60,000		60,000	

10. SECONDARY TECHNICAL CODES (*maximum 6 codes of 3 positions each*)

11. SECONDARY PURPOSE CODE

12. SPECIAL CONCERNS CODES (*maximum 7 codes of 4 positions each*)

A. Code							
B. Amount	60,000						

13. PROJECT PURPOSE (*maximum 480 characters*)

To develop the capability of the Rural Electrification Board to effectively provide the technical, managerial and engineering capability and leadership necessary to establish self-sustaining, financially viable, properly managed and maintained rural electric cooperatives providing reliable electric power at reasonable rates to rural residents.

14. SCHEDULED EVALUATIONS: Interim MM 09 YY 88 | Final MM 09 YY 90

15. SOURCE/ORIGIN OF GOODS AND SERVICES: [X] 000 [X] 941 [ ] Local [ ] Other (*Specify*)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (*This is page 1 of a ____ page PP Amendment.*)

R a De Bruce

Raymond A. DeBruce, Control

17. APPROVED BY

Signature: Bonnie A. Pounds

Title: Acting Director

Date Signed: MM 06 DD 05 YY 86

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM DD YY

Project Authorization

Name of Country: Bangladesh Name of Project: Rural Electrification III

Number of Project: 388-0070

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended (the FAA), I hereby authorize the Rural Electrification III Project (The "Project") for the People's Republic of Bangladesh (the "Cooperating Country") involving planned obligations of not to exceed Sixty Million United States Dollars ($60,000,000) in grant funds over a five year period from date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the Project. The planned life of the Project is from the date of initial obligation until September 30, 1991.

2. The Project will enhance the capability of the Rural Electrification Board (REB) to provide the technical, managerial and engineering assistance required by rural electric cooperatives (PBSs) to provide reliable electric power to their customers on a cost-effective basis.

3. The Project Agreement(s) which may be negotiated and executed by the officer(s) to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority shall be subject to the following essential terms and convenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate:

a. Source and Origin of Commodities, Nationalty of Services
Except as A.I.D. may otherwise agree in writing:

1. Commodities financed by A.I.D. under the project shall have their source and origin in Bangladesh or in countries included in A.I.D. Georgraphic Code 941;

2. Except for ocean shipping, the suppliers of commodities or services shall have Bangladesh or countries included in A.I.D. Geographic Code 941 as their place of nationality; and

3. Ocean shipping financed by A.I.D. under the project shall be financed only on flag vessels of the United States or Bangladesh.

b. Conditions Precedent to Disbursement

(1) Prior to disbursement, or to the issuance of any commitment documents under the Project Agreement, for any purpose other than technical assistance, the Cooperating Country shall furnish in form and substance satisfactory to A.I.D.:

(a) A plan to ensure that for the life of the Project power generation, transmission and substation capacity will be adequate to meet the forecasted load within each of the areas served by the Rural Electrification Board (REB) under this project, and

(b) A plan, by December 31, 1986, or such later date as AID may agree in writing, to implement in phases the recommendations (including revised tariffs for PBSs) of the Bangladesh Power Sector Tariff Study (funded by the United Nations Development Program) as agreed to by AID and the Bangladesh Government.

4. Waiver

The following waiver is approved, based upon the justifications set forth in the Project paper:

Pursuant to Section 124 (d) of the FAA, I hereby waive the requirement that the Cooperating Country provide 25 percent of the costs of the Project. Bangladesh is a relatively least developed country.

Charles W. Greenleaf, Jr.
Assistant Administrator
Asia, Near East Bureau

Date: 7/23/86

BANGLADESH
RURAL ELECTRIFICATION III
(388-0070)

FY 1986 PROJECT PAPER

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ANNEXES

ACRONYMS AND ABBREVIATIONS

ACRE	Area Coverage Rural Electrification
AID	Agency for International Development (United States)
ADB	Asian Development Bank
BADC	Bangladesh Agricultural Development Corporation
BARD	Bangladesh Academy for Rural Development
BCIC	Bangladesh Chemical Industries Corporation
BEPP	Bangladesh Energy Planning Project
BDG	Bangladesh Government
BFIDC	Bangladesh Forest Industries Development Corporation
BKB	Bangladesh Krishi Bank (Agricultural)
CDSS	Country Development Strategy Statement
CIDA	Canadian International Development Agency
DTW	Deep Tube Well
FAR	Federal Acquisition Regulations (US)
FRI	Forest Research Institute
FRLC	Federal Reserve Letter of Credit
FX	Foreign Exchange
GC	Gilbert & Commonwealth (formally Commonwealth Associates International Inc.)
GWH	Gigwatt Hour
HT	High Tension
IDA	International Development Association
IFB	Invitation for Bid
KFAED	Kuwait Fund for Arab Economic Development
KFW	The German Foreign AID Agency
KWH	Kilowatt Hours
KV	Kilovolt
LC	Local Costs
LLP	Low Lift Pump

LRMC	Long-Run Marginal Cost
LT	Low Tension
MW	Megawatt
MVA	Megavolt Ampere
MPO	(Water) Master Plan Organization
NRECA	National Rural Electrification Cooperatives Association
O&M	Operation and Maintenance
PBS	Palli Bidiut Samity (Rural Electrification Cooperative)
PDB	Power Development Board
RE	Rural Electrification
REA	Rural Electrification Authority
REB	Rural Electrification Board
STW	Shallow Tube Well
RFP	Request for Proposals
RFQ	Request for Quotations
ROW	Right of Way
TA	Technical Assistance
TCF	Trillion Cubic Feet
TDY	Temporary Duty
US	United States
USAID	United States Agency for International Development Mission in Dhaka
8(a)	Small Business Administration designated Small Business Firm
WB	World Bank

SECTION I - RECOMMENDATION AND SUMMARY OF FINDINGS

A. Recommendation

It is recommended that the project, described herein, be authorized. The proposed project consists of a grant of $60.0 million to the Bangladesh Government (BDG) for the country's rural electrification (RE) program.

BDG will grant approximately $13.8 million of AID grant funds to the Rural Electrification Board (REB) to finance technical assistance, evaluations, studies, U.S. training and for the direct support of REB facilities and activities. The remaining $46.2 million will finance commodities for the intensification of the systems in the rural electric cooperatives called Palli Bidyut Samities (PBSs) funded by AID through projects RE I & II. These funds will be on lent from the BDG to the REB and the REB, in turn, will subsequently lend the funds to each of the AID supported PBSs.

B. Summary Description of AID Project

The RE III project will concentrate on the intensification of the distribution network in the 17 PBSs previously funded by AID through the construction of approximately 3,500 miles of 11 KV distribution line and sixteen 10 MW sub-stations. AID funds will also be used to finance substation transformer spares for the 13 PBSs funded by RE I and to finance a small amount of materials and commodities needed by REB in support of the overall RE program. AID is also providing funding for all the technical assistance contemplated for the BDG's rural electrification Phase III program. The project will be implemented by the REB, an agency established in 1977 by the BDG to administer rural electrification activities.

C. Summary of Issues

In the course of project design several areas of concern arose including: (a) the need to rationalize power tariffs charged by both PDB and PBS to adequately reflect supply costs; (b) the need to improve the financial performance of PBSs; (c) the need for a large commodity procurement element in the project in existing PBSs; and (d) continuation of the present TA consultant for the RE III project. The last two issues have been satisfactorily resolved during the design stage and are discussed in this project paper. The first two issues are analyzed in Section III.B. The results of this analysis, together with the results of related studies being supervised by the World Bank, will provide a basis for policy dialogue with the BDG. This dialogue will be supported by linking the obligation of funds through amendments in future years to the satisfactory agreement between USAID and the BDG on various CPs dealing with tariffs and financial performance.

D. Statutory Criteria

This grant meets all Statutory Criteria.

E. Congressional Notification Requirements

USAID submitted a draft Congressional Notification to AID/W on June 1, 1986 via cable DHAKA 4004.

F. Project Committee

Gene V. George, PD&E (Chairperson)
Mike Calavan, PD&E
Steve Allen, RLA
Turra Bethune, PRO
Volker Tondorf, PDE
Jan Van der Veen, ECON
Mary Lewellen, CON
David E. Warner, PD&E
Alan Hurdus, F&AG
Don Reese, PD&E

SECTION II - DETAILED PROJECT DESCRIPTION AND RATIONALE

A. Project Background

Over 84% of Bangladesh's population live in rural areas. Agriculture remains the backbone of the Bangladesh economy, accounting for close to 50% of its gross domestic product and employing over 75% of the labor force. In 1976, less than 3% of the rural population had access to electricity. At that time the BDG decided to extend the public supply of electricity to rural areas to improve the quality of life and stimulate economic growth through the development of agriculture and small-scale agro-industries. Following that decision, a comprehensive rural electrification master plan, funded by AID, was developed by the National Rural Electrification Cooperative Association (NRECA). The plan envisages the electrification of all rural areas in five phases by the year 2000.

Rural Electrification under the master plan is based on the concept of "Area Coverage Rural Electrification" (ACRE), involving the design of a basic distribution system to provide a backbone system that can accommodate rapid increases in the number of consumer connections. The ACRE concept involves the development of autonomous member-owned rural electric cooperatives (PBSs), each of which covers an approximate area of 400-500 square miles. On average, the system operated by a PBS will contain 10 MVA substation capacity and 500 miles of distribution lines (both backbone and feeder) providing electricity to 15,000 to 17,000 customers. The formation of PBSs has been progressing smoothly under the guidance of REB and with the assistance from two consulting firms, NRECA and Commonwealth Associates, Inc. (CAI), financed by USAID.

The rural electrification master plan envisages the creation of 62 PBSs by the year 2000 in five phases. The various phases are defined by time units and not by the number of PBSs energized though the target is to have the whole country covered by electric service by the beginning of the next century. Presented below is a table detailing the time frames for the five phase BDG RE program:

TABLE 1
Rural Electrification Phases

Phase	Time Period
I	1978 - 1986
II	1982 - 1988
III	1985 - 1994
IV	1990 - 1996
V	1995 - 2000

BDG's Phase I - Only AID and the BDG funded the first phase of the Government's five-phase RE plan. In FY 78, AID provided a $50.0 million grant and loan (RE I) to finance technical assistance, materials and equipment needed to establish an electric distribution systems in thirteen PBSs. The first PBS was electrified June 1, 1980, six months after construction had commenced. All thirteen PBSs were electrified by October 1982. AID funding was increased in FY 80 by $19.3 million to permit additional connections to reach 30% of the consumers in the 13 PBSs which had originally applied for electric service. Total project funding amounted to an estimated $89.1 million for Phase I. AID contributed $69.1 million and the BDG $20 million equivalent in local currency.

BDG's Phase II - The early success of the AID financed RE I project program impressed other donors enough to join with AID in an expansion of the rural electrification program by the development of 20 additional PBSs.

The $50 million AID grant (RE II) financed the construction and development of four new PBSs, additional connections in the first 13 PBSs, and technical assistance for the total rural electrification program.

The World Bank funds (IDA $48 million) financed the construction and development of seven new PBSs; Kuwait ($30 million) covered commodity costs of eight new PBSs; and Finland ($6 million) financed one new PBS. The ADB ($10.3 million) funds were used to extend two AID RE I funded PBSs into areas with large diesel tubewell concentrations and the potential for new tubewells. Total project funding for Phase II amounted to an estimated $186.9 million, $144.3 million from donors and $42.6 million from the BDG.

REB has to date electrified all of the first 13 PBSs constructed under RE I. Construction of buildings, substation foundations and some distribution line is underway at one of four RE II PBSs. Five PBSs financed by Kuwait are electrified and construction is underway at the other Kuwaiti PBSs and at several of the IDA funded PBSs. Many of the projected targets have been exceeded in construction and service hook-ups; those for irrigation, small commercial and industrial ventures are exceeding 1980-81 estimates. The operational PBSs are providing service to approximately 190,000 meters (March 1, 1986) located in 4100 villages and along the 7000 electrified miles of distribution lines constructed in 70 Upazilas. The 190,000 meters include service to over 475,000 households consisting of almost 1,800,000 people, 21,500 commercial establishments, over 6,300 irrigation systems and 2,300 industrial plants. New meter connections are being added at the rate of over 4,000 per month.

BDG's Phase III - The rural electrification program under Phase III includes system expansion in 31 out of the 33 existing PBSs established under the first two phases and the construction of 7 new PBSs. The objective of Phase III is to cover about 23,300 square kms of rural areas and provide service to about 500,000 consumers (meter connections). The estimated cost of Phase III is about $253 million, including about $179 million in foreign currency. This Phase started in FY 86. The WB recently signed a $79 million loan to establish seven new PBSs and expand five existing PBSs as part of the Phase III rural electrification program. An AID grant of $60 million will finance the intensification of the network in the 17 PBSs built under RE I & II, as well as funding all of the technical assistance for Phase III and U.S. training for 30 REB and PBS staff. The BDG is also discussing Phase III financing with Canada, Japan, Finland, Denmark, Kuwait, and Saudi Arabia. A firm commitment from Canada to expand the 8 PBSs built by the Kuwait Fund is expected shortly. The BDG is only

in the early discussion stage with the other donors.

B. Project Rationale

The USAID Country Development Strategy Statement (CDSS) for FY 1986 contains three program goals: reducing human fertility, increasing agricultural productivity, and expanding rural employment. USAID firmly believes that rural infrastructure provides a stimulus to economic activities that eventually lead to expansion of agricultural production and employment opportunities. Rural electrification is a prime example of how infrastructure - electricity - has contributed to the development of industries and agriculture in rural Bangladesh. Sufficient data is not available to definitively assess the impact of rural electrification in Bangladesh. However, consumption patterns of electricity is heavily oriented towards productive users (i.e. electric powered irrigation pumps, and commercial and industrial consumers) which results in increased agricultural production and additional employment possibilities.

Any success in our rural electrification activity is not simply a matter of building the necessary infrastructure. Sustained generation of energy to the rural area depends ultimately on the ability of cooperatives to achieve financial viability by rationalizing the electric rate structure, intensifying the density of service and improving the management capability of the different institutions. These will be the foci of our continued efforts in rural electrification and provide the basic rationale for the RE III project.

C. Project Description

The purpose of the RE III project is to: 1) enhance the capability of the REB to effectively provide the technical, managerial and engineering assistance the PBSs require to provide reliable electric power to their customers on a cost effective basis, 2) provide resources needed to intensify electricity supply at USAID-funded PBSs, and 3) to provide a framework for a policy dialogue on rationalizing electric rate schedules and improving the financial performance of PBSs. Under the RE III project, the REB will place increasing emphasis on management of the existing PBS systems and intensifying coverage within the PBS areas. The intensification of PBSs is expected to improve their financial performance. A timetable will be established for implementing recommendations concerning power tariffs (based largely on a study initiated by the World Bank, and funded by the United Nations Development Program) and concerning steps to strengthen the financial viability of PBSs.

Prior to finalizing the design for the AID proposed RE III project, an assessment was financed entitled "Rural Electrification in Bangladesh Management, Engineering, and Financial Assessment" conducted in November 1985 by the Oak Ridge National Laboratory, Oak Ridge, Tennessee. The recommendations of this assessment provided valuable inputs for the project design in the policy areas of electricity pricing considerations, PBS financial performance and the level and types of technical assistance required to implement the RE program.

The project will be implemented by REB over a 5 year period (FY 1987 through FY 1991) with the following outputs achieved:

a) Intensification of service connections within the 17 USAID funded PBSs by constructing an estimated 3,500 miles of new distribution and

feeder lines and providing each PBS with an additional 10 MVA or more substation capacity. This will allow connection of 140,000 new meters including 295,000 households or 1,800,000 people, 15,200 commercial businesses, a minimum of 4,500 irrigation users and 1,700 industrial consumers by the year 1991.

b) Technical assistance provided by consultants for training, line construction, system management and maintenance for the entire rural electrification program (including other donor projects) through 1991.

c) Training of 30 REB and PBS staff in two to three month courses in the United States. In addition, the technical assistance training advisors will assist the REB Training Directorate to annually provide in country training for 4,500 REB and PBS employees in specialized courses necessary for effective operation, maintenance and management of electrical distribution systems, and training of a minimum of 1,200 village electricians to enable them to install and repair wiring in households, commercial and industrial enterprises. AID will fund all training in the U.S.; in-country training however, will be funded completely as a BDG contribution to the project.

Intensification of service connections within the PBS areas

The BDG has made a major shift in its policy for the RE program. The present focus is more on intensification of service connections within a PBS area in lieu of the extensive expansion of the backbone system to new PBS areas (though some expansion will occur). USAID has provided the lead in convincing the BDG to change this focus. The inclusion of a commodity procurement element in RE III to support the intensification position has strengthened our ability to influence the BDG decision. The concept has been accepted by other donors interested in continuing funding of RE activities. The pattern for investments in rural electrification in Phase III is for donor agencies to finance intensification in PBSs in which they have made an investment (World Bank and Finland) or as is the case with Canada, expansion in PBSs initially financed with Kuwait funds. It does not now appear that any other donor will fund intensification activities in any of the 17 PBSs built under RE I and II, requiring AID to include a substantial commodity procurement element in the project in addition to the funding of TA and U.S. training.

The AID commodities will be used to intensify the PBS line network and connect more consumers, especially those who have signed up long ago and are awaiting power. As of now only about 30% of the original potential consumers within the 13 RE I PBSs have been connected and only 40% (approximate) will have been hooked up by the end of AID's RE II project. A vast potential for expansion exists, Dhaka I PBS and Tangail I PBS have together almost 500 potential industrial customers awaiting service. Many of these potential customers did not even exist in customer surveys performed 6 years ago. However, capacity and financing constraints preclude all but bare minimal expansion.

RE III will finance commodities for 16 new 33/11 KV/10 MVA substations, a few replacement 5 MVA substation transformers, 3500 miles of new distribution and feeder lines, and commodities to bring service to the meter point of potential customers. Each PBS will add 220 line miles and this will increase average PBS line milage to 720. Because of the institutional and financial development thrust of this project, further PBS line extensions will be primarily handled by domestic resources. Emphasis on

line staking and construction is, as under RE II, placed on productive users, e.g. irrigation and small industries. This further supports the consumption patterns that have developed since RE I, where expectations were that KWH consumption would be 3.6% agricultural, 38.0% industrial/commercial and 58.4% domestic. The 1983-84 record was 23.6% agricultural, 53.3% industrial/commercial and only 23.1% domestic. Moreover, distribution and feeder lines to be built under RE III are being staked so as to hook up line mile loads about double that first expected under RE I staking.

The 17 PBSs constructed and established under USAID's RE I and RE II projects can more easily attain financial viability by better control over operation and maintenance costs, good collection practices and a larger customer base, particularly in relation to plant investment. Completed and planned construction will enable the PBSs to connect about 40% of those in the service areas who have applied for connections. Intensification under RE III will allow this to increase from 40% to roughly 60%. Depreciation and administration costs as a percentage of sales under RE III are expected to decline from 22 percent to 12 percent by 1992. Consumer connections are expected to grow by 10 percent annually for the first five years with the additional connections provided by RE III.

With two 5 MVA substations a typical PBS can now handle 15,000 to 17,000 customers. RE III will provide 10 MVA more substation capacity per PBS to be phased in by 1990. It will provide some backbone line but its main expenditures will be on feeder lines, many single phased, which will reach customer load centers. This will allow many important financial and operating ratios to be improved.

The PBSs will construct feeder lines to provide electrical service to areas with the greatest number of users per mile as determined by a survey. The surveys will concentrate on identifying industrial, commercial and irrigation users with the highest potential demand for electricity. A minimum standard of revenues equal to 200 percent of breakeven costs will be used in planning the location of new distribution (feeder) lines. About $44 million in commodities will be needed to construct the additional 3,500 miles of backbone and feeder lines and the new substations. The Bangladesh Government will finance about $19.3 million dollars in construction, training and procurement related local costs.

Construction will be performed by local contractors under the supervision of REB and the PBSs' local private engineering consultants. REB's expatriate consultants will monitor and report on the effectiveness of the overall construction program.

Technical Assistance

Bangladesh is fortunate in having extremely capable and dedicated top level management in REB. Management below the top level, however, needs strengthening. Consequently, considering present TA needs and the needs that will be created by the implementation of Phase III of the rural electrification program, a strong program of technical assistance will continue to be necessary for at least another four years if the rural electrification program is to achieve its objectives and become financially and managerially viable.

The technology transfer process is a long and tedious effort requiring a high level of outside involvement for an extended period of time.

Experience in other developing countries with rural electrification programs indicates technical assistance is typically required for 12-15 years. Since the RE program began in 1978 and to date has received eight years of TA, an additional four to five years of TA would not be inconsistent with experiences in other countries with similar activities.

This project will provide expatriate technical assistance under a host country contract arrangement. The consultants will provide assistance to the total RE program, including other donor funded activities. The TA will include assistance in the areas of training, construction, PBS management and operations, materials specifications and REB operations. The TA will be directed at institutionalization of REB and PBS management systems, including physical plant construction and operation, and a continuing strong training program.

The TA team's monitoring and evaluation functions serve to reinforce the systems' procedures established by REB under RE I and II and, thereby, help institutionalize efficient management and construction practices by enforcing compliance with approved procedures. The TA contract will include short term specialists for training (such as meter repairs) and management and engineering needs in specialized areas, (such as inventory control and substation repair) which do not require continuous assistance. Home office services for procurement, material specifications review and engineering and management support services are also provided for in the TA budget (see Annex I Table I.3)

An assessment of the USAID Rural Electrification Program conducted by the Oak Ridge National Laboratory (ORNL) in November, 1985 recommended twenty advisors be engaged for at least the first two years of RE III implementation. The present work force of seventeen consultants should not be reduced, but three new positions should be created and the role of the team leader revised. The three new positions are: (a) one additional Financial Advisor; (b) one Material Management Advisor; and (c) one Maintenance/System Operation Advisor. We have provisionally budgeted for up to 20 full time advisors and the equivalent of two person years for short term specialists providing 756 person-months of technical assistance services during the 1987-91 period.

Training

There is a need for even greater attention to training in the immediate future. PBSs and the REB are now expected to assume greater operational responsibilities with less and less direct attention of expatriate advisors. The size of the RE program continues to expand. While the training effort in the RE program to date has been singularly successful with over 7000 attendees having participated in a wide range of training, minimum levels of training must be increased by 50% with no decrease in instruction quality in order to meet minimum levels of institutionalization. Fortunately, the REB training directorate is functioning well and is receiving an adequate level of attention by senior REB officials. Management and administrative training is moving to the forefront of the RE program and is likely to remain there.

AID funds will directly finance all of the U.S. training activities. Thirty REB and PBS staff will attend selected two to three month training courses in the U.S. focussing on management and operation of electric utilities organizations that are run primarily by rural electric cooperatives. The various courses will be selected to address specific

needs of the growing RE program. Experience to date with this type of training activity has been extremely positive and beneficial to the success of the REB.

The BDG is committed to providing training to all levels of the RE program. This commitment is demonstrated by the fact that all in-country training expenditures are paid for out of the BDG contribution to the RE III project. This is not a recent occurrance. For both RE I and II, the BDG provided funding for all in-country training activities. The RE III project will fund two TA training advisers who will be working full time with the Training Directorate. The advisors will continue the work begun under RE I and II in the areas of course material development, training techniques and developing the skills of the Training Directorate to conduct all of the necessary training.

The technical assistance contractor has prepared a report, "Projected Training Needs RE Phase III," which is Annex F-7. USAID has reviewed and revised the report and now finds it acceptable as a basic working document regarding the 1986-1991 in-country training plan for the entire rural electrification program. The outline training plan places emphasis on types of training which will enhance the ability of REB and PBS officers and staff to manage and operate their ongoing training in management, administrative and financial areas. REB's training program is designed to meet its own requirements, together with those of PBSs and local construction and consulting firms which are implementing the rural electrification program.

The project will provide training to about 4,500 REB, PBS and contractor employees per year including 1200 village electricians and 360 construction contractor personnel. This contrasts with the 2,000 employees per year trained under RE II. The higher level of training will be necessary to maintain the high standards of performance required by REB to meet the needs created by the planned seven new PBSs and the intensification in 31 of the 33 existing systems. Training will be conducted by REB's training directorate staff with the assistance of the expatriate consultants. Training is divided into institutional and technical components with a planned program of professional development based upon an approved and progressively phased training plan.

Training courses will be weighted towards more PBS management and operations courses. Training required for construction activities will decline, relative to management operation training needs, due to the emphasis on intensification rather than system expansion. The rapid pace of new PBS construction to date has required that technical training take precedence over management training, resulting in a large backlog of operation management training needs. REB will expand both its training staff and facilities to meet the new training targets.

D. Relation to AID Strategy

AID's long-range development strategy emphasizes four basic programmatic components: (a) institutional development and training; (b) technology-research development and transfer; (c) policy dialogue; (d) reliance on the private sector and market forces. This project positively involves all four.

The REB and PBSs are patterned after the Rural Electrification Authority (REA) in the United States and its 1,000 rural electric cooperatives. The REB has developed into the best managed local institution in the energy

sector (as noted by the Bangladesh Energy Planning Project BEPP team) and it is gradually taking on more and more responsibility with a minimal level of outside technical assistance. Yet AID feels the institution building tasks are incomplete. We are now budgeting for further technical assistance to continue the successful tasks of institution building.

The construction and commodity standards as developed in the U.S. and modified for local conditions are being rigorously adhered to in spite of pressure on the REB to modify or change these standards so that donors with restricted procurement rules can participate. AID's substantial support of the RE program has helped avert any diminution of standards.

The engineering and construction is being carried out by private firms who are being thoroughly trained by the REB and the Consultant. RE system construction has spawned many local industries which supply some of the materials needed to achieve electrification of most of Bangladesh's 68,000 villages. Electric connections to small, medium and large industries are providing opportunities for private enterprises to develop. Both backward and forward linked enterprises profit from RE. Industries which need cheap "shaft power" gain from the provision of electricity. A future impact study in 1987 will look at the locational aspects of providing electric power to industry and, if possible, measure or estimate migrational influences.

Through policy dialogue, the government was persuaded to set up the autonomous REB which has proved to be the key factor in the success of the program. Further dialogue provided for inter alia assurances of reasonably adequate supplies of power to the PBS and assisted in rate adjustment decisions. AID has been instrumental in changing the BDG policy of expanding the backbone system of the rural electrification program to new areas to one of investing in the intensification of the existing systems to assist in improving the financial performance of PBSs. Dialogue is continuing on tariff and financial issues and the ramifications are discussed in various sections of this paper particularly the conditions precedent and covenants (Section IV).

REB will encourage local manufacturers to produce and supply electrical hardware, treated wood poles, transformers and electrical equipment by advising them on REB specification requirements. REB tests locally manufactured materials and equipment to determine whether manufacturers meet the quality requirements of REB. Qualifying local suppliers will be allowed to submit bids in competition with international suppliers for RE procurements.

E. Relation to the Country Development Strategy Statement

The FY 1986 Country Development Strategy Statement (CDSS) contains three mutually supportive program goals as the focus for the Bangladesh AID program: reducing human fertility, increasing agricultural productivity, and expanding employment.

The Rural Electrification III Project will have a measurable impact on agricultural productivity and value added through electric pump irrigation and agro-processing facilities such as cold storage plants and grain mills. It will also expand rural employment through these increased agricultural activities and through encouraging the establishment of industrial and commercial businesses. It could also have an impact on reducing human fertility as suggested by preliminary studies which indicated a definite

correlation in several countries between rural electrification and the reduction of human fertility. (See Annex G.1)

The project supports other objectives such as providing private sector engineering and construction firms opportunities to design, construct, and service the PBS system and its consumers. Through July 1984, for example, REB and USAID funds totalling some $19 million have been used to purchase locally produced commodities. In addition manufacture's sales of locally produced electric motors quintupled from Tk. 6,800,000 (1981-82) to Tk.36,300,000 (1983-84) and have probably increased since then. Much of this new motor production is being used in irrigation. Local transformer production has also increased substantially with the REB and potential REB customers now making transformer purchases directly to assure quicker hook-up.

The rural electric systems are owned and operated by the consumers through an elected Board of Directors. The people are proving that they are able to operate these sophisticated management and physical systems. PBSs are providing reasonably reliable service to their consumers.

F. Cost Estimates

Construction material costs are estimated by using FY 1986 costs of materials for a typical mile of line for each category of line plus substations (for detailed material costs see Annex I Table I.2). An inflation rate of 5% annually was used in calculating the inflation allowance for commodities. The inflation factor may be slightly overstated in view of the increasing competition created by Code 941 suppliers who have entered the electrical materials market.

The estimated cost for technical assistance was based upon a continued level of activity with 20 fulltime advisors for the first 3 years of the project and then declining to around five advisers by the PACD. The total level of effort of TA, including - 114 person-months required in FY 86-87, but not included in the present contract (which ends in July 1987), is 870 field person-months and 160 home office person-months (See Annex I Table I.3).

REB is planning a headquarters office - training - systems operations complex for which we contemplate providing workshop tools, machinery, and training materials.

REB owns large warehouses in the port cities of Chittagong and Khulna. The Khulna facility is being used primarily as the initial receiving and storage point for the bulk of imported materials such as poles, substations, conductors, etc. To assist in off-loading of imported items directly to the Khulna warehouse, a temporary jetty is in operation while a permanent one is under construction. AID will finance the purchase of a crane to facilitate material handling.

TABLE 2

SUMMARY COST ESTIMATE AND FINANCIAL PLAN *

(In thousand US$)

Item Description	AID Funds FX	AID Funds LC	BDG Funds LC	Total
I. Commodities	43,238			43,238
II. Construction			12,459	12,459
III. Support Commodities	882		200	1,082
IV. Technical Assistance Training Studies & Evaluation	11,050	2,400	-0-	13,450
V. REB Operating Expense			5,131	5,131
VI. Contingency	2,430		1,510	3,940
Grand Total:	57,600	2,400	19,300	79,300

* Detailed breakdown of the various elements is contained in Annex I.

G. Financial Plan

Estimated Costs for AID Project

The total RE III project costs are estimated at $79.3 million (See Table 2) including AID funds of $60.0 million and BDG funding of $19.3 million equivalent. The AID funds will include $44.1 million for project materials and commodities, $13.5 million for technical assitance and training in the U.S., and $2.4 million is available for contingencies. The AID local cost component shown in Table 2 is for local cost support of the TA consultants. Commodity costs are detailed in Annex I Table I.2 and TA cost details are shown in Annex I Table I.3.

Obligations

The project will be implemented over a five year period beginning in FY 1986 with obligations in five tranches ending in FY 1990 (See Table 3). The BDG expenditures will gradually increase from $1.2 million dollars in FY 1986 to $5.4 million in FY 89 and $4.5 million in FY 1990. BDG expenditures are relatively smaller at the project beginning due to the long lead times involved in commodity procurement and the corresponding lag in gearing up for construction. Then the BDG expenditures peak during the mid-project period (FY 89) and decrease in the final years as system construction is completed.

Disbursements

USAID's projections show AID obligations and disbursements at the following amounts (in Millions of Dollars).

TABLE 3
PROJECTED OBLIGATIONS AND DISBURSEMENTS

Year (FY)	Obligations	Disbursements	Pipeline
1986	6.5	.3	6.2
1987	10.2	9.5	6.9
(Cumulative)	(16.7)	(9.8)	
1988	15.0	15.5	6.4
(Cumulative)	(31.7)	(25.3)	
1989	21.0	14.8	12.6
(Cumulative)	(52.7)	(40.1)	
1990	7.3	14.5	5.4
(Cumulative)	(60.0)	(54.6)	0
1991	0	5.4	0

The rate of expenditure is based on the following projections:

- o During FY 1986 AID project funding totals only $6.5 million. Release of this first tranche is subject to some conditionality but not the more difficult conditions required in subsequent tranches.

- o Line materials and other commodities will be purchased and funds disbursed for the 17 PBSs at this number of PBSs each year:

  FY 87-3
  FY 88-4
  FY 89-5
  FY 90-3
  FY 91-2

This schedule, which may be slightly modified in the out years, allows for strengthening the PBSs which have begun to experience severe supply constraints first and to allow the other PBSs (still in the majority) to complete their RE II investment program prior to the receipt of more commodities. Given performance over the past 2 years, expenditure projections will easily be attained. RE II, which has a PACD of December 31, 1987, has only $200,000 of funds left unearmarked.

H. Implementation and Procurement Plan

Commodity Procurement

Commodity procurement under RE I and RE II has been implemented through formal competitive bidding under host country contracting procedures set forth in AID Handbook 11, Chapter 3. REB has handled procurement well under RE I and II and only minor adjustments are indicated. These HB 11 competitive procedures will, therefore, be followed for RE III commodity procurement. REB, in conjunction with the TA team, will develop the IFB packages for equipment required for the initial intensification process. The lead time from IFB development to delivery of goods is 12-18 months. Therefore, the process will begin in late FY 86 and continue for the duration of the RE III project.

Procurement of commodities will require a substantial part of AID funds (about 80%). Commodities are generally bid competitively under Code 941 tenders using procedures which have proven very successful in assuring that quality commodities are delivered in a timely manner. Small and minority firms have been successful in winning several commodity supply contracts under RE II, and this trend can be expected to continue in RE III. Based on prior experience, small value (under $100,000) procurement may be required occasionally to procure small items of relatively low value needed quickly to avoid implementation delays, as well as a small amount of support commodities.

The possibility of engaging a Gray Amendment PSA in procuring commodities under the small value procedures will be investigated during project implementation. A Gray Amendment PSA could assist the project by bundling together packages of small value procurements consisting of items of known constant demand. Total procurement of such bundles, packaged in amounts of $50,000 to $100,000 procured utilizing HB 11 Chapter 3 procedures as modified to encourage Gray Amendment purchases, may reach $1,500,000. PSA services may be required beginning late FY 87.

Additionally, USAID will require the TA contractor, which will be charged with assuring proper advertisement of IFBs for AID financed commodity procurement on behalf of the BDG, to separately notify eligible 8(A) or Gray Amendment suppliers. AID will provide lists of such potential suppliers to REB. The TA contractor will be required to maintain adequate records on all procurements and note in the contractor's quarterly progress report all 8(A) or Gray procurements, both in total and as a percent of all procurements for the quarter.

Technical Assistance

Technical assistance retains a key role in the ultimate success of the rural electrification program. The other donors have looked to AID to continue funding the expatriate TA team. In 1984, reviews of TA to RE resulted in a tripartite (AID, BDG and NRECA/GC) agreement about the composition of the TA team during the July 1984 to July 1987 period. The 36 month TA contract extension, which was signed in July 1984, places more emphasis on advising, monitoring and training than in the past and minimizes the "hands on" type of TA which tends not to result in successful knowledge and applications transfers.

Under the RE III project, TA will include enough expatriate professionals to allow for continued expansion of the RE program from 33 PBSs to 40 PBSs with several older PBSs picking up small contiguous areas and intensification within the 31 existing PBSs. USAID believes that the institution building and technology transfer aspects of the technical assistance being delivered to the PBSs will require no less than 20 expatriate advisors over the next 2-3 years. The technology transfer and institution building momentum of the TA team's work, which has been building as the basic PBS plant is completed and electrified, could be lost if an adequate level of TA is not continued. AID is particularly concerned about training at all levels, and despite the impressive training results to date believes an even more intense effort is required.

Though the number of TA advisors will be increasing from seventeen to twenty, the responsibility per advisor will increase dramatically. REB and PBS staff will be taking a greater role in the management and operation of

the RE program as the area to be covered by each advisor increases. Under RE I and II as the system construction of an individual PBS was completed and made operational, the TA requirements shifted from technical inputs to management and operational concerns thus TA involvement per PBS was less staff intensive. At any one time, the number of PBSs requiring TA was 20-22. During the next five year period, work will continue on the original 33 PBSs (funded by AID and other donors) through intensification of the systems as well as the addition of seven new PBSs funded under the World Bank project. Therefore, the T.A. team will be involved with every aspect of the RE program in all 40 PBSs. As the REB and PBS staff matures and is exposed to increased levels of training, a major portion of the work will be performed by them. This will permit the TA team to cover the expanded area of the RE program with basically the same level of personnel and will eventually allow for the reduction in the size of the TA by the PACD.

While emphasis on TA and training remains great, the percent of total (all sources) project funds devoted to these activities will drop to 7% of donor funding in Phase III, down from 9% in Phase II and 17% in Phase I. This 7% figure is derived from firm donor commitments to date. A more donors contribute to Phase III this percent will continue to fall.

Accordingly, we have budgeted $13.5 million for TA and training (AID funds will only support U.S. training). In the Project Grant Agreement, AID will include a condition precedent and covenant requiring AID funds used for TA and training be passed through the BDG to the REB in grant form.

Because REB has demonstrated the capacity to administer a TA host country contract, this method of contracting will be continued under the RE III project.

USAID believes that the services of the incumbent TA (NRECA) should be continued for the duration of the RE III project. As above, much of the success of the rural electrification program in Bangladesh can be attributed to the TA supplied by NRECA. NRECA has been instrumental in adapting the REA approach of providing rural electrification through cooperatives to the situation in Bangladesh. The development of PBSs into bodies capable of providing electric power and related services to its members has been a major focus of the TA effort. Much of the success of the development of the PBSs is a result of NRECA's extensive experience with rural electric cooperatives in the U.S. and other third world countries. A strong bond has been developed between REB and NRECA which has contributed to a positive working relationship. A number of REB staff have participated in various training activities conducted by NRECA in the U.S. This U.S. training effort will continue during RE III implementation. Because of their extensive involvement in the RE program in Bangladesh, NRECA has been able to identify U.S. training courses that are appropriate for the continued development of the REB. USAID/Bangladesh is, therefore, requesting that the Administrator waive competition and permit REB to negotiate with NRECA to provide TA for the RE III project. USAID has prepared such a waiver, based upon the more detailed justification of approval to negotiate with a single source per AID Handbook 11, Chapter 1, Section 2.4.2 found in Annex K.

Upon receipt of the waiver, REB will negotiate a four year contract with NRECA (July 1987 to July 1991) to provide the required technical services. The waiver does not include the engineering services of Gilbert Commonwealth, however. During contract negotiations NRECA will be required

to submit a subcontracting plan covering small disadvantaged business concerns or Gray Amendment Firms as subcontractors. At least 20% of the prime contract cost must pass through to 8(A) or Gray Amendment firms. Joint ventures with 8(A) or Gray firms will also be eligible as subcontractors, so that NRECA could, for example, chose to subcontract with Gilbert Commonwealth in a joint venture with a Gray Firm, or to subcontract all technical engineering tasks to such a firm.

Training

AID funds will be used to finance thirty participant training trips to the U.S. for REB and possibly PBS officials. The courses, as in the past, will concentrate on management skill enhancement in the operation of a rural electric utility by cooperatives. The scheduling of the particular training courses has not been finalized, but plans are for 6-8 participants to attend training sessions each year beginning in FY 87. The TA contractor will be responsible for identifying, arranging and overseeing all of the U.S. training activities.

3. Gray Amendment Certification

The Mission Director certifies that the procurement plan for this project was developed with full consideration of maximally involving such organizations in the provision of required goods and services and that the Project is appropriate for minority or Gray Amendment organization contracting as stated in this section of the PP.

TABLE 4

IMPLEMENTATION SCHEDULE

ACTIVITY	1986	1987	1988	1989	1990	1991
1. Funding Obligated	--->	--->	--->	--->	--->	
2. Material & Equipment Tendering - Int'l	---------->					
3. Material & Equipment Delivery Bangladesh - Int'l		---------->				
4. Small Value Procurement			---------->			
5. Material Tendering Local	---------->					
6. Material Delivery Local		---------->				
7. Membership Drive PBS	---------->					
8. Line Design	---------->					
9. Line Staking and Right of Way Clearing	---------->					
10. Line Construction			---------->			
11. Substation Construction			---------->			
12. Training Program in-country		---------->				
13. Training Program U.S. and Third Country		--->	--->	--->	--->	
14. Consumer Hook-ups			---------->			
15. Technical Assistance Contract	---------->					

I. Other Donors

Several other donors (WB $79 million; Canada-$40 million est. and Finland-$8 million est.) expect to participate in the Phase III RE program which is in itself part of the longer term Five Phase Bangladesh total electrification program. The longer term program will provide grid electricity to basically all of the densely settled rural areas of Bangladesh.

The success of USAID's RE I & II Projects convinced other donors that RE was a desirable investment, and beginning in 1982 the WB, Kuwait and Finland began funding 16 additional PBSs. Technical assistance for all 33 PBSs (17 USAID and 16 other donor funded) was provided by USAID funded consultants under a host country contract to REB. The use of one consultant team for all donors has been very effective in helping to ensure that the high standards developed by REB were uniformly applied to other donor funded PBSs. As a result, other donors planning to participate in Phase III have agreed to use USAID funded TA for their segments of the program. Canada has indicated that their assistance will be conditioned upon USAID's funding of TA for their segment of the program.

The WB has signed a $79 million follow on project which will establish 7 new PBSs and intensify coverage within the 5 PBSs built under their first project. Finland will likewise intensify the coverage in the one PBS built with their funds in Phase II. Canada does not intend to provide funds for any new PBSs, but will intensify coverage within the 8 PBS areas built by Kuwait under Phase II. The use of other donor funds for intensification rather than expansion alone is largely attributable to the close coordination between USAID and the other donors. By providing funds for commodities as well as TA, USAID will continue to be a major contributor to RE, and thus continue to exert influence with other donors over program policy and direction. Maintaining the same material and systems standards and specifications for all donor's program components will continue to be an area requiring close donor coordination.

Donor coordination on the RE program has been extremely successful. In the first instance one TA consultant is providing advisory services for the overall program. Second uniform standard technical specifications apply to all rural electrification procurement and construction regardless of source of funding. Third a unified donor position has convinced the BDG to focus on intensification in lieu of rapid expansion of the backbone system. Finally, and most important, donors have been working together in maintaining a policy dialogue to get the BDG to review the pricing of electricity to arrive at a more rational rate schedule and to look at ways of improving the PBSs financial performance. On this last point, the WB, through the United Nations Development Program, has engaged a consultant to conduct a power rate study looking into long-run marginal cost of electricity, PBS rate schedules and subsidies. USAID has had discussions with the WB and the firm conducting the study, and will participate in discussions with the WB and BDG on implementation of the recommendations of the study. Future obligations will be contingent upon progress made by the BDG in implementing the final recommendations.

BDG Contribution

BDG funding to support this activity is estimated at $66 million bringing the total Phase III funding to around $253 million. These costs do not include interest accrued during construction or custom duties and sales taxes paid by REB. This level of funding is a considerable commitment

which demonstrates the high level of BDG support RE receives.

The BDG budget of $28 million support planned for RE I was met by BDG expenditures over the life of the project. RE II, although not yet completed, is receiving financing adequate to meet BDG planned support of about $13.9 million. The popularity of the RE program with rural population translates into popular support for the government which, in turn, has created strong support for RE by the BDG. The Third Five Year Plan recognizes the importance of electrification to development in Bangladesh and provides funds to meet the BDG budget of $19.3 million for RE III. The BDG contribution to RE III amounts to 24 percent of total project costs. For this reason a waiver of Sections 110(a) and 124(d) of the FAA is included in the Project Authorization. However, the BDG's commitment to the RE effort has been demonstrated in the overall level of BDG funding for all three phases of the USAID RE projects. As an aggregate, the BDG contribution represents 25 percent of the total project costs for RE I, II & III (AID $179.3, BDG $61.2).

SECTION III - PROJECT ANALYSES

A. Administrative Analysis

Organization of REB

REB is a government entity which was formed in 1977. It is responsible for the initiation, planning and implementation of rural electrification schemes within the framework of the rural electrification master plan. REB's specific responsibilities include: (a) arranging finance for rural electrification schemes; (b) construction of new distribution systems and rehabilitation of existing schemes; (c) organizing prospective consumers into PBSs and prescribing their by-laws; (d) establishing technical and administrative standards for PBSs; and (e) approving their tariffs. According to the Presidential Ordinance which created REB, it is also responsible for electricity generation to supply rural areas; however, at present, it is not carrying out this task. On this point, the WB has financed a study to investigate certain PBSs cogenerating a portion of their requirement to supplement the power supplied by the national grid. The study is primarily looking at gas fired units, thus limiting the study area to those PBSs in the east zone close to gas distribution systems. REB's management consists of a chairman, three full-time members and four part-time members. The period, terms and conditions of appointment for the chairman and members are determined by the BDG. REB's organization chart is shown in Annex J.

Scheme Selection and Implementation

REB's project area selection criteria consider such things as the availability of power supply, roads, population density, irrigation requirements, and the promotion of regional balance. A project proforma is prepared following the provisional allocation of foreign exchange to a proposed project, and contains details of project targets, proposed physical facilities, proposed financing and a cost-benefit analysis for the project. Following a review of the project proforma by the Planning Commission, it must be approved by the Executive Committee of the National Economic Council (ECNEC). REB then establishes PBSs in the project area.

REB exercises statutory control over PBSs. This includes the supervision of their operations, assisting with the implementation of

technical and administrative control systems which REB has developed for the PBSs, and training PBS staff. REB has established a 'Rate Cell' which reviews PBS tariffs. Following implementation of a project by REB, schemes are handed over to the newly created PBSs. REB lends the initial cost of the scheme, secured by a mortgage, to the PBS, provides loans to cover working capital requirements, and arranges financing required to expand PBSs.

Palli Bidyut Samities - PBSs (Rural Electrification Cooperatives) Organization Structure

The PBS system consists of member-owned autonomous cooperatives for electricity distribution in rural areas. A PBS's initial Board of Directors is selected from local citizens, subject to the approval of the REB Board of Directors. After their appointment the directors register the PBS with REB, which then proceeds to promote PBS membership among potential electricity consumers. The Board of Directors consists of 10-15 members elected by an annual membership meeting. Eligibility to become or remain a director includes being a bona fide member of a PBS and a resident of the area. Any person or organization in a PBS area may become a member of the PBS following acceptance by the Board of Directors and payment of the membership fee of Tk. 10.00. REB, with assistance from the NRECA consulting team, has developed a typical organizational structure for PBSs. Two sample organizational charts have been prepared as flexible models to meet different levels of activity. The General Manager is the chief executive and is accountable to the Board of Directors. Four main departments, each headed by an Assistant General Manager, are responsible for extension and member services, finance, construction and maintenance, and general services.

PBS Responsibilities and Operations

PBS responsibilities begin when a scheme is handed over to it after being constructed and electrified. The principal objective of a PBS is to supply its members and other consumers (hospitals, street lights, schools etc.) with electricity. Its functions include: (a) planning and implementing the expansion of local distribution systems with financial and technical assistance from REB; (b) purchase of electricity from PDB; (c) distribution of electricity and making consumer connections; (d) meter reading, billing and collection; (e) setting tariffs, with approval of REB; and (f) providing technical and financial assistance to consumers for wiring their premises and acquiring and installing electrical appliances and low tension (LT) capacitors to improve power factors.

About 190,000 connections (supplying over 475,000 consumers) had been made by March 1985, and in FY 84 the average number of new connections made per month was 4,000. Total energy consumption increased from 44.97 GWH in FY 83 to 88.08 GWH in FY 84, with an associated increase in average annual consumption per connection from 660 kWH to 880 KWH. Meter reading, billing and collection are satisfactory in all the PBSs; all consumers are billed regularly every month and in FY 84 96% of revenues were collected on time. By October 1984, PBSs had constructed, with the assistance of local consultants and contractors, about 400 km of additional distribution lines for which REB provided the financing.

The REB is providing technical assistance to the PBSs including management of construction, setting of construction and operating standards and specifications, and establishing training courses and systems.

The REB field inspection staff, with the advise of the TA consultant, is supervising the local line design consultants and contractors to ensure compliance with REB standards. This is working well and completed construction reflects acceptable workmanship. Eighty percent of the local contractors currently engaged in line construction are now experienced and need less and less supervision. However, the overall involvement of the TA consultants remains important. The consultant is still monitoring quality control through on-site inspections and overseeing of all construction activities. REB engineering staff is taking on more of this work each year and the ratio of expatriate engineers to construction costs is and will steadily decrease.

All 13 PBSs under RE I have been electrified and have assumed responsibilities such as inspecting consumers' personal electric installations and making service connections. After the completion of all Phase I construction, scheduled for mid 1985, these PBSs will be sufficiently experienced to assume full operation and maintenance responsibilities, with REB providing general guidance and policies. The chance of this succeeding looks promising, as verified by USAID engineers during site inspections, although AID is becoming concerned about the possible incipient problems of maintenance which may occur after 5 to 7 years. This potential problem area needs to be closely monitored. A Maintenance/System Operation Advisor will be added to the TA team to assist the REB and PBSs in addressing this issue.

The PBSs purchase bulk power from PDB at the PBS substation level. Operation and maintenance of all these substations and the distribution and feeder systems down to customer meters is the responsibility of the PBS.

The installation of interior house wiring and hook-ups to irrigation units etc. is the responsibility of the consumer. Prior to supplying electricity to a meter, PBS inspectors certify installations for conformance with REB standards. This has been accomplished successfully.

To ensure a smooth transfer of technology, local consulting engineering and surveying firms have been employed by REB from the start of RE I. The TA consultant provides guidance and general supervision to these firms, working, as much as possible, through REB engineering staff. Line and other construction work is handled by local contractors directly supervised by the engineering consulting firms. This approach has worked very well. These local consultants should form the nucleus for a sound electrical engineering/ construction industry in Bangladesh. Continuation of appropriate technical assistance is essential for achieving this objective.

As in the past, the technical responsibilities of the local consultants will include:

- o preparing detailed line design (staking sheets)
- o supervising right of way (ROW) clearing
- o preparing system maps
- o providing general engineering consulting services
- o supervising construction.

B. Financial Analysis

1. Overview

The objective of this section is to analyze the financial issues concerning the RE program in light of prior experience, policy concerns expressed by USAID and other donors, and the emphasis on intensification present in RE III. This is accomplished by first summarizing the current financial position of the original 13 PBSs financed by USAID. Then, the major financial issues facing the RE program are identified and discussed. Finally, a case study of a "typical" PBS is used to analyze the financial issues identified previously and to suggest appropriate policy responses.

2. Current Financial Position:

a. Financial Performance:

One indicator of the financial performance of the 13 PBSs is their ability to meet the financial covenants under which they were established. These dictate that each PBS, once the 5 year grace period expires, should be able to meet its operating expenses and begin repayment of principal and interest on the REB loan used to finance initial construction. In the remainder of this section, PBS financial performance is reviewed and some of the determinants of this performance are analyzed.

Evidence concerning financial performance of the PBS can be obtained by analyzing their operating margins during the years since electrification and by assessing their abilities to make principal and interest repayments.(1) Relevant data on financial performance is summarized in Table 1.

The data indicate that only 4 of the 13 PBSs had positive operating margins during the most recent fiscal year. On the other hand, all PBSs except one either reduced their operating deficits or increased their operating surpluses between FY 83/84 and FY 84/85. The overall financial performance of the PBSs is likely to continue to improve ceteris paribus as consumer densities and average levels of consumption increase.

However, operating margins are apt to decline for most PBSs in FY 85/86. The 5 year grace period will expire for most of them and consequently, they must begin (at least in theory) to make repayments of principal and interest. Estimated operating margins for FY 85/86 are also presented in Table 1. They indicate that none of the PBSs which end their grace period in FY 85/86 will be able to make full principal and interest repayments, although 7 PBSs should be able to make partial payments.

The final columns in Table 1 present the average tariff for each PBS as of the first quarter of FY 85/86 and the average tariff which is required if each PBS is to cover its operating costs and make whatever principal and interest payments are due.(2) These tariff increases are relatively large for most PBSs and thus provide another indication of the financial difficulties confronting many PBSs in the near term.

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(1) It must be kept in mind that only limited evidence on these topics is available since they have all be electrified 5 years or less.

(2) This required average tariff is estimated based on an assumed zero price elasticity of demand.

b. Determinants of Financial Performance:

i. Subsidies: The subsidies received by PBSs constitute one of the key determinants of their financial performance. These subsidies take three forms: 1) bulk electricity is supplied to the PBSs at a subsidized rate by the PDB, 2) a subsidy equal to any positive difference between operating expenses and revenues is paid to each PBS by the BDG during its first five year of operation, and 3) capital is supplied to each PBS at a subsidized interest rate.

The magnitudes of these three subsidies are summarized in Table 2. At present, the largest source of subsidies identified above is (3), the low interest rate paid by the PBSs on REB loans. Operating subsidies (2) for the original PBS's should become insignificant in the near future as their grace periods expire. Bulk electricity subsidies (1) are also likely to decline (at least on a per KWH basis) as PDB tariffs move towards LRMC.

ii. Demand-side factors: Demand-side determinants of financial performance relate to factors which affect the potential demand for electricity in a RE area. One such factor is the relative maturity of the PBS. As is demonstrated in Table 3, 3 of the 4 PBSs with positive operating margins in FY 84/85 are relatively mature - being electrified in 1980 or 1981. Perhaps more importantly, data from Table 3 indicate that these four PBSs supply relatively large amounts of power to irrigation and industrial consumers. Such consumption contributes to higher load factors and better financial performance.

iii. Tariffs: Electricity tariffs - both the bulk supply rate charged by the PDB and the tariffs charged by the PBS themselves - are an important determinant of PBS financial viability. The subsidies provided to PBSs via a low bulk rate tariff are discussed above. PBS tariffs, which were established largely by the REB and which vary little among PBSs, are summarized in Table 4. A comparison of these tariffs with the bulk supply rate (Tk. 0.95/KWH or approximately Tk. 1.20/KWH after adjusting for line losses) demonstrates that commercial, irrigation, and industrial tariffs not only cover bulk supply costs but also provide a margin which can be applied toward PBS operating expenses. This finding emphasizes how financially important it is for PBSs to develop adequate productive use loads and also points to the need for PBS tariff reforms which contribute to financial viability (while still being consistent with efficiency or equity objectives).

3. Financial Issues:

The above review of PBS financial performance highlights several financial issues which need to be addressed. These include: 1) the ability of PBS to meet existing financial covenants which are uniform for all PBSs and which provide only a five year grace period, 2) the financial implications of RE intensification at existing PBSs and 3) opportunities for PBS tariff reforms which improve their financial performance and which are consistent with efficiency and distributional objectives.

Concerning the first issue, RE by its very nature has strong developmental and distributional objectives. RE experience in other countries leads one to question whether the financial covenants imposed on PBSs, i.e. full principal and interest repayment plus the termination of

operating subsidies after the 5 year grace period, are feasible and consistent with these other objectives. This is especially true for certain PBSs which supply less developed areas with smaller potential markets for RE.

The RE III project focuses primarily on the intensification of existing PBSs. Intensification builds upon previous investments by PBS's and thus permits significant economies of scale to be realized. As a result, the financial performance of PBSs should improve with intensification. The question is: how significant will the improvement be?

Finally, considerable efforts are already underway to rationalize electricity pricing policies in Bangladesh. One certain result is that the bulk power tariffs charged PBSs by the PDB will increase significantly. PBS tariffs will also have to increase to reflect more fully both this increased energy costs and the costs of building and operating PBS distribution systems. Evidence suggests that PBS's tariffs can increase significantly and still remain attractive to potential consumers (See Annex F.2.b). However, there is a need to analyze the implications which various combinations of PDB and PBS tariff increases have for the financial performance of PBSs.

The financial issues identified above are analyzed in the next section. This is done through case studies of several "typical" PBSs.(1)

a. Financial Analysis of "Typical" PBSs:

In this section, the financial performance of typical PBSs is modeled in the context of existing financial covenants and then several options for improving this financial performance are assessed.(2) The following types of PBS are considered: 1) an average non-intensified PBS, 2) an average intensified PBS, 3) an above average (in terms of energy sold) non-intensified PBS, and 4) an above average intensified PBS.

i. Financial performance: The current financial performance of these types of PBSs is analyzed by determining their yearly operating margins and net incomes and then assessing their abilities to meet existing financial covenants.(3) Operating margin and net income for each type of PBS are summarized in Table 5.

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(1) Specifically, key parameters reflecting demand, line losses, and system costs represent averages derived from the Natore I and II and Jessore I and II PBSs. For more details on these parameters see Annex F.2.a.

(2) Only "non-technical" options which relate to tariffs, intensification, and financial covenants are considered. Efforts to improve performance through such technical approaches as reducing line losses or PBS capital and operating costs are not analyzed.

(3) These covenants dictate an end to operating subsidies after the fifth year of operation and repayment of principal and interest starting 6 years after initial loan disbursement by the REB. Full repayment of principal and interest in a given year is possible when net income for that year is positive.

Results of this analysis suggest that both average non-intensified and average intensified PBSs are unlikely to be able to comply with loan repayment requirements in the first 15 years even given the highly subsidized nature of such loans.(1) This result is consistent with what is currently occuring in actual PBSs which are finishing their loan grace periods. Above average PBS -- those which supply areas characterized by higher levels of electricity demand -- exhibit somewhat better financial performance. Full principal and interest repayment can begin in such a non-intensified PBS by roughly year 12, and by year 9 in an intensified PBS.(2)

ii. Policy options to improve financial performance: Given the existing pattern of PBS financial performance described above, there is a clear need for improvement. Several options for improving financial performance are discussed below.

Tariffs: Considerable work in the area of power tariff rationalization is ongoing in Bangladesh. While the principal objective is improved efficiency resulting from tariffs which more closely reflect economic supply costs, such tariff reforms also have important financial implications for PBSs. Bulk tariffs to PBSs are certain to rise significantly and are likely to be restructured to include peak/off-peak pricing and a demand charge. With respect to PBS tariffs, the factor affecting PBS financial performance is the margin between the bulk tariff paid by a PBS and the average retail tariff at which the PBS sells power.(3) It is obvious that in order to merely maintain the status quo this margin must be retained by the PBS as the bulk tariff increases. However, the margin must, in fact, be increased if financial performance is to actually improve. Data presented in Table 5 and Annex F.2.a can be used to estimate the increase in the margin required to provide the PBS with a positive net income in a given year. Results from such an analysis are summarized in Table 6.

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(1) The financial projections summarized in Table 5 perhaps understate the extent to which intensification will strengthen PBS financial performance. Since intensification is assumed to begin in year 7, the resulting benefits show up only in years 8-15. If one assumes intensification occurs starting in year 1, the resulting financial projections provide a clearer demonstration of the resulting financial gains. Such an analysis for an average PBS shows that financial viability (i.e. positive net income) is achieved by year 12 (rather than in year 17 if there is no intensification). This finding underscores an important point - the soonner intensification occurs, the greater are the resulting financial benefits. In fact, intensification is most effective if it takes place during initial PBS construction. That is, it would be economically and financially desirable to construct PBSs which initially connect more consumers.

(2) Ignoring, for simplicity, principal and interest arrears from year 6 until repayment begins.

(3) The margin is currently Tk. 0.75.

It is clear from Table 6 that average PBSs would have to achieve quite significant increases in their retail margins in order to meet repayment requirements prior to year 10. Moreover, since the bulk tariff is likely to increase significantly in the future, the absolute increase in the average PBS tariff required to meet loan repayment needs will be very large indeed. For example, if the bulk rate doubles to Tk. 1.9/KWH then the average tariff required to meet repayment needs for a base case PBS would be Tk. 3.87 in year 6 or Tk. 3.27 in year 8. This compares to the current average PBS tariff of Tk. 1.7.

Consumers mix and density: From the above discussion, it should be clear that very large tariff increase are required to meet repayment requirements in early years. These increases may not be acceptable. Such required increases can be reduced by efforts to increase the density of consumers through intensification, or to connect those types of consumers (primarily commercial and industrial) which pay relatively high tariffs and which contribute to high PBS load factors.

Other: Other policy changes may ease the financial burden confronting PBSs. For example, PBSs might be allowed to use a fraction of their depreciation funds towards the payment of principal and interest.(1) If this fraction was between one-half and three quarters, then the effect would be to advance by 3-5 years the date at which average intensified or non-intensified PBS can begin to make full principal and interest repayments.

PBSs are currently required to make annual loan repayments consisting of level principal payments plus interest. The result is that repayments are highest in the first year of payback and then decline as the interest component of the repayment declines. An alternative repayment scheme would be to require level payments of principal and interest. This would have the advantage of requiring lower repayments during early years when PBSs naturally have less ability to repay.(2) The initial reduction in repayments would not be great, however. Under current loan conditions, first year repayments would decline by approximately 1.3%, and by lesser amounts in subsequent years.

Another possible change in loan repayment conditions is lengthening of the grace period. This period is currently five years starting from when the loan is disbursed. Since PBS organization and construction typically takes several years, PBSs often operate for only 2-3 year before the end of the grace period. In this context, a longer grace period appears sensible. This is especially true for certain PBSs which supply less well developed markets for electricity. In fact, it might be appropriate for repayment conditions to vary with the nature of the market supplied by the PBS.

b. Implications for USAID Policy Dialogue:

The above analysis suggests that many PBSs will have difficulty satisfying the financial covenants under which they were established. As a result, there is a clear need for reforms which lead to either improved PBS financial performance or more appropriate covenants.

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(1) This does not occur at present since depreciation accounts must be fully funded.

(2) Of course, repayments would be higher in later years.

A variety of reforms which can contribute to improved financial performance are outlined above. These include: a) intensification of existing PBSs, b) efforts to increase the margin between the bulk tariff rate charged by the PDB and the average retail rate charged by the PBS,(1) c) efforts to connect relatively more commercial and industrial consumers, and d) revisions of PBS loan repayment terms.(2) No single reform is apt to fully eliminate the financial challenges confronting PBSs. Thus a policy dialogue which addresses a number of the reforms identified above is required.

The design of the RE III project -- with its emphasis on intensification -- already focuses on some of the areas of reform noted above. The remaining areas of reform relate primarily to tariff and loan repayment terms. Critical to these concerns is the ongoing power sector tariff and subsidy study funded by UNDP and implemented by WB. In order to accomplish most effectively its policy objectives in these areas, USAID should participate to the extent possible in the negotiations with the BDG which lead to implementation of the study findings. Furthermore, obligation of funds for RE III should be linked via CPs to the agreements reached in these negotiations.

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(1) Accomplished by increasing PBS tariffs relative to the bulk tariff and/or reducing PBS line losses.

(2) An improved supply of power to the PBSs is also of critical importance.

Table 1: Statistics on the Financial Performance of PBS's (a)

PBS	Operating Margin (Tk. X 10^3) FY 81/82	FY 82/83	FY 83/84	FY 84/85	FY 85/86 (est.)	Tariff Data (Tk/KWH) Average Tariff/KWH (1st Quarter FY 85/86)	Average Tariff Required to Break even for FY 85/86
Comilla I	(2839)	(2567)	(2696)	761	(11741)	1.58	2.40
Sirajgong	(2718)	(3232)	(4994)	(1612)	(9576)	1.59	2.31
Dhaka	(4282)	(1070)	1138	5024	(4350)	1.66	1.79
Jessore I	(2327)	(2857)	(4181)	(2889)	(7070)	1.43	2.40
Jessore II	(3266)	(3367)	(4179)	(992)	(8896)	1.63	2.46
Pabna I	-	(1509)	(2240)	(2531)	(3068)	1.79	2.12
Pabna II	(601)	(1852)	(2189)	(2180)	(2531)	1.33	2.08
Habiganj	(115)	(1454)	(1783)	969	1708 (b)	1.42	less than 1.7
Natore I	(3833)	(2760)	(4043)	(899)	(7522)	1.43	2.30
Natore II	(873)	(2432)	(2066)	(612)	(1683)	1.35	1.84
Chandpur	(914)	(2103)	(3828)	(2975)	(5627)	1.32	2.61
Moulovibazar	(2667)	(1991)	(2266)	2256	(904)	1.42	1.76
Tangail	(1885)	(1129)	(2215)	(425)	(480)	1.55	1.74

(a) Operating margin = (billed tariff revenues + other revenue) - (cost of power + O&M gov't duty + any principl and interest repayment).

(b) Grace period still in effect.

Table 2:Estimates of RE Subsidies

PBS	Bulk Tariff Subsidy (Tk. X 10^3) (a) FY 85	FY 86 (est.)	Operating Subsidy for 1st 5 years (Tk X 10^3) (b) FY 82	FY 83	FY 84	FY 85	Interest Subsidy on PBS Loan (Tk X 10^3) (c)
1. Dhaka	30352	28736	4282	1070	0	0	20424
2. Tangail	19587	16553	1885	1128	2215	425	17802
3. Comilla I	17038	15138	2839	2567	2696	0	23000
4. Chandpur	8062	5072	914	2103	3828	2975	17250
5. Habiganj	10486	11755	115	1454	1783	0	13800
6. Moulvibazar	13073	14713	2667	1991	2266	0	11744
7. Pabna I	5858	5851	-	1509	2240	2531	11730
8. Pabna II	5496	5524	601	1852	2189	2180	11500
9. Sirajgonj	16541	12988	2718	3232	4994	1612	17250
10. Natore I	9829	91212	3833	2760	4043	899	15143
11. Natore II	11693	10490	873	2432	2066	612	17250
12. Jessore I	11682	8654	2327	2857	4181	2889	18400
13. Jessore II	9881	10682	3266	3367	4179	992	17250
Total:	169578	157368	26320	28322	36680	15115	212543

(a) Equals (Tk.1.76 - Tk. 0.78) X KWH's purchased for FY 85, and (Tk.1.76 - Tk.0.95) X estimated KWH's purchased for FY 86.

(b) Assumes the subsidy paid each year equals the calculated operating deficit, i.e. (billed tariff revenue and other opeating revenue) - (cost of power + O&M + government duty + depreciation).

(c) Estimated for the 6th year of PBS operation, given the estimated total utility plant as of June 1985. Interest subsidy = [total utility plant X (14.5% - 3%)], where 14.5% is the assumed market rate of interest.

Table 3: PBS Energy Consumption by Consumer Category in December 1984

PBS	Month/Year Officially Electrified	Monthly PBS Energy Consumption (MWH) Total	% Irrigation	% Domestic	% Commercial	Industrial
Comilla	1/1981	1342	30	16	5	49
Chandpur	12/1981	721	44	23	10	23
Dhaka	6/1980	2325	39	18	2	41
Jessore I	6/1981	886	47	21	8	24
Jessore II	3/1981	713	47	22	7	24
Pabna I	1/1984	463	34	24	7	35
Pabna II	1/1983	385	15	33	14	37
Sirajgong	4/1981	1369	44	20	8	31
Natore I	3/1981	995	57	18	4	21
Natore II	6/1982	768	27	25	7	41
Habiganj	10/1982	696	4	18	7	70
Moulvibazar	6/1981	920	0.3	19	2	79
Tangail	10/1981	1192	14	24	2	60

Table 4:PBS Tariffs by Year (Tk./KWH) (1) (2)

Tariff Category

PBS	Domestic						Small Commercial						Irrigation						Industry						Street Light (3)					
	80/81	81/82	82/83	83/84	84/85	85/86	80/81	81/82	82/83	83/84	84/85	85/86	80/81	81/82	82/83	83/84	84/85	85/86	80/81	81/82	82/83	83/84	84/85	85/86	80/81	81/82	82/83	83/84	84/85	85
Dhaka	0.75	0.75	0.80	0.80	0.80	1.0	-	-	1.25	1.25	1.40	1.80	0.70	0.85	1.0	1.0	1.15	1.60	0.95	1.05	1.45	1.50	1.70	2.10	60.0	60.0	60.0	70.0	75.0	85
Tangail I	-	0.75	0.80	0.80	0.80	1.0	-	-	-	1.25	1.35	1.60	-	0.85	1.0	1.0	1.15	1.50	-	1.05	1.50	1.50	1.65	1.85	-	60.0	60.0	70.0	70.0	85
Comilla I	0.75	0.75	0.75	0.80	0.80	1.0	-	-	1.25	1.25	1.50	1.70	0.80	0.85	1.0	1.0	1.10	1.50	0.90	1.05	1.40	1.50	1.70	1.90	60.0	60.0	60.0	70.0	70.0	85
Chandpur	0.75	0.75	0.75	0.80	0.80	1.0	-	-	1.25	1.25	1.50	1.70	0.70	0.85	1.0	1.0	1.25	1.50	0.90	1.05	1.40	1.50	1.70	1.90	60.0	60.0	60.0	70.0	70.0	85
Habiganj	-	-	0.75	0.80	0.80	1.0	-	-	1.40	1.40	1.35	1.60	-	-	1.0	1.0	1.0	1.40	-	-	1.45	1.50	1.65	1.80	-	-	60.0	70.0	70.0	85
Moulavibazar	0.75	0.75	0.90	0.80	0.80	1.0	-	-	1.30	1.30	1.40	1.60	0.70	0.85	1.0	1.0	1.0	1.40	0.90	1.05	1.50	1.50	1.65	1.80	60.0	60.0	60.0	70.0	70.0	85
Pabna I	-	0.75	0.75	0.80	0.80	1.0	-	-	1.25	1.30	1.40	1.60	-	0.85	1.0	1.0	1.25	1.45	-	1.05	1.45	1.50	1.70	1.95	-	60.0	60.0	70.0	70.0	85
Pabna II	-	0.75	0.75	0.80	0.80	1.0	-	-	1.25	1.25	1.50	1.70	-	0.85	1.0	1.0	1.15	1.40	-	1.05	1.45	1.50	1.70	1.85	-	60.0	60.0	70.0	70.0	85
Shirajganj	0.75	0.75	0.75	0.80	0.80	1.0	-	-	1.25	1.25	1.60	1.75	0.70	0.85	1.10	1.10	1.25	1.50	0.90	1.05	1.50	1.50	1.70	1.90	60.0	60.0	60.0	70.0	70.0	85
Jessore I	0.75	0.75	0.75	0.80	0.80	1.0	-	-	1.25	1.25	1.60	1.70	0.70	0.85	1.0	1.0	1.25	1.50	0.90	1.05	1.45	1.50	1.70	1.85	60.0	60.0	60.0	70.0	70.0	85
Jessore II	0.75	0.75	0.80	0.80	0.80	1.0	-	-	1.25	1.25	1.50	1.70	0.70	0.85	1.0	1.0	1.25	1.50	0.90	1.05	1.45	1.50	1.70	1.80	60.0	60.0	60.0	70.0	70.0	85
Natore I	0.75	0.75	0.80	0.80	0.80	1.0	-	-	1.25	1.25	1.60	1.70	0.70	0.85	1.15	1.15	1.25	1.50	0.90	1.05	1.50	1.50	1.70	1.85	60.0	60.0	60.0	70.0	70.0	85
Natore II	-	-	0.80	0.80	0.80	1.0	-	-	1.25	1.25	1.50	1.60	-	-	1.15	1.15	1.25	1.50	-	-	1.50	1.50	1.70	1.85	-	-	60.0	70.0	70.0	85

(1) For the original AID financed PBS's.

Source: REB

(2) Most PBS's have minimum monthly charges for most categories of consumers. This is typically based on 20 KWH and 18 KWH consumption for domestic and commercial consumers respectivel, horse power for irrigation consumers, and on connected load (KW) for industrial consumers. There is a monthly demand charge of Tk. 30/KW for industrial consumers over 25 KW. Tariff penalties for industria and irrigation consumers with power factors below .85 also exist.

(3) Tk./Month/Light

Table 5: Summary Financial Analysis (Tk x 10^3) 3/

Case/Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Base Case															
a. Operating margin 1/	-	-	-2034	-2409	-1275	-474	836	2022	2603	3250	3996	4753	5750	6792	7952
b. Net income 2/	-	-	-	-	-	-10131	-9295	-8109	-7528	-6873	-6135	-5378	-4381	-3339	-2169
2. Intensified Base Case:															
a. Operating margin	-	-	-2034	-2409	-1275	-474	836	3198	4889	7680	9022	10495	12194	13004	15008
b. Net income	-	-	-	-	-	-10131	-9295	-6933	-5242	-2451	-1109	-6700	-5061	-4251	-2247
3. Above Average Base Case:															
a. Operating Margine	-	-	-1817	-1663	188	1602	3785	6029	6812	7889	9090	10345	11914	13572	15411
b. Net income	-	-	-	-	188	-8055	-6346	-4282	-3319	-2242	-1041	214	1783	3341	5290
4. Above Average Intensified Base Case:															
a. Operating margin	-	-	-1817	-1663	188	1602	3785	8249	11547	15790	17943	20296	22989	24415	27561
b. Net income	-	-	-	-	188	-8055	-6346	-1882	1416	5459	7812	3101	5734	7160	10306

1/ Equals total operating revenue minus the sum of bulk energy costs, O&M, and depreciation.

2/ Equals operating margin minus any interest expense and principal payment plus any government operating subsidy.

3/ Analysis assumes: a) no increase in PDB load shedding, b) no arrears, c) the same mix of consumers throughout the 15 years, and d) a constant spread of Tk. .75 between the bulk and average retail tariffs.

Table 6: Increase in Average Retail Margin Required to Earn Zero Net Income in a Given Year (Tk.)(a)

Case/Year	Year 6	Year 8	Year 10	Year 15
1. Base Case	1.22	.62	.44	.09
2. Intensified Base Case	1.22	.40	.09	.05
3. Above Average Base Case	.64	.22	.09	-
4. Above Average Intisified Base Case	.64	.07	-	-

(a) A zero price electricity of demand is assumed.

C. Economic Analysis

Overview:

A detailed economic analysis of RE III is presented in Annex F.3. This section summarizes that analysis and highlighs its important findings. Specially, the objectives of this section are to identify and discuss the principal economic benefits resulting from RE III and then compare the magnitude of such benefits with estimates of the economic costs of RE III so as to determine the strength of its economic justification. In the subsections below, the quantifiable benefits of RE are described and then a methodology for actually estimating these benefits, and the corresponding economic costs of RE, is outlined. Finally, the economic return on the investment required to intensify a "typical" PBS is estimated and an important sensitivity analysis is performed.

Economic Benefits of RE III:

RE III focuses on the intensification of existing PBSs. By extending distribution lines of existing backbone systems in PBSs, a number of benefits should be realized. PBS load factors should increase and line losses should decrease due to more efficient utilization of the distribution system. Intensification should also directly benefit consumers by increasing access to electricity. This should result in economic cost savings as electricity is substituted for more costly sources of energy. Consumers also benefit from welfare gains as the quality of rural life improves with the availability of this higher quality source of energy. Finally, some production increases are likely as the RE program stimulates increases in irrigation and other productive activities.

Methodology

The methodology used is this economic analysis attempts to quantify the RE benefits described above and then compare them with the economic costs of RE. These benefits go either to consumers who substitute electricity for some other source of energy after the advent of RE ("switchers") or to new consumers who utilize energy only after RE becomes available. Benefits to "switchers" take the form of economic cost savings; while for new consumers, economic benefits are measured by willingness-to-pay for electricity (See Annex F-3 for more details).

Economic cost savings per consumer can be measured in a relatively straightforward fashion. Estimating willingness-to-pay is more difficult, however. While a complete estimate of consumers willingness-to-pay requires detailed knowledge of their demand functions for electricity, a minimum estimate is provided by consumers actual tariff payments. This minimum estimate is utilized here, with the result being a rather conservative estimate of RE benefits for new consumers.

The economic benefits of RE estimated using this approach are then compared with the economic costs of RE. These consist of: 1) the cost of constructing and operating the PBSs, 2) the costs of supplying energy to PBS consumers - measured in terms of the long run marginal cost of power supply, and 3) private costs, which measure the costs of house or business wiring, light bulbs, and so on. All such costs are estimated in constant prices and net of any taxes and duties.

Results:

The methodology described above was used to estimate the economic rate of return on the investment required to intensify a "typical" PBS. A 30 year life time was assumed. The estimated rate of return on the RE III investment is 27 percent. This is relatively high and indicates that investments in PBS intensification have, on average, a strong economic justification.

In the economic analysis described above, economic cost savings, which occur as electricity is substituted for other energy sources, account for more than half of total economic benefits. These cost saving were estimated based on the economic cost of petroleum products in Bangladesh in 1985. However, oil prices collapsed in early 1986. If oil prices were to remain in the future at their current low levels, then the economic return to PBS intensification would be reduced to approximately 19 percent.(1) Nevertheless, even under this oil price scenario RF III still demonstrates a good economic return. Moreover, it is unlikely that oil prices will remain, over the long run, at their current low levels. Any upward movement in oil prices will cetecus paribus strengthen the economic justification of RE III.

D. Social Analysis

REB has set up an 'Evaluation Cell' in its program planning directorate to assess the impact of completed rural electrification schemes on rural communities. A base line study of the 13 RE I PBSs has been completed by REB's Evaluation Cell, USAID and Dhaka University's Institute of Statistical Research and Training (ISRT). The study, which was undertaken in 1983, assessed the socio-economic changes which have occurred in rural communities as a result of electrification. The results of the study are encouraging and indicate that nearly all of the objectives of the ACRE program are being realized.

Two major issues are briefly examined here: 1) The positive institutional impacts of RE on administration and politics in rural Bangladesh, and 2) the impacts of electrification in one productive sector--rice processing--on female employment. (For a fuller treatment of these issues refer to Annex F-4.)

Several years of project experience confirms that RE has been associated with highly successful institutional development. Not only do PBSs competently deliver a productive resource; they also show great promise in offering demonstration and spread effects within the rural political economy. They are "islands of local autonomy and administrative efficiency" introduced into a rural system dominated by patron/clientage and hierarchy on the one hand, and an inefficient, self-absorbed bureaucracy on the other. The RE system--consisting of PBSs and REB--has already demonstrated its ability to create local institutions which are responsive to their members' needs and openly "political," on occasion, and which are moving steadily toward financial autonomy and administrative competence.

The prescribed initial structure for PBSs--boards selected by a local electorate, local control over hiring and firing of professional staff,

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(1) Assuming post 1985 prices are 50% of 1985 prices.

annual membership meetings, public access to board meetings and minutes, etc.--has ensured relatively transparent operations, assured customers that they're getting fair treatment, and caused board members and professional staff to be quite responsive to member needs.

PBSs, occasionally supported by interventions from REB leadership, have also facilitated the practice of open politics in the broader rural political arena. This is healthy because it provides local residents an opportunity to question and challenge arbitrary actions by central bureaucratic authority. Recent experiences of a PBS in North Bengal are instructive. (Annex F-4, Pg. 2)

There can be no doubt that RE has positive economic and social impacts. Electric pumps support higher, more reliable yields from existing crops and allow cultivation of new crops during new seasons. This not only creates new work for male agriculturists but may offer new opportunities for women in agricultural processing. Cold storage units support expanded production of potatoes, onions and other crops and facilitate export of shrimp. Small machine shops and factories have opened in substantial numbers providing jobs and new products.

Electrified retail shops offer more sophisticated products and services. Potters, weavers, and other craft workers use high quality light sources to extend their effective working hours. Students are able to extend their study hours. Soccer games, volleyball matches, and public meetings take place on newly-lighted school grounds. Television enhances communication between capital and countryside.

Up to mid-1985, the following employment - generating, electrical service connections were made:*

- o Commercial Centers and Shops: 24,325 connections. In some cases, shops are opened in response to newly - available electricity. In other cases, electrical connections have enabled owners of existing shops to expand product lines services, and business hours. As overall demand increases, rural jobs and incomes are increased.

- o Irrigation Pumps: 5,910 connections. Some electric pumps replace diesel predecessors. However, due to relatively lower investment and operating costs, most electric pumps are new, and are introduced at sites where investment has been considered too expensive. The REB estimates that, up to mid-1985, winter (boro) rice production area had been expanded by 200,000 acres as a result of introduction of new electric pumps in PBS areas. In addition, electric pumps make possible, or increase, production of wheat, potatoes and sweet potatoes, spices, winter vegetables, and other crops. It is likely that electric pumps have already increased seasonal work opportunities for hundreds of thousands of rural workers in PBS areas.

- o Industries: 2,845 connections. Machine shops and small factories offer new jobs in rural areas. In the long run,

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* REB, Rural Electrification Programme, Bangladesh -- The First Five Years, 1980-85, pp. 11-16

electrified small industries can be expected to provide hundreds of thousands of jobs in the countryside.

Household hookups (about 300,000 up to mid-1985) enable rural families engaging in crafts (potters, weavers, mat and basket makers) to extend their effective work hours. In most areas it is probably necessary to give focussed promotional support to new small industries.

The REB is exploring several possible approaches to small industries promotion in rural areas. Evidence of their serious interests in this area include: inclusion of a representative of the Bangladesh Small and Cottage Industries Corporation on the Board; participation of REB and PBS employees in a recent training seminar held in conjunction with the Bangladesh Small and Cottage Industries Corporation and the BDG Agricultural Bank.

There is ample evidence of positive economic impacts (enhanced income new part-time and full-time jobs). However, it is difficult to quantify those impacts at present. Major impact evaluations in 1987, and later in the Project, will provide quantitative insights.

However, at least one area of negative impact must be measured against this impressive catalogue of positive benefits. In order to assess the impact of electrified rice milling on female employment, two representative processing units are compared below: A is a dheki (foot-operated mortar and pestle) unit, capable of processing about 400 maunds of rice annually, using the labor of one woman. B is a semi-mechanized mill equipped with a steel huller, an automatic winnower/separator, parboiling equipment, semi-pukkha building and a 5,000 ft² drying floor. It is broadly representative of the technology which is replacing dheki processing.

TABLE 6

	A Dheki Unit	B Semi-Mechanized Unit
Fixed Investment	Tk. 1000 (Dheki, parboiling pans)	Tk. 300,000 (Machinery, structures, land)
Employees	1	9
Per Capita Daily Production	1.3 maunds	6.1 maunds
Person Days Required for Annual Crop of 16 Million Tons	336,000,000	72,000,000
Full-Time Jobs Available Under This Technology	1,120,000	240,000 female - 144,000 male - 96,000

If we assume abrupt conversion from technology A to technology B, there would be a net loss of about 880,000 jobs. Of jobs newly created, perhaps 40% (or 96,000) would be taken by men, with the remaining 60% (or 144,000) availble to women. The scenario is, of course, over dramatic. The conversion process has already occupied a decade and will require

another decade or more. It's probably more useful to: 1) envision loss of roughly 30-50,000 full-time jobs each year, or 2) assume several thousand women will lose full-time work, while 100,000-200,000 more gradually lose part-time opportunities. In any case, the bulk of the jobs will be lost anyway since there has been widespread adoption of diesel mills in non-electrified rural areas.

Beyond the fundamental fact of net employment loss, it is also appropriate to examine the social debits and credits associated with dheki and rice mill work. The following tentative formulations can be made:

- On average, mill workers are substantially better paid. Earnings probably coincide with the upper half of the range for dheki workers. (Many women hired for rice husking receive only daily meals and one sari for two or three months of employment following the paddy harvest). (See Annex F-4).

- Mill workers are generally provided with cash income, crude shelter, and some food (broken rice) at the work site. The mill offers a job and something more--a physical refuge for rural women who find their personal situation in the village intolerable. Many workers are divorced, widowed, or abandoned women with dependent children. They are able to achieve a precarious subsistence for themselves and their children without direct patronage from any male.

Electrification of rice mills and loss of jobs by dheki workers are but two aspects of a massive process of economic growth and change. Some positive aspects of rural electrification were discussed above. Other elements in the process include: technical innovations in agriculture and small industry which are <u>not</u> specifically dependent on electrification; improved roads and other transport facilities; new--larger scale and longer distance--marketing networks for paddy and other commodities; and the advent of an entrepreneurial class in rural Bangladesh, eager to invest and earn outside the agricultural sphere. The process is socially, politically, and economically complex, with positive and negative impacts distributed to all corners of Bangladeshi society.

Job losses associated with electrified rice mills cannot be argued away. But effects are not wholly negative; the situation is ameliorated by the following observations:

- Dheki jobs are being lost gradually, over a period of years and many women are losing subsistance level part-time, not cash earning full-time work.

- Mill jobs offer <u>some</u> advantages over dheki jobs in terms of personal autonomy, opportunities to achieve subsistance <u>outside</u> the villages, and higher earnings.

- Female workers in mills located close to markets and highways have high public "visibility," thus slowly and partially legitimizing non-professional female employment.

- Jobs are being lost as part of broader economic/historical process which has many positive aspects for men, women, and children. New jobs are being created in off-season farming and small industries; grain production is increasing faster than

population, and prices of basic foods are going down; transport facilities are being improved and individual physical mobility is increasing; women are finding jobs in garment and electronics factories; etc.

On balance, RE is having positive economic and social impacts on rural Bangladesh.

E. Methods of Financing

USAID has prepared an appraisal of the host country's ability to contract as required by HB 3. This appraisal is shown as Annex G-4.

During the implementation of RE I and RE II, REB has built a procurement directorate that has performed well in executing the hundreds of host country procurement actions required. REB has a standard system of formal competitive procurement which is in accordance with AID HB 11, Chapter 3 procedures. In addition, USAID monitors and approves all host country contracts, for both commodities and technical assistance. In addition to th $119 million of AID RE I and RE II funds, REB has the task of procuring materials for other donor funded projects. Based upon past success and compatibility among donors, host country contracting is preferred.

The host country contracting mode will be utilized for over 95% of the procurements financed under RE III. Each of the contracts will be approved by USAID and will utilize an approved method of financing. The technical assistance foreign exchange costs will be financed under an AID Direct Letter of Commitment.

The local currency costs of the technical assistance contractor will be paid directly by the host government who will request an advance from the USAID to meet the contractor's immediate disbursing needs. The advance will be replenished monthly upon submission of approved, processed claims by the host government. This financing mechanism helps institutionalize voucher examination and accounting procedures in the host government. Each contractor's claim is first reviewed, approved, and paid by the BDG. Subsequently, the advance is replenished after USAID examines and certifies the accuracy of the contractor's claim. This procedure has greatly improved the BDG's ability to apply contract provisions to payment requests while still allowing for USAID scrutiny of the claim.

Commodity procurement will be implemented through host country contracts financed by Mission issued direct letters of commitment. Although this is not a preferred method of financing, the BDG does not have the financial resources to make payment and seek frequent reimbursement from AID for expanses. In addition, contractors prefer having a USAID letter of commitment which, in effect, guarantees prompt, expenditious handling of claims. As such, this is a highly desired financing mechanism.

USAID will also review and approve any IFBs for commodities to be purchased under AID funding and must also approve award recommendations. USAID will continue its PBS and REB monitoring activities. Its present program of formally inspecting every PBS at least once each year will be maintained.

Major project implementation actions such as the reservation and commitment of funds will be handled through project implemention letter procedures, as in the past. It is expected that the systems in place now within USAID can easily meet the $10-12 million of annual disbursements expected under this project, even with personnel turnover, especially given the fact that USAID is now successfully managing the RE II project with disbursements running at a $20 million annual rate.

TABLE 7

METHODS OF FINANCING

Element	Method of Implementation	Method of Payment	Amount (US$000)*
Construction Commodities	Host Country Contract	Direct Reimbursement, Commitment via direct L/Com with payment effected by EFT or USAID	43,238
Support Commodities	Host Country Contract	Direct Reimbursement Commitment via direct L/Com with payment effected by EFT or USAID	882
Technical Assistance	Host Country Contract	Foreign exchange costs will be reimbursed under direct L/Com. Local currency costs will be provided under a Letter of Commitment or an advance to BDB who will reimburse contractor's expenses.	12,210
Training	Host Country Contract	Foreign exchange costs will be reimbursed under direct L/Com. Local currency costs will be provided under a Letter of Commitment or an advance to BDB who will reimburse contractor's expenses.	500
Evaluation Studies and Audits	AID Direct Contract PIO/Ts		740

*Provision for contingency is $2,430,000.

F. Environmental Review

The RE III PID approved by AID/W in April 1985 contained an Environmental Annex referring to the extensive environmental examinations and reviews on the predecessor projects which had all recommended and received negative determinations. There has been no change in the activity nor ha there been any information emanating from the activity which

changes this negative determination decision. Please note Annex F-5 for a short review of the important environmental issues.

G. Technical Analysis

The technical analysis in Annex F-1 reviews the country's overall electric power generation and transmission situation with detailed projections on load growth and capacity through the early 1990's with general projections until 2000. There is likely to be adequate generation capacity after some 1985-86 shortages are overcome. There may be local problems in transmission and grid station capacity. AID will cover this with grant conditionality. A soon to be released study by the Bangladesh Energy Planning Project (BEPP) will provide planning reference for the power sector through the year 2000.

Generation

PDB has designed a program to augment its generation capacity in accordance with anticipated total system load growth (which includes REB estimated demands). Commitments are firm up to the end of year 1990 and planned thereafter, up to the year 2000. The "Summary of Power System Master Plan Study" is attached as Annex G-2.

Annex F-1C shows the Load vs Generation Balance supported by a graphic display (Table F-1C). As can be seen in Annex F-1C a positive firm capacity balance will be achieved in the last quarter of 1986. This should greatly reduce the load sheddings experienced today, especially those in the West Zone. Annex F-1D shows the ongoing and future power station construction up to 1990. Presently, demand growth is projected at very high levels year after year (Annex F-1E), an unlikely scenario over such a long period, especially with the more realistic electric rates projected in the next few years. However, the BDG should not be inhibited in seeking financing of power stations at this point given incipient power shortages which would be likely without major capacity additions.

Transmission

The Power Development Board (PDB) is responsible for all power generation and transmission in Bangladesh. Distribution of power in cities and municipalities may soon be handled by separate distribution entities organized under the BDG societies act. Main PDB transmission voltage is 132 KV, sub-transmission voltages are 66 and 33 KV. The 33 KV sub-transmission system is of primary concern. Although the PDB has improved the 33 KV transmission lines to a great extent, constant monitoring of the condition of these vital lines is important. Since PDB gives the 132 KV transmission lines (National Grid) highest priority next to the generating stations, there may not be a need for great concern about their state and capacity.

Although PDB has ambitious plans for upgrading and new construction of grid stations (See Annex F-1D), Annex F-1C shows a few capacity shortfalls with the plan under Annex F-1D fully implemented. The overall margin of grid station capacity is estimated to be positive, but there are potential area deficiencies as seen in Annex F-1B; e.g. Comilla, Sylhet I and the not yet completed Jamalpur II PBS. In contrast to that, other areas have an abundance of capacity.

The PDB is aware that their gridstation capacity may be unevenly distributed. In PDB load forecasts, the PDB distributed REB loads (which were given to them as a lump sum figure, project wise) on a percentage basis in accordance with historical, mostly pre-REB gridstation data. Detailed load data on the basis of individual PBS load centers have been (June 1985) furnished to USAID by the REB consultants to aid in the preparation of this Project Paper. USAID has initiated contact between the REB technical consultants, Gilbert Commonwealth (GC) and the PDB consultant, Energieplan (West Germany), who are involved in the PDB power master-plan study. We expect a more accurate PDB load forecasting and gridstation capacity distribution profile and schedule will result, thus providing information to grapple with the potential capacity deficit shown in Annex F-1B. The REB will periodically update its load forecasting on an area basis so that the PDB can be alerted long before grid stations become overloaded.

Losses in PBS supply systems have been falling since they were energized. In June 1984, system losses in seven out of 13 PBSs which had been energized for at least two years were about 10 percentage points higher than the anticipated levels, namely that losses would not exceed 25% in a PBS's first year of operations, 20% in the second year, 15% in the third year and 10% in subsequent years. REB attributes these excess losses to the fact that transformers are not fully loaded during the initial years of operation of a PBS. Non-technical losses are believed to be low since members of a PBS perceive that it is in their own interest to report any form of theft of electricity. However, the exact causes of these excess losses have not been ascertained. A study is planned for late FY 86 by the REB, with the assistance of its consultants.

System Design

PDB power (33 Kv) will be stepped down to 11/6.35 Kv as the primary distribution voltage. The primary system will have the Wye configuration with multi-grounded neutral. Main feeders and branch feeders are 4-wire 3 phase, whereas primary tap circuits may be either 3 phase or single phase according to loads encountered; existing or potential. The developments under RE II have shown that a predetermination of 3 phase vs. 1 phase high tension distribution mix is difficult at best and the pragmatic approach is to let the load demand determine the distribution line configuration. Presently, the mix has settled at 60% 3 phase and 40% single phase versus the RE I planned mix of 70% single phase and 30% 3 phase.

Line design consists of the conceptual design (key map) and the actual design according to field data, e.g. types and sizes of existing and potential loads. Field design/staking criteria remain as developed under RE II where productive use has the highest priority and domestic consumers are picked up along the way; except that now the criteria calls for hooking up an equivalent of 100 domestic customers for each mile of distribution or feeder line to be installed. This compares with 50 domestic customers per line mile in RE I and II. The bias, as noted, is towards productive users (a STW is considered the equal of 8 domestic customers, a DTW the equal of 50).

The practice of taking over PDB load centers such as bazars (trading centers) will continue if such areas fall under the PBS jurisdiction. Since these ex-PDB load centers need extensive rehabilitation it may be expected that 10% to 15% of the commodities will be utilized for this purpose.

PBS line routing criteria remains unchanged, i.e. primary main circuits (backbone lines) will run along existing roads, branch (feeder) lines will be staked according to load requirements determined by the local consultant from sign up data and field verification. PBS sub-stations are located at sites accessible throughout the year.

Secondary (feeder) distribution voltage is either 400/230 volt three phase or 230 volt single phase according to load requirement. Power frequency is 50 hertz (cycles per second).

H. Data Collection, Monitoring and Evaluation Plan

During implementation of Rural Electrification I and II projects there have been various reports, assessments and a socio-economic impact study. Rural Electrification III (RE III) implementation will include assessing the various existing sources of information, determining information needs and gaps and designing an on-going system for data collection and monitoring. RE III will provide for a more focused and structured means for collecting, assessing and utilizing the required information.

User Identification

The many potential users of project information include individuals at many levels, in many organizations and in various functional capabilities. Identified users include:

- Bangladesh Power Development Board (PDB)
- Rural Electrification Board (REB), Ministry of Energy
- Palli Bidyut Samities (PBS), rural electric societies
- Bangladesh Planning Commission
- Bangladesh Agricultural Development Corporation (BADC)
- Bangladesh Small and Cottage Industries Corporation (BSCIC)
- Integrated Rural Development Program (IRDP)
- World Bank, Asian Development Bank, Kuwait, Finland, Canada
- The contractor, NRECA
- USAID project and program officers and senior management
- AID/W.

The type of information required will generally address project progress and performance, project impact and achievements, and project costs, budgeting, and financial viability requirements for planning and resource allocation decisions.

Outputs To Be Achieved

The goal of this project is to improve the standard of living and quality of life in rural Bangladesh. The purpose is to develop the capability of the Rural Electrification Board to effectively provide the technical, managerial and engineering capability and leadership necessary to establish self-sustaining, financially viable, properly managed and maintained rural electric cooperatives providing reliable electric power at reasonable rates to rural residents.

The outputs of the project reflect the activities being undertaken to achieve the goal and purpose of the project. By measuring progress and the effect or impact of those activities or outputs, information users will be able to monitor and evaluate this project. The outputs are the following:

- In 17 PBSs, backbone and distribution lines constructed.
- In 17 PBSs, substations installed and functioning.
- In 17 PBSs, domestic, small commercial meter, industrial and irrigation pump connections (hook-ups) completed.
- PBS and REB personnel and local consultants and contractors trained in management and technical skills.
- REB staff training in U.S. completed.
- By 1990, 20 to 25 percent more village electricians trained and certified.
- By 1991, 17.5 percent of all villages in Bangladesh electrified by USAID's Rural Electrification Project.
- In each PBS, customer services unit established and functioning effectively.
- In 17 PBSs, annual meetings with membership establish and attended by the majority of the membership.
- REB policies and procedures established including appropriate lending and tariff rate structures.
- Average annual KWH consumption per connection reaches 1,000.

Priority Evaluation Questions

The design of the data collection, monitoring and evaluation system for this project will be structured to be a simple, low cost and focused system. To achieve a generation of only essential information, the data collection will be centered around the outputs listed above and the following questions asked by program decision makers:

1. What effect does electrification have on the socio-economic well-being of the country?
2. Can the Rural Electrification Board (REB) achieve and maintain the capability to manage efficiently and effectively a rural electrical service delivery system?

3. Can the PBSs, as they are created, continue to function as efficient cooperatives based on democratic principles?

4. With sufficient hook-ups per geographic area, can each PBS achieve financial viability?

5. Are tariff structures and lending rate policies appropriate for achieving PBS financial viability?

Key Indicators* and Administrative Data

The REB, USAID and the project contractor will develop mutually agreed to indicators for measuring project progress, performance and achievements. Indicators will answer the questions of how, why and what is happening. They provide the basis for determining what data to collect and monitor and they will provide the basis for conducting project evaluations. An illustrative set of indicators is listed below for consideration.

I. Financial and Economic Viability

A. Ratio of PBS tariffs to the real cost of electricity to consumers.

B. Adequacy of initial capitalization of PBSs.

C. Margin between bulk rates and tariffs is adequate to cover all costs.

D. Ratio of delinquent electric receivables to current billings.

E. Proportion of revenue generated by commercial, industrial, irrigation and domestic consumers.

F. Ratio of technical and non-technical losses to total power generated.

G. Consumer base to plant investment.

II. Power Distribution Management

A. PBS Member Service and Power Use Program operational.

B. Bank credit availability for installation of connections.

C. Frequency of meter reading, billing and collection.

D. PBS capability for setting equitable and viable tariffs.

E. Majority of PBS members attend annual meetings.

G. Rate of expansion of local distribution system per unit of time (# of hook-ups).

H. Number of villages electrified.

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* An indicator is a measure of a problem or condition.

I. Private sector (engineering, construction, material manufacturing, supplies and transport) capable of supplying required goods and services to PBSs and customers.

III. Construction Management and System Maintenance

A. Backbone and distribution line constructed per unit of time.

B. MVA substations capacity installed per PBS annually.

C. Percent increase in load factor above current 25% per unit of time.

D. Percent KWH system losses from current average of 21 percent in March 1986.

E. Response time for meter repairs.

IV. Human Resources Development

A. Village electricians trained, certified and providing timely services.

B. Employee attrition/retention rates.

C. Institutionalization of REB and PBS personnel training in management, technical, operational and maintenance skills.

D. Effective training program developed for local contractors and consultants in technical skill areas.

E. Percentage of staff positions filled.

F. Career development program for personnel realized.

V. Socio-economic Impact

A. Total area irrigated and subsequent increase in grain production.

B. Number of small, medium and large industries created and/or expanded.

C. Number of agro-processing facilities created.
D. Increase in industrial production levels.

E. New employment opportunities generated.

F. Labor dislocations.

G. Type and level of locally produced commodities.

H. Savings in foreign exchange due to change in type of energy use.

I. Net change in income levels.

J. Public security.

K. Community services (religious, health, etc.) availability.

L. Fertility reduction (CPR).

M. New practices and activities within the household, e.g., student study hours, refrigeration, working hours, security and so forth.

N. Number of household hook-ups.

Appropriate Methodologies for Monitoring and Evaluation:

A combination of quantative and qualitive methods of assessment will be used to answer the "what is happening" and "why and how" questions. As suggested in the Bureau Guidance, a combination of administrative record keeping and small targetted studies will be used to answer "what is happening". These methods will facilitate project monitoring. For the broader question's of "why and how", generally addressed in evaluations, a series of case studies, analytical studies and perhaps rapid low-cost methodologies will be employed.

During the implementation of RE III from September 1986 to August 1991 (20 quarters) the following is scheduled to take place:

Quarters 1-4:

- Methods of administrative record keeping will be designed and employed to include training information, construction progress, performance indicators, rate of new hook-ups, financial information and so forth.

- The administrative records data will be monitored quarterly and reviewed as part of the QIR (Quarterly Implementation Review) process.

- In the second quarter, a study will be carried out to identify the positive incentives required for achieving financial viability.

- In the fourth quarter, case studies will be performed on the existing PBSs in the project. Through the case study approach, goals for each PBS will be established towards achieving financial viability. Project implementation monitoring will then include, on a PBS specific basis, monitoring the progress of each PBS against established time specific goals.

Quarters 5-8:

- Continue administrative record keeping and project monitoring including the findings in the USAID QIRs. Identify and conduct analyses of this data as required to answer the evaluation questions outlined above.

- In the fifth quarter, contract, organize and collect data to measure the socio-economic impact of the project. The study will be structured to complement the socio-economic impact study conducted in the geographic area of 4 PBSs in 1982. Findings of the 1987 study will be compared to that of the 1982 study to measure impact. Additional newer PBSs will be included in the study for comparision with findings in the socio-economic study scheduled

for the 17th quarter in 1990. Data collected will include, inter alia, new enterprises established, additional land under irrigation and the subsequent increase in crop production levels, new employment generated as well as labor dislocations, and the affect on household and community activities.

Quarters 9-12:

- Continue administrative record keeping and monitoring the project by integrating the findings into the QIRs.

- In 9th quarter, an external evaluation or assessment will be performed similar to the assessment conducted in November 1985.

- In the 12th quarter, case studies will again be performed to measure the progress of PBSs against the benchmarks established in the earlier case studies for reaching financial viability. More in-depth case studies will be carried out on the PBSs lagging behind in achieving goals for financial viability.

Quarter 13-16:

- Continue administrative record keeping and monitoring the project by integrating the findings into the QIRs.

Quarters 17-20:

- Continue administrative record keeping, compile data, and conduct final summary analyses.

- In the 17th quarter repeat the socio-economic impact study and conduct comparative analyses to determine the socio-economic effectiveness of the project over the LOP.

- Also in 17th quarter an external evaluation will be undertaken, the second of two to be performed during the LOP of Phase III.

- In the last quarter the contractor will submit a final report including a project appraisal and an final impact evaluation will be performed.

Counterpart Support and Involvement

The effectiveness of the information system will, in large measure, be dependent upon counterpart support as well as that of USAID and the contractor. The burden of data collection for the project has fallen on the contractor to-date. While the information is useful to both the contractor and USAID, it's potential usefulness to the Ministry and Power Development Board is significant. During implementation of RE III, the contractor will work closely with the REB Directorate of Planning and Evaluation to develop data collection systems relevant to PBS construction, operation, and financial viability. The system for data collection will be designed to address the indicators developed by the REB, contractor and USAID.

Because the information required will include PBS specific financial, operational and construction information, the data collection and analysis system will involve the 17 PBSs as well as REB officials. Working with the

contractor, the REB evaluation official will coordinate implementation of the system at the central level at REB and with the individual PBSs through the Members Services and Productive Uses Offices in each PBS.

The contractor and the REB project manager and evaluation official will jointly identify the information required, sources of information, and methods of retrieval, collection and analysis. The system will be implemented within the operational framework of the REB and the network of PBSs, and the information is to be shared with the contractor and USAID for reporting, project monitoring and evaluation purposes.

To support data collection activities, the project's in-country training component will incorporate some data collection training into every training program at every level. The training will be adapted to the level and responsibilities of the trainees vis-a-vis data collection, monitoring and evaluation within the power distribution system from the REB to the PBSs.

Feedback Procedures

In order to ensure dissemination of data collected and analyzed to the identified users of the information, a bi-annual report (every six months) will be prepared by the REB Program Planning and Evaluation Division with the assistance of the consultant's Chief of Party. This report will include the following:

1) Findings of the on-going administrative record keeping data that respond to the indicators of project progress and performance ;

2) Progress reports or findings of the socio-economic impact studies and case studies; and

3) Findings and recommendations of special analytical studies that may be conducted during project implementation including results of relevant studies performed by other donors.

The REB Program Planning and Evaluation Office will be responsible for preparation and distribution of the bi-annual report to the identified information users.

TABLE 9

Data Collection, Monitoring and Evaluation Budget

I. Socio-eonomic impact studies (5th and 17th quarters)	$ 200,000
II. Case studies in 4th and 12th quarters	$ 80,000
III. Analytical Studies (2)	$ 60,000
IV. Two External Evaluations	$ 100,000
V. Impact Evaluation	$ 50,000
VI. Short-Term Technical Assistance:	
A) Design and Implementation of Administration Record Keeping -- 2 person months	$ 20,000
B) Administrative Record Keeping Data Analysis -- 3 person months	$ 30,000
Total:	$ 540,000

TABLE 10

RURAL ELECTRIFICATION PHASE III PROJECT
DATA COLLECTION, MONITORING AND EVALUATION PLAN

	Project Implementation Quarter																				
Methodology	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Post Project
Administrative Record Keeping	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
QIR's (Monitoring)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Socio-economic Impact Study					X												X				
Case Studies				X								X									
Analytical Studies		X																			
External Evaluations/ Assessments									X								X				
Impact Evaluation																				X	

I. Issues

The primary issues to be addressed during project implementation are: (a) strengthening the financial performance of PBSs, and b) rationalizing PDB and PBS tariffs so as to achieve greater consistency with the economic costs of supplying power without sacrificing PBS financial viability.

While it is still early to evaluate the financial performance of AID-funded PBSs, several conclusions are becoming clear. First, the financial performance of PBSs is improving as they mature. Second, financial performance is generally strongest in those PBSs which supply markets characterized by a relatively high demand for electricity on the part of productive use consumers. Third, despite their improving financial performance, virtually all PBSs will be unable to fully meet the current schedule of loan repayment.

Intensification will clearly help improve the financial performance of PBSs. A variety of other actions will also be useful. Efforts are needed to reduce line losses and to ensure that intensification leads to relatively more productive use consumers being connected. Loan repayment conditions should be revised so as to make them more realistic given the nature of RE and the types of markets supplied by many PBSs.

Tariff reform is another way of addressing the financial needs of PBSs. Such reform must, however, be undertaken within the context of an overall energy sector pricing policy. A review of commercial energy pricing policies demonstrates that electricity tariff increases for both PDB and PBS are justified on efficiency grounds. A key element in this process of tariff reform is the ongoing Bangladesh Power Sector Tariff Study. This study will estimate the economic costs of supplying power to various categories of PDB and PBS consumers. These estimates will provide the basis from which the WB determines a set of tariff reform recommendations to be negotiated with the BDG. AID proposes to participate in these negotiations.

AID plans to tie the second obligation for RE III to policy reforms related to the satisfactory attainment of the agreement reached in these negotiations. Specific benchmarks will be established and USAID will place further conditions on the release of the final obligations.

SECTION IV - CONDITIONS PRECEDENT & COVENANTS

Conditions Precedent to Disbursement

(1) Prior to disbursement, or to the issuance of any commitment documents under the Project Agreement, for any purpose other than technical assistance, the Cooperating Country shall furnish in form and substance satisfactory to A.I.D.:

(a) A plan, to ensure for the life of the Project, power generation, transmission and substation capacity will be adequate to meet the forecasted load within each of the areas served by the Rural Electrification Board (REB) under this project, and

(b) A plan, by December 31, 1986 or such later date as AID may agree in writing, to implement in phases the recommendations (including revised tariffs for PBSs) of the Bangladesh Power Sector Tariff Study (Funded by the United Nations Development Program) as

agreed to by AID and the BDG.

Covenants

The Cooperating Country shall covenant that:

(1) The Cooperating Country will continue to provide operating support to project PBSs in accordance with a formula acceptable to AID.

(2) The agreed to revised rate schedule (see C.P. 2a above) for PBSs will permit the PBSs to earn revenues sufficient to cover electricity purchases, administrative expenses, depreciation, and interest and principal repayment. The REB will also investigate the possibility of utilizing a portion of the depreciation fund to offset payments of interest and principal.

(3) The Cooperating Country will properly operate, maintain, and repair the main 132/33 KV transmission lines, the 33 KV sub-transmission lines including rights of way, and the substations which service PBSs developed or improved under this or predecessor projects.

(4) The Cooperating Country, in particular the Power Development Board (PDB) and the REB, will conduct continual coordinated load forecasting so as to ensure the adequate distribution of power to PBSs served by the Project but to avoid overloading of grid stations.

(5) The Cooperating Country shall cause PDB to use REB construction standards in building any new distribution lines in REB designated areas of operation.

BANGLADESH: Rural Electrication III (388-0070)

ANNEXES

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PID APPROVAL MESSAGE

UNCLAS STATE 117055

17 APRIL 1985

SUBJECT: RURAL ELECTRIFICATION III PID (388-0070)

REFTEL : STATE 101209

AA/ASIA HAS APPROVED PROCEEDING WITH DEVELOPMENT OF SUBJECT PROJECT PAPER. HE DISCUSSED PROJECT WITH AID COUNSELOR AND DA/PPC, BOTH OF WHOM EXPRESSED SOME CONCERN ON MOVING AWAY FROM STRATEGY AGREED UPON LAST YEAR AND WHO MAY RAISE QUESTIONS PRIOR TO PROJECT AUTHORIZATION. MISSION SHOULD BE SURE TO ADDRESS THOROUGHLY THE ISSUES RAISED DURING PROGRAM WEEK, SUMMARIZED BELOW, WITH PARTICULAR EMPHASIS ON RATIONALE FOR CONTINUING TO PROVIDE LARGE COMMODITY INPUT.

THE MAJOR ISSUES DISCUSSED REVOLVED AROUND:

1. LARGE COMMODITIES CONTENT: THE INCLUSION OF DOLS. 40.0 MILLION FOR COMMODITIES CONTRADICTS UNDERSTANDINGS REACHED AT THE TIME OF RE II APPROVAL AND REFLECTED IN LAST YEAR'S CDSS. (BASICALLY, WE WERE TO PHASE OUT OF COMMODITY PROCUREMENT AND FOCUS ON ENGINEERING, TA, TRAINING, MANAGEMENT IMPROVEMENTS. ETC. OUR PRESENCE IN THAT CAPACITY WAS TO HAVE BEEN A CATALYST FOR OTHER DONORS TO FINANCE COMMODITIES). THE PC RAISED THE FOLLOWING QUESTIONS WHICH SHOULD BE ADDRESSED PRIOR TO PP APPROVAL:

A. WHAT HAS CHANGED SINCE 1981 TO WARRANT A LARGE COMMODITY INPUT?

B. WHAT WILL BE OBTAINED FROM PROJECT WITH COMMODITIES?

- RATE STRUCTURE POLICIES
- ECONOMIC DEVELOPMENT IN COOP SERVICE AREAS

C. WHAT WILL NOT BE OBTAINED WITHOUT PROJECT COMMODITIES?

D. WILL OTHER DONORS FILL THE COMMODITY GAP IF WE FINANCE SOFT INPUTS ONLY?

E. WILL THIS PROJECT SATISFY CURRENT DEMAND FOR INTENSIFICATION WITHIN 17 COOPS AND/OR PUT THE COOPS ON VIABLE FINANCIAL GROUND?

2. RATE STRUCTURE: THE PC FELT THE PROJECT OBJECTIVES ARE UNCLEAR AS TO THE WEIGHT GIVEN TO CONSOLIDATION OF 17/33 COOPS VS. NATIONAL RATE STRUCTURE POLICY. A HEAVY COMMODITY COMPONENT MAY BE WARRANTED IF ACCOMPANIED BY A CLEAR POLICY OBJECTIVE. PROJECT SHOULD HAVE A CLEAR STRATEGY FOR CONDUCTING POLICY ANALYSIES REGARDING A RATIONALIZED RATE STRUCTURE, SUBSIDIES, ETC., IN CONJUNCTION WITH THE POWER DEVELOPMENT BOARD IBRD AND OTHERS. PROJECT SHOULD PROBABLY HAVE A POLICY

ANALYSIS/STUDIES COMPONNT AND TA TEAM INVOLVEMENT IN THIS AREA. FOR ASSISTANCE ON TARIFF AND INSTITUTIONAL ISSUES, SEE REFTEL ON POSSIBLE TDY IN EARLY MAY BY R. ICHORD.

3. TA CONTRACT: THE PC RECOMMENDS THAT THE TA SERVICES BE COMPARED.

OTHER CONCERNS:

4. TECHNICAL ASSISTANCE SUCCESS TO DATE: PP SHOULD DESCRIBE ACCOMPLISHMENTS OF THE EXTENSIVE TA OVER THE PAST NINE YEARS.

5. BENEFIT INCIDENCE: PP SHOULD INCLUDE A CAREFUL ANALYSIS OF ECONOMIC AND SOCIAL BENEFITS OBTAINED TO DATE. THROUGH EVALUATION OF RE PROGRAM SHOULD PRECEDE NEW PROJECT.

6. NATIONAL EXPANSION PROGRAM: PP SHOULD EXPLAIN THE ROLE THAT AID (THROUGH THE PROJECT) IS PLAYING AND WOULD CONTINUE TO PLAY IN ASSISTING THE BDS PLAN FOR EXPANSION OF ITS NATIONAL ELECTRIFICATION PROGRAM, INCLUDING GENERATION CAPACITY.

7. OTHER DONORS: PP SHOULD INCLUDE ANALYSIS OF AID ROLE VIS-A-VIS IBRD IN ELECTRICITY GENERATION POLICY.

8. PERFORMANCE DISBURSEMENT: MISSION SHOULD CONSIDER STRUCTURING THE PROJECT SO AS TO MAKE SEVERAL DISBURSEMENT TRANCHES DEPENDENT ON SATISFACTORY POLICY MEASURES. SHULTZ.

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 1986 to FY 1991
Total U.S. Funding $60,000,000
Date Prepared: June 4,1986

Project Title & Number: Rural Electrification III (388-0070)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal:	Measures of Goal Achievement:		Assumptions for achieving Goal:
Improving the standard of living and quality of life in rural Bangladesh.	1. Electric irrigation coverage of the 17 PBS's increases from 199,845 acres as of 3/31/85 to 429,211 acres by 1990.	1. REB, PBS, Consultant	1. Electric motors and pumps continue to be available to farmer and credit allows their purchase.
	2. Total tons of grain as of 3/31/85 due to electric irrigation increases from 297,360 tons to 623,600 tons in the 17 AID PBS's by 1990. (Additional grain dry season primarily).	2. BDB, PBS, REB, USAID, Consultant.	2. HYV seeds, adequate fertilizer made available in sufficient quantities to the farmers.
	3. Direct farm related employment opportunities increase by 1990 because of electric pump irrigation, and other complementary input use.	3. Study to be carried out by Consultant, REB and USAID.	3. Money available to carry out study.
	4. Agricultural processing employment opportunities increase by 1990 due to increased agricultural production due to electric irrigation.	4. Study to be carried out by Consultant, REB and USAID.	4. Money available to carry out study.
	5. Small, medium and large industries in PBS service areas create new employment opportunities by 1990.	5. Study to be carried out by Consultant, REB and USAID.	5. Money available to carry out study.
	6. Positive impact on household because of lower cost power for lighting, night time studying, use of appliances, better communications, electrified clinics, hospitals and schools.	6. Impact study to be carried out by consultant, REB, USAID.	6. Money available to carry out impact study.
	7. Electricity contributes to decline in fertility rate.	7. Simple study to try and ascertain if a correlation between an electrified area and decline in birth rate can be measured . Prior studies have idenfied such a correlation elsewhere.	7. Money available for such study.

Project Purpose:	Conditions that will indicate purpose has been achieved: End of project status.	Means of Verification:	Assumption for achieving purpose:
To develop the capability of the Rural Electrification Board effectively provide the technical, managerial and engineering capability and leadership necessary to establish self-sustaining, financialy viable, properly managed and maintained rural electric cooperatives providing reliable electric power at reasonable rates to rual residents.	Rural Electrification Board 1. Able to arrange financing for RE program.	1. Consultant, USAID other donors.	1. REB program viable & other donor provide funds.
	2. Able to organize consumers into PBS's and prescribe their by-laws.	2. REB, Consultant	2. Monies available for additional PBS's.
	3. Able to properly oversee the construction of new distribution systems and rehabilitation of existing ones.	3. REB, Consultant	3. Monies available for continued expansion.
	4. Capable to prepare, review and update Policies and Procedures.	4. REB, Consultant	4. REB and Consulant have adequate staff to handle work.
	5. Training Directorate able to produce course curriculum, conduct training, evaluate and update with little outside assistance by 1991.	5. REB, Consultant	5. Minimum turnover of Training Directorate staff.
	6. Able to develop simplified, equitable, financially sound retail rates for each PBS.	6. REB, Consultant, USAID	6. Policy dialogue with BDG results in policy supportive of economic pricing of power bought and sold by the PBS's.
	7. REB System personnel able to obtain relevant operating data from PBS's, conduct data analysis, determine problems and recommended remedial action.	7. REB, Consultant	7. Minimum turnover of personnel.
	8. REB Systems personnel able to reach competency in equipment repair (regulators, OCR's and minor transformer renovation).	8. REB, Consultant	8. Minimum turnover of personnel
	9. Personnel able to perform substation component dielectric testing, visual inspections and and mechanical testing.	9. REB, Consultant	9. Minimum turnover of personnel
	10. Annual audits of each PBS satisfactorily carried out by REB audit office.	10. REB, Consultant	10. REB able continue independent operations free of political considerations.
	11. Outside audits of REB and PBS's, conducted periodically, show mature and financially sound organizations.	11. Private Auditors	11. Program for periodic outside audits supported supported by REB, BDG.
	12. Appropriate REB, PBS records are prepared to ensure suitable budgetary control and timely recording of procurement transactions.	12. REB, PBS, Consultant	12. Minimum turnover of personnel consultant has adequate staff to handle work.
	13. A sanctioned professional service for REB is fully functional with salaries, allowance and professional opportunities favorable to attract and retain capable personnel. Rapid rotation of senior management is eliminated.	13. REB, USAID, Consultant	13. USAID, Consultant policy dialogue with BDG carried on a continuing basis.
		1-13. These indicators can can be verified by independent review.	

Palli Biddut Samitys (PBS's, Rural Electric Societies, Cooperatives)

1. Board of Directors of each PBS functioning smoothly, continued participation of Boards in training courses, sound direction given by Boards to PBS General Managers.	1. REB, PBS, Consultant records and reports.	1. GOB and REB continues place importance on sound PBS Board of Directors.
2. Effective PBS Member Service and Power Use program as measured by increased KWH sold and by satisfaction of customer/members.	2. REB, PBS, Consultant records and reports.	2. Incentives other than electricity for commercial, small and medium industries and market forces positively impact the preconditions for industrial & commercial growth.
3. Each PBS carries on an effective maintenance program, minimum response time for repairs, each able to test and repair meters.	3. REB, PBS, Consultant records and reports.	3. Minimum turnover of staff and and updating of skills with training courses.
4. Annual Meeting attendance increases each year and members take active participation in affairs of their member-owned PBS.	4. REB, PBS, Consultant records and reports.	4. Annual Meeti gs not discouraged by authorities.
5. PBS's operate on a sound financial basis so as to meet all present and future obligations.	5. REB, PBS, Consultant records and reports.	5. REB develops equitable and financially sound rates, PDB sells power at equitable rate to PBS.
6. At each PBS planned and emergency outage time meets country-wide standard.	6. REB, PBS, Consultant records and reports.	6. PDB provides reliable power to PBS.
7. PBS Board Members equitably represent entire membership, developing their knowledge and skills as Board Members, and have a sense of commitment to the PBS.	7. REB, PBS, Consultant records and reports.	7. Board elections continue to be carried out in a democratic manner.
8. PBS and Board assumes leadership role to encourage development of the agricultural, commercial and industrial potential of its service area.	8. REB, PBS, Consultant records and reports.	8. Investment climate postive.
9. PBS able to plan and implement expansion of local distribution systems with financial and technical assistance from REB.	9. REB, PBS, Consultant records and reports.	9. Monies continue to be available for expansion from BDG and donors, PBS's generatge internally some of the expansion funds.
10. PBS's are able to provide TA to help consumer for wiring and acquiring and installing electric connections, machinery and appliances. Financial assistance available in some degree from PBS's but primarily from the credit markets, particularly rural branch Banks.	10. REB, PBS, Consultant.	10. Money available for loan program by PBS to consumers if needed but main funding source becomes rural branch Banks.

11. PBS's able to carry on meter reading, billing and collection. Disconnects caused by bills outstanding for more than 90 days kept to 1 or 2% of customer base in any month.	11. REB, PBS, Consultant.	11. PBS's continue to have authority to disconnect the meter for non-payment of electric bill after 90 days and can continue to enforce stiff reconnect fees.
12. PBS able to arrive at and set viable and equitable tariffs with the approval of the REB.	12. REB, PBS, Consultant.	12. BDG continues to support enhancement of all tariffs to long range marginal cost levels.
13. Each PBS is providing enough operational level training to staff and/or is using special training conducted by REB as necessary to achieve a self-training capacity.	13. REB, PBS, Consultant.	13. REB Training Directorate and PBS training activities receive adequate attention and funds.
14. Domestic private sector consulting engineering, construction, material manufacturing, supply and transportation firms become fully capable of supplying PBS's with all needed goods and services of standard quality and in a reasonable time. They also become capable of meeting demands of PBS customers for transformers, electric motors and the like.	14. REB, PBS, private firms, Consultant. 1-14 these indicators can be verified by independent review.	14. Policy dialogue with BDG and REB continues to foster local private sector to supply as great a percentage as possible of supplies, materials and services needed by the RE program.

Outputs:	Magnitude of Outputs:	Means of Verification	Assumption for Achiving Outputs:
1. In 17 PBSs backbone and distribution lines constructed.	1. Add approximately 3,500 miles of lines by by 1991.	1. REB, Consultants.	1. AID funds and local currency budget made available.
2. In 17 PBSs substations installed and functioning.	2. From 28 as of 3/31/85 to 44 by 1992.	2. REB, Consultants.	2. AID funds and local currency budget made available.
3. In 17 PBSs; (a) domestic, (b) irrgation pump connection (hook-ups) completed (c) small commercial meter, and (d) industrial	a. Additional 295,000 households or 1,770,000 people served.	a. REB, PBSs, Consultants.	a. All Donor funds and local currency budget made available.
	b. Additional 4,400 pumps connections by 1991.	b. REB, PBSs	b. Pumps and electric motors continue to be readily available. Domestic motor output increases steadily and or Government allows import of motors without high duties.
	c. Additional 1,700 commercial connections by 1991.	c. REB, PBSs	c. Marketing system provides incentives for increasing production. Productive Uses program impacts positively on commercial enterprises.
	d. Additional 1,770 industrial connections by 1991.	d. REB, PBSs	d. Marketing system, investment incentives etc. provide additional reasons to build industrial plants.
4. PBS and REB personnel, and local consultants and contractors trained in management and technical skills.	4. From 6,019 as of 3/31/85 to 28,803 by 1991.	4. REB, Consultant	4. Suitable trainees made available.

5. REB staff training in U.S. completed.	5. From a total of 21 as of 3/31/85 to 51 by 1990. Under Phase III total of 30.	5. REB, Consultant	5. BDG gives permission for study in U.S.
6. By 1990, 20 to 25 percent more village electricians trained and certified.	6. As of 3/31/85, 4,000 trained and 3,000 certified to 5,600 trained and 4,200 certified as of 1990.	6. REB, PBSs, Consultant.	6. Adequate supply house wiring materials.
7. By 1991, 17.5 percent of all villages in Bangladesh electrified.	7. From 3,110 as of 3/31/85 to 15,000 by 1990-91.	7. REB, PBSs, Consultant.	7. Phase III project implementation proceeds on a timely basis.
8. In each PBS, customer services unit established and functioning effectively.	8. Each PBS will have an assistant general manager for member services.	8. REB, PBS	8. PBS able to staff position.
9. In 17 PBSs, annual meetings with membership established.	9. Annual Meetings held in all energized PBS's.	9. REB, PBS, Consultant.	9. Political conditions allow for free and open Annual Meetings. Countryside stable.
10. REB policies and procedures established including appropriate lending and tariff rate structure.	10. Continual reviewing, updating, revising and adding to the formal policies and procedures.	10. REB, Consultant.	10. Power tariff studies produce acceptable rate schedules.
11. Annual KWH consumption per connection averages 1,000.	11. Ave. Annual KWH Consumption per connection increases from 660 in 1983, 801 KWH in 1984 to 880 in 1991.	11. REB, PBS, Consultant.	11. PBS's receive reliable power from BPDB.

Project Inputs:	Implementation Target (Type and Quantity)		
Reference PP Table 4A, 4C, 4D:	Reference PP Table 4A.	1. AID Financial Reports. 2. TA consultants quarterly reports	1. AID obligates project funds as planned. 2. BDG funds made available as planned.
1. Commodities	1. $43,238,000		
2. Technical Assistance	2. 948 PM Long Term 24 PM Short Term 160 PM Home Office		
3. Support Commodities	3. 882,000		
4. REB Overhead	4. $18,800,000		

PROJECT NO. 388-0070

5C(1) - COUNTRY CHECKLIST

Listed below are statutory criteria applicable generally to FAA Funds, and criteria applicable to individual fund sources: Development Assistance and Economic Support Fund.

A. GENERAL CRITERIA FOR COUNTRY ELIGIBILITY

1.	FAA Sec. 481(1); FY 1986 Continuing Resolution Sec. 528. Has it been determined or certified to the Congress by the President that the government of the recipient country has failed to take adequate measures or steps to prevent narcotic and psychotropic drugs or other controlled substances (as listed in the schedules in section 202 of the Comprehensive Drug Abuse and Prevention Control Act of 1971) which are cultivated, produced or processed illicitly, in whole or in part, in such country or transported through such country, from being sold illegally within the jurisdiction of such country to United States Government personnel or their dependents or from entering the United States unlawfully?	No.
2.	FAA Sec. 481(h)(4). Has the President determined that the recipient country has not taken adequate steps to prevent (a) the processing, in whole or in part, in such country of narcotic and psychotropic drugs or other controlled substances, (b) the transportation through such country of narcotic and psychotropic drugs or other controlled substances, and (c) the use of such country as a refuge for illegal drug traffickers?	No.
3.	FAA Section. 620(c). If assistance is to a government, is the government liable as debtor or unconditional guarantor on any debt to a U.S citizen for goods or services furnished or ordered where (a) such citizen has exhausted available legal remedies and (b) the debt is not denied or contested by such government?	No.
4.	FAA Sec.620(e)(1). If assistance is to a government, has it (including government agencies or subdivisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities?	No.

5.	FAA Sec. 620(a), 620(f), 620D; FY 1986 Continuing Resolution Sec. 512. Is recipient country a Communist country? If so, has the President determined that assistance to the country is important to the national interests of the United States? Will assistance be provided to Angola, Cambodia, Cuba, Iraq, Syria, Vietnam, Libya, or South Yemen? Will assistance be provided to Afghanistan without a certification?	No. N/A No. No.
6.	FAA Sec. 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction by mob action of U.S. property?	No.
7.	FAA Sec. 620(l). Has the country failed to enter into an agreement with OPIC?	No, OPIC Agreement signed January 15, 1975.
8.	FAA Sec. 620(o); Fishermen's Protective Act of 1967, as amended, Sec. 5. (a) Has the country seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters? (b) If so, has any deduction required by the Fishermen's Protective Act been made?	a) No. b) N/A
9.	FAA Sec. 620(q); FY 1986 Continuing Resolution Sec. 518. (a) Has the government of the recipient country been in default for more than six months on interest or principal of any AID loan to the country? (b) Has the country been in default for more than one year on interest or principal on any U.S. loan under a program for which the appropriation bill (or continuing resolution) appropriates funds?	a) No. b) No.
10.	FAA Sec. 620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the amount of foreign exchange or other resources which the country has spent on military equipment? (Reference may be made to the annual "Taking Into Consideration" memo: "Yes, taken into account by the Administrator at time of approval of Agency OYB." This approval by the Administrator of the Operational Year Budget can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)	N/A

11.	FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption?	No. N/A
12.	FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget? (Reference may be made to the Taking into Consideration memo.)	Not in arrears.
13.	FAA Sec. 620A. Has the government of the recipient country aided or abetted, by granting sanctuary from prosecution to, any individual or group which has committed an act of international terrorism?	No.
14.	ISDCA of 1985 Sec. 552(b). Has the Secretary of State determined that the country is a high terrorist threat country after the Secretary of Transportation has determined, pursuant to section 1115(e)(2) of the Federal Aviation Act of 1958, that an airport in the country does not maintain and administer effective security measures?	No.
15.	FAA Sec. 666. Does the country object, on the basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. who is present in such country to carry out economic development programs under the FAA?	No.
16.	FAA Secs. 669, 670. Has the country, after August 3, 1977, delivered or received nuclear enrichment or reprocessing equipment, materials, or technology, without specified arrangements or safeguards? Has it transferred a nuclear explosive device to a non-nuclear weapon state, or if such a state, either received or detonated a nuclear explosive device? (FAA Sec. 620E permits a special waiver of Sec. 669 for Pakistan.)	No. No.
17.	FAA Sec. 670. If the country is a non-nuclear weapon state, has it, on or after August 8, 1985, exported illegally (or attempted to export illegally) from the United States any material, equipment, or technology which would contribute significantly to the ability of such country to manufacture a nuclear explosive device?	No.

18. ISDCA of 1981 Sec. 720. Was the country represented at the Meeting of Ministers of Foreign Affairs and Heads of Delegations of the Non-Aligned Countries to the 36th General Assembly of the U.N. of Sept.25 and 28, 1981, and failed to disassociate itself from the communique issued? If so, has the President taken it into account? (Reference may be made to the Taking into Consideration memo.) No.

19. FY 1986 Continuing Resolution Sec. 541.

Are any of the funds to be used for the performance of abortions as a method of family planning or to motivate or coerce any person to practice abortions? No.

Are any of the funds to be used to pay for the performance of involuntary sterilization as a method of family planning or to coerce or provide any financial incentive to any person to undergo sterilization? No.

Are any of the funds to be used to pay for any biomedical research which relates, in whole or in part, to methods of, or the performance of, abortions or involuntary sterilization as a means of family planning? No.

20. FY 1986 Continuing Resolution.

If the assistance being made available to any organization or program which has been determined as supporting or participating in the management of a program of coercive abortion on involuntary sterilization? No.

If assistance is from the population functional account, are any of the funds to be made available to family planning projects which do not offer, either directly or through referral to or information about access to, a broad range of family planning methods and services? N/A

21. FY 1986 Continuing Resolution Sec. 529. Has the recipient country been determined by the President to have engaged in a consistent pattern of opposition to the foreign policy of the United States? No.

22. FY 1986 Continuing Resolution Sec. 513. Has the duly elected Head of the Government of the country been deposed by military coup or decree? No.

B. FUNDING SOURCE CRITERIA FOR COUNTRY ELIGIBILITY:

1. Development Assistance Country Criteria.

FAA Sec. 116. Has the Department of State determined that this government has engaged in a consistent pattern of gross violations of internationally recognized human rights?	No.
If so, can it be demonstrated that contemplated assistance will directly benefit the needy?	N/A

2. Economic Support Fund Country Criteria:

FAA Sec. 502B. Has it been determined that the country has engaged in a consistent pattern of gross violations of internationally recognized human rights? If so, has the country made such significant improvements in its human rights record that furnishing such assistance is in the national interest?	N/A

PROJECT NO. 388-0070

SC(2) - PROJECT CHECKLIST

Listed below are statutory criteria applicable to projects. This section is divided into two parts. Part A. includes criteria applicable to all projects. Part B. applies to projects funded from specific sources only: B.1. applies to all projects funded with Development Assistance loans, and B.3. applies to projects funded from ESF.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE? a) Yes.
HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT? b) Yes.

A. GENERAL CRITERIA FOR PROJECT

1. FY 1986 Continuing Resolution Sec. 524, FAA Sec. 634A.

Describe how authorizing and appropriations committees of Senate and House have been or will be notified concerning the project.

Congressional Notification will be made before obligation.

2. FAA Sec. 611(a)(1). Prior to obligation in excess of $500,000, will there be (a) engineering, financial or other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

(a) Yes.

(b) Yes.

3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?

Not required.

4. FAA Sec. 611(b); FY 1986 Continuing Resolution Sec. 501. If for water or water-related land resource construction, has project met the principles, standards, and procedures established pursuant to the Water Resources Planning Act (42 U.S.C. 1962, et seq.)? (See AID Handbook 3 for new guidelines.)

N/A

5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?

Yes, Mission Director's Sec. 611(e) Certification attached to Project Paper.

6.	FAA Sec. 209. Is project susceptible to execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	No.
7.	FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; and (c) encourage development and use of cooperatives, and credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	(a) N/A (b) It fosters the private initiative of local, consultants, suppliers, and contractors in system development through competitive bidding process. (c) Encourages use of rural electric cooperatives as a mechanism for providing electric service. (d) N/A (e) Improves technical efficiency of local manufacturers and agriculture through cheaper source of energy for irrigation. (f) N/A
8.	FAA Sec. 601(b). Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	The project promotes involvement of U.S. private sector manufacturers supplying commodities as well as U.S. consulting firm providing technical assistance.
9.	FAA Secs. 612(b), 636(h); FY 1986 Continuing Resolution Sec. 507. Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars.	The host country contribution will be local currency equivalent of $18.8 million to cover local construction and material costs.
10.	FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	No.
11.	FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?	Yes.
12.	FY 1986 Continuing Resolution Sec. 522. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?	N/A

3.	FAA Sec. 118(c) and (d). Does the project comply with the environmental procedures set forth in AID Regulation 16? Does the project or program take into consideration the problem of the destruction of tropical forests?	a) Yes. b) N/A
4.	FAA Sec. 121(d). If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (dollars or local currency generated therefrom)?	N/A
5.	FY 1986 Continuing Resolution Sec. 533. Is disbursement of the assistance conditioned solely on the basis of the policies of any multilateral institution?	No.
6.	ISDCA of 1985 Sec. 310. For development assistance projects, how much of the funds will be available only for activities of economically and socially disadvantaged enterprises, historically black colleges and universities, and private and voluntary organizations which are controlled by individuals who are black Americans, Hispanic Americans, or Native Americans, or who are economically or socially disadvantaged (including women)?	5-10%

. FUNDING CRITERIA FOR PROJECT

. Development Assistance Project Criteria:

a.	FAA Secs. 102(a), 111, 113, 281(a). Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the	(a) The project will provide electricity to the rural poor who are involved in the planning and decision making process through election of officials to Board of PBS. System development is highly labor-intensive using poor of the locality to construct distribution system. (b) This project uses rural electric cooperatives with a president and board of locally elected officials. Technical assistance and training is provided to develop the capabilities in the cooperatives to carry out their functions.

improvement of women's status; (e) utilize and encourage regional cooperation by developing countries?	(c) Local residents are encouraged actively participate in electo process and operation of the P (d) One seat on the PBS Board is reserved for a woman. (e) N/A.
b. FAA Sec. 103, 103A, 104, 105, 106. Does the project fit the criteria for the type of funds (functional account) being used?	Yes, Sec. 103
c. FAA Sec. 107. Is emphasis on use of appropriate technology (relatively smaller, cost-saving,labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)?	Yes.
d. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed" country)?	Cooperating Country will provide 24.2%; 25% requirement will be waived as Bangladesh is an RLDC.
e. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?	Yes.
f. FAA Sec. 128(b). If the activity attempts to increase the institutional capabilities of private organizations or the government of the country, or if it attempts to stimulate scientific and technological research, has it been designed and will it be monitored to ensure that the ultimate beneficiaries are the poor majority?	Yes.
g. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental processes essential to self-government.	This project promotes commercial and agricultural growth through use of inexpensive sources of energy for industry and irrigation. Institutional development is promoted through formation of rural electric cooperatives of local elected officials contributing to the decision making process. Local level technicians are provided with the skills and training required for electric service installation and operation.

. Development Assistance Project Criteria (Loans Only):

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, at a reasonable rate of interest. N/A

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

3. Economic Support Fund Project Criteria:

a. FAA Sec. 531(a). Will this assistance promote economic or political stability? To the maximum extent feasible, is this assistance consistent with the policy directions, purposes, and programs of part I of the FAA? N/A

b. FAA Sec. 531(c). Will assistance under this chapter be used for military, or paramilitary activities? N/A

c. ISDCA of 1985 Sec. 207. Will ESF funds be used to finance the construction of, or the operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified that such country is a party to the Treaty on the Non-nonproliferation of Nuclear Weapons or the Treaty for the prohibition of Nuclear Weapons in Latin America (the "Treaty of Tlatelolco"), cooperates fully with the IAEA, and pursues nonproliferation policies consistent with those of the United States? N/A

d. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made? N/A

PROJECT NO. 388-0070

5C(3) - STANDARD ITEM CHECKLIST

Listed below are the statutory items which normally will be covered routinely in those provisions of an assistance agreement dealing with its implementation, or covered in the agreement by imposing limits on certain uses of funds.

These items are arranged under the general headings of (A) Procurement, (B) Construction, and (C) Other Restrictions.

A. PROCUREMENT

1. FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed? Yes.

2. FAA Sec. 604(a) Will all procurement be from the U.S. except as otherwise determined by the President or under delegation from him? Yes.

3. FAA Sec. 604(d). If the cooperating country discriminates against marine insurance companies authorized to do business in the U.S., will commodities be insured in the United States against marine risk with such a company? Yes.

4. FAA Sec. 604(e); ISDCA OF 1980 Sec. 705(a). If offshore procurement of agricultural commodity or product is to be financed, is there provisions against such procurement when the domestic price of such commodity is less than parity? (Exception where commodity financed could not reasonably be procured in U.S.) N/A

5. FAA Sec. 604(g). Will construction or engineering services be procured from firms of countries which receive direct economic assistance under the FAA and which are otherwise eligible under Code 941, but which have attained a competitive capability in international markets in one of these areas? No.
Do these countries permit United States firms to compete for construction or engineering services financed from assistance programs of these countries? N/A

6. FAA Sec. 603. Is the shipping excluded from compliance with requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 per centum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and

	tankers) financed shall be transported on privately owned U.S. flag commercial vessels to the extent such vessels are available at fair and reasonable rates?	No.
7.	FAA Sec. 621. If technical assistance is financed, will such assistance be furnished by private enterprise on a contract basis to the fullest extent practicable? If the facilities of other Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?	a) Yes. b) N/A
8.	International Air Transport. Fair Competitive Practices Act, 1974. If air transportation of persons or property is financed on grant basis, will U.S. carriers be used to the extent such service is available?	Yes.
9.	FY 1986 Continuing Resolution Sec.504. If the U.S. Government is a party to a contract for procurement, does the contract contain a provision authorizing termination of such contract for the convenience of the United States?	Yes, such clauses are routinely inserted in all A.I.D.-direct contracts.
B.	CONSTRUCTION	
1.	FAA Sec. 601(d). If capital (e.g., construction) project, will U.S. engineering and professional services be used?	Yes.
2.	FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable?	Yes.
3.	FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed $100 million (except for productive enterprises in Egypt that were described in the CP)?	N/A
C.	OTHER RESTRICTIONS	
1.	FAA Sec. 122(b). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter?	N/A

2. FAA Sec. 301(d). If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights? N/A

3. FAA Sec. 620 (h). Do arrangements exist to insure that United States foreign aid is not used in a manner which, contrary to the best interests of the United States, promotes or assists the foreign aid projects or activities of the Communist-bloc countries? Yes.

4. Will arrangements preclude use of financing:

a. FAA Sec.104(f); FY 1986 Continuing Resolution Sec. 526: (1) To pay for performance of abortions as a method of family planning or to motivate or coerce persons to practice abortions; (2) to pay for performance of involuntary sterilization as method of family planning, or to coerce or provide financial incentive to any person to undergo sterilization? (3) to pay for any biomedical research which relates, in whole or part, to methods or the performance of abortions or involuntary sterilizations as a means of family planning; (4) to lobby for abortion? (1) Yes. (2) Yes. (3) Yes. (4) Yes.

b. FAA Sec. 488. To reimburse persons, in the form of cash payments, whose illicit drug crops are eradicated? Yes.

c. FAA Sec. 620(g). To compensate owners for expropriated nationalized property? Yes.

d. FAA Sec. 660. To provide training or advice or provide any financial support for police, prisons, or other law enforcement forces, except for narcotics programs? Yes.

e. FAA Sec. 662. For CIA activities? Yes.

f. FAA Sec. 636(i). For purchase, sale, long-term lease, exchange or guaranty of the sale of motor vehicles manufactured outside U.S., unless a waiver is obtained? Yes.

g. FY 1986 Continuing Resolution, Sec.503. To pay pensions, annuities, retirement pay, or adjusted service compensation for military personnel? Yes.

h. FY 1986 Continuing Resolution, Sec.505. To pay U.N. assessments, arrearages or dues? Yes.

i. FY 1986 Continuing Resolution, Sec.506. To carry out provisions of FAA section 209(d) (Transfer of FAA funds to multilateral organizations for lending)?	Yes.
j. FY 1986 Continuing Resolution, Sec.510. To finance the export of nuclear equipment, fuel, or technology?	Yes.
k. FY 1986 Continuing Resolution, Sec. 511. For the purpose of aiding the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights?	Yes.
l. FY 1986 Continuing Resolution, Sec.516. To be used for publicity or propaganda purposes within U.S. not authorized by Congress?	Yes.

Deputy Secretary .

ANNEX-D

Ministry of Finance
External Resources Division
Shor-e-Bangla Nagar
Dacca-7

D.O. No...ERD/Am-1(P)-96/85/202

Date.....July 14, 1985.

Subject : Proposal for a Rural Electrification-III Project .

Dear Dr. Westley ,

We are very much pleased to learn that USAID has tentatively pfogrammed $ 50 million for the proposed Rural Electrification-III Project which would finance commodities to intensify coverge of consumers within the 17 Palli Bidyut Samities and Technical Assistance to REB in managing the entire RE programme .

PDE

ACTION TO:	
REPLY DUE: 7/28	
INFO	
DIR	—
DD	—
PRO	—
AID/EC	
PDE	—
F&AGR	
P&H	
TRG	
CONT	—
MGT	
PER	
TRV	
RLA	—
GSO	
REPLY/NAN Int'l	
Date	
File:	

We have been informed by the Rural Electrification Board that the proposed expansion programme in the 17 PBSs covering 70 Upazilas would permit construction of about 4000 miles of power distribution lines and about 20 new 33/11 KV sub-stations. This would serve about 350,000 house holds , 14000 commercial shops , 4000 irrigation pumps and 2000 small industries in about 2600 villages . The REB estimates that to accomplish these programmes , an amount of $ 65 million in foreign exchange induding technical assistance for the entire RE programme will b be required .

We , accordingly , request you to consider the proposal for providing $ 65 million for the proposed Rural Electrificatio -III project to finance a part of the Area Coverge Rural lectrification Phase-III of REB .

RECEIVED JUL 15 1985 US AID DHAKA

Awaiting to hear a favourable response from you .

Sincerely yours ,

(Noor-Al Ahad)

To

Mr. John R. Westley ,
Director , USAID Mission to Bangladesh ,
Jibon Bima Bhabon (4th floor) ,
10 , Dilkusha Commercial Area ,
Dhaka.

ANNEX E

BANGLADESH
RURAL ELECTRIFICATION II PROJECT

CERTIFICATION PURSUANT TO SECTION 611(e) OF THE FOREIGN ASSISTANCE ACT OF 1961, AS AMENDED

I, Bonnie A. Pounds, Acting Mission Director, the principal officer of the Agency for International Development in Bangladesh, having taken into account, among other things, the maintenance and utilization by the Bangladesh Government and its agencies of similar projects previously financed by the United States, do hereby certify that in my judgement Bangladesh has the financial and human resources capability to utilize effectively the project to be financed by this grant.

This judgement is based upon considerations discussed in the Project Paper to which this certification is attached.

Bonnie A Pounds

Bonnie A. Pounds
Acting Director

June 5, 1986

Date

132 KV Grid Station Capacity

Present and future Capacities for PDB 132 Kv Grid Stations which feed AID funded PBSs (seen at the 132 Kv Bus).

Transformer Ratings are Peak Values (Fan Cooling On).

Name	Installed Capacity		
	Present Peak MVA	Future Capacity (1) Date	Peak MVA
Comilla (3)	20.00	Nov 85	40.00
Tongi	116.00	Feb 87	191.00
Mirpur	100.00	Apr 87	175.00
Shahjibazar	15.00	=====>	15.00
Srimongal(2)	13.34	Jun 86	40.00
Jamalpur	10.00	Jun 86	20.00
Jessore (2)	13.34	Nov 85	40.00
Ishurdi (3)	33.34	Aug 85	40.00
Bogra	26.60	Aug 85	82.00
Rangpur	13.34	Aug 85	40.00
Saidpur (3)	13.34	Jun 86	32.50
Noapara	13.34	Nov 85	53.30
Kulshi	126.00	=====>	126.00
Natore	New Const.	Dec 85	20.00
Rajshahi	New Const.	Dec 85	25.00
Tangail	New Constr.	Jul 85	26.70
Lalmonirhat	New Constr.	Jul 89	40.00
Pabna	New Constr.	Jan 90	82.00
Serajganj	New Constr.	Jan 90	40.00
Shazadpur	New Constr.	Dec 85	80.00
Kabirpur	New Constr.	Dec 87	82.00

Notes: (1) 132 Kv winding capacity of transformer(s) feeding PBS
(2) Multi winding (132/33/11 Kv)

USAID PBS COINCIDENTAL PEAK DEMANDS ON PDB 132 Kv GRIDSTATIONS IN DEC 1990 (MVA)

PBS Substations-Present Capacity vs. 1990 Loads				PDB Gridstations within PBS Reach			
PBS	Name of SSN	1985 Cap.	1990 Load(1)	Max. Cap.	PBS Load(2)	PDB Load(2)	Margin
Comilla I	Chandina	5.00	10.70	Comilla			
Comilla I	Daudkandi	5.00	8.50				
	Addl.Reqd.(3)	9.20					
Comilla II	Chandpur	5.00	2.10				
Comilla II	Faridganj	5.00	1.30				
Comilla II	Hajiganj	5.00	1.90				
	Addl.Reqd.(3)	-9.70		40.00	22.05	48.71	-30.76
Dhaka I	Dhamrai	5.00	9.40	Tongi			
Dhaka I	Kaliakori	5.00	10.30				
Dhaka I	PBS Headqtrs.	5.00	4.80				
Dhaka I	Savar	5.00	8.90				
	Addl.Reqd.(3)	13.40		191.00	30.06	71.56	89.38
Jessore I	Navarun	5.00	6.30	Jessore			
Jessore I	Topshidanga	5.00	6.60	&			
Jessore II	Avoynagar	5.00	7.80	Noapara			
Jessore II	Monirampur	5.00	6.80				
	Addl.Reqd.(3)	7.50		93.30	24.75	59.11	9.44
Pabna I	Chatmohar	2.50	5.20	Ishurdi			
	Addl.Reqd.(3)	2.70		&			
				Pabna			
Pabna II	Kashinathpur	5.00	11.90	&			
Pabna II	Santhia	5.00	1.80	Serajganj			
	Addl.Reqd.(3)	3.70		&			
				Shazadpur			
Pabna III	Ullapara	5.00	17.50				
	Addl.Reqd.(3)	12.50					
Rajshahi II	Bonpara	5.00	7.00				
Rajshahi II	Lalpur	2.50	3.80				
	Addl.Reqd.(3)	3.30		275.00	42.48	72.00	160.52
Rajshahi I	Natore	5.00	8.80	Natore			
	Addl.Reqd.(3)	3.80		20.00	7.92	6.67	5.41
Sylhet I	Madabpur	5.00	8.10	Shaji-			
Sylhet I	Shaistaganj	5.00	8.10	bazar			
	Addl.Reqd.(3)	6.20		15.00	14.58	10.67	-10.25
Sylhet II	Kamalganj	2.50	4.40	Sri-			
Sylhet II	Moulabibazar	5.00	6.50	mongal			
Sylhet II	Sreemangal	5.00	5.90				
Sylhet II	Sreemangal/PDB	3.00	5.30				
	Addl.Reqd.(3)	6.60		40.00	19.89	15.11	5.00

contd.....

ANNEX F-1B contd.....

Tangail I	Gorai	5.00	10.10	Tangail			
Tangail I	Kurni	5.00	6.10	&			
Tangail I	Tangail	2.50	9.40	Kabirpur			
	Addl.Reqd.(3)	13.10		108.70	23.04	24.44	61.22
Chittagong I	Patia	5.00	12.50	Kulshi			
	Addl.Reqd.(3)	7.50		126.00	11.25	65.78	48.97
Jamalpur II	Sherpur	5.00	11.20	Jamalpur			
	Addl.Reqd.(3)	6.20		20.00	10.08	12.22	-2.30
Bogra II	Shibganj	5.00	8.10	Bogra			
	Addl.Reqd.(3)	3.10		82.00	7.29	24.89	49.82
Rangpur II	Rangpur	5.00	8.10	Rangpur			
	Addl.Reqd.(3)	3.10		40.00	7.29	14.22	18.49
Total present cap. (PBS)		153.00					
1990 Addnl.Reqd.PBS Cap.(3)		92.20					
Total 1990 Peak Gridstation Capacity >>>>>>>>>>>>>>>				1051.00			
Total 1990 Peak Demand (2) and Total Margin >>>>>>>>>>>>>>>>					220.68	425.38	404.94

Notes: (1) Non-coincidental peaks

(2) Coincidental peaks (PBSs at 0.90 and PDB at 0.80 Diversity Factor). PDB loads were extrapolated from area totals, where PDB assumed only a 20% REB contribution.

(3) Figures indicate need for additional PBS transformers or new substations. Negative figures indicate surplus in transformer capacity, e.g. Comilla II.

ANNEX F-1C

LOAD GENERATION BALANCE UPTO 1990

(BASED ON EXISTING, UNDER CONSTRUCTION, COMMITTED & PROPOSED PLANT ADDITIONS)

Feature	June '84	Dec '84	June '85	Dec '85	June '86	Dec '86	June '87	Dec '87	June '88	Dec '88	June '89	Dec '89	June '90
1. Peak Demand:													
a) East Zone	548	586	624	655	686	735	783	838	895	958	1022	1095	1168
b) West Zone	259	286	312	348	384	412	439	471	502	538	573	614	655
c) TOTAL:	807	872	936	1003	1070	1147	1222	1309	1397	1496	1595	1709	1823
2. Capability:													
a) East Zone	672	672	684	704	1030	1125	1335	1475	1785	1895	1895	1895	1895
b) West Zone	326	346	346	352	352	352	352	352	392	382	382	382	382
c) TOTAL:	998	1018	1030	1056	1382	1477	1637	1827	2177	2277	2277	2277	2277
3. Reserve Margin (in % of Peak Demand)	24%	17%	10%	5%	29%	29%	38%	40%	56%	53%	43%	33%	25%
4. Firm Power Transfer through EWI from East Zone to West Zone 1/	83	83	83	83	83	83	228	228	228	228	228	228	228
5. Firm Capability of West Zone 2/	229	319	319	325	325	325	470	470	510	500	500	500	500
6. Firm Capability of East Zone 3/	587	587	599	619	822	915	1125	1265	1575	1685	1685	1685	1685
7. Firm Capability of Integrated Grid 4/	783	803	815	841	1002	1097	1267	1407	1757	1857	1857	1857	1857
8. Surplus (+)/Shortfall(-) of Integrated Grid (7-1c)) of	-24	-69	-121	-162	-68	-50	45	98	360	361	262	148	34
9. Surplus for export from East Zone to West Zone (6-1a) 5/	39	1	-25	-36	136	180	342	427	680	727	663	590	517

Note: 1/ : Firm Transfer Considering 1 Circuit only.

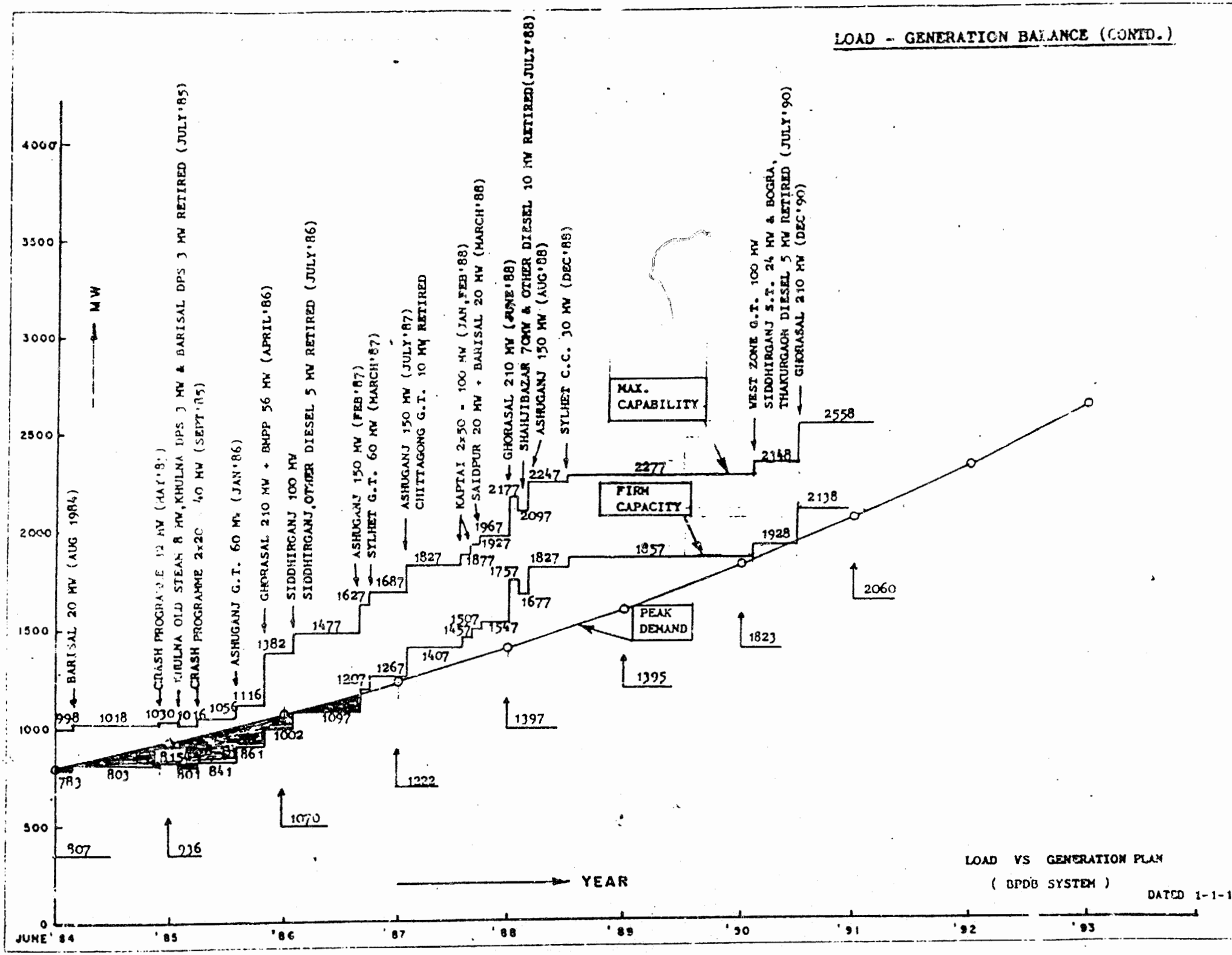
2/ : Firm Capability = Gen. Capability - Largest Unit Capability + Interconnector Firm Capacity.

3/ : Firm Capability = Total Capability of East Zone - 1st Largest Unit Capability.

4/ : Firm Capability = Total Capability of Integrated Grid - (1st Largest + 2nd Largest Unit Capability + One Gas Turbine Unit).

5/ : This depicits Peak Hour situations between 6 to 8-30 P.M.

LOAD - GENERATION BALANCE (CONTD.)



ANNEX F-1D

GENERATION ADDITION PLAN

ON-GOING

About 8 (eight) under construction power plants will be completed during TFYP. The power plants are listed below:

Name of the Project	Capacity (MW) Unit x Unit Capacity	Commissioning	Remarks
1. Ghorasal Thermal Power Station Extension-3rd Unit	1 x 210	June 1986	
2. Ashuganj Thermal Power Station Extension-3rd and 4th Unit.	1 x 150	February 1987	
3. Karnafuliu Hydro Power Station Extension-4th and 5th Unit	2 x 50	Jan-Feb 1988	
4. Ghorasal Thermal Power Station Extension-4th Unit	1 x 210	June 1988	
5. Chittagong Barge Mounted Power Plant	2 x 28	April 1986	
6. Ashuganj Gas Turbine	1 x 60	January 1986	
7. Siddhirganj Gas Turbine	5 x 20	July 1986	Loan agreement not yet signed.
8. Crash Program Generation	3 x 4 2 x 20	May 1985	This includes 12 MW Mobile Gas Turbine to be included in 1984-85 ADP.

GENERATION ADDITION PLAN (Contd.)

NEW PROJECTS

A number of 8 (eight) new power plants are proposed to be included in the TFYP, out of these 4 (four) projects are scheduled to be completed during TFYP and the remaining 4 (four) projects to spill-over to 4th Five Year Plan. The projects are listed below:

Name of the Station	Capacity (MW) Unit x Unit Capacity	Date of Commissioning	Remarks
1. Barisal Gas Turbine Power Plant - 20 MW	1 x 20	March 1988	
2. Saidpur Gas Turbine Power Plant	1 x 20	March 1988	
3. Sylhet Combined Cycle (60 MW Gas Turbine and	1 x 60	March 1987	
30 MW Steam Turbine).	1 x 30	December 1988	
4. Ashuganj Thermal Power Station Extension 5th Unit.	1 x 150	August 1988	
5. West Zone Gas Turbine Power Plant.	1 x 100	1990-91	
6. Ghorasal Thermal Power Station Extension 5th Unit.	1 x 210	December 1990	
7. Karnafuli Hydro Power Plant Extension-6th and 7th Unit.	2 x 50	1991-92	
8. East Zone Steam Power Plant	1 x 210	1991-92	

ANNEX F-1E

ENERGY AND PEAK DEMAND PROJECTION

TOTAL SYSTEM:

Fiscal Year	Peak Demand		Energy Demand		
	MW	% Increase	GWH	% Increase	Load Factor %
1983	709*	-	3433	-	-
1984	761*	7.3	3966	15.5	59.6
1985	936	23.0	4536	14.4	55.3
1986	1070	14.3	5162	13.8	55.07
1987	1222	14.2	5874	13.8	54.87
1988	1397	14.3	6755	15.0	55.20
1989	1595	14.2	7768	15.0	55.94
1990	1823	14.3	8933	15.0	55.94
1991	2060	13	10094	13.0	55.94
1992	2328	13	11406	13.0	55.93
1993	2631	13	12889	13.0	55.93
1994	2973	13	14565	13.0	55.93
1995	3359	13	16458	13.0	55.93
1996	3762	12	18268	11.0	55.43
1997	4213	12	20277	11.0	54.94
1998	4719	12	22507	11.0	54.44
1999	5285	12	24983	11.0	53.96
2000	5919	12	27731	11.0	53.48

* Suppressed peak due to generation shortage.

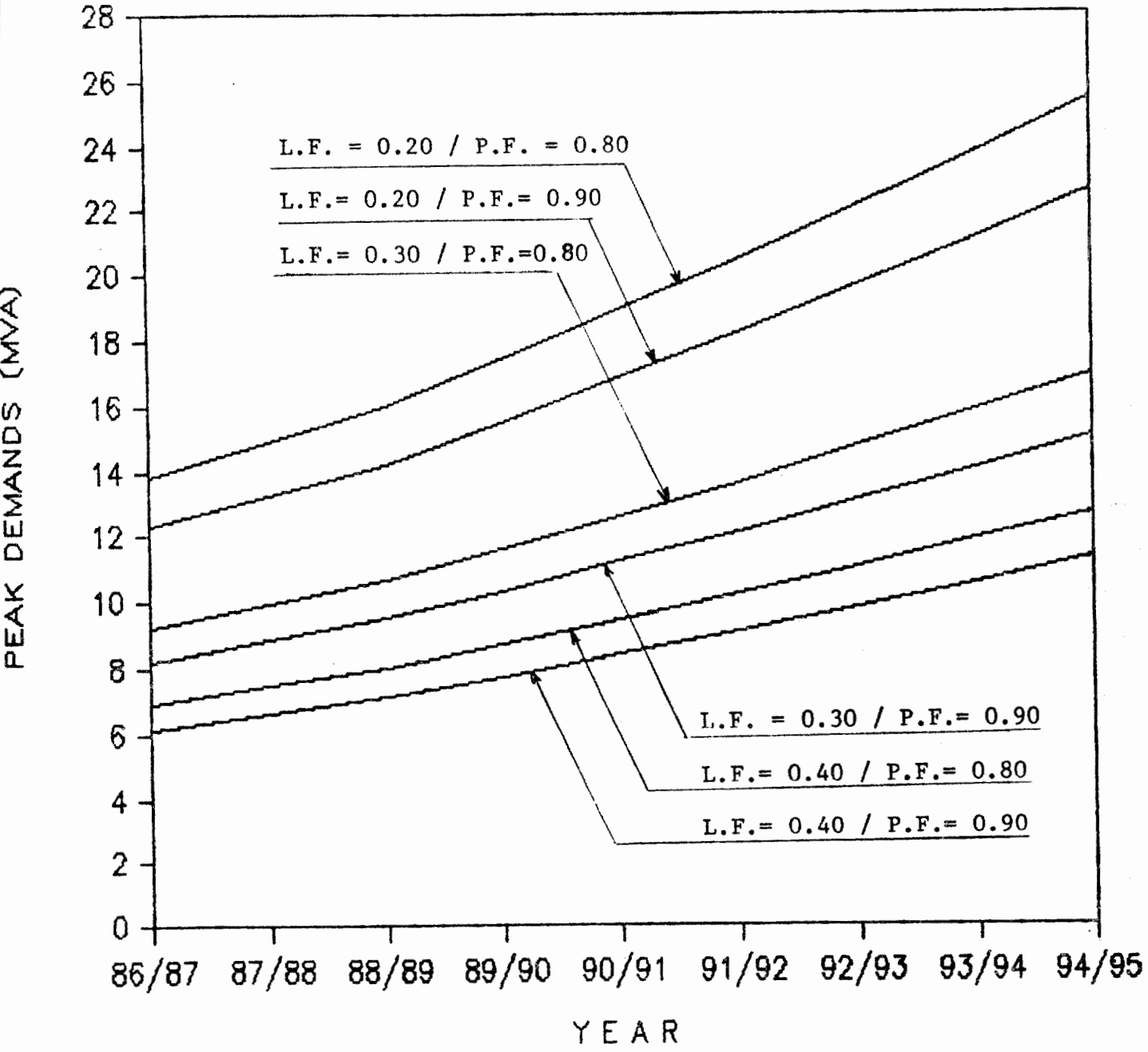
ANNEX F-1F(1)

MODEL PBS PEAK DEMANDS AT VARYING LOAD & POWER FACTORS AND
PEAK REDUCTIONS / SUBSTATION TRANSFORMER COST SAVINGS AT
LOADFACTOR IMPROVEMENTS OVER THE PRESENTLY EXISTING 0.20

YEAR (June - June)	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	94/95	SUPPORTING
MWH SALES (by REB)	19371	20935	22486	24419	26356	29044	31685	34325	36965	GRAPH
PROJECTED MODEL PBS PEAK DEMANDS :--------										
0.40 LOAD F.										
PEAK MW	5.53	5.97	6.42	6.97	7.52	8.29	9.04	9.80	10.55	
PEAK MVA @ 0.80 P.F.	6.91	7.47	8.02	8.71	9.40	10.36	11.30	12.24	13.19	F-1F(2)
PEAK MVA @ 0.90 P.F.	6.14	6.64	7.13	7.74	8.36	9.21	10.05	10.88	11.72	F-1F(2)
0.30 LOAD F.										
PEAK MW	7.37	7.97	8.56	9.29	10.03	11.05	12.06	13.06	14.07	
PEAK MVA @ 0.80 P.F.	9.21	9.96	10.70	11.61	12.54	13.81	15.07	16.33	17.58	F-1F(2)
PEAK MVA @ 0.90 P.F.	8.19	8.85	9.51	10.32	11.14	12.28	13.40	14.51	15.63	F-1F(2)
0.20 LOAD F.										
PEAK MW	11.06	11.95	12.83	13.94	15.04	16.58	18.09	19.59	21.10	
PEAK MVA @ 0.80 P.F.	13.82	14.94	16.04	17.42	18.80	20.72	22.61	24.49	26.37	F-1F(2)
PEAK MVA @ 0.90 P.F.	12.29	13.28	14.26	15.49	16.71	18.42	20.09	21.77	23.44	F-1F(2)
SUBSTATION PEAK/COST REDUCTIONS AT A LOADFACTOR IMPROVEMENT FROM 0.20 TO 0.30 :---										
MVA @ 0.80 POWER F.	4.61	4.98	5.35	5.81	6.27	6.91	7.54	8.16	8.79	F-1F(3)
MVA @ 0.90 POWER F.	4.10	4.43	4.75	5.16	5.57	6.14	6.70	7.26	7.81	F-1F(3)
US $ @ 0.80 POWER F.	46,069	49,788	53,477	58,074	62,681	69,073	75,354	81,633	87,911	F-1F(4)
US $ @ 0.90 POWER F.	40,950	44,256	47,535	51,621	55,716	61,399	66,982	72,563	78,143	F-1F(4)
SUBSTATION PEAK/COST REDUCTIONS AT A LOADFACTOR IMPROVEMENT FROM 0.20 TO 0.40 :---										
MVA @ 0.80 POWER F.	6.91	7.47	8.02	8.71	9.40	10.36	11.30	12.24	13.19	F-1F(3)
MVA @ 0.90 POWER F.	6.14	6.64	7.13	7.74	8.36	9.21	10.05	10.88	11.72	F-1F(3)
US $ @ 0.80 POWER F.	69,103	74,683	80,215	87,111	94,021	103,610	113,032	122,449	131,867	F-1F(4)
US $ @ 0.90 POWER F.	61,425	66,384	71,303	77,432	83,574	92,098	100,472	108,844	117,215	F-1F(4)

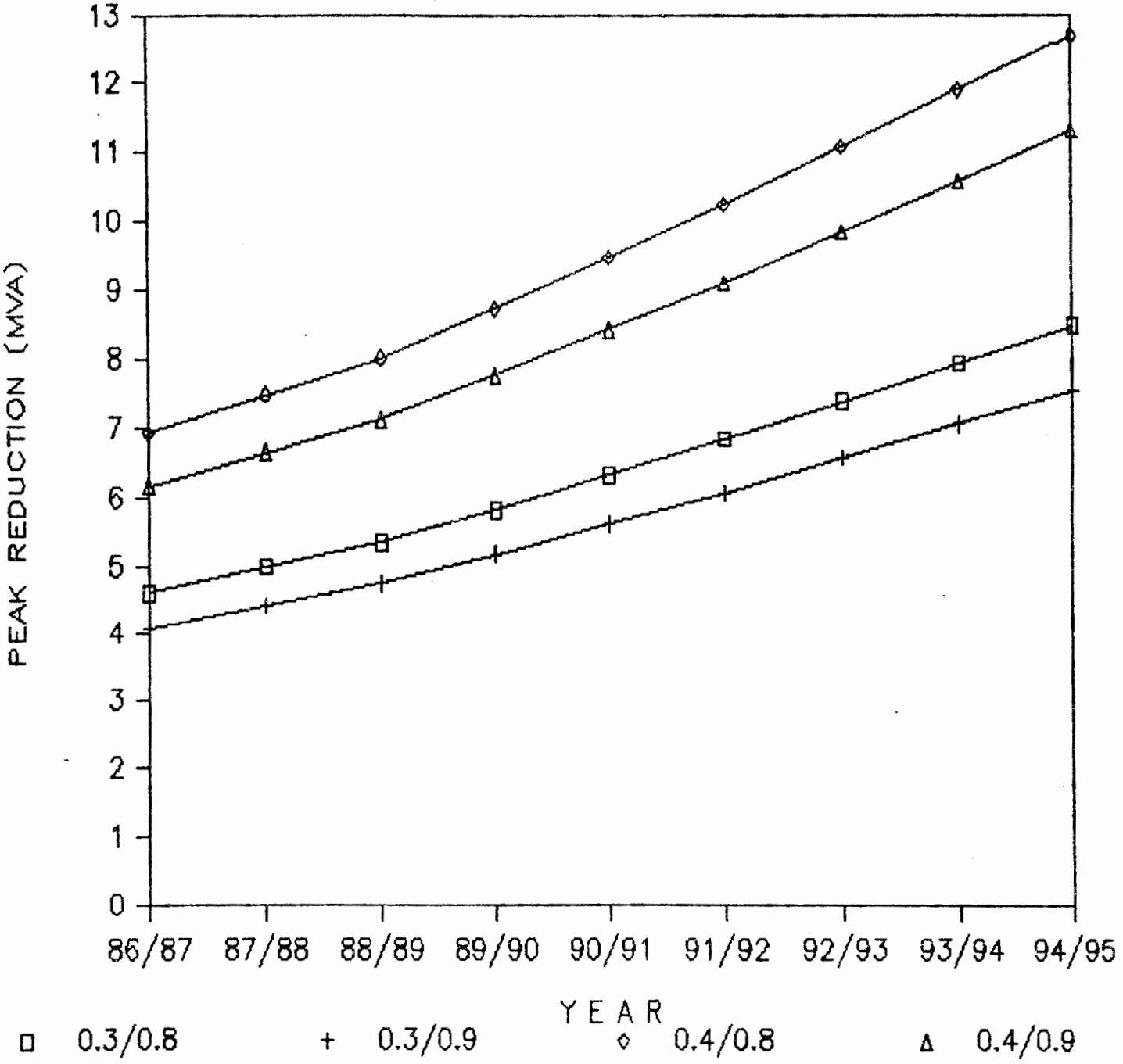
PROJECTED MODEL PBS PEAK DEMANDS

AT VARYING LOAD & POWER FACTORS



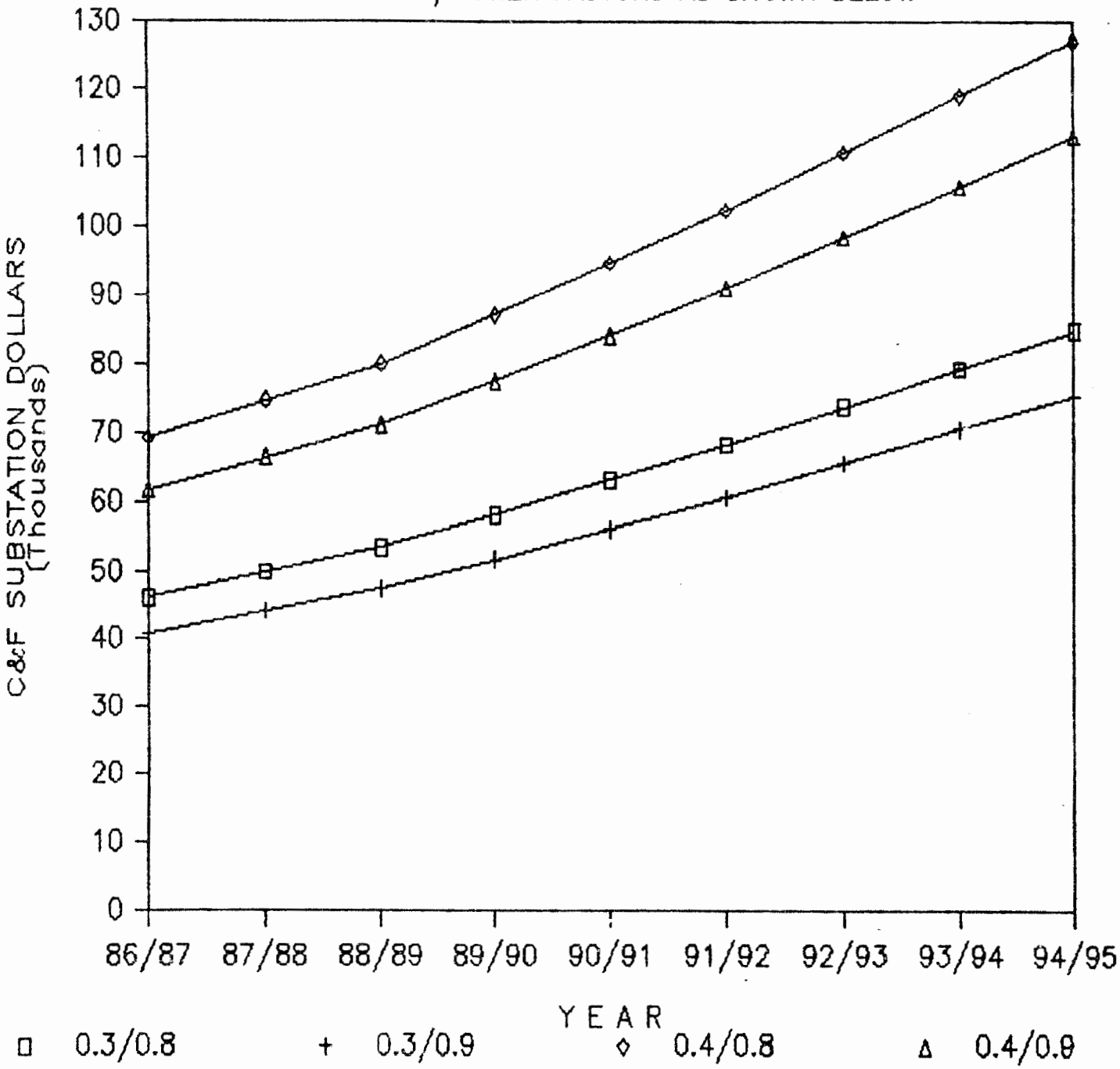
PBS PEAK REDUCTIONS AT LOADF. > 0.20

FOR LOAD/POWER FACTORS AS SHOWN BELOW



PBS FOREIGN EXCHANGE SAVINGS AT LF>0.2

FOR LOAD/POWER FACTORS AS SHOWN BELOW

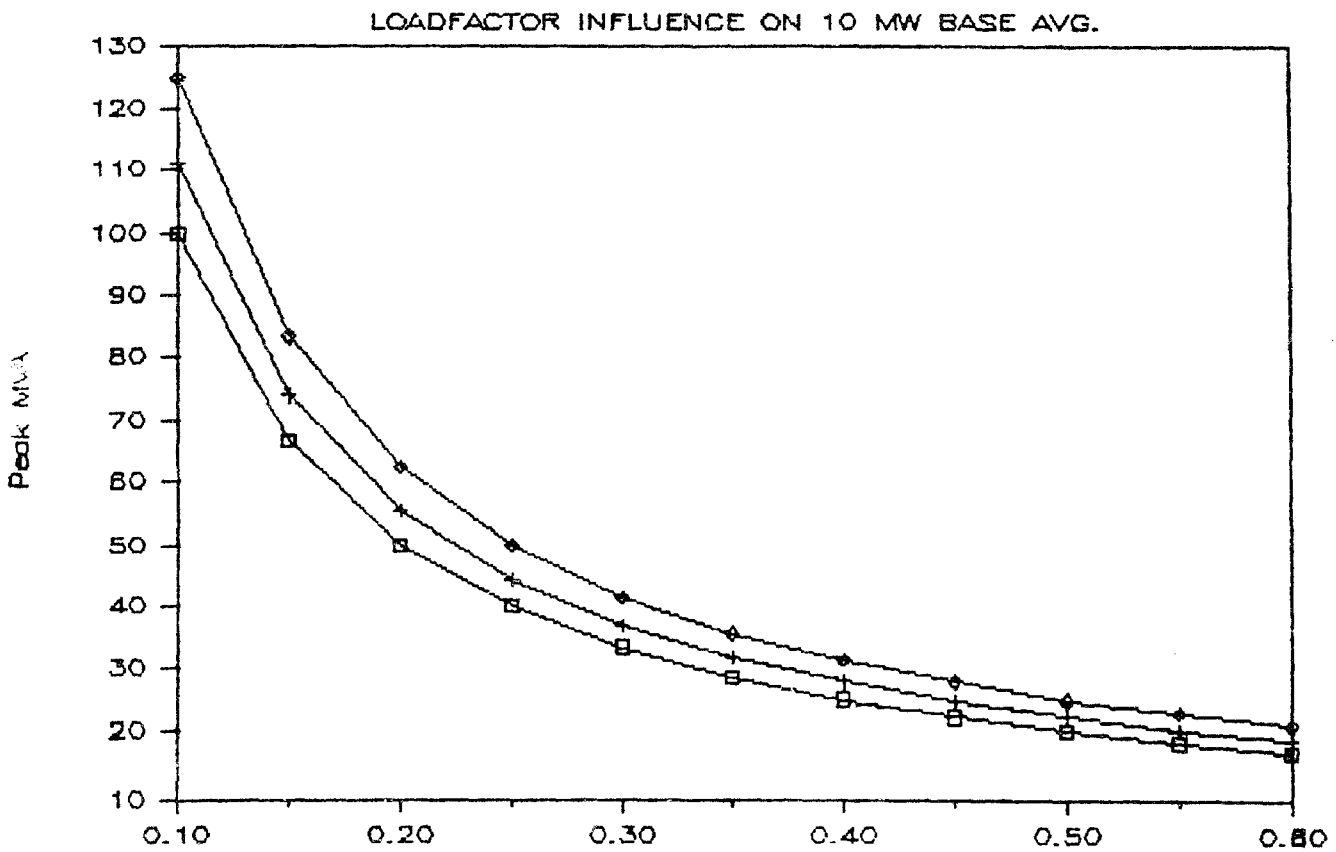


ANNEX F-1F(5)

LOADFACTOR INFLUENCE ON PEAK DEMANDS AT VARYING POWERFACTORS

AV MW	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
LOADFACTOR	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60
PEAK MW (1.0 PF)	100.00	66.67	50.00	40.00	33.33	28.57	25.00	22.22	20.00	18.18	16.67
PEAK MVA @ 0.9 PF	111.11	74.07	55.56	44.44	37.04	31.75	27.78	24.69	22.22	20.20	18.52
PEAK MVA @ 0.8 PF	125.00	83.33	62.50	50.00	41.67	35.71	31.25	27.78	25.00	22.73	20.83

GRAPHIC DISPLAY



Beneficiary Participation

The beneficiaries of rural electrification include households, commercial and industrial enterprises and irrigation users. The financial aspects of rural electrification are considered in this annex (closely related price policy issues are discussed in Annex F-2.B).

Irrigation

In general, irrigation pump users switch from diesel to electric pumps when electricity becomes available. A 1983 limited impact evaluation by REB showed the following comperative fuel costs per acre of irrigation for diesel and electric pumps.

	Diesel	Electric
Low Lift Pumps	Tk. 451	Tk. 228
Shallow Tubewell	Tk. 869	Tk. 447
Deep Tubewell	Tk. 511	Tk. 280

The study also showed that the area irrigated per pump was significantly higher for each category of electric pump (compared to diesel pumps). The lower operating costs and increased irrigation area made possible by use of electrical pumps also creates profitable irrigation possibilities where none would exist with diesel pumps, thus expanding irrigation into previously unirrigated areas. REB estimates, based on consumer surveys, project that over 22,000 electrical irrigation pumps will be in operation by 1990, compared with 6,500 on June 30, 1985. Total irrigated acres will increase from 225,000 in 1985 to 958,000 in 1990, allowing increased grain production of 326,000 tons (See Annex Table G-3, Pg. 8).

Industry and Commerce

Industrial and commercial consumers under RE 1 grew at a much faster than anticipated rate, largely because of the lower operating costs of using electricity as compared to alternate sources of energy, and because of the general push of industries into semi-urban areas. Rural area shopkeepers, agro-processing businesses, jute mills, textile mills and many other businesses took advantage of the lowered costs of electricity to start up or expand their operations. REB estimates that 5 years after RE III funded commodities are installed (7 years from signing of the project agreement) there will be 2,120 new industrial and 14,843 new commercial connections serviced by RE III. REB has given prority to connecting productive uses consumers (including irrigation pumps), with the result that more than 75 percent of the power consumed was by these users.

Households

Residential connections are highly valued by rural households, both because of the lower cost of lighting and the perceived improvement in the quality of life electricity brings. An impact study conducted by REB/USAID found that increases in security, study hours, working hours and income were some of the benefits quoted by respondents of the study. The value placed on electricity by residential users is best illustrated by the high percentage of bills collected, averaging 96 percent in 1983-84 for the 13

PBSs built by AID's RE I.

REB estimates of consumer growth, based upon REB's ability to connect and supply new customers, project total meter connections of 260,000 in 1986-87, to 387,000 in 1991 and to 775,000 by the year 2,000. Most of the new connections will be for residential consumers although it is expected that more than 75 percent of the power consumed will be by industrial, commercial and irrigation consumers.

Rural Electrification Board (REB)

REB is the agency established by the BDG in 1977 with the assigned responsibility of providing planning and implementation for the electrification of Bangladesh's 85,000 rural villages. REB receives donor funding, through the BDG, in the form of a concessionary loan which it relends to the rural electric cooperatives (PBSs) it services. REB also receives government funding for its overhead and for support of RE projects. The long term financial support for REB depends upon the payment of interest by PBSs from which REB retains a differential of 1% over the BDG's loan rate to REB. In addition to income from the loan rate differential, REB is considering adding a surcharge on some services it provides the PBSs. In the long run, continued funding for REB depends upon the ability of the PBSs to generate revenues sufficient to pay operating costs plus interest on their loans. Two of the PBSs have reached the end of the 5 year grace period on loan amortization and have begun to make interest payments on their loans. The last of the 13 Phase I PBSs will reach the end of the grace period in 1988. The BDG will continue to provide REB with operating budget support until income from the PBSs is adequate for REB's needs.

Financial Performance of PBS's:

This section attempts to evaluate the financial performance to date of AID-funded PBS's and to distinguish at least some of the factors which affect this performance.(1) In this context, a PBS's financial performance will be evaluated based on its ability to meet the financial covenants under which it was established, namely, that a PBS's be able to repay - starting 5 years after its formation - the REB loan used to finance the construction of its backbone system.(2)

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(1) Financial performance should not be confused with economic performance.

(2) Repayment is to be made over a 25 year period at as interest rate of 3 percent. Interest at 0.75 percent per annum during the initial 5 year grace period is capitalized.

It is not a simple or straight forward task to provide consistent evaluation of the financial performance of 13 separate PBS's. This is the case for a variety of reasons. Firstly, the PBS's are of different ages. Second, their backbone systems have different technical and cost characteristics. Third, they supply areas with significantly different ecoromic characteristics and potentials. Finally, any evaluation (but especially those for relatively new PBS's) depends heavily on assumptions concerning rates of growth of the number of consumers and average consumption per consumer. Yet experience with the PBS's suggests such growth rates are highly volatile.(3)

1. Operating Margins: Evidence concerning financial performance is obtained most readily by analyzing the PBS's operating margins (positive or negative) during the years since energization. This information is summarized in Table F.2.A.1.

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(3) For example, the growth rates during FY 84/85 of total consumers ranged between roughly 13 percent and 150 percent in the 13 PBS, while changes in average consumption per consumer ranged between -17 percent and 73 percent. As PBS mature, the variability of these rates should be reduced.

TABLE F.2.A.1.: PBS Operating Margins [a] (Tk.X 10^3)

PBS	FY 81/82	FY 82/83	FY 83/84	FY 84/85
Comilla I	(2839)	(2567)	(2696)	761
Sirajgong	(2718)	(3232)	(4994)	(1612)
Dhaka	(4282)	(1070)	1138	5024
Jessore I	(2327)	(2857)	(4181)	(2889)
Jessore II	(3266)	(3367)	(4179)	(992)
Pabna I	-	(1509)	(2240)	(2531)
Pabna II	(601)	(1852)	(2189)	(2180)
Habiganj	(115)	(1454)	(1783)	969
Natore I	(3833)	(2760)	(4043)	(899)
Natore II	(873)	(2432)	(2066)	(612)
Chandpur	(914)	(2103)	(3828)	(2975)
Moulvibazarr	(2667)	(1991)	(2266)	2256
Tangail	(1885)	(1129)	(2215)	(425)

(a) Operating margin = (billed tariff revenues + other revenue) - (cost of power + O&M + gov't duty + depreciation).

Source: REB

The data indicate that only 4 of 13 PBS's had positive operating margins during the most recent fiscal year. On the other hand, all the PBS's except Pabna I either reduced their operating deficits or increased their positive margins between FY 83/84 and FY 84/85. This trend of improving PBS financial status is unlikely to continue into FY 85/86, however. This is because the five year grace period will expire for most PBS; and consequently, they must begin (at least in theory) making repayments of principal and interest. The projected financial status of these 13 PBS's in FY 85/86 is summarized in Table F.2.A.2. None of the PBS's are projected to be able to make full principal and interest payments in FY 85/86, although roughly seven PBS can likely make partial payments.4/ This repayment problem should lesson in the future ceteris paribus as the number of consumers and average consumption per consumer increase. Nevertheless, these financial projections emphasize the need for a careful assessment of the repayment requirements imposed on PBS's. 5/

Table F.2.A.2 also presents the average tariff for each PBS which is required in FY 85/86 (given the projected mix of consumers and average consumption per consumer) if the PBS is to cover operating costs and make whatever principal and interest payments are due.6/ The "required" tariff increases are relatively large for many PBS's. Once again, this situation may improve over time as loads on the PBS systems increase.

4/ The relative financial strengths of the PBS's cannot be ranked according to the results presented in this table since some PBS's will have to repay principal and interest for only a few months in FY 85/86 while others must repay over the full 12 months.

5/ The current requirement that depreciation accounts be fully funded should also be analyzed since these revenues could be used to make up much of the interest and principal repayment shortfall in many PBS's.

6/ The required rate increases are likely biased downward due to the assumed zero price elasticity of demand. This bias is offset somewhat, however, by the exclusion of other operating revenues from the calculation.

Table F.2.A.2.: PBS Financial Projections for FY 85/86 (Tk X 10^3)

PBS	Estimated Tariff Revenues[c]	Operating Expenses[a]	Principal and Interest Expenses[b]	Margin	Average Tariff Required to break Even (Tk.)
Comilla	31943	31204	12479	(11741)	2.40
Sirajgong	27338	27656	9258	(9576)	2.31
Dhaka	60146	51776	12720	(4350)	1.79
Jessore I	18157	20615	4612	(7070)	2.40
Jessore II	22375	20794	10477	(8896)	2.46
Pabna I	12209	14066	1211	(3068)	2.12
Pabna II	11563	12815	1279	(2531)	2.06
Habiganj	24633	22925	0[d]	1708	less than 1.7
Natore I	23511	21615	9418	(7522)	2.30
Natore II	22137	22273	1547	(1683)	1.84
Chandpur	10591	14988	1230	(5627)	2.61
Moulvibazar	30945	26869	4980	(904)	1.76
Tangail	34932	33924	1488	(480)	1.74

(a) Includes O&M, depreciation (at 2.5%), power cost, and allowance for bad debt (2%).

(b) Assumes payment of principal at the rate of 4%/year, and interest on principal of 3%/year. Principal is assumed equal to long term debt as of June 30, 1985. Payment of principal and interest is prorated for the fraction of 85/86 which occurs after the grace period expires.

(c) Assumes average tariff of Tk. 1.7/KWH, and excludes other operating revenues.

(d) Grace period still in effect.

Source: NRECA

Table F.2.A.3 provides information which may be useful in determining specific factors which affect the financial performance of PBS's. For example, three of the four PBS's with positive operating margins in FY 84/85 are relatively mature - being electrified in 1980 or 1981. Perhaps more importantly, these four PBS's supply relatively large amounts of power to irrigation and industrial consumers. Since much of this consumption occurs off peak, it contributes to a higher load factor and better financial performance. 7/ These result concurs with the general belief that viable RE typically depends upon the development of adequate productive uses for electricity.8/

3. Conclusions: The most obvious point to make is that it is still very early to evaluate the financial performance of the original 13 PBS's. All except one of these have been energized less than five years. Moreover, the backbone systems of these PBS's were typically far from complete at energization. Thus there is little evidence available concerning the financial performance of mature PBS's.

Given this caveat, some tentative conclusions can be drawn. First, the underlying economic soundness of the PBS's is improving as they mature. There is evidence to suggest that, over time, deficits are being reduced or surpluses increased (ignoring, for the moment, principal and interest repayment requirements). Second, financial performance is generally strongest in those PBS's which supply relatively large amounts of power to irrigation, small commercial, and especially industrial consumers. Such consumers pay tariffs in excess of the financial costs of delivered energy and generally provide loads which, if properly managed, increase PBS load factors without making excess demands on peak capacity. Third, it is likely that most PBS's will not be able to meet fully the current schedule of loan repayment. This problem is apt to be most severe immediately after the expiration of the 5 year grace period. Moreover, loan repayment may become a more severe problem confronting the REB as PBS's located in areas with less productive use potential come of age. PBS tariff increase and better load management practices can undoubtedly help mitigate this problem. 9/10/

7/ In some cases, specific economic factors may lead to good financial performance. For example, the presence of tea gardens in Moulvibazar.

8/ It is obvious that the development of domestic load cannot contribute to the financial viability of PBS's under current conditions since the energy cost alone of supplying these consumers, roughly Tk. 0.95 (1-average losses)=Tk. 1.19 KWH, considerably exceeds the domestic tariff of Tk. 1/KWH

9/ A more meaningful definition of the date of energization, i.e. one which more accurately reflects when the backbone system is relatively complete, would also be useful.

10/ Evidence suggests that most RE consumers were previously paying significantly more for alternative sources of energy. Thus they should be willing and able to pay higher PBS tariffs. This gap between electricity and alternative energy costs provides an opportunity for the PBS's to increase their net revenues. This opportunity will be reduced, however, as the PDB bulk supply rate continues to increase.

Table F.2.A.3: PBS Energy Consumption by Consumer Category

(1)		Month/Year Officially Electrified	Number of Consumers and Average Consumption by Consumer Category (up to 12/84)								Total Consumption per month by Consumer Category (MWH):12/							
			Irrigation		Domestic		Small Commercial		Industrial		Irrigation		Domestic		Commercial		Industria	
			No.	Av. Cons (KWH/Mo)	No.	Av. Cons. (KWH/Mo)	No.	Av. Cons. (KWH/Mo)	No.	Av. Cons. (KWH/Mo)	Total	(%)	Total	(%)	Total	(%)	Total	
	1. Comilla I	1/1981	280	1450	8927	24	1611	41	194	3359	406	30	218	16	66	5	652	4
	2. Chandpur	12/1981	145	2183	5993	28	1936	36	174	966	316	44	168	23	69	10	168	2
	3. Dhaka	6/1980	518	1573	1184	34	795	71	373	2559	909	39	407	18	57	2	952	4
	4. Jessore I	6/1981	337	1232	6003	31	1418	48	116	1861	415	47	186	21	69	8	216	2
	5. Jessore II	3/1981	293	977	7129	23	1589	30	96	1781	334	47	160	22	48	7	171	2
	6. Pabna I	1/1984	152	1049	3570	31	854	37	90	1892	159	34	110	24	32	7	162	3
	7. Pabna II	1/1983	104	568	4141	31	1008	53	86	1670	59	15	128	33	54	14	144	3
	8. Sirajgong	4/1981	603	873	6395	43	1459	54	235	1782	596	44	276	20	78	8	419	3
	9. Natore I	3/1981	590	966	6256	29	642	54	142	1467	570	57	181	18	35	4	209	2
	10. Natore II	6/1982	310	671	6454	30	1286	40	178	1768	208	27	194	25	51	7	315	4
	11. Habiganj	10/1982	23	1277	4299	30	1086	47	101	4839	29	4	127	18	51	7	489	7
	12. Moulvibazar	6/1981	11	281	6090	28	515	37	72	10087	3	0.3	172	19	19	2	726	7
	13. Tangail	10/1981	551	525	5500	31	266	69	140	5103	171	14	289	24	18	2	714	6
	Average		312	977	6354	30	1113	45	157	2729	321	32	201	20	50	5	410	4

(a) % of total consumption in the PBS excluding street lighting.

Source: AID

Price Policy Analysis

This Annex reviews the implication of current commercial energy pricing policies in Bangladesh in light of the financial performance of AID-financial PBSs. The annex contains recommendations for appropriate energy pricing reforms and relevant technical assistance requirements. To provide an appropriate framework, this Annex begins with a brief discussion of the general pattern of commercial energy supply and demand in Bangladesh.

A. Commercial Energy Use in Bangladesh: (1)

1. Consumption: There are several distinguishing characteristics of commercial energy consuption in Bangladesh. First, much of it has been supply constrained. That is, consumption of certain commercial energy products -- especially electricity and natural gas -- has often been constrained by supply shortages. (2) Second, commercial energy consumption per capita is very low, e.g. 36 Kg of oil equivalent per annum in 1984. As a result of such low consumption, the addition of a single new industrial consumer can lead to a discrete increase in total commercial energy consumption. For example, in 1981 two fertilizer plants accounted for 38 percent of natural gas consumption, while four electric power plants accounted for another 38 percent. Third, the level of commercial energy consumption varies significantly according to geographical region, and is much higher in the East than in the West.

Commercial energy use can be analyzed according to consumption by sector. In this context, most commercial energy in Bangladesh is consumed in two sectors: industrial and residential (or domestic).(3) As indicated in Table F.2.1, commercial energy use is dominated by the industrial sector, which accounts for approximately 44 percent of commercial energy use. The next most important sectors are residential, transportation and agriculture - accounting for 24 percent, 19 percent, and 6 percent respectively of commercial energy use. Within the industrial sector, the consumption of electricity accounts for roughly one half of total commercial energy use, with the remaining balance derived from natural gas (27 percent), petroleum products (17 percent), and coal (12 percent). Resioential consumption is dominated by kerosene (50 percent), electricity (27 percent), and natural gas (23 percent). The transportation sector relies exclusively on petroleum products and coal, while agriculture utilizes mostly diesel fuel (82 percent) and some electricity (12 percent).

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(1) Commercial energy in Bangladesh is derived from coal, petroleum, natural gas, and hydropower. Non-commercial energy use is not reviewed here since RE is a commercial source of energy and typically substitutes only for other forms of commercial energy. However, commercial energy use accounts for less than 50 percent of total energy use in Bangladesh, with this percentage being much lower in rural areas.

(2) This complicates the task of making energy demand projections.

(3) Non-energy uses of potential energy supplies, e.g. natural gas as a fertilizer stock, are excluded.

TABLE F.2.1
COMMERCIAL ENERGY BALANCE, FY83/84

(thousand metric tons oil equivalent)

	Petroleum Products													
	Coal	Crude Oil	LPG	Gasoline	Naptha	Jet fuel	Kerosene	Diesel	Fuel oil	Non-energy	Total	Natural gas	Electricity	Total
Primary Proudction	-	-	-	-	-	-	-	-	-	-	-	2,009	281	2,290
Imports	177	1,057	-	-	-	54	41	276	87	-	485	-	-	1,692
Exports & Foreign Bunkers (-)	-	-	-	-	24	-21(a)	-	-10	-21	-13	-159	-	-	-159
Primary Supply														3,836
Transportation and Losses														
Thermal Powerr Generaton	-	-	-	-	-	-	-19	-55	-167	-	-241	-720	961	0
Oil Refining	-	1,088	7	48	94	4	297	216	231	94	991	-	-	-97(b)
Ener.Sec.Use & Losses(-)(c)	-	-7	-	-7	-3	-3	-22	48	21	-23	11	-102	-404	-502
Stock drawdown	-	39	-	-4	3	1	20	8	15	1	44	-	-	83
Net Supply Demand	177	-	7	51	-	35	317	483	185	63	1,139	1,188	839	3,343
Demand														
Industry	137	-	-	-	-	-	-	11	178	-	189	241	536	1,103
Transportation	40	-	-	51	-	35	-	351	8	-	445	-	-	485
Agriculture	-	-	-	-	-	-	10	120	-	-	130	-	17	147
Commercial	-	-	2	-	-	-	-	-	-	-	2	56	79	137
Residential	-	-	4	-	-	-	306	-	-	-	310	137	163	610
Other Sectors	-	-	-	-	-	-	-	-	-	-	-	-	44	44
Non-Energy Uses	-	-	-	-	-	-	-	-	-	63	63	754(d)	-	817

(a) IBRD estimate
(b) Horizontal balancing item.
(c) Vertical balancing item. Items and totals converted to oil equivalents separately and may not add after rounding.
(d) Fertilizers.

Source : World Bank

When commercial energy use is analyzed by source of energy, it is apparent that about 43 percent of such energy is consumed in the form of petroleum products, 33 percent as electricity, 17 percent as natural gas, and 7 percent as coal. Petroleum product consumption is dominated by such middle distillates as diesel fuel (45 percent) and kerosene (29 percent), and by fuel oil (17 percent).

Most petroleum product consumption occurs in transportation (41 percent), households (29 percent), or industry (18 percent). Electricity consumption is divided mostly between industry (64 percent) and households (19 percent), while natural gas goes to industry (56 percent) and households (32 percent).

2. Supply: Commercial energy in Bangladesh is derived from natural gas, hydropower, petroleum, and coal. (1) The former two energy resources are available domestically, while the latter two are imported. These energy resources can also be characterized by their geographical distribution. Natural gas fields exist both on and offshore in the East Zone. Similarly, developed hydropower capacity and potential exists primarily in the southeast. Substantial coal deposits exist in the northwest. However, their utilization is not expected to be economically viable in the foreseeable future.

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(1) Peat deposits exist in the Faridpur and Khulna districts. Some consideration has been given to its use in a 30 MW pilot power plant in Faridpur.

Reasonably well developed supply systems exist for electricity, petroleum products, and (to a lesser extent) natural gas. [2] Up until 1982, completely separate power grids existed in the East and West Zones [3] supplying about 426 MW and 237 MW of available capacity in the East and West respectively. These grids were connected at the end of 1982 by a 500 MW interconnector. Their combined capacity has increased to roughly 1010 MW by 1985. At the same time, the rural distribution network has been expanded significantly by the rural electrification program. Natural gas is supplied to Dhaka and Chittagong and to several other smaller towns via pipelines. Natural gas is also supplied via pipeline to several cement and fertilizer factories, and to power stations. Petroleum products are either imported directly or refined in Chittagong from imported crude oil. Refinery production is such that insufficient amounts of kerosene and diesel are produced, while excess amounts of gasline/naptha and fuel oil are produced (and thus exported.)

Bangladesh's commercial energy supply strategy is driven by at least three factors: (1) the high cost (in foreign exchange) of petroleum imports, (2) the relative abundance of natural gas deposits, and (3) the rapid depletion of forest reserves and other traditional fuels. These factors jointly determine a strategy aimed at reducing use of petroleum products by substituting the use of natural gas and encouraging a more energy efficient economy. This substitution of natural gas for petroleum is achieved by inter alia making gas supplies available to more urban areas, by increasing the use of gas fired power plants (and by transmitting this electricity to the West Zone), and by developing the supply of electricity (as a substitute for kerosene and diesel) in rural areas. [4] Another important part of any energy supply strategy involves the establishment of appropriate energy pricing policies. This topic is considered below.

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(2) Many of these systems were re-built after the War of Liberation in the early 1970's.

(3) BPDB also operates a few MW of isolated generating units in both Zones. Significant amounts of of captive generation also exist.

(4) The use of compressed natural gas as a substitute for gasoline or diesel, and liquified petroleum gas as a substitute for kerosene (lighting), gasoline (transport), or diesel (pumping) is also being considered.

B. Commercial energy pricing and supply costs in Bangladesh:

1. Overview: Commercial energy prices in Bangladesh are, in general, set by the Government, while non-commercial energy prices are market determined. For the most part, commercial energy prices are uniform through out the country.(1) The electricity tariffs charged to PBS consumers are an exception since these are set by each PBS with the assistance and approval of the REB (see below). As is usually the case, existing commercial energy prices are determined by a variety of economic, financial, and distributional concerns. The latter two factors have tended to predominate so that energy prices have often been set below economic supply costs (petroleum prices since 1982 are an exception). Recently, however, international aid donors (expecially the Asian Development Bank and the World Bank) have promoted the adoption of energy prices which reflect actual supply cost and have provided technical assistance to help establish what such prices should actually be.

2. Current Prices:

Recent natural gas prices for the Titas Gas Company are presented in Table F.2.2(2)

Table F.2.2: Natural Gas Tariffs (1) (Titas Gas Co.) (Tk. per MCF)

	July '82	July '83 - Current
Electric Power	10.5	11.5
Fertilizer	10.5	11.5
Industrial	31.0	36.0
Commercial	31.0	36.0
Domestic (Metered)	27.0	34.0
Domestic (Unmetered)		
Single burner/month	35.0(2)	45.0
Double burner/month	65.0(2)	80.0

(1) Excludes meter rental charges where applicable and excise duties.

(2) Irrespective of consumption

Current and past ex-depot prices for petroleum product are summarized in Table F.2.3 (next page). These prices were last increased in March 1983. The Ministry of Energy and Mineral Resources is authorized, however, to increase these prices automatically by up to 10 percent if supply costs increase.

(1) Differences in transportation costs do result in inter-regional variations, however

(2) Titas Gas Company is the only gas distribution company with significant numbers of domestic, commercial and industrial consumers.

Table F.2.3 Bangladesh Petroleum Product Prices (Taka/IG)

Product	July '82 Ex-depot price	July '82 Import Parity (1)(2) CIF Chittagong	March '83 Ex-depot Price
Premium Gasoline	69.3	29.1	75.6
Regular Gasoline	63.8	27.3	66.7
Jet Fuel	42.0	30.2	
Kerosene	32.8	29.91	32.8
Diesel Oil	32.8	28.6	32.8
Fuel Oil	24.5	18.8	24.5

(1) FOB Singapore plus freight to Chittagong
(2) Exchange rate July 1982, Tk. 22 = US$ 1.00.

Electricity is supplied in Bangladesh by the PDB and (in rural areas) by the PBS's. PDB tariffs are the same throughout the country for various categories of consumers. Changes in these tariffs must be approved by the Cabinet. Tariffs for various types of PBS consumers in vary slightly among PBS's. Changes in the tariff structure of any PBS must be approved by the REB. PDB and PBS tariffs in recent years are summarized in Tables F.2.4 and F.2.5 respectively.

PDB tariffs (Table F.2.4) have increased rapidly (in nominal terms) during the last six years, i.e. by an average of 38 percent in 1979, 47 percent in 1980, 28 percent in 1982, 3.2 percent in 1983, 13 percent in 1984, and approximately 20 percent (1) in 1985. In contrast to this general pattern of annual increases, the bulk supply rates PDB charged to the PBS's remain constant at Tk. 0.78 between 1981- August 1985 and increased by only 22 percent in September 1985. Other important changes in PDB rates have occured with the introduction of both peak/off-peak energy charges for certain large consumers and demand charges for all categories of consumers except PBS's. Current PDB tariffs are still somewhat inconsistent with the structure of supply costs since domestic and irrigation consumers pay the lowest rates. Nevertheless, the most recent tariff revision represents a significant step towards the rationalization of PDB tariffs.

(1) Assessment team estimate.

Table F.2.4: Bangladesh BPDB Electricity Tariff Structure (Taka)

	July '82 - June '83				
	Min. Monthly Charge/KW[3]	Energy Charge/KWH[1]	Energy Charge/KWH[2] Peak	Off-Peak	Demand Charge per KW[3]
A. Domestic	-	0-50 KWH: Tk. 0.50 50-250 KWH: Tk. 0.60 250-400 KWH: Tk. 0.70 above 400 KWH: Tk. 2.0	-	-	-
B. Irrigation	Annual Charge Tk. 250/H.P./Year[4]	Tk. 0.5/Tk.1.0[5]	-	-	-
C. Industry	Annual Charge Tk.90 (single phase) Tk.500 (3 phase)	Tk. 1.5	Tk.4.0	Tk. 1.1	
D. Commercial	Tk. 45	0-100 KWH: Tk. 1.4 above 100 KWH: Tk.2.5	-	-	-
E. Consumers above 50 KW (except Jute Mills)	Tk. 35	Tk. 1.55	Tk. 3.15	Tk. 0.9	-
F. Jute Mills above 50 KW	Tk. 35	Tk. 1.3	-	-	-
G. 5 MVA or above	Tk. 65	Tk. 1.35	Tk. 2.5	Tk. 0.8	-
H. PBS's	Tk. 50	Tk. 0.78	-	-	-

(1) For consumers without time of day meters.
(2) For consumers with time of day meters
(3) Per KWH of contracted or connected load.
(4) Not less than Tk. 1000/yr for single phase or Tk. 3000/yr for 3 phase.
(5) Up to 250 KWH/More than 250/KWH.(!!!)
(6) Rate applies to all consumption.

Table F.2.4 (continued): Bangladesh BPDB Electricity Tariff Structure (Taka)

	March - April '85					Sept '85 - Present				
	Min. Monthly Charge/KW[3]	Energy Charge/KWH[1]	Energy Charge/KWH[2] Peak	Off-Peak	Demand Charge per KW[3]	Min. Monthly Charge/KW[3]	Energy Charge/KWH	Energy Charge/KWH Peak	Off-Peak	Demand Charge Per KW[3]
omestic	-	0-250 KWH : Tk. 0.6 250-400 KWH : Tk. 0.85 above 400 KWH : Tk. 2.25	-	-	-	-	Up to 100 KWH:Tk.1.0 Up to 350 KWH:Tk.1.1[6] above 350 KWH:Tk.2.75[6]	-	-	Tk. 10
rrigation	Tk.250/HP/Year[4]	Tk. 1.0	-	-	-	Tk.250/H.P./Year[4]	Tk. 1.4	-	-	Tk. 30
Industry	-	Tk. 1.7	Tk.4.0	Tk. 1.2	-	-	Up to 5 KW: Tk.1.95 above 5 KW load:Tk.2.05	Tk.5.85	Tk.1.95	Tk. 30
Commercial	Tk. 45	0-100 KWH : Tk. 1.85 above 100 KWH : Tk. 2.5	-	-	-	Tk. 45	Gov't:Tk.2.15 - 2.8 Commercial: Tk.25-30	-	-	Tk. 10
Consumers above 50 KW (except Jute Mills)	Tk. 70	Tk. 1.7	Tk.3.25	Tk.1.0	-	Tk. 70	Gov't: Tk.2.25 Commercial:Tk.2.80 Irrigation:Tk.1.9 Industry: Tk.2.0	Tk.6.75 Tk.5.7	Tk.2.7 Tk.1.9	Tk. 30
Jute Mills above 50 KW	Tk. 70	Tk. 1.45	-	-	-	Tk. 70	Tk.1.65	-	-	Tk. 30
5 MVA or above	Tk. 65	Tk. 1.55	Tk. 3.0	Tk.0.9	-	Tk. 65	Tk.1.75	Tk.4.95	Tk.1.65	30
PBS's	Tk. 50	Tk. 0.78	-	-	-	Tk. 50	Tk.0.95	-	-	-

Source: BPDB

The level and structure of any PBS's tariffs has, in general, been affected by at least five factors: 1) the cost of power (bulk supply rates) purchased from PDB, 2) the level of PDB rates to individual consumers (since a PBS and the PDB often supply consumers in the same area), 3) the requirement that repayment of the REB loan begin after five years, 4) a recent World Bank covenant that the average, per KWH PBS tariff must not be less than the average per KWH PDB tariff,(1) and 5) the ability to pay on the part of PBS consumers.

It is evident from Table F.2.5 that there is very little inter - PBS variation in tariffs. This is undoubtedly due to the strong role which REB and its consultants have played in setting tariffs. In all PBS, tariffs are lowest for domestic consumers and highest for industrial consumers. Domestic tariffs have remained relatively stable over the last five years increasing 25 percent in nominal terms and decreasing in real terms. In contrast, both irrigation and industrial tariffs have more than doubled in nominal terms.

Average tariff revenues per KWH sold in each PBS are summarized in Table F.2.6 for FY 83/84, FY 84/85, and the first quarter FY 85/86. This figures suggest the need for an increase in average tariffs in PBS's if the World Bank covenant requiring an average tariff of Tk. 1.7/KWH is to be met by December, 1985.

3. Commercial energy supply costs in Bangladesh:

The economic supply cost of energy should measure the opportunity cost of the resources used to obtain the type of energy in question. The appropriate measure of this opportunity cost depends inter alia upon nature of the energy source and the alternative markets available to it. For example, petroleum is a tradeable energy source. Thus its supply cost in Bangladesh is determined by the market price for petroleum (perhaps f.o.b. Singapore) plus transport cost to Bangladesh. In contrast, natural gas is produced domestically within Bangladesh, exists in a fixed supply, and has limited export market potential. This means that the economic supply cost is determined by the economic cost of production plus a depletion premium.(2) Finally, electricity is a non-tradeable, non-exhaustible energy source. Thus its supply cost equals its economic cost of production - the so-called long run marginal cost (LRMC). This LRMC typically varies with voltage level and the time of consumption (i.e. during the peak or off-peak period).

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(1) As of September 1985, the average PDB tariff is estimated to be Tk. 1.7/KWH.

(2) This premium is added to the production cost since an increment on present production leads to the more rapid substitution of some more expensive alternative source of energy.

Table F.2.5:PBS Tariffs by Year (Tk./KWH) (1) (2)

PBS	Tariff Category																											
	Domestic						Small Commercial						Irrigation						Industry						Street Light (3)			
	80/81	81/82	82/83	83/84	84/85	85/86	80/81	81/82	82/83	83/84	84/85	85/86	80/81	81/82	82/83	83/84	84/85	85/86	80/81	81/82	82/83	83/84	84/85	85/86	80/81	81/82	82/83	83/84	84/85	8
Dhaka	0.75	0.75	0.80	0.80	0.80	1.0	-	-	1.25	1.25	1.40	1.80	0.70	0.85	1.0	1.0	1.15	1.60	0.95	1.05	1.45	1.50	1.70	2.10	60.0	60.0	60.0	70.0	75.0	8
Tangail I	-	0.75	0.80	0.80	0.80	1.0	-	-	-	1.25	1.35	1.60	-	0.85	1.0	1.0	1.15	1.50	-	1.05	1.50	1.50	1.65	1.85	-	60.0	60.0	70.0	70.0	8
Comilla I	0.75	0.75	0.75	0.80	0.80	1.0	-	-	1.25	1.25	1.50	1.70	0.80	0.85	1.0	1.0	1.10	1.50	0.90	1.05	1.40	1.50	1.70	1.90	60.0	60.0	60.0	70.0	70.0	8
Chandpur	0.75	0.75	0.75	0.80	0.80	1.0	-	-	1.25	1.25	1.50	1.70	0.70	0.85	1.0	1.0	1.25	1.50	0.90	1.05	1.40	1.50	1.70	1.90	60.0	60.0	60.0	70.0	70.0	8
Habiganj	-	-	0.75	0.80	0.80	1.0	-	-	1.40	1.40	1.35	1.60	-	-	1.0	1.0	1.0	1.40	-	-	1.45	1.50	1.65	1.80	-	-	60.0	70.0	70.0	8
Moulavibazar	0.75	0.75	0.80	0.80	0.80	1.0	-	-	1.30	1.30	1.40	1.60	0.70	0.85	1.0	1.0	1.0	1.40	0.90	1.05	1.50	1.50	1.65	1.80	60.0	60.0	60.0	70.0	70.0	8
Pabna I	-	0.75	0.75	0.80	0.80	1.0	-	-	1.25	1.30	1.40	1.60	-	0.85	1.0	1.0	1.25	1.45	-	1.05	1.45	1.50	1.70	1.95	-	60.0	60.0	70.0	70.0	8
Pabna II	-	0.75	0.75	0.80	0.80	1.0	-	-	1.25	1.25	1.50	1.70	-	0.85	1.0	1.0	1.15	1.40	-	1.05	1.45	1.50	1.70	1.85	-	60.0	60.0	70.0	70.0	8
Shirajganj	0.75	0.75	0.75	0.80	0.80	1.0	-	-	1.25	1.25	1.60	1.75	0.70	0.85	1.10	1.10	1.25	1.50	0.90	1.05	1.50	1.50	1.70	1.90	60.0	60.0	60.0	70.0	70.0	8
Jessore I	0.75	0.75	0.75	0.80	0.80	1.0	-	-	1.25	1.25	1.60	1.70	0.70	0.85	1.0	1.0	1.25	1.50	0.90	1.05	1.45	1.50	1.70	1.85	60.0	60.0	60.0	70.0	70.0	8
Jessore II	0.75	0.75	0.80	0.80	0.80	1.0	-	-	1.25	1.25	1.50	1.70	0.70	0.85	1.0	1.0	1.25	1.50	0.90	1.05	1.45	1.50	1.70	1.80	60.0	60.0	60.0	70.0	70.0	8
Natore I	0.75	0.75	0.80	0.80	0.80	1.0	-	-	1.25	1.25	1.60	1.70	0.70	0.85	1.15	1.15	1.25	1.50	0.90	1.05	1.50	1.50	1.70	1.85	60.0	60.0	60.0	70.0	70.0	8
Natore II	-	-	0.80	0.80	0.80	1.0	-	-	1.25	1.25	1.50	1.60	-	-	1.15	1.15	1.25	1.50	-	-	1.50	1.50	1.70	1.85	-	-	60.0	70.0	70.0	8

(1) For the original AID financed PBS's.

Source: REB

(2) Most PBS's have minimum monthly charges for most categories of consumers. This is typically based on 20 KWH and 18 KWH consumption for domestic and commervial consumers respectivel, horse pow for irrigation consumers, and on connected load (KW) for industrial consumers. There is a monthly demand charge of Tk. 30/KW for industrial consumers over 25 KW. Tariff penalties for industri and irrigation consumers with power factors below .85 also exist.

(3) Tk./Month/Light

Table F.2.6:Average Tariff Revenues per KWH Sold (Tk./KWH) (a)

PBS	FY 83/84	FY 84/85	1st Quarter FY 85/86 (b)
1. Comilla I	1.28	1.43	1.58
2. Chandpur	1.29	1.39	1.59
3. Dhaka	1.30	1.52	1.66
4. Jessore I	1.17	1.34	1.43
5. Jessore II	1.39	1.54	1.63
6. Pabna I	1.40	1.57	1.79
7. Pabna II	1.20	1.35	1.33
8. Sirajgong	1.22	1.36	1.42
9. Natore I	1.14	1.38	1.43
10. Natore II	1.18	1.32	1.35
11. Habigan)	1.24	1.41	1.32
12. Moulvibazar	1.19	1.36	1.42
13. Tangail	1.13	1.43	1.55

(a) Variations in average revenues/KWH in a given PBS are due to changes in: 1) tariff, 2) average consumption per consumer, and 3) the mix of consumers.

(b) First quarter FY 85/86 includes July 1 - September 30, 1985. The average for this quarter may not be exactly comparable with the averages for FY 83/84 and FY 84/85 due to the seasonality of irrigation load.

Source: REB

Petroleum products in Bangladesh are priced above their economic supply costs while natural gas and electricity are priced below. Of particular relevance to RE in Bangladesh is the relation between petroleum product and electricity prices. Since electric energy in rural areas primarily substitutes for petroleum products, the subsidization of electricity prices relative to petroleum prices clearly provides an "artificial" incentive for petroleum product consumers, e.g. households, tubewells, and rice mills, to switch to electricity.(1)

4. Implications of current commercial energy pricing policies:

Looking at the entire commercial energy sector, it is clear that, on efficiency grounds, electricity and natural gas prices should continue to rise toward their economic supply costs. This will reduce the financial appeal of RE to potential consumers, but should lead to efficiency gains.

Within the specific context of RE, PDB should consider the adoption of a bulk rate tariff to the PBS's which more closely reflects supply cost and incorporates both an energy charge and a demand charge. Such a demand charge should help reduce capacity shortages within the PDB grid and improve the PDB load factor by providing an economic incentive for the PBS's to improve their load factors.

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(1) This is not to say that there is no economic rationale for switching to electricity. In fact, least economic cost comparisons suggest that such a rational exists in Bangladesh. However, this relative price distortion may promote electrification in cases when it is not justified on efficiency grounds.

PBS tariff increases (especially for productive use and large residential consumers) are justified on efficiency grounds. Moreover, financial comparisons of the costs of using electricity or petroleum products for pumping, motive power, or lighting suggest that there is room for such tariff increases. In this way, some of the economic benefits of RE which occur in the form of cost savings could be transferred to the PBS's in the form of higher tariff revenues. In addition, the PBS's should strive to ensure that demand charges are applied when economical and that tariff penalties for low power factors are enforced.(1) Finally, within this general framework of higher (but more economically rational) tariffs, the possibility of offering relatively low tariffs (set roughly at off-peak energy costs) to productive use consumers who restrict their consumption to off-peak periods should be seriously considered. (2)

C. Subsidies associated with RE:

For the purpose of this section, an economic subsidy is considered to exist when a resource is supplied at a price which is less than its economnic (or opportunity) cost. At least four kinds of subsidy can be identified in the current RE program in Bangladesh: 1) bulk electricity is supplied to the PBS's at a subsidized rate by PDB; 2) a subsidy equal to any positive difference between operating expenses and revenues is paid to

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(1) The REB has tentatively approved the adoption (as of December, 1985) of tariffs which include an energy charge plus a demand (or capacity charge) for all categories of consumers except for small domestic and commercial.

(2) The relatively low tariffs PBS's charge irrigation consumers might be at least partially justified in this fashion - as long as irrigation pumping is restricted to off-peak periods. Such a tariff should accompanied by programs to informer consumers about the benefits of increasing/reducing offpeak/peak consumption.

each PBS by the BDG during its first five years of operation;(1) 3) the capital required to build the backbone system of each PBS is supplied thru REB and ultimately from the BDG and international donors at the subsidized interest rate of 3 percent;(2) and 4) within a given PBS, there are cross subsidies between various categories of consumers. The first three such subsidies generally transfer resources (or income) from the BDG, other PDB consumers, or foreign donors to the PBS. The fourth subsidy transfers resources among consumers in a given PBS. Since domestic tariffs are lowest, and industrial tariffs are highest, resources are transferred inter alia from the latter type of consumer to the former type of consumer.

The results presented in Table F.2.8 indicate the magnitude of resources transferred to the PBS's via the first three kinds of subsidy described above.(3) At present, the largest source of subsidy is the low interest rate paid by PBS's on REB loans. Over time, this subsidy is likely to become even more important as the PDB bulk tariff rate moves closes to LRMC, and as growth rates of energy consumption in PBS's level off.

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(1) It is unclear whether the energy cost component of operating costs which is used in the determination of the appropriate subsidy is calculated based on actual line losses or target line losses (which are generally lower).

(2) During the five year grace period, the subsidized interest rate is only 0.75 percent per year. This interest is capitalized to be repaid starting in year six.

(3) Except for the operating subsidy, results presented in Table IV.8 should be viewed as approximations. This is due to inter alia uncertainties concerning LRMC at the 33 KV level and the actual investment in total utility plant for each PBS.

Table F.2.B:Estimates of RE Subsidies

PBS	Bulk Tariff Subsidy (Tk. X 10^3) [a]		Operating Subsidy for 1st 5 years (Tk X 10^3) [b]				Interest Subsidy on PBS Loan (Tk X 10^3) [c]
	FY 85	FY 86 (est.)	FY 82	FY 83	FY 84	FY 85	
1. Dhaka	30352	28736	4282	1070	0	0	20424
2. Tangail	19587	16553	1885	1128	2215	425	17802
3. Comilla I	17038	15138	2839	2567	2696	0	23000
4. Chandpur	8062	5072	914	2103	3828	2975	17250
5. Habiganj	10486	11755	115	1454	1783	0	13800
6. Moulvibazar	13073	14713	2667	1991	2266	0	11744
7. Pabna I	5858	5851	-	1509	2240	2531	11730
8. Pabna II	5496	5524	601	1852	2189	2180	11500
9. Sirajgonj	16541	12988	2718	3232	4994	1612	17250
10. Natore I	9829	91212	3833	2760	4043	899	15143
11. Natore II	11693	10490	873	2432	2066	612	17250
12. Jessore I	11682	8654	2327	2657	4181	2889	18400
13. Jessore II	9881	10682	3266	3367	4179	992	17250
Total:	169578	157368	26320	28322	36680	15115	212543

(a) Equals (Tk.1.76 - Tk. 0.78) X KWH's purchased for FY 85, and (Tk.1.76 - Tk.0.95) X estimated KWH's purchased for FY 86.

(b) Assumes the subsidy paid each year equals the calculated operating deficit, i.e. (billed tariff revenue and other opeating revenue) - (cost of power + O&M + government duty + depreciation).

(c) Estimated for the 6th year of PBS operation, given the estimated total utility plant as of June 1985. Interest subsidy = [total utility plant X (14.5% - 3%)], where 14.5% is the assumed market rate of interest.

ECONOMIC ANALYSIS

Least Cost Study

The first requirement of economic analysis is to demonstrate that the proposed supply of electricity in a typical rural area provides a lower cost way of accomplishing the economic and social requirements of the residents: evening lighting for domestic and commercial potential connectors as well as for street lighting in upazila centers and any other sizeable urban agglomerations; and motive power for small industries and irrigation pumps.

This issue of lower costs using electricity compared to kerosene for lighting and compared to diesel fuel for motive power was previously studied in some detail for earlier PPs of AID and for the appraisals of other RE donors. In particular the REB produced in 5/84 a publication, Pre-feasibility Study Report on Area Coverage Rural Electrification, Phase III, which devoted a number of pages to tables comparing these costs for different types of irrigation pumps and for small industries in rural Bangladesh. All such comparisons gave the edge to electricity taking into account the lower initial capital costs for electric motors compared to diesel engines and the lower annual operating costs. Costs of domestic lighting via electricity and via kerosene including lamps, wicks, batteries (high income households only) etc. were also dealt with in the PP for Phase II.

Slightly more up-to-date cost comparisons are now available and continue to show a lower average cost by using electricity for most types of consumers. (In the case of commercial connections the picture is possibly different since shops in hats and bazars did not previously remain open after dark and so there is no sound comparison to be made with kerosene as in the case of houses. Undoubtedly commercial establishments are going to pay more for energy than they were paying in the great majority of cases; but they find that prospect undaunting as attested to by their willingness to stay open into the evening hours.

In view of the foregoing demonstrations this Annex does not give details on least cost analysis. Of course, whether the extent of electricity's economic cost reductions are high enough to warrant the investments necessary to provide that type of energy in rural areas is a separate issue addressed in the rest of the economic analysis.

Economic Feasibility Analysis

The main Tables, Tables BO, CO, and DO, in this Annex, with their respective sets of explanatory notes, contain the detailed information used in estimating the summary benefits and costs columns shown in Table A and the economic internal rate of return.

The analysis was carried out for a 30-year period, corresponding to the average length of useful life of most major RE components, and is for the typical rural electric cooperative society (PBS).

The analysis incorporates two principal types of benefits according to whether the consumer who connects has previously been using an alternative commercially distributed means of lighting or of motive power or if the consumer is projected to be a newly established business or newly irrigated farm area. For the former the benefits are the avoided costs; i.e., costs which otherwise would have been paid for the least expensive alternative type of lighting/motive power (the type used before converting). For the latter the benefits are the sum of (a) the amount to be paid to the PBS for its electricity and (b) a measure of the consumers' surplus. In the absence of a detailed specification of the relevant demand curves, an approximate value for the consumers' surplus may be calculated by applying a proportionality factor to the difference between the amounts actually paid to the PBS and the higher costs borne by the consumer if substitutes were used.* The 1985 ADB study on economic analysis of power projects suggests that the proportionality factor typically falls in the 25 to 35 percent range. Given the large percentage increase in electricity supplied in the typical PBS due to this project, 25% proportionality factor would be appropriate in this analysis. Valuing additional supplies at the prevailing tariff reflects the lower limit to the consumers' willingness to pay. The resulting EIRR is clearly based downward. In rural electrification projects this downward bias generally is considered unacceptable. Typically, in the past, for such projects, the entire quantity of additional supply has been valued in terms of costs of substitutes. But "the value of power in terms of substitutes really reflects the upper limit to the willingness to pay...." "The consumers' surplus per unit of additional consumption is influenced by the difference between the upper and lower limits (e.g., if the demand curve were linear, consumers' surplus would be 0.5 times the product of the change in price and quantity demanded. Nonlinearity reduces the 0.5 proportionality factor)." See ADB, Economic Analysis of Power Projects, Economic Staff Paper No.24, January, 1985.

The ADB study clearly also states that "...the impact of electricity supply on the net value of production should be reflected in the willingness to pay...it must be noted that electricity is only one of the many inputs that will contribute to additional production. Hence the entire increase in the net value of production is not the marginal product of electricity...." (ADB, Economic Analysis of Power Projects, Economic Staff Paper No.24, January 1985, p.18).

However, in this analysis, we do not include any estimate of consumers' surplus. It is clear that the costs borne by consumers of substitutes for electricity exceed by a fairly large margin the amounts paid for electricity. Applying a 25% proportionality factor would no doubt yield a substantial estimate of consumer surplus. A measure of the internal rate of return that excludes consumers' surplus clearly is conservative. Since that conservative measure for this project is a substantial 27%, and given both the elusive nature of the concept of a consumers' surplus and the heroic assumptions needed to measure it, we have elected not to try. The project is easily defended on the basis of a conservative 27% internal rate of return. Costs are noted elsewhere in this paper but here have been somewhat revised due to the need for shadow pricing domestic outlays including the unskilled labor component. Costs include the five years of major capital investment to upgrade the capacity of the 17 PBSs; the ensuing annual investments to permit adding new connections through Year 20; annual operating and maintenance costs; and the projected cost of energy purchases at bulk rates (true economic rates, not necessarily the financial rates to be charged by the Bangladesh Power Development Board to the PBSs.)

The EIRR

As stated above, an EIRR of 27% was obtained. Consumers who convert to electricity account for a somewhat larger share of the total benefits, as can be seen by comparing the "avoided costs" column with the "PBS Revenues" column.

The substantial rise in bulk power costs for a typical PBS (to cover real economic costs) together with the additional KwH charge the PBSs must levy on their customers (to cover distribution costs and to become, in due time, self financing) means that electricity is here projected to become significantly more dear to final consumers. Small industry currently pays Tk. 1.70 per KwH; the projected tariff reaches Tk. 3.07 in 1992 and Tk. 4.05 by 2004. Commercial, domestic and irrigation pump tariffs are less; e.g., irrigators are here projected to pay Tk. 1.61 in 1986/87 rising to tk. 3.03 in 2003. Such increases may lead to reductions in either the projected number of connections for certain consumer classes or to reduced annual consumption (on the average per type of connection) or to both. That possibility has not led however to any reduction in the projected connections or MwH consumed in the typical PBS. The reason is certainly not any sound knowledge of the demand curves (price elasticity with respect to demand) of various consumer categories; calculating those curves has remained impossible for lack of data.

The reasons are, rather, the expectation that alternative liquid fuels will also be rising in price in the later years of this century and into the next, and also the obvious ability of major categories of consumers to afford higher electricity prices due to their apparent substantial profits from enhanced production. (This statement, of course, is not applicable to domestic consumers.)

Sensitivity Analysis

Table E gives the results in terms of the IRR for six different types of tests, taken one at a time, plus four combinations of certain tests, all but one lowering the basecase IRR. As some of the types of tests have more than one alternative assumption, altogether nine re-computed IRRs are shown in Table E for the separate tests.

The most important sensitivity tests involve changes in the assumed prices of electricity (the subsidy issue) and changes in the density of the areas served by a typical PBS (the density-self sufficiency issue). The only type of test having a notable effect on the IRR involves sizeable reductions in the number of projected connections of all types--either 20% or 50% fewer than the base case. The former cuts the IRR back from 27% to 22% and the latter reduction takes it down to 14%. The other types of tests may be in general interesting variations, such as upping the capital investments during years 6 to 20 or reducing the net incomes of irrigators and small industry owners due to projected electricity price increases, but they affect the IRR only marginally. Commonly, those other tests drop it but 3 or 4 percentage points at the most.

The reason to look at the effect of many fewer increased connections per year arises from the uncertainty as to how many additional consumers of the six types are apt to hook up during the 20 years following the beginning of investments in Phase III (1986/87). Only a few PBSs have been operating even as long as four or five years, most less. Thus, there's little base for making any kind of mathematical extrapolation of growth trends. The question is further complicated by this entire RE III only intensifying the availability of electric power in 17 already established, functioning PBSs rather than building new rural electric coops. So far the REB and the PBSs have had only a small amount of experience with this intensification approach (a part of RE II). Additional connections will arise, during RE III, from two different situations: a) following the construction of new lines into parts of the 17 PBSs not previously served and b) following the augmentation of capacity in existing lines (mainly increased substation capacities, but also more transformers and like gear). How to estimate the increased number of consumers whose energy needs can be accommodated by these two different situations has naturally proven difficult.

Limitations could arise on the ability of the typical PBS to add 36,810 new connections during the 20 years--the base case--due to several factors including some unforeseen shortfall in power availability from the PDB. Thus, the 20% reduction test (No. 1.1.1 in Table E) would appear a reasonable cutback, whereas the 50% drop in connections is just a hypothetical calculation, not any kind of expectation. It's part of the "worst-case scenario" shortly to be mentioned.

Omission of Many Other Types of Benefits

Efforts were unsuccessful to quantify significantly large additional categories of benefits (quite apart from consumers' surplus), though there are solid theoretical grounds to know they exist. They are often mentioned in RE documents. Noteworthy ones include a) enhanced quality of lighting especially inside houses, aiding reading, studying, some types of recreation; b) enhanced night time security in housing compounds and in urban areas where street lights are placed; c) a marked possible upgrading of services of electrified clincis and especially at health complexes (refrigeration for medicines and vaccines, possible use of electric instruments such as sterilizers and X-ray machines; d) an evident boost to increased contraceptive use and hence eventual lowered fertility (substantial correlations elsewhere have been documented); e) introduction of improved center-periphery communications centers are rare; f) gradual spread of new mentality or attitudes favoring modernization, productivity (noticed in the studies of RE's impact in a number of countries); and g) lessened domestic drudgery at least in higher income households with the advent of a few electric appliances.

In the other direction, there is some evidence, not readily quantified, that RE displaces employment, especially of women traditionally involved in husking rice and similar tasks taken over by new small industries; and that nighttime lighting may just lengthen the already deplorably long working hours (not

necessarily paid) of household members and employees of shops and small industries--but without corresponding increases in their incomes.

All of the foregoing pros and cons await further evaluation before they can be relied upon significantly to affect decision making about RE investments. In net terms it is felt the unquantified pluses exceed the unquantified minuses by a wide margin.

EXPLANATORY NOTES FOR TABLE A

Shadow Pricing the Projected Capital Investments and the Projected O & M Costs

Unskilled labor: A minor proportion of itemized project costs include use of some labor which needs to be shadow priced. Workers employed in the construction and operations/maintenance programs of the PBSs who would otherwise have only unskilled opportunities sometimes would have earned nothing at all, or would have earned a very low wage. This Annex follows the practice of the World Bank RE appraisal report in using 0.75 as the unskilled labor cost-reducing factor

Proportion of costs estimated as involving unskilled labor: The REB staff have estimated that the following costs contain significant amounts of unskilled labor to be shadow priced:

Line construction costs: 50% of cost represents labor charges to be shadow priced.

Substation construction costs: also 50% of cost represents labor charges to be shadow priced.

Annual capital outlays required for connecting up the projected number of additional consumers through Year 20 following the five year construction phase: 15% of costs represents labor charges to be shadow priced.

Operations and maintenance costs: 80% of the projected O&M cost is linked to labor which should be shadow priced.

Factoring down domestic RE costs to border prices: Project costs to be paid in local currency for locally purchased goods and services should be reduced to omit customs duties and sales taxes, so that such costs compare with foreign-source goods and services, all of which are priced without any duties or taxes added. The normal approach is to use a Standard Conversion Factor (SCF). Following the recent World Bank appraisal report on Phase III-A of the rural electrification program, a SCF of 0.8 was used, and applied to all costs not to be paid with foreign exchange. This 0.8 factor was used also on all but 12% of the O & M costs--that being the portion estimated to require foreign imports.

The capital outlays involved in adding consumers by the typical PBS through Year 20 have also been multiplied by the SCF of 0.8, after the labor portion was shadow priced, based on a REB statement that no foreign exchange will be needed for that purpose.

B. The Economic Cost of Power Purchased

Table D-0 with its following notes contains the two source columns: a) The projected price, in real (1985) terms, of the energy the typical PBS will have to buy ("Economic Bulk Power Rates"), and b) the quantity of such energy ("Amount of Power Purchased from PDB"). The product of those two columns in Table D-0 gives the set of projected costs ("Economic Costs of Power Purchased from PDB") shown in Table A.

C. The "Private Costs" Column

The first eight columns of Table D-0 provide the separate projections of private costs, for domestic and commercial consumers separately, including costs at time of connection (wiring) as well as annual costs to replace lighting tubes and bulbs. Four columns ("wiring and light bulbs replacement costs") from Table D-0 are summed to give the "Private Costs" column in Table A.

D. All Benefits Less All Costs; the IRR

The stream of net benefits attributable to the investments proposed for this project are given in the last of Table A, with the economic rate of return (IRR) shown beneath. The 27% means that if the amounts shown in the column above were discounted by 27% per year, through the 30th year, the net present value would be zero.

TABLE A

COSTS OF RE PHASE III-B PROGRAM TO YEAR 30, THEIR COMPARISON TO BENEFITS, RESULTING IRR

TYPICAL

YR BEGINNING CAPITAL INVESTMENT		C O S T S					SUMMARY OF ALL BENEFITS				IRR
		Scheduled Capital Investment* [Tk000s]	Capital Investment After Shadow Pricing [Tk000s]	Economic O & M Costs [Tk000s]	Economic Cost of Power Purchased from PDB [Tk000s]	Private Costs [Tk000s]	GRAND TOTAL ALL COSTS [Tk000s]	Avoided Costs (Table B-0) [Tk000s]	PBS Revenues from All Newly Developed Connections (Table C-0) [Tk000s]	GRAND TOTAL ALL BENEFITS [Tk000s]	Total Avoided Costs +Benefits from PBS Revenues less Total Costs [Tk000s]
1986/87	1	21,745	20,633	143	1,278	475	22,529	1,789	814	2,604	(19,925)
	2	32,100	30,458	166	3,953	1,126	35,704	5,371	2,747	8,118	(27,586)
	3	20,709	19,650	256	6,616	1,482	28,004	8,977	4,938	13,915	(14,089)
	4	17,603	16,703	349	9,897	2,074	29,023	13,485	7,965	21,451	(7,572)
	5	11,390	10,808	448	13,300	2,518	27,074	18,405	11,527	29,932	2,858
	6	2,059	1,462	551	17,793	3,063	22,870	23,824	16,989	40,814	17,944
	7	2,059	1,462	660	22,451	3,557	28,130	29,527	23,449	52,976	24,846
	8	2,059	1,462	774	28,118	4,050	34,404	35,529	28,558	64,078	29,674
	9	2,059	1,462	894	34,187	4,543	41,086	41,797	33,964	75,760	34,674
1995/96	10	2,059	1,462	1,019	40,910	5,037	48,428	48,373	39,667	88,041	39,613
	11	2,059	1,462	1,035	48,107	5,530	56,134	55,271	45,407	100,679	44,544
	12	2,059	1,462	1,035	55,980	6,023	64,500	62,558	51,526	114,084	49,584
	13	2,059	1,462	1,035	64,397	6,517	73,411	70,162	58,073	128,234	54,823
	14	2,059	1,462	1,035	73,284	7,010	82,791	78,236	64,798	143,034	60,243
	15	2,059	1,462	1,035	82,731	7,503	92,732	85,488	72,065	157,553	64,821
	16	1,030	731	1,035	89,345	7,738	98,850	89,842	77,120	166,962	68,112
	17	1,030	731	1,035	96,242	8,372	106,380	94,254	82,116	176,369	69,989
	18	1,030	731	1,035	103,748	8,618	114,133	98,800	87,468	186,269	72,136
	19	1,030	731	1,035	111,550	9,058	122,374	103,502	93,549	197,051	74,677
2005/6	20	1,030	731	1,035	117,521	9,305	128,593	108,260	97,959	206,220	77,627
	21	0	0	1,035	119,706	8,984	129,725	109,795	104,735	214,529	84,805
	22	0	0	1,035	121,890	8,984	131,909	111,360	106,146	217,506	85,597
	23	0	0	1,035	124,511	8,984	134,530	112,956	107,840	220,796	86,266
	24	0	0	1,035	127,133	8,984	137,152	114,585	109,534	224,119	86,967
	25	0	0	1,035	129,754	8,984	139,773	116,246	111,228	227,474	87,701
	26	0	0	1,035	132,375	8,984	142,394	117,940	112,922	230,862	88,468
	27	0	0	1,035	134,996	8,984	145,016	119,666	114,615	234,284	89,268
	28	0	0	1,035	137,618	8,984	147,637	121,431	116,309	237,740	90,103
	29	0	0	1,035	140,239	8,984	150,258	123,229	118,003	241,232	90,974
2015/16	30	0	0	1,035	142,860	8,984	152,879	125,063	119,697	244,760	91,880

*Sum of capital investment 1st 5 yrs. only = Tk103,547K or = $3,698K @Tk @Tk28/$1

IRR [CALC] 26.76%
IRR [GUESS] 0.25

NOTE: Additional columns supporting entries in most of the above COST columns (left side of Table) are in Table D-0 and it's following pages of explanatory notes

DESCRIPTION OF PRINCIPAL ESTIMATES, ASSUMPTIONS AND SOURCES FOR TABLE B-0

Economic cost of alternative fuel and lubricants projected to year 30

Projection of CIF prices for kerosene, diesel and lube: The Bangladesh Energy Planning Project (BEPP) projected the CIF cost of imported kerosene and diesel to the year 2000 by five-year periods, using a "low" and "high." Comparing those to recent price quoted on a CIF basis by the Bangladesh Petroleum Corporation ($250/MT for high speed diesel and $275 for kerosene), the BEPP "high" projection is more suitable. The diesel projection is $233/MT in 1985, $242 in 1990, then rising by an average annual rate of 4.05% to 2000. Similarly, their projection for kerosene ("SKO" in their table) is $270 in 1990 and it rises by an average annual rate of 4.09% to 2000. For the present projection an annual compound rate of 4.0% was used beginning in fiscal 1990/91 (5th year of the project), continuing through 1999/2000. Thereafter, a 2% per year fuel price increase was assumed.

Fuel shadow prices: To the CIF current prices noted in 1.1, related costs must be added; namely, transportation and other fuel distribution costs. Accordingly, shadow prices were taken as the current retail prices less CDST.* For diesel that raises the CIF price of Tk6.05/ltr. to Tk7.10; for kerosene the CIF price of Tk6.33/ltr. rises to Tk10.90; and for lubricants the shadow price is Tk16.00/ltr. The 4% per year increase from year 5 through year 14 (1999/2000) and the 2% per year from 2000 onwards (para. 1.1) was applied only to the CIF portion of fuel and lube costs, thus excluding internal transport and distribution costs.

Domestic (Residential) Avoided Costs

No. of meters from REB projection just for RE Phase III-B, which has annual increases through year 20 (2005/06)--see para. 5 below.

Avoided costs are for the least cost alternative of lighting households (2.5 per meter). These lighting costs include not only kerosene costs but also a number of others costs related to use of kerosene. Most of these avoided costs differ with income level. As in the RE-II project paper, two broad income groups are used, but with an assumption of 50% in each rather than the 70%-30% split assumed in RE II. A prime source for upping the percentage accounted for by the high income group was the REB survey of 6/84, "Policy Paper No. 6; The Impact of Electrification on Fertility in Rural Bangladesh: A Preliminary Report."

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*Customs duties and sales taxes.

The assumptions and prices, according to income group, are shown in Table B-1.

The information contained in Table B-1-A is derived from the information contained in Table B-1. The data in the last column is presented in Table B-0 as the "total" (Avoided Costs for Domestic Consumers for a typical PBS).

Table B-1 - Alternative Domestic Lighting Costs by Income Group

	INCOME	
	LOW	HIGH
Initial Investment (per meter -- 2.5 households)		
a) 3 kupi lamps per HH assumed good for 1 year and priced at Tk10 each . . . . . Tk	60*	
b) 3 hurricane lamps/HH assumed good for for 2 yrs. each @ Tk50 each		Tk 150*
c) 2 kupi lamps as in a)		40*
Maintenance		
a) Wicks for 3 kupi lamps (@Tk5/lamp)/HH .	30*	
b) Hurricane lamp wicks (@Tk1/lamp), 12 per year/lamp, 36 per HH		72*
c) Hurricane lamp chimneys: 2 per year per lamp, @Tk7 each, per HH		84*
d) Wicks for 2 kupi lamps, as in a) . . .		20*
Energy Costs		
a) Kerosene: 96 lbs. per year per HH @Tk3.50/lb.CIF (initially, assumed through '89/90 then increasing as in 1.1 avove	940	
b) Kerosene: As in a), internal transport & distribution costs @Tk2.54/lb. . .	400*	
c) Kerosene: 200 lbs. per year, CIF portion valued as in 2.3.3(a) above.....		1,750
d) Kerosene: As in c), internal transport & distribution		1,016*
TOTALS at current fuel cost	1,418*	3,132*
Average	(2,275*)	

* Cost shown have been shadow priced at 0.8 of financial cost.

Deep and Shallow Tube Wells, Low Lift Pumps--Costs Avoided

Table B-2 - Estimated Average Costs of Alternative Energy for Irrigation Pumps, by Type

	DTB	STW	LLP
Capital outlays			
a) Investment in diesel engines (excluding CDST; i.e., shadow price. Assumed constant in real terms.)	Tk46,750	Tk12,750	Tk21,250
b) Horsepower (same as Phase II PP)	30	6	18
c) Estimated average life, years . .	15	10	10
d) Annualized investment	3,117	1,275	2,125
Annual operating and maintenance			
a) No. hours per year operated . . (Boro and Aus seasons)	1,000	700	700
b) Fuel consumption, ltr./hr. . . .	4.54	1.36	2.86
c) Liters burnt	4,545	954	1,991
d) CIF cost of fuel used (Tk6.05/ltr., current; see 1.2 above) . . .	27,495	5,772	12,046
e) Internal transport & distribution @ Tk1.05/ltr.	3,818*	802*	1,673*
f) Amount of lubricants, ltrs. .	170.4	24.1	72.7
g) Cost of lubricants @Tk13.60/ltr. estimated CIF price currently	2,317	328	989
h) Internal transport & distribution @ estimated Tk2.40/ltr.	327*	46*	139*
i) Estimated repair and maintenance	2,000*	1,200*	1,200*
TOTALS at current fuel cost	**39,074***	**9,423***	**18,172***
Final totals excluding row (i)	37,074*	8,223*	16,972*

* Costs shown have been shadowed priced at 0.8 of financial cost
** Repair and Maintenance excluded from estimates of avoided costs bendits (see p. ____, below).

Proportion of yearly new irrigation pump connections which are assumed to be converting from diesel engines to electricity:

Recent consultations with the Director of the Planning and Program Directorate of the REB led to the following estimates of proportions of connections converting per year, which were held constant through out the projection period:

a) For deep tube wells (DTW) 40%
(NOTE: REB historical experience is that 50-60% of new connections are conversions, but for the type of program in Phase III-B that was lowered in recognition of the likelihood that Phases I and II would have a higher rate due to having given a high priority to serving existing diesel pumps. Unserved parts of the PBSs are expected to have somewhat less density of existing pumps.)
b) For shallow tube wells (STW) 10%
c) For low lift pumps (LLP) 75%

The **numbers** of total connections per type of connection (including industries and commercial shown in the next table) are from the REB and are just for the project. The projection assumes:

a) that a fairly rapid build-up will occur during the first five years after the construction begins, just for the territory of the typical PBS being served for the first time with new lines (reaching a total of 8,320 connections by end of the fifth year);

b) a steady growth of connections during years 6-15 at a constant absolute amount (2,279) per year equal to 10% of

[b.1] the total number of connections achieved by the end of year 5 plus

[b.2] the 14,470 connections the typical PBS is projected to have achieved by the end of its fifth year counting from the beginning of the project for all of the power lines installed and energized during RE I and II; and

c) a growth during years 16-20 equal to 5% of the total number of connections achieved by the end of year 5 including the 14,470 connections due to Phases I and II (= 1,140 increase per year).

The proportional distribution of the six types of connections during years 1-20 was done by the REB using a standard percentage breakdown reflecting the experience of the PBSs in recent years, especially the result of RE-II. The distribution for RE-III new lines to be installed during years 1-5 differs slightly from the one used by the REB for years 6-20 when additions are being made each year to all lines throughout the PBS as a result of RE-III's improvements to the capacities of all lines.

The information contained in Table B-2-A is derived from the information contained in Table B-2. The data in the three "Totals" columns of Table B-2-A are presented in the three "Avoided Costs" columns (for DTW, STW and LLP respectively) of Table B-0.

DERIVATION OF AVOIDED COST BENEFITS FOR DOMESTIC CONSUMERS

			LOW INCOME GROUP			HIGH INCOME GROUP			TOTAL AVOIDED COST		
	YEAR	FUEL COST		+ OTHER	= TOTAL	FUELCOST	+ OTHER	= TOTAL	AVG HI-LO	x METERS	= TOTAL £Tk000s
986/87	1	CONSTANT	840	578	1,418	1,750	1,382	3,132	2,275	728	1,656
	2		840	578	1,418	1,750	1,382	3,132	2,275	2,184	4,969
	3		840	578	1,418	1,750	1,382	3,132	2,275	3,640	8,281
	4		840	578	1,418	1,750	1,382	3,132	2,275	5,460	12,422
	5	GROWTH .04%	874	578	1,452	1,820	1,382	3,202	2,327	7,280	16,939
	6		909	578	1,487	1,893	1,382	3,275	2,381	9,121	21,714
	7		945	578	1,523	1,969	1,382	3,351	2,437	10,963	26,714
	8		983	578	1,561	2,047	1,382	3,429	2,495	12,804	31,946
	9		1,022	578	1,600	2,129	1,382	3,511	2,556	14,646	37,429
995/96	10		1,063	578	1,641	2,214	1,382	3,596	2,619	16,487	43,173
	11		1,105	578	1,683	2,303	1,382	3,685	2,684	18,329	49,197
	12		1,150	578	1,728	2,395	1,382	3,777	2,752	20,170	55,514
	13		1,196	578	1,774	2,491	1,382	3,873	2,823	22,012	62,144
	14		1,243	578	1,821	2,590	1,382	3,972	2,897	23,853	69,100
	15	GROWTH .02%	1,268	578	1,846	2,642	1,382	4,024	2,935	25,695	75,421
	16		1,294	578	1,872	2,695	1,382	4,077	2,974	26,615	79,163
	17		1,320	578	1,898	2,749	1,382	4,131	3,014	27,537	83,003
	18		1,346	578	1,924	2,804	1,382	4,186	3,055	28,458	86,937
	19		1,373	578	1,951	2,860	1,382	4,242	3,096	29,379	90,970
2005/6	20		1,400	578	1,978	2,917	1,382	4,299	3,139	30,300	95,104
	21		1,428	578	2,006	2,976	1,382	4,358	3,182	30,300	96,413
	22		1,457	578	2,035	3,035	1,382	4,417	3,226	30,300	97,747
	23		1,486	578	2,064	3,096	1,382	4,478	3,271	30,300	99,108
	24		1,516	578	2,094	3,158	1,382	4,540	3,317	30,300	100,496
	25		1,546	578	2,124	3,221	1,382	4,603	3,363	30,300	101,912
	26		1,577	578	2,155	3,285	1,382	4,667	3,411	30,300	103,357
	27		1,608	578	2,186	3,351	1,382	4,733	3,460	30,300	104,830
	28		1,641	578	2,219	3,418	1,382	4,800	3,509	30,300	106,333
	29		1,673	578	2,251	3,486	1,382	4,868	3,560	30,300	107,865
015/16	30		1,707	578	2,285	3,556	1,382	4,938	3,612	30,300	109,429

TABLE B-2-A

DERIVATION OF AVOIDED COST BENEFITS FOR IRRIGATION CONSUMERS

			DEEP TUBE WELLS			SHALLOW TUBE WELLS			LOW LIFT PUMPS		
YEAR		FUEL COST	FUELCOST	+ OTHER	= TOTAL (Tk000s)	FUELCOST	+ OTHER	= TOTAL (Tk000s)	FUELCOST	+ OTHER	= TOTAL (Tk000
1986/87	1	CONSTANT	29,812	7,262	37.07	6,100	2,123	8.22	13,035	3,937	16.97
	2		29,812	7,262	37.07	6,100	2,123	8.22	13,305	3,937	17.24
	3		29,812	7,262	37.07	6,100	2,123	8.22	13,305	3,937	17.24
	4		29,812	7,262	37.07	6,100	2,123	8.22	13,305	3,937	17.24
	5	GROWTH .04%	31,004	7,262	38.27	6,344	2,123	8.47	13,837	3,937	17.77
	6		32,245	7,262	39.51	6,598	2,123	8.72	14,391	3,937	18.33
	7		33,534	7,262	40.80	6,862	2,123	8.98	14,966	3,937	18.90
	8		34,876	7,262	42.14	7,136	2,123	9.26	15,565	3,937	19.50
	9		36,271	7,262	43.53	7,422	2,123	9.54	16,188	3,937	20.12
1995/96	10		37,722	7,262	44.98	7,718	2,123	9.84	16,835	3,937	20.77
	11		39,231	7,262	46.49	8,027	2,123	10.15	17,508	3,937	21.45
	12		40,800	7,262	48.06	8,348	2,123	10.47	18,209	3,937	22.15
	13		42,432	7,262	49.69	8,682	2,123	10.81	18,937	3,937	22.87
	14		44,129	7,262	51.39	9,029	2,123	11.15	19,695	3,937	23.63
	15	GROWTH .02%	45,012	7,262	52.27	9,210	2,123	11.33	20,089	3,937	24.03
	16		45,912	7,262	53.17	9,394	2,123	11.52	20,490	3,937	24.43
	17		46,830	7,262	54.09	9,582	2,123	11.71	20,900	3,937	24.84
	18		47,767	7,262	55.03	9,774	2,123	11.90	21,318	3,937	25.26
	19		48,722	7,262	55.98	9,969	2,123	12.09	21,744	3,937	25.68
2005/6	20		49,696	7,262	56.96	10,169	2,123	12.29	22,179	3,937	26.12
	21		50,690	7,262	57.95	10,372	2,123	12.50	22,623	3,937	26.56
	22		51,704	7,262	58.97	10,579	2,123	12.70	23,075	3,937	27.01
	23		52,738	7,262	60.00	10,791	2,123	12.91	23,537	3,937	27.47
	24		53,793	7,262	61.06	11,007	2,123	13.13	24,008	3,937	27.94
	25		54,869	7,262	62.13	11,227	2,123	13.35	24,488	3,937	28.42
	26		55,966	7,262	63.23	11,452	2,123	13.57	24,978	3,937	28.91
	27		57,086	7,262	64.35	11,681	2,123	13.80	25,477	3,937	29.41
	28		58,227	7,262	65.49	11,914	2,123	14.04	25,987	3,937	29.92
	29		59,392	7,262	66.65	12,153	2,123	14.28	26,506	3,937	30.44
2015/16	30		60,580	7,262	67.84	12,396	2,123	14.52	27,037	3,937	30.97

FIRST TYPE OF RE BENEFITS: AVOIDED NEW CONNECTIONS ALREADY USING ALTERNATIVE ENERGY

TYPICAL PBS

EG- L MENT		DOMEST Meters [No.]	 TOTAL (000s)	DEEP TUBE WELLS Meters Total [No.]	 Converted Use [No.]	Avoided Costs COST/METER [Tk 000s]	 TOTAL [Tk 000s]	SHALLOW TUBE WELLS Meters Total [No.]	 Converted Use [No.]	Avoided Costs COST/METER [Tk 000s]	 TOTAL [Tk000s]	LOW LIFT PUMPS Meters Total [No.]	 Converted Use [No.]	Avoided Costs COST/METER [Tk000s]	 TOTAL [Tk000s]	TOTAL AVOIDED COSTS (sum of all previous 'Total' columns) [Tk000s]
87	1	728	1,656	5	2	37.07	74	11	1	8.22	8	4	3	16.97	51	1,789
	2	2,184	4,969	16	6	37.07	222	34	3	8.22	25	12	9	17.24	155	5,371
	3	3,640	8,281	26	10	37.07	371	57	6	8.22	49	21	16	17.24	276	8,977
	4	5,460	12,422	39	16	37.07	593	86	9	8.22	74	31	23	17.24	397	13,465
	5	7,280	16,939	52	21	38.27	804	114	11	8.47	93	42	32	17.77	569	18,405
	6	9,121	21,714	73	29	39.51	1,146	160	16	8.72	140	60	45	18.33	825	23,824
	7	10,963	26,714	93	37	40.80	1,509	206	21	8.98	189	78	59	18.90	1,115	29,527
	8	12,804	31,946	114	46	42.14	1,938	252	25	9.26	231	96	72	19.50	1,404	35,520
	9	14,646	37,429	134	54	43.53	2,351	298	30	9.54	286	115	86	20.12	1,731	41,797
/96	10	16,487	43,173	155	62	44.98	2,789	344	34	9.84	335	133	100	20.77	2,077	48,373
	11	18,329	49,197	175	70	46.49	3,254	390	39	10.15	396	151	113	21.45	2,423	55,271
	12	20,170	55,514	195	78	48.06	3,749	436	44	10.47	461	170	128	22.15	2,835	62,558
	13	22,012	62,144	216	86	49.69	4,274	482	48	10.81	519	188	141	22.87	3,225	70,162
	14	23,853	69,100	237	95	51.39	4,882	528	53	11.15	591	206	155	23.63	3,663	78,236
	15	25,695	75,421	257	103	52.27	5,384	574	57	11.33	646	224	168	24.03	4,036	85,488
	16	26,815	79,163	267	107	53.17	5,690	598	60	11.52	691	234	176	24.43	4,299	89,842
	17	27,537	83,003	278	111	54.09	6,004	620	62	11.71	726	242	182	24.84	4,520	94,254
	18	28,458	86,937	288	115	55.03	6,328	643	64	11.90	761	252	189	25.26	4,773	98,800
	19	29,379	90,970	298	119	55.98	6,662	666	67	12.09	810	262	197	25.68	5,059	103,502
/96	20	30,300	95,104	308	123	56.96	7,006	689	69	12.29	848	270	203	26.12	5,302	108,260
	21	30,300	96,413	308	123	57.95	7,128	689	69	12.50	862	270	203	26.56	5,392	109,795
	22	30,300	97,747	308	123	58.97	7,253	689	69	12.70	876	270	203	27.01	5,484	111,360
	23	30,300	99,108	308	123	60.00	7,380	689	69	12.91	891	270	203	27.47	5,577	112,956
	24	30,300	100,496	308	123	61.06	7,510	689	69	13.13	906	270	203	27.94	5,673	114,585
	25	30,300	101,912	308	123	62.13	7,642	689	69	13.35	921	270	203	28.42	5,770	116,244
	26	30,300	103,357	308	123	63.23	7,777	689	69	13.57	937	270	203	28.91	5,870	117,940
	27	30,300	104,830	308	123	64.35	7,915	689	69	13.80	952	270	203	29.41	5,971	119,668
	28	30,300	106,333	308	123	65.49	9,055	689	69	14.04	969	270	203	29.92	6,075	121,431
	29	30,300	107,865	308	123	66.65	8,198	689	69	14.28	985	270	203	30.44	6,180	123,223
5/16	30	30,300	109,429	308	123	67.84	8,345	689	69	14.52	1,002	270	203	30.97	6,288	125,045

: See the following pages for explanations ates, assuaptions and sources for all parts of the Table.

TABLE C-0

SECOND CATEGORY OF BENEFITS: FOR NEW COMMERCIAL, INDUSTRIAL AND IRRIGATION CONNECTIONS: WILLINGNESS TO PAY

TYPICAL PBS

YEAR BEGINNING CAPITAL INVESTMENT		PROJECTED PDB BULK RATE and PBS AVG. TARIFF RATE		COMMERCIAL CONNECTIONS			SMALL INDUSTRIAL CONNECTIONS			ALL NEWLY DEVELOPED IRRIGATION CONNECTIONS			Total Revenue from All these Connections to PBS	GRAND TOTALS PBS Revenues from All Newly Developed Connections
		Projected Bulk Power Rate	Projected Avg. PBS Tariff from All Types of Connections	This Tariff @ Constant 1.106:1 Ratio to Avg. Tariff	Energy Purchased by All Connections	Total Revenue to PBS	This Tariff @ Constant 1.220:1 Ratio to Avg. Tariff	Energy Purchased by All Connections	Total Revenue to PBS	This Tariff @ Constant 0.936:1 Ratio to Avg. Tariff	Total of such Connections	Energy Purchased by New Irrigators		
		[Tk/KwH]	[Tk/KwH]	[Tk/KwH]	[MwH]	[Tk000s]	[Tk/KwH]	[MwH]	[Tk000s]	[Tk/KwH]	[No.]	[MwH]	[Tk000s]	[Tk000s]
1986/87	1	0.98	1.72	1.90	33	62	2.10	270	567	1.61	14	115	185	814
	2	1.06	1.86	2.06	98	202	2.27	837	1,899	1.74	44	371	646	2,747
	3	1.15	2.01	2.22	164	364	2.45	1,404	3,443	1.88	72	601	1,131	4,938
	4	1.25	2.17	2.40	246	590	2.65	2,106	5,575	2.03	108	886	1,800	7,965
	5	1.36	2.35	2.60	328	851	2.87	2,808	8,051	2.20	145	1,194	2,625	11,527
	6	1.47	2.51	2.78	469	1,303	3.06	3,834	11,740	2.35	203	1,680	3,946	16,999
	7	1.60	2.71	3.00	611	1,830	3.31	4,887	16,157	2.54	261	2,153	5,461	23,449
	8	1.67	2.72	3.01	752	2,263	3.32	5,913	19,622	2.55	319	2,621	6,673	28,558
	9	1.74	2.75	3.04	894	2,718	3.36	6,739	23,280	2.57	377	3,095	7,965	33,964
1995/96	10	1.82	2.79	3.09	1,035	3,195	3.40	7,965	27,111	2.61	436	3,585	9,361	39,667
	11	1.90	2.82	3.12	1,177	3,670	3.44	9,018	31,026	2.64	494	4,058	10,711	45,407
	12	1.99	2.87	3.17	1,319	4,185	3.50	10,044	35,168	2.69	552	4,531	12,173	51,526
	13	2.08	2.93	3.24	1,460	4,731	3.57	11,070	39,571	2.74	611	5,021	13,771	58,073
	14	2.17	2.99	3.31	1,602	5,296	3.65	12,096	44,124	2.80	669	5,495	15,378	64,798
	15	2.26	3.06	3.38	1,743	5,898	3.73	13,149	49,088	2.86	727	5,963	17,079	72,065
	16	2.35	3.15	3.48	1,914	6,618	3.84	13,662	52,503	2.95	757	6,206	18,298	77,120
	17	2.44	3.23	3.57	1,985	6,733	3.94	14,175	55,858	3.02	786	6,458	19,525	82,116
	18	2.54	3.32	3.67	1,955	7,180	4.05	14,688	59,492	3.11	815	6,692	20,797	87,468
	19	2.64	3.43	3.79	2,026	7,685	4.18	15,201	63,610	3.21	844	6,932	22,254	93,549
2005/6	20	2.69	3.47	3.84	2,097	8,048	4.23	15,741	66,638	3.25	973	7,166	23,274	97,959
	21	2.74	3.71	4.10	2,097	8,605	4.53	15,741	71,247	3.47	973	7,166	24,883	104,735
	22	2.79	3.76	4.16	2,097	8,721	4.59	15,741	72,207	3.52	973	7,166	25,219	106,146
	23	2.85	3.82	4.22	2,097	8,860	4.66	15,741	73,359	3.58	873	7,166	25,621	107,840
	24	2.91	3.88	4.29	2,097	8,999	4.73	15,741	74,512	3.63	873	7,166	26,024	109,534
	25	2.97	3.94	4.36	2,097	9,138	4.81	15,741	75,664	3.69	873	7,166	26,426	111,228
	26	3.03	4.00	4.42	2,097	9,277	4.88	15,741	76,816	3.74	873	7,166	26,828	112,922
	27	3.09	4.06	4.49	2,097	9,416	4.96	15,741	77,968	3.80	873	7,166	27,231	114,615
	28	3.15	4.12	4.56	2,097	9,555	5.03	15,741	79,121	3.86	873	7,166	27,633	116,309
	29	3.21	4.18	4.62	2,097	9,693	5.10	15,741	80,273	3.91	873	7,166	28,036	118,003
2015/16	30	3.27	4.24	4.69	2,097	9,834	5.17	15,741	81,425	3.97	873	7,166	28,438	119,697

NOTES: 1. See attached pages for explanation of the various projections, tiaates, assuaptions and sources for all parts of the above Table.

2. Source: REB, Irrigation connections are aggregations of energy purchased by Deep Tube Well, Shallow Tube Well and Low Lift Pump irrigators respectively.

EXPLANATORY NOTES FOR TABLE C-0

A. Projected PDB Bulk Rate and "Typical" PBS Average Tariff Rate (in constant Taka; no inflation allowance)

The PDB Projected Bulk Power Rate

Years 1-7: These rates are projected on the basis of an interpolation between the recently agreed 1985/86 bulk rate of Tk0.90/KwH and the independently projected economic bulk tariff of Tk1.60 slated for 1992/93 (year 7). (see notes for Table D-0 for explanation of the basis for the economic rates used in this analysis). Payment by the PBSs of such a true economic rate by then is a distinct possibility in view of the rather rapid rise in power rates planned by the PDB. A discussion with the Head of the Master Planning Cell of that Board revealed that an average retail rate of Tk2.15 is expected by them by the year 1989/90. On the reasonable assumption that the REB/PBS average retail rates rise correspondingly, in constant prices, during the same period, the REB advises that its likely bulk tariff rate would be Tk1.23 after deducting from the Tk2.15 the typical PBS' spread of Tk0.92 in 1989/90 (a figure contained in REB financial projections for the typical Phase III PBS). That Tk 1.23 projection compares very closely to the Tk1.25 in the same year obtained from the aforementioned interpolation.

Years 8-30: The projected bulk rates which the PBSs will pay to the PDB correspond exactly with the economic bulk rates separately projected, in Table D-0 below, on the basis of studies into future probable electricity prices by the Bangladesh Energy Planning Project for the Planning Commission.

The bulk rates rise, under this projection, by 4.4+% per year during the 7 years 1993/2000 (end of the BEPP projection);

By an assumed 4.0% annually through 2005; and

By an assumed 2.0% per year thereafter.

The last two assumed rates should be understood as meaning the real cost increase in mostly coal-powered electricity generation.

The PBSs' average tariff (or, more accurately, their average revenue per KwH sold) is throughout the projection period assumed to be the bulk rate paid to the PDB plus the year-to-year spread required by the typical PBS to attain a 5-6% return on investment by the sixth year and there after of RE III, out of which additional connections can be self-financed (i.e., attainment of financial viability).

The particular year-to-year spread used here, from an REB financial projection for a typical PBS.

The absolute PBS spread rises from Tk0.74/KwH in 1986/87 (year 1) by annual increments of Tk0.06-0.07 to reach a peak of Tk1.11 in year 7, then decreasing steadily by Tk0.04 per year to year 12 when the spread starts leveling out and stays at about Tk. 0.78 until the end of the 20th year (2005/06)--the last year of the REB's projection. In other words, during ther period of years 8-15 the typical PBS is expected to achieve revenues sufficient to allow its average charge per KwH to shrink relative to what it's likely to have to pay the PDB for bulk power. For the last 10 years the Tk. 0.78 spread was simply assumed to continue unchanged.

B. Summary of "Willingness to Pay" Benefits for those Newly Connecting to PBS Lines-- Not Converting from Previous Types of Commercially-Purchased Energy

This major category of economic benefits consists of a minimum estimate based on the amount of energy consumed. Consumers' surplus is ignored.

Use of financial rates as distinct from economic rates is appropriate for this calculation, so that if the projected PBS tariff rate for a particular category of consumer was a subsidized rate, it will be used here.

Commercial Connections: The REB reports having found that shopkeepers mainly use electricity to permit remaining open into the evening. Thus, this category of PBS customers do not offer avoided costs benefits since electric lights are generally not displacing kerosene and the associated costs of using kerosene. Accordingly, only the second category of benefits are available to commercial customers--an estimate of the willingness to pay by these shopkeepers, arising from being able to stay open into the evening and to offer in some cases new commercial services from installing refrigerators and freezers.

The "willingness to pay" approach being used here to estimate this category of benefits is limited to the projected purchase of energy according to the REB's recent experience, for this category of consumers. In order to project the typical PBS's tariff for commercial customers the existing PBS tariff structure was assumed to continue so that the ratio of the commercial rate to the PBS's average revenue per KwH sold remains the same. The appropriate column heading in Table C-0 shows that this rate has the ratio of 1.106:1; i.e., 10.6% above the average.

In addition, a further benefit of electricity for these commercial enterprises would be their consumers' surplus. However, as with other categories of consumers, no estimate of consumers' surplus is made. Thus the benefits here attributed to commercial enterprises are conservative completely omitting an estimate of any consumer surplus.

Industrial Connections: The REB staff has noticed during the past 4 to 5 years that virtually all of the small industries connecting are new enterprises. Virtually none are prior industries using diesel-powered engines to operate their typical machines (paddy husking, flour milling, oil pressing etc.). Accordingly, all of the industrial connections here considered, for a typical PBS during RE III, are treated as new businesses; accordingly there's no possibility of any avoided costs benefits from these consumers.

To project the revenues to the PBS based on the "willingness to pay" of industrialists, the existing ratio of the tariff for industrial connections to the average revenue per KwH from all consumers was kept constant at 1.22:1--i.e., a rate 22% above the PBS's average receipts from each KwH sold. The quantity of electricty projected to be sold to these small industries was projected by the REB staff according to recent experience. Consumers' surplus is ignored.

Irrigation Connections: Each of the three types of irrigation pumps have connectors who are pro-jected to convert from diesel engines, thus offering an avoided cost benefit already taken into account in Table B-0.

For newly established irrigators, the proportion of all new connections falling into that category out of all connections, per type of pump, came from REB estimates based mainly on operating experience of the last 4-5 years--as discussed in the explanatory notes to Table B-0. Converting pump operators are, of course, the remainder.

Newly established irrigators enjoy enhanced production over non-irrigated farming, the economic values attributable to RE being their willingness to pay the irrigation tariffs charged by the PBSs. Again, this is a conservative estimate that ignores consumers' surplus.

For each type of electric-powered irrigation pump, the PBSs charge the same tariff. The ratio to the average PBS revenue-per-KwH has been maintained throughout the projection period at 0.936:1 (i.e., a tariff 93.6% of the average receipts, from all types of connections, per KwH). Use of that ratio gives the streams of PBS revenue shown in Table C-0 for all three types of pumps combined, when multiplying by the projected KwHs consumed per year per type of pump.

The final column of Taole C-0 is transferred to Table A, Column "PBS Revenues from all Newly Developed Correnctions." This is a conservative set of estimates of benefits, as noted above.

TABLE D-0

CALCULATIONS SUPPORTING SOME OF THE COST COLS. OF TABLE A

YEAR BEGINNING CAPITAL INVESTMENT		PRIVATE COSTS - DOMESTIC CONSUMERS				PRIVATE COSTS - COMMERCIAL CONSUMERS				POWER COSTS		
		Meters [No.]	Increase [No.]	Wiring @ Tk480 per Connection Every 15 Yrs. [Tk000s]	Light Bulb Replacement Cost @ Tk210 per Connection [Tk000s]	Meters [No.]	Increase [No.]	Wiring @ Tk500 per Connection Every 15 Yrs. [Tk000s]	Light Bulb* Replacement Cost @ Tk339 per Connection [Tk000s]	Amount of Power Purchased from PDB includes 13% Line Loss from PDB [MwH]	Economic Bulk Power Rate Including Incremental Capital, Fuel & O&M Costs [Tk/KwH]	Financial O&M Costs (from REB) [Tk000s]
1986/87	1	728	728	349	76	73	73	37	12	819	1.56	215
	2	2,184	1,456	699	306	218	145	73	49	2,519	1.57	250
	3	3,640	1,456	699	612	364	146	73	99	4,188	1.58	385
	4	5,460	1,820	874	956	546	182	91	154	6,264	1.58	526
	5	7,280	1,820	874	1,338	728	182	91	216	8,365	1.59	674
	6	9,121	1,841	884	1,722	1,043	315	158	300	11,191	1.59	830
	7	10,963	1,842	884	2,109	1,357	314	157	407	14,032	1.60	994
	8	12,804	1,841	884	2,496	1,672	315	158	513	16,837	1.67	1,165
	9	14,646	1,842	884	2,882	1,986	314	157	620	19,648	1.74	1,346
1995/96	10	16,487	1,841	884	3,269	2,301	315	158	727	22,478	1.82	1,535
	11	18,329	1,842	884	3,656	2,615	314	157	833	25,319	1.90	1,559
	12	20,170	1,841	884	4,042	2,930	315	158	940	28,131	1.99	1,559
	13	22,012	1,842	884	4,429	3,244	314	157	1,046	30,960	2.08	1,559
	14	23,853	1,841	884	4,816	3,559	315	158	1,153	33,771	2.17	1,559
	15	25,695	1,842	884	5,203	3,873	314	157	1,260	36,607	2.26	1,559
	16	26,615	920	791	3,493	4,030	157	115	1,340	38,019	2.35	1,559
	17	27,537	922	1,141	5,686	4,188	158	152	1,393	39,443	2.44	1,559
	18	28,458	921	1,141	5,879	4,345	157	152	1,446	40,846	2.54	1,559
	19	29,379	921	1,316	6,073	4,502	157	170	1,500	42,254	2.64	1,559
2005/6	20	30,300	921	1,316	6,266	4,660	158	170	1,553	43,688	2.69	1,559
	21	30,300	0	884	6,363	4,660	0	158	1,580	43,688	2.74	1,559
	22	30,300	0	884	6,363	4,660	0	157	1,580	43,688	2.79	1,559
	23	30,300	0	884	6,363	4,660	0	158	1,580	43,688	2.85	1,559
	24	30,300	0	884	6,363	4,660	0	157	1,580	43,688	2.91	1,559
	25	30,300	0	884	6,363	4,660	0	158	1,580	43,688	2.97	1,559
	26	30,300	0	884	6,363	4,660	0	157	1,580	43,688	3.03	1,559
	27	30,300	0	884	6,363	4,660	0	158	1,580	43,688	3.09	1,559
	28	30,300	0	884	6,363	4,660	0	157	1,580	43,688	3.15	1,559
	29	30,300	0	884	6,363	4,660	0	158	1,580	43,688	3.21	1,559
2015/16	30	30,300	0	884	6,363	4,660	0	157	1,580	43,688	3.27	1,559

NOTE: See separate pages of explanatory notes for above Table

*Includes flourescent tubes

EXPLANATORY NOTES FOR TABLE D-0

Private Costs

Definition: Private costs are paid out of the pockets of consumers connected to PBS lines during project implementation. These are costs on "the other side of the meter." They comprise two types:

Wiring and related costs at the time of hooking up.

Recurrent costs of privately-owned electricity-using equipment, such as light bulb replacement. (Costs of KwH purchased are dealt with elsewhere in this analysis.

Categories of consumers whose private costs have been projected: Only domestic and commercial consumers are considered here. Wiring and related costs at the time of hooking up are assumed to be absorved into the cost of the pumpsets and the industrial equipment of the irrigation and industrial consumers. Annual maintenance costs for electrical industrial equipment are assumed to be negligible. Note also that, in Table B-2, benefits attributable to avoided costs of pumpsets driven by alternative fuels exclude repair and maintenance estimates.

Amount estimated as paid for electric wiring when connecting: The two column headings for domestic and commercial wiring costs show the estimated Tk480 and Tk500 costs, respectively. The former is the average of the low income and high income separate estimates, the former at Tk360 per meter and the latter at Tk600. As noted in the case of Table B-0, each income group is projected to be approximately one-half of all domestic connections during the 30-year period.

REB staff confirmed the estimated wiring costs, which are somewhat modified from those used in the Phase II PP (cf. Table B-1 in Annex F, RE-IIProject Paper).

Amount estimated as light bulb replacement costs: Discussions with REB staff produced an estimate of six months average life for an ordinary bulb and 1.5 years for a flourescent tube, with the average bulb costing Tk12 and the average tube Tk200. Flourescent tubes are attributed only to commercial connections; specifically, two tubes and three regular bulbs per average shop. The number of bulbs assumed in the low and high income homes were two and five, respectively.

Number of domestic and commercial meters to which above costs apply: The private wiring costs apply just to the projected number of additional connections per year, which are shown for each type of connection in the columns of Table D-0 headed, "Increase." The light bulb replacement costs are not applied to the number of meters shown in the two respective columns (domestic and commercial); rather, these replacement costs are applied to a mid-year number of connections.

The mid-year projection was calculated as under:

Sum of (end of prev. year, shown in "Meters" Col.) + (1/2 following year's added connections)

B. Power Costs

Projection of economic bulk power rates: This column differs from that used in Table C-0 to project revenues received by the typical PBS from certain categories of consumers (newly founded industries and irrigated farms), where the bulk rate was pegged to the "most likely" feasible rates of increase during the early years of the projection; (see the notes to Table C-0). For economic analysis the rate used is not one that the Power Development Board (PDB) will likely apply to PBSs; rather, it is a rate intended to take into account foreseeable incremental real costs likely to be incurred by the economy as it seeks to generate, transmit and distribute the amount of power projected as likely to be demanded by Scenario C of the Bangladesh Energy Planning Project. Those costs take into account the BEPP's estimates of long-run marginal costs for the chief fuel, gas; the additional cost for depleting the gas resource as required to bring the cost of gas up to the cost of the least expensive alternative fuel (coal) within 15 years from exhaustion of exploitable gas reserves (1999 for Scenario C); the "average incremental costs" of building the generation, transmission and distribution facilities per five-year period through 2000, and the operations and maintenance costs of the electricity system. (All of these projected costs are summed in the BEPP's Interim Report of 12/84.) Some downward adjustment in the taka/KwH figures of that table were made after consultation with BEPP staff. The resulting bulk rates are as shown in Table D-0. The first-year cost of Tk.1.56 is a sharp contrast with the 1985/86 bulk rate recently agreed of Tk.0.90/KwH. The probable PDB bulk rate in Table C-0 does not reach the economic rates of this Table until 1993.

Assumed course of bulk rate after 2000: The assumption was made that the calculated rate of increase in the bulk rate between the mid-points of the BEPP five-year periods (1993-98) would continue through 2000. (The latter rate is 4.6% per year.) Thereafter, the assumed rate of increasedrops to 4%/year through 2005 and then to 2%/year through Year 30, 2015/16. Those assumptions are the same as made for the PDB's projected rates payable by the PBSs, and by their customers after adding the projected PBS spread, when calculating the benefits identified in Table C-0.

Electricity consumption projection for the typical PBS, 1986-2016: The column in Table D-0 showing MwH per year comes directly from the REB's projection of the number of connections supplied each year, multiplied by its estimate of the average MwH consumed per year per type of connection for the various consumer categories the REB's assumptions, from their records, are:

Table D-1, REB Estimates of Energy Use per Type of Consumer

Avg. domestic meter	360KwH/Yr.
Avg. commercial "	450 "
Avg. small industry	27,000 "
Avg. irrigation	
- Deep Tubewells	21,941 KwH/Yr
- Shallow Tubewells	4,000 "
- Low Lift Pumps	9,215 "

Source: REB, Project Paper, ACRE Phase III-A, Dhaka, 8/84, p. 43

Operation and Maintenance Costs: The final column of Table D-0 gives estimated outlays for operation and maintenance projected by the REB for the typical PBS.

SOCIAL/INSTITUTIONAL ANALYSIS

Two major issues are examined here: 1) The positive institutional impacts of RE on administration and politics in rural Bangladesh, and 2) The impacts of electrification in one productive sector--rice processing--on female employment.

Positive Institutional Impacts

Several years of project experience confirms that RE has been associated with highly successful institutional development. Not only do PBSs competently deliver a productive resource; they also show great promise in offering demonstration and spread effects within the rural political economy. They are "islands of local autonomy and administrative efficiency" introduced into a rural system dominated by patron/clientage and hierarchy on the one hand, and an inefficient, self-absorbed bureaucracy on the other. The RE system--consisting of PBSs and REB--has already demonstrated its ability to create local institutions which are responsive to their members' needs and openly "political" on occasion, which are nevertheless moving steadily toward financial autonomy and administrative competence.

The PBSs: Participatory and Political

PBS board members are elected from geographic sub-regions within the service area. Each board member represents an area of perhaps 20-25 mi^2, and roughly 1000-2500 current customers. In addition, each board member represents a large body of potential customers in areas not yet electrified. Since potential customers who apply for service and pay an initiation fee are allowed to vote, neither board members nor PBS staff can ignore their interests.

The prescribed initial structure for PBSs--boards selected by a local electorate, local control over hiring and firing of professional staff, annual membership meetings, public access to board meetings and minutes, etc.--has ensured relatively transparent operations, assured customers that they're getting fair treatment, and caused board members and professional staff to be quite responsive to member needs. The overall effect is to create "open politics" within the PBSs.

Institutional politics don't ensure perfectly smooth planning and operation. For example, plans for service extension may become heavily politicized, so that concerns for technical and economic efficiency are relegated to second place. However, there is evidence that efficiency concerns do not dominate centralized, bureaucratic decision-making* in Bangladesh, either and PBS organization and procedures have the virtue of making decision processes quite transparent to members.

PBSs, occasionally supported by interventions from REB leadership, have also facilitated the practice of open politics in the broader rural political arena. This is healthy because it provides local residents an

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* e.g. When cabinet ministers request aid agencies to build major structures in their home districts, to support planned political campaigns.

opportunity to question and challenge arbitrary actions by central bureaucratic authority. Recent experiences of a PBS in North Bengal are instructive.

A vigorous Deputy Commissioner (DC), head of district administration, was using all of his influence to promote youth activities, especially cultural activities. Himself a playwright, he assisted a variety of local clubs in organizing libraries, publishing schemes, etc. One club he was sponsoring fell behind in paying electricity bills clubhouse. In accordance with routine PBS practice (and good administrative procedures for a public utility electric service was cut off. The precise nature and chronology of succeeding events is subject to varied interpretation; however PBS officials offer the following account:

- o They were summoned to a public enquiry, at which the DC announced to a large crowd that "no disconnections will occur in my district without my authorization".
- o Some local men (perhaps associated with the disconnected club) detained the PBS finance manager for several hours against his will.
- o The local magistrate issued a non-bailable warrant for the arrest of the PBS General Manager (GM).
- o The GM then fled to a nearly cantonment, took refuge with a supportive Army colonel, and contacted the REB in Dhaka.
- o REB leadership arranged to have the warrant quashed and for establishment of a commission of inquiry.

At the time of a field visit in November, 1985, the incident had not been fully resolved; though there were some initial indications that PBS administrative autonomy would be confirmed. There was evidence, in retrospect anyway, that local PBS board members had rendered political support to their professional managers, though the dispute was largely between central government and PBS administrators.

The dispute can be usefully viewed as a clash between traditional/"patrimonial" politics and modern/"rational" policies. In the former, the ultimate power holder has implicit authority to control and allocate virtually all resources within a locality. Administrative legitimacy derives from a single locus. In the latter, there can be numerous spheres of competence and control. Administrative legitimacy derives from a contractual relationship--e.g. among PBS customers, staff, and board members. The relationship will continue so long as organizational competence--fair billing, timely payment, adequate service--continues. PBSs will win some of these skirmishes, and lose others. Where they win, the RE system, and the rural political system, will be "modernized" and strengthened.

Institution building in the RE system will be successful to the extent that PBSs are participatory and efficient. While basic electric service initially attracts customers, members will be strongly supportive only if

service is rendered competently, and in response to customer needs. Customer support strengthens the PBS in several ways:

- o Satisfied customers will pay bills.
- o Satisfied customers will support PBS staff and board when they cut off power to those who steal electricity or refuse to pay bills.
- o Satisfied customers will support their organization in disputes with patrimonial power. When the PBS wins, staff will have a freer hand to provide efficient, responsive service.

The REB plays a fundamental role at the beginning; in planning, construction, and initiation of PBSs. It also has a strong continuing role; in technical training of PBS staff and board members, centralized procurement, communication, and protecting PBSs against bureaucratic interference.

Financial Autonomy and Administrative Competence

Benchmarks used until now to measure success in institutional development of PBSs are clearly over-optimistic. It is unlikely that any PBS will ever achieve financial autonomy within five years of electrification. For most, 8-10 or even more years is a reasonable standard. By mid-1988, one PBS (Dhaka I) may be capable of achieving positive cash flow while repaying subsidized loans and distributing underpriced electricity. It is unlikely that any other PBS will be capable of achieving even this highly qualified form of autonomy until after 1990. There are at least two reasons for assuming a longer period of maturation is required: 1) Electric cooperatives generally take a long time to achieve economic viability.* 2) While systemic support (from REB) for local administrative competence is strong and unequivocal, incentives for achieving financial autonomy are ambiguous.

When an area is newly electrified, standardized domestic (lighting, fans, TVs, radios) and commercial (mainly lighting and fans) applications are quickly introduced. If there is sustained economic growth, steady growth of domestic/commercial hookups and predictable addition of new appliances by established users can be assumed. However, it is reasonable to assume that overall demand in these sectors will substantially "mature" within months of completion of line construction. Maturity in productive uses--by farmers and small industrialists--will arrive gradually, after a decade or more, with far less predictable annual increments.

Farmers (using electric pumps to "intensify" production) must experiment with: new species and varieties, cropping regimes, marketing arrangements, systems for water sharing, and operation and maintenance new equipment. In addition, raising capital for pumps and tubewells takes time. Perhaps 5-7 years are required for a new cropping pattern to emerge, and for electricity demand in agriculture to mature.

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* Some in the U.S. have taken 20 years or more to achieve positive cash flows.

Small industrialists (using electrified lathes, drillpresses, mills, and other machinery) require 5-15 years to experiment and develop appropriate local uses. They must experiment with: product lines, production processes, marketing, labor force mobilization, transport, etc. Acquisition of financing and capital may consume considerable time, and those businesses that process newly-introduced farm products will necessarily lag a year or two behind agricultural innovation.

For these reasons, REB and donor officials should not expect PBSs to achieve financial viability in less than 8-10 years, and should anticipate a 12-15 year development process in many cases. Project documents of REB, USAID, and other donors should be revised accordingly. On the other hand, it is necessary to give careful attention to benchmarks and incentives which support steady movement toward financial autonomy. Without these, few PBSs will be inclined to accomplish the final "breakthrough".

Systemic support for building and maintaining administrative competence is consistent and strong. The entire system is closely modelled on practices in American electric co-ops. Billing and accounting procedures, organization charts, training curricula, job descriptions, even standard forms, are transferred virtually whole from U.S. practice.* Clear incentives are given to PBS employees and board members, and the system works well: approved applicants receive timely hookups; line repairs are made; excepting daily load shedding, service is reliable; bills are calculated accurately; and sent and paid regularly; employees tend to their jobs; and the board meets monthly.

However, on the subject of financial autonomy, incentives are more ambiguous. There are some messages that this final stage must eventually come. For example Form 550, a monthly financial statement prepared by each PBS, has a front page "bottom line" clearly indicating the amount of subsidy the organization receives. A decreasing deficit figure clearly indicates progress toward autonomy, and employees and board members presumably recognize that the figure must eventually be positive. In addition, strong value has been placed on reduction of power line losses (particularly on lines taken over from PDB). This leads to direct improvement in expenditure/earning ratios, and again supports movement toward eventual autonomy.

However, careful examination of Board and Staff actions suggests there is considerable scope for decisions which are likely to delay achievement of autonomy. Three observations from a field trip to North Bengal are illustrative:

- The Board of Natore I resisted the hiring away of a valued engineer (by a wealthier PBS) by offering him a quadruple step increase to his annual salary. He accepted. This action, which

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* Some observers may suspect this as cultural imperialism. The best rejoinder is probably that "It seems to be working." In addition, there are relatively few models of non-patrimonial organization to be discovered in Bangladesh.

might be considered "good business" in an autonomous organization, simply increases the monthly subsidy received by the PBS, and delays achievement of autonomy.

- Both Natore PBSs are beginning to perform "deposit work." That is, they are extending poles and line to potential agricultural and industrial customers willing to reimburse for expenses incurred. Deposit work customers receive service earlier than planned, while PBSs receive substantial one-time payments and new customers. However, PBSs are drawing poles, crossarms, wire, insulators, etc. from existing commodity lots set aside for planned expansion. If the deposit work is additional to planned line construction, PBSs will eventually need to procure additional commodities. An autonomous organization would be planning ahead for additional procurement, and would also be concerned that deposit work is correctly priced (to reflect accurately prices of labor and materials, and additional generation and distribution costs). PBS officials at Natore show neither concern, and apparently anticipate central subsidies, if required.

- A meeting with visiting USAID officials in Natore clearly indicated that PBS board members are ardent, skilled proponents of further donor contributions and BDG subsidies to existing PBSs. Unfortunately, as long as these resources are captured by existing PBSs, expansion of electric service into new rural areas will be proportionally slowed down. So long as external resources are forthcoming, PBS Boards have little need to make the toughest decisions--to increase rates, trim operating costs, or deny service to potential customers.

An IDA-sponsored study of electric rate structures (carried out in mid-1986) will examine, many other issues, appropriate pricing policies and administrative procedures for timely achievement of PBS autonomy. If the recommendations are judged adequate, USAID should join other donors and REB in strongly supporting them. If recommendations developed are inadequate or incomplete, USAID will support additional TA and research in this area.

Female Employment in Rice Processing

Experience shows that mechanized rice mills will be introduced in virtually any area of rural Bangladesh where electric service is newly introduced. In many cases, electric mills are substituted for diesel-powered predecessors; in some cases, electric mills add new milling capacity and substitute for hand processing by village women.

Where electricity is available, semi-mechanized milling is a highly attractive business. Initial investments of Tk. 200,000 - 1,000,000 (for a rice huller, an automatic separator/winnower, parboiling equipment, struc-

tures, and a large cement drying floor) bring routine annual returns of 25-40%.* Well-managed mills operated as an adjunct to own-account paddy trading may bring returns of 50% or more. Power milling is also attractive to customers. Total processing charges are on the order Tk. 9-13/maund (in early 1986); while the effective cost of hand pounding ranges from Tk. 10-25. In addition, power mills can handle sizable lots of paddy (e.g. 10 or 100 maunds) in the same period that a dheki operation processes a maund or two.

Mills are profitable at annual production levels for below the technical capacity of machinery. In most cases, the production facility which limits overall capacity is the concrete floor for solar drying of paddy before and after parboiling. Drying floors vary in size from roughly 3,000-15,000 ft². Thus purchase of land, often in prime roadside or market locations, is often a major expense in establishing a mill.

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* A small, moderately successful mill in the Mymensingh Highway south of Joydebpur provides an example:

Capital Investment (Machinery, Structures, Drying Floor) -	Tk. 150,000
Land Value (1/6 acre, locally valued at Tk. 900,000/acre)-	Tk. 150,000
Total Investment	Tk. 300,000
Gross Annual Income (Housing Fee - Tk. 6/maund, 20,000 maunds yearly)	Tk. 120,000
Expenses (Operator's salary - Tk. 12,000; Electricity and maintenance - Tk. 10,000; Depreciation - Tk. 15,000; Taxes - Tk. 5,000)	- 42,000
Net Return	Tk. 78,000 or 26%

In May, 1986, a businessman in Bangladesh is considering investment in a somewhat larger mill. He estimates the following investment costs and annual returns:

Capital Investment (Machinery, Structures)	Tk. 520,000
Drying Floor	Tk. 80,000
Land	Tk. 300,000
Total Investment	Tk. 900,000
Gross Annual Income	Tk. 600,000
Annual Expenses	Tk. 200,000
Net Return	Tk. 400,000 or 144%

In order to assess the impact of electrified rice milling on female employment, two representative processing units will be compared: A is a dheki unit, capable of processing about 400 maunds of rice annually, using the labor of one woman. B is a semi-mechanized mill with a steel huller, an automatic winnower/separator, parboiling equipment, semi-pukkha building and a 5,000 ft² drying floor. It is broadly representative of the technology which is replacing dheki processing.

	A Dheki Unit	B Semi-Mechanized Unit
Fixed Investment	Tk. 1000 (Dheki, parboiling pans)	Tk. 300,000 (Machinery, structures, land)
Employees	1	9
Per Capita Daily Production	1.3 maunds	6.1 maunds
Person Days Required for Annual Crop of 16 Million Tons	336,000,000	72,000,000
Full-Time Jobs Available Under This Technology	1,120,000	240,000 female - 144,000 male - 96,000

If we assume abrupt conversion from technology A to technology B, there would be a net loss of about 880,000 jobs. Of jobs newly created, perhaps 40% (or 96,000) would be taken by men, with the remaining 60% (or 144,000) availble to women. The scenario is, of course, over dramatic. The conversion process has already occupied a decade, and will require another decade or more. It's probably more useful to: 1) envision loss of roughly 30-50,000 full-time jobs each year, or 2) assume several thousand women will lose full-time work, while 100,000-200,000 more gradually lose part-time opportunities.

Enumeration of net job losses does not complete our review of the impact of electric rice milling on female employment. Village dheki workers and female rice mill workers belong to roughly the same socioeconomic strata in rural areas--e.g. they are predominantly from landless or near landless households and often lack husbands or other immediate male supporters. In addition, many tasks carried out--solar drying, parboiling, manual separation of rice from by-products--are equivalent. However, broadly considered, working conditions of dheki workers and rice mill workers are quite different.

Dheki operators work under a variety of contractual arrangements, of which the most common are:

1) Seasonal employment - A well-to-do farming or landowning household hires a poor woman to work for a rice processing season (about two months after a major harvest). The woman receives three daily meals and an agreed-upon bonus at the end of the season. Typical bonuses include: a sari, a maund of paddy, or a cash payment of up to Tk. 150. If the woman has dependents and the patron household is generous, she may be allowed to take extra large portions of the evening meal to share with her family. At present prices, daily earnings approximate Tk. 10-15. This pattern is reported for Brahmanbaria, Barisal, and Joydebpur, and it assumed that it is widespread in rural Bangladesh. It is possible that the bulk of hand processed rice in rural Bangladesh is produced under this arrangement.

2) A poor woman dries, parboils, and husks paddy at her own home, or the home of a patron/customer. She generally receives paddy in 1-1 1/2 maund lots, and under fair weather conditions completes the work in one day. With the assistance of minor children, a woman may process as much as two maunds in a day. The dheki (foot operated rice pounding device), drying floor, and parboiling pans may be provided by the worker or her customers. Payment arrangements and earnings vary widely. Reported payments include:

   - Dhaka District - The family which requires its rice to be husked gives the "processor" 1 1/2 maunds of paddy, and gets back 1 maund (40 seers) of hand pounded rice. The processor provides fuel for parboiling, and receives 2-3 seers of whole rice, broken rice, husks, bran, and about Tk. 5. Estimated (current) daily earnings - Tk. 23-30.

   - Rajshahi District - The customer provides 1 maund of paddy, and receives 25 seers of hand pounded rice. The processor provides fuel for parboiling, and receives 2-3 seers of rice, broken rice, bran, and husks. Estimated daily earnings - Tk. 20-28.

   - Rangpur District - The processor works at the house of the customer and, for each maund of paddy processed, receives 1 1/2 seers of rice and a meal. Estimated daily earnings - Tk. 15-22.

   - Barisal District - For each maund of paddy processed the worker receives 1 seer of rice and (perhaps) some by-products. Estimated daily earnings - Tk. 10-15.

In addition, there is another contractual arrangement which was described to the writer as transitional.

3) Profit Sharing - During the period when rice mills were first introduced in rural Barisal, rice dealers arranged for drying and parboiling of paddy within the village, before taking it to the mill. (Generally, rice is dried and parboiled at the mill).

This work was generally done by a female kinsman of the trader. She waited until rice and by products had been sold, and received 1/4 of accumulated profit.

Female rice mill workers also work under a variety of contractual arrangements and working conditions. Representative examples include:

1) Cooperative work groups attached to a mill - At one mill near Joydebpur, eight workers are divided into two work gorups, each consisting of three women and one man. The groups provide pre-hulling (solar drying and parboiling) and post-hulling (separation of broken rice from bran and husks) processing services, for a one time charge of Tk. 3/maund. Fees are paid directly to the group and divided equally among male and female workers. (A separate Tk. 6 hulling fee is paid directly to the mill owner or his agent.) Men do heavy lifting and carrying and women do virtually all other owrk. Workers earn roughly Tk. 20 per day, receive about 1/2 seer of broken rice, and are allowed to sleep and cook in crude, temporary structures. Workers are all kinsmen, and hail from a nearly village.

2) Labor gang under a labor sardar - A group which, depending on the season, has 7-20 members, works under the supervision of a labor organizer called a "sardar". Females slightly outnumber males throughout the year. The sardar organizes all work at the mill (including operation of machinery) and receives a fee of Tk. 5 for each maund of paddy processed. The fee is received from the owner, who charges a total of Tk. 13 per maund processed. Team members receive equal shares; the sardar receives a double share. Average daily earnings are Tk. 20-25. In addition, female workers receive about 1/2 seer of broken rice daily, and male workers are allowed to sell off ashes produced during parboiling. Workers are given shelter at the site. Core members of the group are kinsmen from Manikganj District, but during busy periods local strangeers are added to the team.

3) Labor gang working under direct supervision of the mill owner - A work gang of 10, (5 women and 4 men) carries out all pre-and post-hulling operations. One of the men is the informal group leader. The mill owner receives a fee of Tk. 13 per maund of paddy processed, and maintains written records. Workers are paid twice a month. Women receive a small cash fee (Tk. 30 per 100 maunds of paddy processed, to be divided among 5-6 women). In addition the women share one half of all broken rice produced, all bran, and rice husk not consumed in parboiling. Total per capita female earnings are worth roughly Tk. 20-25 per day. Men earn Tk. 40-50 per day. All workers are provided crude shelter at the mill. The workers are kinsmen, from Barisal. Two women

are married to fellow workers. Three women have been widowed, divorced, or abandoned. The sixth female is a teenager who has not yet married.

An additional pattern is known, but has not been directly observed by the writer:

4) Salaried workers - Both male and female workers may be hired on a monthly basis, receiving salaries of Tk. 300-600.

Beyond the fundamental fact of net employment loss, it is also appropriate to examine the social debits and credits associated with dheki and rice mill work. The following tentative formulations can be made:

- On average, mill workers are better paid. Earnings probably coincide with the upper half of the range for dheki workers.

- Mill workers are generally provided with cash income, crude shelter, and some food (broken rice) at the work site. The mill offers a job and something more--a physical refuge for rural women who find their personal situation in the village intolerable. Many workers are divorced, widowed, or abandoned women with dependent children. They are able to achieve a precarious subsistence for themselves and their children without direct patronage from any male.

- There are indications that irregular sexual liaisons are common among male and female workers. (It's not clear whether this is a "debit" or "credit"; it may allow women to enter into more egalitrian unions than are generally possible in rural areas.) There is the added danger that women will be forced into semi-prostitution.

Electrification of rice mills and loss of jobs by dheki workers are but two aspects of a massive process of economic growth and change. Other elements in the process include: technical innovations in agriculture and small industry which are not specifically dependent on electrification; improved roads and other transport facilities; new--larger scale and longer distance--marketing networks for paddy and other commodities; the advent of an entrepreneurial class in rural Bangladesh, eager to invest and earn outside the agricultural sphere; increasing landlessness and displacement of agricultural labor; and accelerating urbanization. The process is socially, politically, and economically complex, with positive and negative impacts distributed to all corners of Bangladeshi society.

Even within semi-automated rice mills, "women's work" is under attack in at least three ways:

1) Introduction of electric winnower/separators - This innovation substitutes electricity and machinery directly for female workers. The machinery has already been introduced in mills, and will probably be installed in those remaining over the next several years. It doesn't completely eliminate post-hulling

work, since manual skills of women are required to separate broken rice grains from bran and husks. However, several thousand additional jobs will be lost in this way to machines.

2) Scale of production - Larger semi-mechanized mills handle larger lots of grain. Since extensive lifting and carrying is involved, it is likely that such mills use proportionally more men and fewer women. As some mills expand women will lose a few thousand more jobs to men.

3) More sophisticated parboiling apperatus - A process is now being used in some mills which suffuses paddy with steam for a short time, rather than parboiling in hot water for a longer time. A large boiler and self-unloading vats are used, and the paddy is subjected to parboiling on two occasions, 48 hours apart. This innovation improves the extraction ratio for rice (from roughly 67.5% to roughly 75.0%) and thus justifies installation of new apparatus and higher processing charges. In the process, more women surrender their jobs to men. Paddy is handled in larger lots, and men are required for heavy lifting and carrying tasks. In this way, women will lose a few thousand more jobs, to men.

During the forseeable future, some 120-130,000 women will find regular work in rice mills. They will retain their positions because they are willing to work cheaper than men. Over the period of a generation (beginning 10-15 years ago) nearly a million "women's jobs" will be lost to power mills, both electric and diesel. The harmfulness of these events cannot be argued away. But effects are not wholly negative; the situation is ameliorated by the following observations:

- Without rural electrification, most of the women's would be lost anyway, to diesel mills.

- Dheki jobs are being lost gradually, over a period of years and many women are losing part-time, not full-time work.

- Mill jobs offer some advantages over dheki jobs in terms of personal autonomy opportunities to achieve subsistance outside the villages, and higher earnings.

- Female workers in mills located close to markets and highways have high public "visibility," thus slowly and partially legitimizing non-profassional female employment.

- Jobs are being lost as part of broader economic/historical process which has many positive aspects for men, women, and children. e.g. New jobs are being created in off-season farming and small industries; grain production is increasing faster than population, and prices of basic foods are going down; transport facilities are being improved and individual physical mobility is increasing; women are finding jobs in garment and electronics factories; etc.

Environmental Issues

There has been no significant changes or findings which would alter the negative determinations reached in the Phase I and Phase II project papers.

1. Electric Powered Irrigation

Numerous reports including recent information from consultants assisting the Master Plan Organization of the Bangladesh Water Development Board indicate that annual groundwater recharging has prevented any permanent drop in groundwater table levels from seasonal pumping.

There is the possibility, however, that local conditions can be such that the groundwater table may be lowered in the dry season to the point where a STW drawing subsurface water from 28-30 foot maximum may not be able to operate effectively. This does not cause any serious longer-range environmental problems other than what the situation would have been without the pumps , but could cause financial losses for the pump owner/users.

This situation did occur in one area in 1983, and could happen again, yet Several factors may reduce this risk in the future. Individual, business and cooperative owners of electric irrigation units are learning to space their units properly and to apply water management techniques. The government may issue well spacing regulations or, more to AID's liking, provide better information to irrigation pump owner/users on spacing and water management.

Farmers are beginning to extend irrigation to rainy season rice crops to "top off" natural rains and to prevent dry spell losses. Some irrigation units farmerly in use 100-120 days per year are now being used 120 to 180 days per year. Since financial risks are lessened this practice is likely to spread.

2. Line Staking and Pole Location Criteria

These issues were discussed quite completely in the earlier PP's. There has been only very minor changes in these criteria over time. Poles are located and anchored so as to have the least possible chance of being knocked or blown over. The line crews attempt to limit lines passing areas which will require excess maintenance in the future. Villages are schooled in the need of the lines to maintain adequate night of way clearance and tought to avoid contact with wires etc.

3. Forest Cuttings for Wood Poles

Annual extraction in Bangladesh of wood for poles was estimated at about one hundredth of one percent of annual national wood extraction. However, the pole wood has to be from reasonably straight trees suggesting perhaps impact of this extraction may be several times as much. This would

still appear to represent a very small amount, no more one tenth of a percent of all extracted trees wood and perhaps almost two percent of wood extracted from reserve forests. While there may eventually be a need for a plantation approach to grow domestic trees for utility pole and crossarm purposes, USAID has decided at this point the best approach would be to require the TA contractor to provide an expert to study the feasibility of such an undertaking, funds to carry it out if found feasible are not identified in this project.

Energy
Rural Electrification and the Energy Situation in Bangladesh

BDG's energy strategy concentrates on exploiting indigenous commercial energy sources, primarily natural gas, and on keeping commercial energy imports, primarily petroleum products, to a minimum. There has been a pronounced shift towards use of domestic commercial energy supplies and away from imports. The energy value of Natural gas used (all domestically produced) overtook the energy value of petroleum products (all imported) in 1983-1984 and could be double that of petroleum products by 1987-88. Imports of coal have declined to very low levels.

Even with the rapid growth rates of commercial energy consumption experienced over the last 6-8 years, commercial energy still supplies only a bit over a third of total energy consumed in the country. But the situation is changing rapidly; per capita use of traditional sources of energy; dung, twigs leaves and wood, rice straw and husks and other agricultural residues, has stagnated for the last 10-11 years at about 250 gigajoules per capita per year and now may be declining. Households, mainly rural households remain very dependent on these sources for cooking fuel. (Thus AID's new forestry initiative.) Commercial energy consumption, fired by rapid compounded growth in the gas sector, may be on the order of 140 gigajoules per capita by 1986-87 almost double 1973-74 per capita consumption.

The substitution of natural gas for petroleum, a high BDG priority, can be seen by these figures. In 1973-74 petroleum supplied 55% of all commercial primary energy, natural gas supplied 36.5%, by 1984-85 the situation had essentially reversed with petroleum products supplying 34% of commercial energy consumed and natural gas 56%. (The remainder being supplied by hydro electric power and coal).

Rural electrification supports this substitution. Rural residents using electricity reduce their kerosene purchases to minimal levels and the substitution of electric power for diesel power in pumping has ocurred on about half of the 6,300 pumps now electrified. This amounts to only 3,000 thus far out of over 150,000 diesel units but the number is growing quickly. (See Table _____) Certain industrial plants have opted for the convenience of electricity for shaft power - even so the overall electric power use in rural areas is still quite low.

Domestic use of kerosene primarily for lighting now accounts for about 30% of Bangladeshes petroleum imports. Use of electric lighting in PBS areas is expected to reduce the demand for kerosene for lighting by about 10% by 1991-92, saving approximately 40,000 tons of kerosene imports per year. This is based on RE reaching about 7% of the countrys rural population in 1991 and assuming a slightly higher per capita consumption of kerosene by these people than the national average. Considerable amounts of diesel will be saved by using electric pump and electric shaft power. In all perhaps the importation of 50-60,000 tons of petroleum products can be avoided annualy by 1991. At $250 per ton the savings in FX are very substantial, $12,500,000 to $15,000,000 annually or about 1.4% of recent export earnings.

The government has succeeded in programs to substitute gas for oil and coal for electric power generation and should be able to achieve some further substitution, but at a much reduced rate of change since virtually all large power stations have been converted to gas. However, most new plants expected to come on stream in the next 5 years will be combined cycle gas fired stations. RE's role over the next few years will become important in the substitution effort even with this new gas fired generation plants increasing the percentage of natural gas in the domestic energy consumption figures.

The finite gas resources (11 TCF at present measurement) need to be sold at prices which will encourage reasonable conservation but prevent unnecessary market inroads by imported fuels. And comprehensive programs of planning and executing the search for and development of domestic energy supplies, especially gas, are paramount. Attention is being paid to these issues in a reasonably satisfactory fashion. Donors are requesting that the government pay particular attention to energy pricing and to aim towards pricing commercial energy with little or no cross subsidies at rates which will equal long range marginal costs taking into account such factors as the possible need to switch to higher priced imported fuels during the first decade of the 21st century if no significant future gas finds are made. The more realistic pricing of commercial energy, a trend now in clear evidence in Bangladesh, should eventually dampen demand growth. This is a welcome trend particularly in the power sector, where the considerable attention given by PDB to adding new generation, transmission and distribution facilities has diverted it somewhat from sound management practices. PDB line losses are in the area of 35%, almost double REB's fairly good recent record of 18% to 19%.

There are possibilities of shortfalls in electric generating and transmitting capacity. USAID has reviewed basic documents pertaining to both and feels that while the generation situation will be tight for the moment there is a very good chance it will improve in 1987-88 if even 75% of new capacity comes on stream close to schedule. Transmission capacity is relatively good but there maybe some serious capacity shortfalls at the grid station level. AID is requiring that a plan satisfactory to AID to provide adequate (in most cases up to 20 MW per PBS) power delivery to PBS substations be submitted by govt. prior to AID release of Phase III funds in excess of $6.5 million.

The BDG only very recently has begun to focus on the country's serious constraints in traditional fuels which are resulting in such problems as undernourished draft animals, low milk production, fairly rapidly escalating fuelwood prices, overcutting and consequent depletion of reserve and homestead trees, inadequate manure and vegatable matter returned to fields with consequent soil structure and fertility problems, insufficient, easily available supplies of burnable materials (for cooking) for the poorer classes forcing women and children to spend considerable time scavenging, and the like.

Rural Electrification, if it results in large increases in rice production as predicted will help alleviate the traditional fuel resource constraints in two ways. More rice husks and straw will be available for cooking and other purposes. Some rural incomes will increase enabling the higher fuelwood prices to be paid by a wider segment of the population. This may help encourage small woodlot production. The reader is referred to the 1985 Agroforestry Research and Extension PP for further information on the critical bio-mass shortage situation in Bangladesh.

PROJECTED TRAINING NEEDS
RE PHASE (III)

A specific training function for REB has been included as an integral part of the rural electrification program. This function is perceived as being basically a centralized program supported by a program of field follow-up supervision, and a field program of Job Training and Safety for selected PBS employees.

The administrative center is the REB Training Institute. The REB Training Institute has as its basis a planned program of formal training for all levels of leaders and employees in both REB and the PBSs as well as outside groups like the engineering consulting and construction firms who are working in the program. This formal training is implemented through the organizing and conducting of training courses, workshops, seminars, and conferences. A comprehensive curriculum plan for REB and the PBSs has been developed as an aid in accomplishing this purpose.

The Director of Training has the responsibility for administering the REB training function. He is expected to develop his own staff for carrying out the greater part of this responsibility.

He is, however, receiving input from all Directorates for identifying training needs, developing training courses, providing technical information and assistance, and providing instruction in specialized areas.

The training functions of REB can be categorized as:

1. Program planning and scheduling.
2. Course and training program development.
3. Development of training aids and physical facilities.
4. Staff and trainer development.
5. Course presentation and training program implementation.
6. Field supervision and follow-up training.
7. Development and monitoring of PBS conducted training.
8. Training records.
9. Training logistics.
10. Evaluation of training effectiveness.

Each of these listed components make up an integral part of training activity of REB. Although the training course presentation itself is the focal point, all of the other "support" activities can claim equal status in making training effective.

The areas which will need immediate attention in order to ensure that all segments of the training function are in their proper relationships are:

1. The total amount of training designated for each category of employee.

2. The level to which REB will provide training for meeting these needs.

3. The number of trainees who will need to be trained by REB:

   a. Those currently employed and participating in ongoing programs.

   b. New employees requiring training because of employee turnover.

   c. New trainees requiring training because of growth of the program (new PBS's and expanded PBS's).

   d. The number who can or will be trained outside the REB Training Directorate.

4. The amount of the training responsibility which the PBSs will need to take on themselves.

5. The time span scheduled for completion of the total training program for each class of trainee.

This Annex is based on the TA contractor's current opinion (as reviewed and accepted by USAID) of needs for:

1. Amount of training required for proficiency in each position.

2. The time span (optimum) for completion of total training for each postion.

3. Number of trainees who will need to be trained by REB Training Directorate.

4. Conferences, workshops, seminars of a general nature required for the purposes of updating, sharing of ideas, and keeping abreast of new technology.

5. The number who would profit from foreign training either in USA or other countries.

This annex will attempt to show what is needed to effect the total training requirements of RE for the five-year period from October 1, 1986 to October 1, 1991.

Projection of Training Needs REB (October 1, 1986 - October 1, 1991)

This projection uses as its basis the training requirements recommended by the contractor and reviewed by AID for those who are or will be working in the rural electrification program and who should be trained by REB,

A recommended training program has been suggested for each position. These programs are expected to run from one to nine years for each position depending upon the position level technical difficulty and the like. The

recommended training is what the consultant thinks is needed for the employee to effectively do his job.

The amount of training recommended is the maximum which seems to be realistically appropriate to recommend.

It is recognized that the employee has had extensive formal education but the training recommended will be needed to prepare him for his special responsibility in the rural electrification program.

The fact that most employees will advance from position to position has little significant effect on these projections.

No consideration has been given here that PBS officers. Board Directors and engineering consultants should additionally and on a regular basis attend workshops and seminars for the purposes of updating, sharing of ideas and learning of new developments. Field training time scheduled at the entry stage of employment is not included in these figures. Another facet of training which is also not considered here is the need from time to time to conduct special training of an urgent or emergency nature.

The projections here are for the formal training recommended which is to be conducted by the REB Training Directorate.

As these projections are considered it must be recognized that the training statistics encompass three areas of need:

1. There is presently a backlog in meeting the current training needs. During the study period, it is assumed that this backlog will be reduced to an acceptable level.

2. Continuing training is necessary over a prescribed number of years for each job category.

3. New trainees will continually enter the program because of program expansion and employee turnover.

Assumptions made are based upon:

1. Organization of seven new PBSs and expansion of system capacity and of some service areas in established PBSswill increase the number of Upazila's served from 127 by the end of Phase II 86-87 to 198 by 1991-92.

2. Employee turnover will be 15 percent annually for PBS and REB employees and 20 percent for PBS Boards of Directors, engineering consultants and construction contractor personnel.

All of the above considerations work together to arrive at the projections of needs which follow. The needs in general are projected at the maximum level. They are also compared with the present levels of training provided by REB in order to show requirements for staffing and for physical facilities.

The summaries show that to reach maximum training levels within the project period will require an approximate increase of 150 percent from present training activity levels to accomplish thispurpose. This means increasing staff and facilities by one and one-half times and in some areas, more than this will be required. For example:

Training Category	Percent Increase in Training Activity Needed Compared with Present Levels of Training (by training weeks)
Orientation, Management, Administration	578%
Finance	400%
Technical Training	77%
PBS Boards of Directors	38%

In addition, it is to be taken that training personnel time will also be required for field monitoring, field testing, field training, and field follow-up supervision. It is estimated that 20 percent of the total training staff will be required for these purposes.

At present, 50 percent of the courses identified in the curriculum plan are being conducted. Others are in various stages of development. It is assumed that all courses to be conducted within the project period will have been developed by the time they are scheduled to be conducted.

It must be noted from the above tabulation that training in management and finance is running far below the mark and that activity in these areas needs to be increased significantly. At present REB Deputy Directors and above and PBS General Managers receive no continuing training past the entry level. The projection calls for their training to continue during the full time of the study. A better acceptanc by REB of technical training has caused this phase of training to have proceeded at a more acceptable pace. PBS Board of Directors training has progressed very close to schedule. As a result, PBS operating management training has not kept pace with the training of Boards of Directors.

The follow tabulations show the training needs for the project period.

Total Training Need

	1987	1988	1989	1990	1991
Total Trainees in Total Courses	4424	4820	4752	4153	4223
Total Batches in Total Courses	310	360	393	351	348
Total Weeks Training Required	357	407	408	344	341

Needs Per Year (5-year average)

Total Trainees in Total Courses	4474
Total Batches in Total Courses	352
Total Weeks Training Required	372

Training Required by:

PBS

	1987	1988	1989	1990	1991
Total Trainees	3249	3663	3488	3206	3038
Total Batches	219	268	285	263	237
Total Weeks	268	325	310	270	237

REB

Trainees	1116	1126	1157	904	1062
Batches	86	90	101	84	104
Weeks	80	74	83	66	88

Consultants--Contractors

Trainees	59	31	107	43	123
Batches	5	2	7	4	7
Weeks	13	8	15	9	16

Training Requirement by Category
(by weeks training)

PBS Needs:

Boards of Directors	25 weeks	9%
Orientation, Management, Administration	68 weeks	25%
Finance	17 weeks	6%
Technical	160 weeks*	59%
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* Taken from curriculum plan for 6-year maximum program.

REB Needs:

Orientation, Management Administration	73 weeks	58%
Finance	16 weeks	12%
Technical	38 weeks	30%
	---	---
	127 weeks*	100%

Engineering Consultants and Construction Contractors Needs:

Technical	29 weeks*	100%

Total Requirements (by weeks)

Board of Directors	25 weeks	6%
Orientation, Management, Administration	141 weeks	33%
Finance	33 weeks	8%
Technical	226 weeks	53%
	425 weeks	100%

Comparison of Needs with Present Performance
(based on performance for last half of 1983-84 fiscal year)

	Current Performance	Need
Total Batches in Total Courses (per year)	2000	4474
Total Batches in Total Courses	152	352
Total Weeks Training	148	372

Comparison by percent training (by weeks)

Board of Directors	11%	6%
Orientation, Management, Administration	12%	33%
Finance	4%	8%
Technical	75%	53%

Staffing requirements will be projected on the basis of 45 weeks training per classroom and two instructors required per classroom for full-time use during this time.

Training Category	Weeks Required	Needs
Board of Directors	23 weeks	4 classrooms
Orientation, Management, Administration	123 weeks	8 instructors
Finance	30 weeks	
Technical	197 weeks	4 classrooms
		9 instructors
Field Instructors required		4 instructors

In addition, a job training and safety program for PBS outside personnel is also recommended. This will require four additional field personnel for this program.

Assuming that 30 percent (the approximate present level) of the instruction will be provided by outside instructors, the staffing need is determined as follows:

Institutional Training -- Six instructors (classroom)

Deputy Director -- Institutional Training
Deputy Director -- Management Training
Deputy Director -- Administration and Finance Training
Asst. Director -- Management and Member Service Training
Asst. Director -- Institutional and Supervisor Training
Asst. Director -- Office System Training

Technical Training -- Seven Instructors (classroom)

Deputy Director -- Technical Training

Asst. Engineer (3) -- Technical Training
Sub-Asst. Engineer (4) -- Technical Training

In addition, the field programs will require eight instructors:

Field Follow-up Program:

Deputy Director -- Field Institutional Training
Asst. Director -- Field Institutional Training
Deputy Director -- Field Technical Training
Asst. Engineer -- Field Technical Training
Asst. Engineer (2) -- Job Training and Safety Program
Sub-Asst. Engineer (2) -- Job Training and Safety Program

Support Staffing requirements:

Deputy Director -- Planning and Records
Asst. Director -- Records
Asst. Director -- Publications
Asst. Director -- Examinations
Asst. Director -- Training Logistics

Total Training Directorate staffing requirements to adequately meet the training needs for the period of 1987-1991 in the rural electrification program are:

1 -- Director of Training
6 -- Deputy Directors
8 -- Assistant Directors
6 -- Assistant Engineers
6 -- Sub-Assistant Engineers
plus necessary supporting staff.

Classroom and Basic Support Facilities

In addition to need for the eight classrooms previously mentioned, the following facilities will also be required.

It is proposed that all training be housed in a single building. In a single building. In additional, it is proposed that an area no smaller than 400 foot by 700 foot be furnished adjacent to the classroom building for necessary outdoor technical training activity.

A library with suitable furnishings and sufficient reference volumes will need to be a part of the physical needs of the Institute. Adequate storage space for training equipment and supplies as well as for publications and audio-visual materials must be provided.

Space is now at a premium and must be increased to accommodate a staff of 21 officers plus a support staff of approximately 15 others.

At least one laboratory area will need to be available for specialized types of technical training.

Training Logistics:

In order to run a smooth training operation, adequate support facilities are required. These include:

1. Vehicles for transporting trainees and for transport of instructors in field training programs.

2. Hostel facilities for trainees coming to Dhaka.

3. Office machines.

4. Facilities or access to facilities for publishing printed training materials.

5. Miscellaneous classroom audio-visual equipment and capacity for developing audio-visual aids.

6. Adequate rest house facilities in the field to house field instructors.

Transportation:

To meet the needs of the training program at Dhaka, there will be need for two microbuses and one coaster bus. In addition, there will need to be two vehicles available for field instructors.

Hostel:

Hostel space in Dhaka will need to be increased to accommodate 45 trainees at one time in Institutional classes and 30 trainees in Technical Training. Facilities for food preparation must also be available.

Office Machines:

Additional machines required will be:

1 -- Photocopies
3 -- Typewriters
1 -- Stencil duplicating machine
1 -- printing calculator.

Printed Material:

There will be need for a long-term contract with a local printer for setting up and printing training text/reference materials and other needed printed matter.

Audio-visual Aids:

Audio-visual aids can be produced in-house or purchased commercially. The Directorate should not attempt to produce sophisticated Audio-visual aids itself but should contract for this. Needed additional audio-visual equipment is per list submitted elsewhere.

Need for Foreign Advisors

Course Development:

At the present time two foreign training advisors (Institutional and Technical) are working with the Director of Training and have helped to develop the training program to its present stage. The Technical Training Advisor's position is scheduled to be dropped from the Rural Electrification Phase II portion of the project on January 10, 1986. Continuation of the training program in Phase II and implementation of the full program in Phase III becomes excessively difficult (if not impossible) if this happens.

In order to fully implement a complete training program by the end of Phase III as recommended, both advisors will need to be retained for the full period of Phase II and in addition, it is recommended that the two foreign training advisors remain during the entire period of RE Phase III. It will take this long to realize full implementation of the recommended curriculum plan.

As of the end of 1984, the curriculum had been 40 percent implemented. Fifty to sixty percent implementation is expected by the beginning of Phase III of both advisors remain to the end of Phase II. And at this rate, it will take to the end of Phase III to complete all course development and to conduct every course for first monitoring and evaluation. Two foreign advisors will need to continue their present rate of output to accomplish this. Foreign advisors should remain until local staff have been trained and all courses have been properly developed and satisfactorily conducted by them.

Professional Conferences and Workshops:

There is a continuing need to hold conferences in the various areas of job activity for technical specialists, managers, and supervisors for purposes of continuing professional improvement. Although this type of program has not yet been accepted by REB, it is important that such a program of conferences (annual of semi-annual) be established. Training advisors will be needed during Phase III to help plan, conduct, and to evaluate the effectiveness of these programs in both the institutional and technical phases. Such a program on an annual basis should also be planned and conducted for PBS Boards of Directors.

Job Training and Safety Program:

As yet no Job Training and Safety Program has been started for the continuing training and the development of job proficiency of PBS operations personnel. It is important for the success of the PBS electric system operation that this field program be started as soon as possible, yet not later than early in Phase III. A technical training advisor will be needed to help establish and conduct this during the time of the implementation.

RURAL ELECTRIFICATION AND FERTILITY CHANGE

Warren C. Robinson*
and Sarah F. Harbison

Most recently there have been a growing number of solidlybased empirical studies showing a link between electrification and fertility. Typically these studies show that in a multivariate analysis of the determinants or factors associated with variation in fertility, rural electrification emerges as a significant and negatively-related independent variable. The studies are diverse with respect to area studied, duration of study and methodology used. Nevertheless the studies find an undeniably strong effect of electrification on fertility, even when a large number of variables is included in the analysis.

On the Northern Coast of Mindinao Island in the Philippines, 10 out of 24 municipalities had been electrified by 1975. This large-scale electrification effort in very rural, relatively inaccessible and undeveloped area, began in 1971. It quickly become clear that fertility was falling rapidly in those areas effected by electricity, and detailed studies of this apparent relationship were undertaken. The research focussed on the social economic and demogaphic changes associated with rural electrification. A very short, exploratory study was conducted in 1975, examining who used electricity, for what purpose, and how users benefitted. A more detailed 12-month follow-up study was conducted in 1977 to help identify specific mechanisms through which electrification affected a wide range of concerns, including income employment, health, productivity, education and population growth. Intensive interviews were conducted with three groups including:

(1) administrators/supervisors of both public and private establishments such as firms, educational and service institutions, and large farms: (2) employees of such institutions: (3) married couples. The study covered both electrified and non-electrified areas. As noted, data on fertility were also available from the earlier but still ongoing demographic data collection effort. In the area most affected by the electrification project, the Crude Birth Rate declined from 46 to 30 between 1971 and 1975. The non-electrified area showed a smaller decline, from a CBR of 41 to one of 36 during the same period. Similarly, contraceptive prevalence rose to about 33 percent in the electrified areas, as compared to 21 percent in the non-electrified areas. Detailed follow-up surveys found that electrification has a substantial impact on community level services and also on general well-being and development. Production, income, employment (both in agriculture and inoustry), and health, education and social services were judged to have improved due to electrification.

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In analysing of data from 16 states of India, the impact of socio-economic variables and family planning program inputs on program outputs (acceptor rate and user rate) and on fertlity (crude birth rate) was evaluated using multivariate regression techniques (World Bank, 1974). The study reported that "electricity consumption per capita could explain as much as 61 percent of the interstate variation in user rates; the best that (any other) variable could accomplish was less than 50 percent of the variance".

A study conducted in Thailand to assess the impact of electrification on fertility 300 households in each of two villages were subject to Investigation. The two villages were similar in other socio-economic characteristics except for the presence and absence of electricity. Comparing the electrified village with the non-electrified village, the study concluded that thus far electricity has not lead to major changes in economic or social behavior. The single exception is TV viewing. Although relatively few households (20) own a TV set, the impact extends to the village as whole because neighbors and friends frequently come to watch. Contraceptive practice is significantly higher in the electrified village (62 percent) than in the village without electricity (51 percent). This is true at all levels of economic status. Similarly, cumulative fertility is 3.12 in the electrified village and 3.52 in the non-electrified village. A comparison of recent past fertility presents the same picture. During the period 1976-79, in the electrified village there were 6.3 birth per married women aged 15-44, while in the non-electrified village the rate was .825. These differences exist among both users and nonusers of contraception.

A study conducted in the USA was concerned with the causes of the rapid decline in U.S. rural farm fertility which occured in the period 1940 to 1970. Although both rural and urban fertility in the U.S. had fallen almost continuously since 1800, the relative levels remained almost unchanged up to 1940. That is, in 1800 the urban fertility ratio was 64 percent of the rural ratio and in 1940 it was 58 percent.

Data employed were measures of fertility and various economic, social and technological factors drawn chiefly from the Census of Agriculture and Population for 1940, 1950, 1960 and 1970 plus other data where available. The unit of analysis was the state. Among the technology variable employed in the regression analysis was percentage of farm households having electricity. This was consistently negatively (and in 3 of 4 regressions significantly) related tofertility. In other words, the significantly related to thje degree of rural electrification cross-sectionally. Over time the rise in thej percent of households electrified was associated with declining rural farm fertility.

Rural electrification is relatively new to Bangladesh. In winter 1983-84 the Rural Electrification Board with USAID help, undertook the first evaluation of the socio-economic impact of electrification in those areas which had been "energiged" in the first phase, 1980-81. This evaluation involved a survey of six villages in each of four rural cooperative areas chosen randomly from a list of all villages in the areas. The number of villages chosen was arbitrary and based on a

desire to obtain a large enough sample of homesteads to permit some area analysis but small enough to make field work manageable. In each selected village about one of six of the listed electricity users was selected randomly, yielding a total of 400 electrified households. Some 200 non-electrified households were also selected randomly in the same villages for comparison purposes. Female interviewers were employed and a detailed fertility-family planning questionnaire administered as well as the socio-economic questionnaire put to the head himself by male interviewers.

There was a modest but discernable effect of electrification on the fertility-family planning variables. Some 82 percent of the women in electrified households found family planning "acceptable" whereas only 73 percent in the non-electrified group did. Children ever born averaged about the same for the two groups-5.4 and 5.9- but desired family size was lower in the electrified group, 2.9 as opposed to 3.2 These modest differences can perhaps be explained by the relatively short time since the households receive electricity, and also by continued problems in creating a functioning family planning service supply network in rural Bangladesh. Thus, low use does not necessarity mean low latent demand. The most striking finding was a sharp attitudinal change among these largely illiterate rural women. Over 64 percent were film in their expectation that their children's education would benefit in future due to electrification, 60 percent desired their daughters to have at least matriculate level education. And 72 percent desired that their daughters be able to work outside the home earning money. These responses suggest major changes are underway which, with proper family planning service and supply, could lead to a sharp increase in contraceptive practice and decline in fertility.

Electrification-fertility "connection" has been established by the research thus far undertaken. Empirically, it is, quite simply, there in various countries, in various time periods, and at various levels of aggregation, even when the investigators are not looking for it. Areas, villages and households with access to electricity have higher contraceptive prevalence and lower fertility than areas, villages and households without access to electricity. The effect seems to function as both a community-level and household-level variable but this is difficult to judge with assurance since most studies thus far have not collected household-level data on electrification.

Theoretically, electrification does not fit in well to the standard or schemes of the determinants of fertility. It is not a neat, easily classified variable like age at marriage, or proportion contracepting. Instead it is an important background variable whose effect is pervasive and fundamental. It also illusive. It affects the basic underlying technological structure of production and economic activity in both the village at large and the household. It also leads to important attitude changes, shifts in the household work structure and raised aspirations.

There are several important policy implications of the fertility-rural electrification link. (1) Rural electrification may be a key modernization variable which reduces fertility five to ten years after

availability at the village level. This assigns a high priority to electrification as a policy intervention. (2) The social benefits of such fertility reduction may legitimately be added to the other benefits of rural electrification to justify the rather large capital investment required of such programs. The fertility impact is an important secondary benefit of electrification. (3) Understanding the role of electrification also strongly suggests that family planning services should follow the spread of the rural electrification system since highly favorable attitudes and behavior patterns are likely to be encountered in the electrified areas.

SUMMARY OF POWER SYSTEM MASTERPLAN STUDY

Power System Master Plan Study was started in June 1983 and the "Draft Interim Report" was published in August 1984. The report was discussed in a final review meeting held on 7th October 1984 which was attended by ADB, Planning Commission and other concerned agencies. The report is scheduled to be finalised as Final Interim Report by mid January 1985 based on the comments received and decisions taken in the review meeting.

The Power System Master Plan Study reviewed the load forecast - one low scenario and other high scenario. The low scenario forecast gives a growth rate of about 13.3% for FY 83-90, 10% for FY 90-95, 8% for FY 95-2005 (5883 MW by 2005) and the high scenario indicates a grrowth rate of 15.6% gct FY83-90, 14.8% for 90-95, 12.6% for FY 95-2000 and 10% for FY 2000-2005 (11396 MW by 2005). The lower scenario is termed as benchmark forecast and the high scenario is termed as Maximum Probable Load Forecast.

The future power system expansion sequences were based on the Benchmark Load Forecast. One test case was also done based on the high scenario load forecast. Salient features of the results of the PSMP Study are furnished in the following attachments:

(i) List of Projects
(ii) Financial Implications
  a) Capital Requirement
  b) Financial Performance
(iii) Miscellaneous Information
  a) Load Forecast
  b) Recommendations
(iv) Minutes of Review Meeting
(v) Comments of ADB

(I) LIST OF PROJECTS

a) TABLE 10.3: GENERATION COMMISSIONING SCHEDULE - PLAN

Denchmark Planning Forecast

EWI No. 2(FY 1993) - Gas West (FY2000)

Fiscal Year	SYSTEM ADDITIONS Instld No.		Capac. MW	Unit No.	Type	Fuel	Site-Zone	System Inst. Cap. MW
1985	1	x	60.0	1	stm	gas	Chtgg E	1017.5
	1	x	110.0	2	stm	oil	Khuln W	
	1	x	30.0	1	c-c	gas	Ashug E	
	1	x	20.0	1	g-t	oil	Baris W	
1986	2	x	28.0	1.2	g-t	gas	Chtgg E	1046.5
1987	1	x	55.0	2	g-t	gas	Ashug E	1101.5
1988	1	x	2.0.0	3	stm	gas	Ghora E	1381.5
	2	x	20.0	2,3	g-t	oil	Baris W	
	1	x	30.0	2	c-c	gas	Ashug E	
1989	1	x	210.0	4	stm	gas	Ghora E	1921.5
	2	x	150.0	3.4	stm	gas	Ashug E	
	2	x	50.0	4.5	hyd	-	Kapta E	
1990	1	x	150.0	5	stm	gas	Ashug E	2071.5
1991	1	x	77.0	1	g-t	oil	Saidp W	2334.5
	2	x	150.0	1.2	c-c	gas	Chtgg E	
1992	1	x	77.0	2	g-t	oil	Saidp W	2567.0
	2	x	103.0	1.2	g-t	gas	Fench E	
1993					EWI	No2	River	2885.0
					EWI	No2	Land	
	1	x	318.0	1	stm	gas	Sidd2 E	
1994	1	x	318.0	2	stm	gas	Sidd2 E	3184.0
1995	2	x	103.0	3.4	g-t	gas	Fench E	3390.0
1996	1	x	318.0	3	stm	gas	Sidd2 E	3724.0
	2	x	103.0	1.2	g-t	gas	Shaji E	
1997	2	x	103.0	3.4	g-t	gas	Shaji E	3930.0
1998	1	x	103.0	1	g-t	oil	Khuln W	4351.0
	1	x	318.0	4	stm	gas	Sidd2 E	4351.0
1999	1	x	103.0	2	g-t	oil	Khuln W	4659.0
	1	x	315.0	1	g-c	gas	Ghor2 E	
2000	1	x	424.0	1	stm	gas	Bagha W	5111.0
	1	x	103.0	3	g-t	gas	Khuln W	
2001	1	x	424.0	2	stm	gas	Bagha W	5479.0
2002	1	x	315.0	2	c-c	gas	Ghor2 E	5739.0
2003	1	x	424.0	3	stm	gas	Bagha W	6353.0
	1	x	315.0	3	c-c	gas	Ghpr2 E	
2004	1	x	424.0	4	stm	gas	Bagha W	6777.0
2005	1	x	315.0	4	c-c	gas	Chor2 E	7195.0
	1	x	103.0	4	g-t	gas	Khuln W	

(I) IST OF PROJECTS (CONTD.)

a) TABLE 10.II: GENERATION COMMISSIONING SCHEDULE - PLAN IN

Maximum Probable Load Forecast

EWI No. 2(FY 1992) - Gas West (FY 1996)

Fiscal Year	SYSTEM ADDITIONS Instld No.		Capac. MW	Unit No.	Type	Fuel	Site-Zone	Zone	System Inst. Cap. MW
1985	1	x	60.0	1	stm	gas	Chtgg	E	1017.5
	1	x	110.0	2	stm	oil	Khuln	W	
	1	x	30.0	1	c-c	gas	Ashug	E	
	1	x	20.0	1	g-t	oil	Baris	W	
1986	2	x	28.0	1.2	g-t	gas	Shtgg	E	1046.5
1987	1	x	55.0	2	g-t	gas	Ashug	E	1281.5
	2	x	20.0	2.3	g-t	oil	Baris	W	
	2	x	70.0	1.2	g-t	gas	Chtgg	E	
1988	1	x	210.0	3	stm	gas	Ghora	E	1591.5
	1	x	30.0	2	c-c	gas	Ashug	E	
	2	x	35.0	1.2	c-c	gas	Chtgg	E	
1989	1	x	210.0	4	stm	gas	Ghora	E	2131.5
	2	x	150.0	3.4	stm	gas	Ashug	E	2131.5
	2	x	50.0	4.5	hyd	-	Kapta	E	
1990	1	x	150.0	5	stm	gas	Ashud	E	2358.5
	1	x	77.0	1	g-t	oil	Saudi	W	
1991	1	x	77.0	2	g-t	oil	Saidp	W	2720.5
	3	x	103.0	1-3	g-t	gas	Fench	E	
1992					EWI	No2	River		3306.0
					EWI	No2	Land		
	2	x	318.0	1.2	stm	gas	Sidd2	E	
1993	1	x	318.0	3	stm	gas	Sidd2	E	3624.0
1994	1	x	318.0	4	stm	gas	Sidd2	E	4129.0
	1	x	103.0	4	g-t	gas	Fench	E	
	1	x	103.0	1	g-t	gas	Shaji	E	
1995	2	x	103.0	1.2	g-t	oil	Khuln	W	4650.0
	1	x	315.0	1	c-c	gas	Ghor2	E	
1996	2	x	103.0	3.4	g-t	gas	Khuln	W	5405.0
	1	x	424.0	1	stm	gas	Bagha	W	
	1	x	315.0	2	c-c	gas	Ghor2	E	
1997	1	x	424.0	2	stm	gas	Bagha	W	6035.0
	2	x	103.0	2	g-t	gas	Shaji	E	
1998	1	x	424.0	3	stm	gas	Bagha	W	6774.0
	1	x	315.0	3	c-c	gas	Ghor2	E	
1999	1	x	315.0	4	c-c	gas	Ghor2	W	7509.0
	1	x	530.0	1	stm	gas	East		
2000	1	x	424.0	4	stm	gas	Bagha	W	8491.0
	1	x	530.0	2	stm	gas	East		
	1	x	103.0	4	g-t	gas	Shaji	E	

2001	2	x	103.0	1.2	g-t	gas	West	9480.0
	1	x	530.0	3	stm	gas	East	
	3	x	103.0	1-3	g-t	gas	East	
2002	1	x	315.0	1	c-c	gas	West	10579.0
	2	x	103.0	3.4	g-t	gas	West	
	1	x	530.0	4	stm	gas	East	
	1	x	103.0	4	g-t	gas	East	
2003	1	x	315.0	2	c-c	gas	West	11829.0
	2	x	530.0	1.2	stm	gas	East	
2004	1	x	315.0	3	c-c	gas	West	12983.0
	2	x	103.0	1.2	g-t	gas	West	
	1	x	530.0	3	stm	gas	East	
	1	x	103.0	1	g-t	gas	East	
2005	1	x	315.0	4	c-c	gas	West	14137.0
	2	x	103.0	3.4	g-t	gas	West	
	1	x	530.0	4	stm	gas	East	
	1	x	103.0	2	g-t	gas	East	

(I) LIST OF PROJECTS (CONTD.)

(b) Transmission Projects

Compatible transmission links 132 KV and 230 KV as worked out by computer studies have been incorporated to handle the generated power reliably.

(c) Distribution

Provision for distribution has been kept keeping in view of increasing REB programme in rural areas.

(II) FINANCIAL IMPLICATIONS

(a) Capital Requirements

For the Benchmark Load projection annual requirements for capital between FY 1986-90 will average Tk. 9.6 billion (9.6×10) in consistant 1983 terms. For the Maximum Probable projection annual requiements would be Tk. 13.7 billion in constant 1983 terms. Table-A showing 5-Year Plan investment are enclosed.

(b) Projected Financial Performance

Financial projections have been made in the Master Plan Report to the end of 1995 in order to examine the impact of the proposed capital investment programmes. Two projections are made respectively for Bnchmark and Maximum Probable Load Forecasts and are shown in Tables - B & C.

(II) FINANCIAL IMPLICATIONS (CONTD.)

TABLE - 4

(a) CAPITAL REQUIREMENTS BY PLAN PERIOD
(MILLIONS CONSTANT 1983 TAKA INCL. DUTIES TAXES AND I.D.C.)

Investment Scenario	TO FY 85	%	FY 86-90	%	FY 91-95	%
BENCHMARK:						
Generation	7451	40.8	19978	41.7	22471	46.3
Transmission	2400	13.1	8129	17.0	5874	12.1
Distribution	6060	33.2	17682	36.9	17025	35.1
Other	2356	12.9	2066	4.3	3198	6.6
TOTAL	18257	100	47855	100	48548	100
(U.S. $ Million)	861		1994		2024	
Average Annual			9571		9714	
(U.S. $ Million)			399		405	
MAXIMUM PROBABLE:						
Generation	8413	42.7	31856	46.6	42517	45.5
Transmission	2476	12.6	9003	13.2	7977	8.5
Distribution	6479	32.9	25309	37.0	39089	41.8
Other	2346	11.9	2187	3.2	3884	4.2
TOTAL:	19715	100	68355	100	93468	100
(U.S. $ Million)	821		2848	100	3895	
Average Annual			13 671		18 964	
(U.S. Million)			570		779	

1. Numbers may not add due to rounding.
2. Current "Other" works in progress includes approxmitely 1200 Million Taka of equipment to be used for other projects which has not been allocated to those projects.
3. 24 Taka = 1 x U.S.

4. Constant Taka costs obtained by deflating current Taka costs by weighted average foreign and local inflation (60.40).

(II) FINANCIAL IMPLICATIONS (CONTD.)

(B) TABLE - B - SUMMARY OF FINANCIAL PROJECTIONS FOR BENCHMARK CASE (MILLION CURRENT TAKA)

	Actual FY 83	FY 85	FY 90	FY 95
Sales (Gwh)	2399	3024	5919	10014
System Losses (%)	30.1	29.5	24.0	23.0
Load Factor (%)	55.4	55.2	52.5	54.5
Sales Revenues	3061	4640	14627	35681
Avg. Tariff Tk/Kwh Sold	1.28	1.53	2.47	3.56
Operating Costs	2637	2843	8295	22074
Interest Cost	144	183	3130	7986
Net Income	367	1776	3713	6870
Operating ratio	82	59	55	60
Rate of Return on Avg. Fixed Assets (Historic)	8	13	10	11
(Revalued)	7	11	8	7
Self-financing ratio (5 YR AVG.)*	7	18	33	42
(3 YR AVG.)*	7	19	32	41
Debt Service Ratio	2.8	3.6	2.4	2.6
Debt/Equity (% Debt)	51	57	65	64

* Total 5 year centered net internal funds generated as percentage of total 5 year centered capital expenditures plus I.D.C.

(II) FINANCIAL IMPLICATIONS (CONTD.)

(b) TABLE - C - SUMMARY OF FINANCIAL PROJECTIONS
FOR MAX. PROB. CASE
(MILLION CURRENT TAKA)

	Actual FY 83	FY 85	FY 90	FY 95
Sales (Gwh)	2399	3083	6248	12153
System Losses (%)	30.1	29.5	24.0	23.0
Load Factor (%)	55.4	51.8	48.0	46.2
Sales Revenues	3061	4816	18624	59932
Avg. Tariff Tk/Kwh Sold	1.28	1.56	2.98	4.93
Operating Costs	2637	3082	9134	28762
Interest Costs	144	183	3878	11920
Net Income	367	1719	6264	21349
Operating Ratio	82	59	50	55
Rate of Return on Avg. Fixed Assets (Historic)	8	13	13	16
(Revalued)	7	10	10	11
Self-financing ratio (5 YR. AVR.)*	11	16	35	42
(5 YR. AVR.)*	7	15	33	43
Debt Service Ratio	2.8	3.5	2.8	3.4
Debt/Equity (% Debt)	51	58	67	62

* Total 5 year centered net internal funds generated as a percentage of total 5 year centered capital expenditures plus I.D.C.

III. MISCELLANEOUS INFORMATION

(a) TABLE 3.4 MAXIMUM PROBABLE SCENARIO FORECAST

FISCAL YEAR	DEMAND (MW)	LOAD FACTOR%	GENERATION (GWH)	ENERGY* LOSSES%	SALES (GWH)	KWH/CAPITA+ CONSUMPTION
1979	437	55	2122	35	1381	
1980	462	58	2353	40	1406	21
1981	545	56	2662	35	1740	
1982	604	57	3036	33	2028	
1983	707	55	3433	30	2399	ACTUAL
1984	801	57	3890	31	2758	
1985	963	52	4405	30	3083	36
1986	1107	50	4992	28	3508	
1987	1273	50	5644	27	4074	
1988	1481	49	6459	25	4780	
1989	1703	49	7299	25	5486	
1990	1954	48	8229	24	6248	60
AVG GR RATE FY83-90	15.6%		13.3%		14.7%	
1991	2256	48	9385	24	7174	
1992	2594	47	10693	23	8232	
1993	2978	47	12182	23	9372	
1994	3412	46	13878	23	10680	
1995	3898	46	15797	23	12153	107
AVG GR RATE FY90-95	14.8%		13.9%		14.2%	
2000	7046		29442			186
AVG GR RATE FY95-2000	12.6%		13.2%			
2000	11396		49624			281
AVG GR RATE FY2000-2005	10.0%		11%			

* Including station use.

\+ Population estimatesin millions: 1980 - 88.5, 1985 - 99.2, 1990-109.0, 1995-118.1, 2000-126.6, 2005-141.2.
Average growth 2.2%/a (Source: IBRD, Sept. 1983).
Per capita electricity consumption obtained by multiplying generation values by approximately 0.8 (20% technical losses)

III. MISCELLANEOUS INFORMATION (CONTD.)

(a) TABLE 3.5 BENCHMARK SCENARIO FORECAST

FISCAL YEAR	DEMAND (MW)	LOAD FACTOR%	GENERATION (GWH)	ENERGY* LOSSES%	SALES (GWH)	KWH/CAPITA+ CONSUMPTION
1979	437	55	2122	35	1381	21
1980	462	58	2353	40	1406	
1981	545	58	2662	35	1740	
1982	604	57	3036	33	2028	
1983	707	55	3433	30	2399	ACTUAL
1984	797	57	3845	31	2758	
1985	887	55	4306	30	3024	35
1986	993	55	4823	28	3428	
1987	1112	55	5402	27	3878	
1988	1279	54	6104	25	4521	
1989	1471	54	6898	25	5186	
1990	1692	53	7794	24	5919	57
AVG GR RATE FY83-90	13.3%		12.4%		13.8%	
1991	1861	54	8730	24	6674	
1992	2047	55	9777	23	7525	
1993	2252	55	10755	23	8278	
1994	2477	55	11830	23	9106	
1995	2725	55	13014	23	10014	88
AVG GR RATE FY90-95	10.00%		10.8%		11.1%	
2000	4004		19121			121
AVG GR RATE FY95-2000	8.0%		8.0%			
2005	5883		28095			159
AVG GR RATE FY2000-2005	8.0%		8.0%			

* Including station use.

\+ Population estimatesin millions: 1980 - 88.5, 1985 - 99.2, 1990-109.0, 1995-118.1, 2000-126.6, 2005-141.2.
Average growth 2.2%/a (Source: IBRD, Sept. 1983).
Per capita electricity consumption obtained by multiplying generation values by approximately 0.8 (20% technical losses).

III. MISCELLANEOUS INFORMATION (CONTD.)

(b) RECOMMENDATIONS OF POWER SYSTEM MASTER PLAN :

Generation Addition

The recommendations of Master Plan in respect of generation and transmission programme are -

1. 2.20 MW peaking gas turbine at Barisal be added.

2. A large combined cycle plant between 180 and 200 MW (Sites at Fenchuganj, Siddhirganj, chandpur and Sikalbaha may be considered for installation).

3. Construction of a second 85 MW combined cycle plant at Ashuganj (Already under negotiation).

4. Location of a second 2x28 MW barge mounted gas turbine set at chittagong/Sikalbaha (This is already under negotiation).

5. The 150 MW unit No. 5 at Ashuganj be brought forward in a rolling sequence with units No. 3 and 4 now under construction.

6. Further two units of 50 MW each at Kaptai be added in a rolling sequence with units 4 and 5 now commencing field construction.

7. BY the beginning of FY 1986, studies should be put in hand for a peakiing gas turbine plant of about 2x75 MW at Saidpur. The plant should be in commercial srvice by the beginning of the 1991 financial year.

Base Load Genrating Plants

About the base load generating plants in future, PSMP recommended that -

After the completion of 4x300 MW units at Siddirgang/Daudkandi area, the next base load plant should have 4x400 MW units, with the first unit in service in about 1999. It could be built in the region of Baghabari, if the gas interconnector has been built. If the gas interconnector has not been build, the plant could be build on new sites near Ghorasal or Ashugang. If there is insufficient gas, three alternatives have been studied. None of them are urgent but are:

(a) A base lead plant burning imported coal at Mongla (Chalna Port) in the West Zone, near the new container shipping facility. Installed capacities of upto 1600 MW have been examined. Even when the cost of the additional transmission is included, the site would be appropriate if imported coal were necessary.

(b) If a plant burning imported coal is required in the East Zone, a site on the south side of the harbour in Chittagong would be in most suitable.

(c) If Jamalganj coal were to be developed, a nine-month plant of about 1600 MW could be integrated into the Western Zone without difficulty. Coal requirement would be about 3 million tonnes annually.

(d) The performance of large combined cycle plants on other systems should be monitored carefully. The additions listed above imply a total of 370 MW of combined cycle plant by 1988. While this type of plant has much to offer, the BPDB is rightfully cautious in avoiding a sholesale commitment to them until their long term reliability is proven. Bangladesh should not be the location for field tests of this nature.

Peat Fired Generation :

There are extensive deposits of peat in the Faridpur-Khulna area. Indications are that they would potentially support upto 200 MW for 40 years. Extraction of peat by labor intensive methods could also provide much needed employment. The plant would be an attractive addition in the West Zone, which has no known gas reserves. The PSMP has tested the effect of a 200 MW plant located in this region and found that it could easily be integrated into the system. About 700,000 tennes of dry peat would be required annually. The PSMP recommended that a feasibility study be undertaken soon to establish the true extent of the peat reserves, the economic cost of extraction and general parameter of a suitable generating plant. The need for a pilot project should be included in the study.

Oil Fired Generation :

The PSMP concludes that generation of electricity using oil is most unlikely to be economically attractive. The only exception of this viewpoint would be if oil were to be discovered in the Bay of Bangal.

Nuclear Generation :

Bangladesh is a signatory to the Nuclear Non-Proliferation Treaty and there would be no legal constrains on a nuclear power development. On the basis of 12 and 15 percent discount rates, nuclear power will not be economically attractive within the 20 year study horizon. The PSMP concludes that the matter should be reevaluated later.

LPG, and Naptha :

There are indications that enough of these fuels to generate 100 Gwh per year may become available at an economic price by about 1987-88. It is recommended by BMP that the possibility of using these fuels in peaking gas turbines in the zone be investigated.

RURAL ELECTRIFICATION SYSTEM TABLES OF PROGRESS

LINE CONSTRUCTION PROGRESS REPORT
AS OF MARCH 31, 1985

* DESIGNATES PBS NAME CHANGED NAME OF PBS **DESIGNATES CONSTRUCTION NOT STARTED	TYPE OF PROJECT	NUMBER OF POLES ERECTED/ACQUIRED		MILES OF LINE ENERGIZED		NO. OF STAKED CONSUMERS ON NEW CONSTRUCTION	NO. OF PDB CONSUMERS TAKEN OVER BY REB
		NEW CONSTN	RENO-VATION	NEW CONSTN	RENO-VATION		
COMILLA-I	USAID I	13574	718	541	15	20639	1195
*CHANDPUR		8169	771	427	64	16069	1760
DHAKA		10465	767	453	109	17250	1290
JESSORE-I		12046	1107	596	73	18390	1848
JESSORE-II		10337	987	660	68	15613	385
PABNA-I		5271	424	224	79	8299	2288
PABNA-II		6475	564	297	24	6880	1002
*SIRAJGONG		7515	1158	435	100	10156	1937
*NATORE-I		9577	563	435	53	11427	588
*NATORE-II		9268	1048	500	74	12549	1132
*HABIGANJ		7950	510	294	26	14514	440
*MOULVIBAZAR		8795	128	445	31	12942	133
TANGAIL		10820	79	451	19	12093	632
TOTALS		120262	8824	5758	735	176821	14630
BOGRA-II	USAID II	**					
CHITTAGONG-I		**					
JAMALPUR		**					
RANGPUR-II		98					
TOTALS		98					

BARISAL	KFAED	**					
JAIPURHAT		116					
DINAJPUR-I		2392	-	33	-	1920	-
*SATKHIRA		6395	89	231	6	9601	644
*KUSHTIA-I		1695	214				
MYMENSINGH		5623	74	163	1	7168	378
*FENI		5796	-	150	-	8736	-
RANGPUR		4983	204	181	9	5129	221
TOTAL		27050	491	767	16	33321	1243
BARISAL-II	IDA	1395		1			
CHITTAGONG-II		**					
DHAKA-II		**					
*MADARIPUR		1230		1		2217	
*BAGARHAT		497					
*MEHERPUR		**					
*NOAKHALI		100					
TOTALS		3222		2		2217	
*THAKURGAON	FINLAND	62					
TOTALS USAID-I		120262	8824	5758	735	176821	146821
TOTALS USAID-II		98					
TOTALS KFAED		27050	491	567	16	33321	1243
TOTALS IDA		3222		2		2217	
TOTALS FINLAND		62					
GRAND TOTALS		150699	9315	6327	751	212359	15873

Source: MPECA/GC - April, 1985

SUMMARY OF GROWTH
in
TOTAL CONSUMER CONNECTIONS AND KWH USAGE
by
BANGLADESH PALLI BIDYUT SAMITIES

Grantor / Samity Name	Date Energized	Consumers Connected & Average KwH Usage					Percent Increase In Cons.
		At 30.06.1983		06.83 to 12.84	At 31.12.1984		
		Cons.	KWH per Cons.	Cons. Added	Cons.	KWH per Cons.	
USAID							
Dhaka PBS I	02/06/80	11,585	125.1	3,306	14,891	118.7	28.54%
Tangail PBS I	19/10/81	3,696	328.5	3,967	7,663	153.3	107.33%
Comilla PBS I	01/01/81	8,057	58.5	4,949	13,006	83.8	61.42%
Chandpur PBS	13,12,81	4,835	42.0	4,838	9,673	50.4	100.06%
Habiganj PBS	12,10,82	1,299	51.3	5,826	7,125	121.0	448.50%
Moulvibazar PBS	26,06,81	4,639	82.2	3,211	7,850	137.4	69.22%
Pabna PBS I	09,01,84	1,975	70.5	3,582	5,557	66.0	181.37%
Pabna PBS II	06,01,83	1,720	53.3	4,693	6,413	62.1	272.85%
Serajgonj PBS	14,04,81	6,287	85.1	4,027	10,311	94.9	64.01%
Jessore PBS I	29,06,81	5,735	100.8	3,025	8,760	68.4	52.75%
Jessore PBS II	02,02,81	7,250	48.7	2,605	9,855	46.1	35.93%
Rajshahi PBS I	15,03,81	5,327	81.6	4,256	9,583	64.5	79.89%
Rajshahi PBS II	03,06,82	4,893	62.9	4,662	9,555	71.6	95.28%
USAID OVERALL		67,298	90.5	52,944	120,242	87.4	78.67%
KFAED							
Rangpur PBS I	14,04,84	0	0	2,140	2,140	45.7	n/a
Shatkhira PBS	09,02,84	0	0	2,714	2,714	36.2	n/a
Feni PBS	16,02,84	0	0	3,045	3,045	30.2	n/a
Mymensingh PBS	15,03,84	0	0	2,263	2,263	23.4	n/a
Dinajpur PBS	29,12,84	0	0	511	511	24.3	n/a
KFAED OVERALL				10,673	10,673	33.1	n/a
BANGLADESH OVERALL		67,298		63,617	130,915	N/A	94.53%

Exhibit A

GROWTH IN IRRIGATION CONNECTIONS AND KWH USAGE
by
BANGLADESH PALLI BIDYUT SAMITIES

Grantor PBS NAME	Consumers Connected & Average KwH Billed									Percent Increase In Cons. over Period
	At 30.06.1983				At 31.12.84			At 31.12.1984		
	DTW	STW	LLP	AVE KWH CO/MO	DTW	STW	LLP	OVERALL	AVE KWH CO/MO	
USAID										
Dhaka PBS I	193	107	148	2075.1	222	198	158	578	1572.7	29.02%
Tangail PBS I	52	137	14	1684.9	96	421	34	551	524.7	71.43%
Comilla PBS I	30	63	70	892.6	59	123	98	280	1449.7	71.79%
Chandpur PBS	6	0	72	334.9	8	4	133	145	2182.7	85.90%
Habiganj PBS	0	0	1	45.0	3	16	4	23	1276.7	2300.00%
Moulvibazar PBS	0	6	2	41.6	0	11	0	11	280.9	37.50%
Pabna PBS I	1	10	0	360.8	22	130	0	152	1049.0	1081.82%
Pabna PBS II	4	37	0	458.1	12	87	5	104	568.4	153.66%
Serajgonj PBS	67	232	75	1067.8	107	488	88	683	873.1	82.62%
Jessore PBS I	66	60	24	1886.5	89	218	30	337	1232.2	124.67%
Jessore PBS II	13	109	19	1053.9	23	248	22	293	876.5	107.80%
Rajshahi PBS I	40	172	59	1500.0	71	449	70	590	965.6	117.71%
Rajshahi PBS II	14	80	5	788.7	37	265	8	310	671.3	213.13%
USAID OVERALL	486	1013	489	1346.2	749	2658	650	4,057	977.3	104.07%
KFAED										
Rangpur PBS I	0	0	0	0	2	1	0	3	n/a	n/a
Shatkhira PBS	0	0	0	0	4	11	0	15	n/a	n/a
Feni PBS	0	0	0	0	2	7	1	10	n/a	n/a
Mymensingh PBS	0	0	0	0	1	2	0	3	n/a	n/a
Dinajpur PBS	0	0	0	0	0	0	0	0	n/a	n/a
KFAED OVERALL	0	0	0	0	9	21	1	31	n/a	n/a
BANGLADESH OVERALL	486	1013	489	1346.2	758	2679	651	4,088	n/a	105.63%

NOTE: DTW—Deep Tube Well, STW—Shallow Tube Well, LLP — Low Lift Pump.

Exhibit A

SUMMARY OF GROWTH
in
DOMESTIC CONSUMERS BILLED AND AVERAGE KWH USAGE
by
BANGLADESH PALLI BIDYUT SAMITIES

Grantor / Samity Name	Date Energized	Consumers Billed & Average KwH Usage					Percent Increase In Cons.
		At 30.06.1983 Cons.	KWH per Cons.	06.83 to 12.84 Cons. Added	At 31.12.1984 Cons.	KWH per Cons.	
USAID							
Dhaka PBS I	02,06,80	7,492	28.6	4,352	11,844	34.4	58.09%
Tangail PBS I	19,10,81	1,592	31.6	3,908	5,500	31.0	245.48%
Comilla PBS I	01,01,81	5,578	22.0	3,349	8,927	24.4	60.04%
Chandpur PBS	13,12,81	1,784	23.0	4,209	5,993	28.0	235.93%
Habiganj PBS	12,10,82	477	25.9	3,822	4,299	29.6	801.26%
Moulvibazar PBS	26,06,81	1,756	38.8	4,334	6,090	28.2	246.81%
Pabna PBS I	09,01,84	599	20.2	2,971	3,570	30.8	495.99%
Pabna PBS II	06,01,83	942	27.3	3,199	4,141	30.9	339.60%
Serajgonj PBS	14,04,81	4,082	26.1	2,313	6,395	43.1	56.66%
Jessore PBS I	29,06,81	1,645	32.9	4,358	6,003	31.0	264.92%
Jessore PBS II	02,02,81	3,180	23.5	3,949	7,129	22.5	124.18%
Rajshahi PBS I	15,03,81	2,983	27.9	3,273	6,256	28.9	109.72%
Rajshahi PBS II	03,06,82	2,695	29.5	3,759	6,454	30.1	139.48%
USAID OVERALL		34,805	27.2	47,796	82,601	30.2	137.33%
KFAED							
Rangpur PBS I	14,04,84	0	0	643	643	29.8	n/a
Shatkhira PBS	09,02,84	0	0	1,356	1,356	24.8	n/a
Feni PBS	16,02,84	0	0	1,896	1,896	28.0	n/a
Mymensingh PBS	15,03,84	0	0	1,312	1,312	23.1	n/a
Dinajpur PBS	29,12,84	0	0	127	127	24.4	n/a
KFAED OVERALL				5,334	5,334	26.1	n/a
BANGLADESH OVERALL		34,805	27.2	53,130	87,935	29.96	152.65%

Exhibit A

SUMMARY OF GROWTH
in
SMALL COMERCIAL CONSUMERS BILLED AND AVERAGE KWH USAGE
by
BANGLADESH PALLI BIDYUT SAMITIES

Grantor / Samity Name	Date Energized	Consumers Billed & Average KwH Usage					Percent Increase In Cons.
		At 30.06.1983		06.83 to 12.84	At 31.12.1984		
		Cons.	KWH per Cons.	Cons. Added	Cons.	KWH per Cons.	
USAID							
Dhaka PBS I	02,06,80	362	46.0	433	795	71.2	119.61%
Tangail PBS I	19,10,81	90	24.8	176	266	68.9	195.56%
Comilla PBS I	01,01,81	608	19.4	1,003	1,611	41.0	164.97%
Chandpur PBS	13,12,81	427	24.8	1,509	1,936	35.5	353.40%
Habiganj PBS	12,10,82	44	27.3	1,042	1,086	46.7	2368.18%
Moulvibazar PBS	26,06,81	155	33.6	360	515	37.1	360.00%
Pabna PBS I	09,01,84	349	21.1	505	854	37.3	144.70%
Pabna PBS II	06,01,83	72	17.7	936	1,008	53.4	1300.00%
Serajgonj PBS	14,04,81	368	110.6	1,019	1,459	53.5	296.47%
Jessore PBS I	29,06,81	536	34.1	882	1,418	48.0	164.55%
Jessore PBS II	02,02,81	886	26.2	703	1,589	30.0	79.35%
Rajshahi PBS I	15,03,81	322	35.5	320	642	54.2	99.38%
Rajshahi PBS II	03,06,82	210	40.0	1,076	1,286	39.9	512.38%
USAID OVERALL		4,429	35.8	10,036	14,465	44.6	226.60%
KFAED							
Rangpur PBS I	14,04,84	0	0	506	506	27.8	n/a
Shatkhira PBS	09,02,84	0	0	470	470	39.1	n/a
Feni PBS	16,02,84	0	0	197	197	46.9	n/a
Mymensingh PBS	15,03,84	0	0	58	58	26.2	n/a
Dinajpur PBS	29,12,84	0	0	5	5	21.0	n/a
KFAED OVERALL				1,236	1,236	26.1	n/a
BANGLADESH OVERALL		4,429	35.8	11,272	15,701	39.63	254.50%

Exhibit A

SUMMARY OF GROWTH
in
GENERAL POWER CONSUMERS BILLED AND AVERAGE KWH USAGE
by
BANGLADESH PALLI BIDYUT SAMITIES

rantor / Samity Name	Date Energized	Consumers Billed & Average KwH Usage					Percent Increase In Cons.
		At 30.06.1983		06.83 to 12.84	At 31.12.1984		
		Cons.	KWH per Cons.	Cons. Added	Cons.	KWH per Cons.	
SAID							
Dhaka PBS I	02,06,80	221	2,102	152	373	2,559	68.78%
Tangail PBS I	19,10,81	24	17,759	116	140	5,103	483.33%
Comilla PBS I	01,01,81	96	2,060	98	194	3,359	102.08%
Chandpur PBS	13,12,81	34	766	140	174	966	411.76%
Habiganj PBS	12,10,82	2	6,555	99	101	4,839	4950.00%
Moulvibazar PBS	26,06,81	10	8,446	62	72	10,087	620.00%
Pabna PBS I	09,01,84	77	640	13	90	1,802	16.68%
Pabna PBS II	06,01,83	5	4,237	81	86	1,670	1620.00%
Serajgonj PBS	14,04,81	72	1,637	163	235	1,782	226.39%
Jessore PBS I	29,06,81	50	1,637	66	116	1,861	132.00%
Jessore PBS II	02,02,81	56	1,114	40	96	1,786	71.43%
Rajshahi PBS I	15,03,81	63	1,249	79	142	1,467	125.40%
Rajshahi PBS II	03,06,82	170	496	8	178	1,768	4.71%
JSAID OVERALL		880	1,941	1,117	1,997	2,729	126.93%
KFAED							
Rangpur PBS I	14,04,84	0	0	12	12	1,641	n/a
Shatkhira PBS	09,02,84	0	0	15	15	971	n/a
Feni PBS	16,02,84	0	0	1	1	706	n/a
Mymensingh PBS	15,03,84	0	0	1	1	570	n/a
Dinajpur PBS	29,12,84	0	0	0	0	0	n/a
KFAED OVERALL				29	29	1,225	n/a
BANGLADESH OVERALL		880	1,941	1,146	2,026	2,707	130.23

Exhibit A

Electrified Irrigation Pumps
Projected by REB

BDG Fiscal Year End (June 30)	S.T.W.	L.L.P.	D.T.W.	Total	Area irri-gated (acres)	Tons of additional grains
1985	4095	1105	1300	6500	225225	297360
1986	6206	1675	1970	9850	341303	361368
1987	8716	2352	2767	13835	479383	401688
1988	11542	3114	3664	18320	634788	485352
1989	14386	3882	4567	22835	791233	542556
1990	17420	4701	5530	27650	958073	623599

Host Country Contracting

The Rural Electrification Board (REB) has been the implementing agency for AID Financed RE I and RE II since 1978. During that time REB has been responsible, first with an expatriate advisor and since 1984 without an advisor, for the procurement of 119 million dollars of AID Financed commodities and technical assistance. The REB Procurement Directorate has demonstrated their ability to advertise for and evaluate bids to select the best suppliers for quality materials. They have a well established system of contracting and monitoring contract performance. In cases where suppliers have failed to perform according to contract, REB has been quick to apply liquidated damages clauses which are standard in all contracts. A system of withholding the final 10% payment of vouchers submitted by suppliers until all terms and conditions of the contract are satisfied has helped ensure that quality goods are received on a timely basis.

Payment to materials suppliers and consultants are made under USAID issued letters of commitment, except that the dollar costs of the consulting contract are paid by a FRLC. REB has been quick to note any discrepancies in vouchers submitted.

Because of the extensive experience gained during AID's RE I and II, as well as other donor projects, REB is well qualified to continue project implementation with the host country contracting method.

PROJECT AUTHORIZATION

Name of Country: Bangladesh Name of Project : Rural Electrification III

Number of Project: 388-0070

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended (the FAA), I hereby authorize the Rural Electrification III Project (the "Project") for the People's Republic of Bangladesh (the "Cooperating Country") involving planned obligations of not to exceed Sixty Million United States Dollars ($60,000,000) in grant funds over a five year period from date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the Project. The planned life of the Project is from the date of initial obligation until September 30, 1991.

2. The Project will enhance the capability of the Rural Electrification Board (REB) to provide the technical, managerial and engineering assistance required by rural electric cooperatives (PBSs) to provide reliable electric power to their customers on a cost-effective basis.

3. The Project Agreement(s) which may be negotiated and executed by the officer(s) to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate:

a. Source and Origin of Commodities, Nationality of Services

Except as A.I.D. may otherwise agree in writing:

(1) Commodities financed by A.I.D. under the project shall have their source and origin in Bangladesh or in countries included in A.I.D. Geographic Code 941;

(2) Except for ocean shipping, the suppliers of commodities or services shall have Bangladesh or countries included in A.I.D. Geographic Code 941 as their place of nationality; and

(3) Ocean shipping financed by A.I.D. under the project shall be financed only on flag vessels of the United States, or Bangladesh.

b. Conditions Precedent to Disbursement

(1) Prior to disbursement, or to the issuance of any commitment documents under the Project Agreement, for any purpose other than technical assistance, the Cooperating Country shall furnish in form and substance satisfactory to A.I.D.:

(a) A plan, to ensure for the life of the Project, power generation, transmission and substation capacity will be adequate to meet the forecasted load within each of the areas served by the Rural Electrification Board (REB) under this project, and

(b) A plan, by December 31, 1986 or such later date as AID may agree in writing, to implement in phases the recommendations (including revised tariffs for PBSs) of the Bangladesh Power Sector Tariff Study (Funded by the United Nations Development Program) as agreed to by AID and the BDG.

Covenants

The Cooperating Country shall covenant that:

(1) The Cooperating Country will continue to provide operating support to project PBSs in accordance with a formula acceptable to AID.

(2) The agreed to revised rate schedule (see C.P. 2a above) for PBSs will permit the PBSs to earn revenues sufficient to cover electricity purchases, administrative expenses, depreciation, and interest and principal repayment. The REB will also investigates the possibility of utilizing a portion of the depreciation fund to offset payments of interest and principal.

(3) The Cooperating Country will properly operate, maintain, and repair the main 132/33 KV transmission lines, the 33 KV sub-transmission lines including rights of way, and the substations which service PBSs developed or improved under this or predecessor projects.

(4) The Cooperating Country, in particular the Power Development Board (PDB) and the REB, will conduct continual coordinated load forecasting so as to ensure the adequate distribution of power to PBSs served by the Project but to avoid overloading of grid stations.

(5) The Cooperating Country shall cause PDB to use REB construction standards in building any new distribution lines in REB designated areas of operation.

4. Waivers.

The following waiver is approved, based upon the justifications set forth in the Project Paper Supplement:

a) Pursuant to Sections 110(a) and 124(d) of the FAA I hereby waive the requirement that the Cooperating Country provide 25 percent of the costs of the Project, on the ground that Bangladesh is a Relatively Least Developed Country, but will nonetheless contribute 24 percent of the costs of the Project.

_____
Charles W. Greenleaf Jr.
Assistant Administrator
Asia, Near East Bureau

Date:_____

Table I.1

SUMMARY COST ESTIMATE AND FINANCIAL PLAN

(In thousand US$)

Item Description	AID Funds FX	AID Funds LC	BDG Funds LC	Total
I. Construction (Plant)				
a. Line Materials & Transformers	35,000		7,517	42,517
b. Substations (16)	3,200			3,200
c. Substation Transformers (spares)	1,000			1,000
d. Line Construction			2,550	2,550
e. Substation Construction			400	400
f. Local Consultants			1,262	1,262
g. Building Construction			730	730
h. Inflation	4,038			4,038
Subtotal:	43,238		12,459	55,697
II. Support Commodities				
a. Workshop Equipment	75		100	175
b. Training Equipment	50		100	150
c. Crane for Khulna Jetty	357			357
d. REB Office Equipment (Lift)	400			400
Subtotal:	882		200	1,082
III. Technical Assistance				
a. Expatriate Consultants	9,810	2,400		12,210
b. Training in the U.S,	500		-	500
c. Evaluation	540		-	540
d. Studies and Audits	200		-	200
Subtotal:	11,050	2,400	50	13.450
IV. REB Operating Expense				
a. Jetty at Khulna			357	357
b. REB Overhead			689	689
c. System Engineering			395	395
d. Transportation and Insurance			3,190	3,190
e. In-country training			500	500
Subtotal:			5,131	5.131
V. Contingency	2,430		1,510	3,940
Grand Total:	57,600	2,400	19,300	79,300

Source: NRECA/G&C

Table I.2

COST OF MATERIALS FOR 17 AID SUPPORTED PBS'S 3534 LINE MILES

Sl.No.	Material/Equipment	C&F Price in US$ (In 000s)
1.	Treated Wooden Pole, Crossarm, Anchor Log, etc.	10,530
2.	Pole, Line Hardware	2,970
3.	Conductor Bare	5,320
4.	Conductor Insulated (XLPE)	3,550
5.	Insulator (Pin, Suspension & Spool Type)	675
6.	Conductor Accessories	460
7.	Steel Guy and Ground Wire	350
8.	Connector	345
9.	Distribution Transformer 10	5,466
10.	Sectionalizing Devices	1,515
11.	Oil Circuit Recloser	705
12.	Voltage Regulator	55
13.	Street Lighting Equipment	50
14.	Watthour Meter 10	1,354
15.	Watthour Meter 30 and Metering Transformer	945
16.	Line Tools	315
17.	Test Instrument	250
18.	Pole Trailor, Crane, Forklift etc.	145
	Total:	35,000

USAID PHASE III PROJECT -- LINE CONSTRUCTION BY CATEGORY

	Category of line	Mileage		Cost (US $ in 000s)
1.	11/6.35 KV # 4/0 ACSR Neutral 1/0 ACSR	350 miles	3 Phase	3,446
2.	11/6.35 KV # 1/0 ACSR Neutaral # 3 ACSR	70 miles		0,693
3.	6.35 KV # 1/0 ACSR Neutral 1/0 ACSR	350 miles	1 Phase	3,400
4.	6.35 KV # 3 ACSR Neutral # 3 ACSR	1760 miles		17,430
5.	230 Volt Lines	1004 miles	LT	10,031
	Total:	3534 miles		$35,000
6.	Substations	16		3,200
7.	Substation Transformer (Spares)			1,000
8.	Unassigned Materials Inflation Factor			4,038
				$43,238

Source: NRECA

Table I.3

RE III TECHNICAL ASSISTANCE

Position	RE III Supplemental 86-87		Bal. Req. RE III 87-91		Total RE III Req.	
	Staff Months	Est. Amount	Staff Months	Est. Amount	Staff Months	Est. Amount
Team Leader	0	0	48	576,000	48	576,000
REB Fin. Adv./Adm. Officer	18	216,000	36	432,000	54	648,000
Management Advisor	0	0	48	576,000	48	576,000
Management Advisor	0	0	36	432,000	36	432,000
Institutional Training Advisor	0	0	48	576,000	48	576,000
Technical Training Advisor	18	216,000	36	432,000	54	648,000
Material Management Advisor	18	216,000	36	432,000	54	648,000
PBS Finance Advisor	?	0	36	432,000	36	432,000
PBS Finance Advisor	(12)*	0	36	432,000	36	432,000
System Operations Advisor	0	0	36	432,000	36	432,000
System Operations Advisor	18	216,000	30	360,000	48	576,000
Engineering Advisor	0	0	48	576,000	48	576,000
Dist. Planning Engineer	0	0	36	432,000	36	432,000
Const. Design Engineer	0	0	36	432,000	36	432,000
Substation Const. Advisor	18	216,000	18	216,000	36	432,000
Construction Advisor	0	0	48	576,000	48	576,000
Construction Advisor	0	0	36	432,000	36	432,000
Construction Advisor	12	144,000	24	288,000	36	432,000
Construction Advisor	12	144,000	24	288,000	36	432,000
Maintenance/System Operation Advisor	0	0	36	432,000	36	432,000
Short Term Specialists	0	0	24	288,000	24	288,000
TOTAL FIELD:	114	$1,368,000	756	$9,072,000	870	$10,440,000
Home Office	0	0	160	640,000	160	640,000
Logistic Support				203,000		203,000
Allowance for Inflation				852,000		852,000
PSA Agreement	-	-	-	75,000	-	75,000
GRAND TOTAL:	114	$1,368,000	916	$10,842,000	1,030	$12,210,000

* Provided in Short Term Specialist Staff Months of present Agreement.

Table I.4

ESTIMATED ANNUAL EXPENDITURES (in US$000s)

	FY 1986	FY 1987	FY 1988	FY 1989	FY 1990	FY 1991	Total
AID							
Construction Commodities		7,000	10,000	10,000	10,000	3,200	40,200
Technical Assistance	342	2,035	3,745	3,766	2,455	707	13,050
Support Commodities			712				712
Inflation		500	1,000	1,000	1,038	500	4,038
Contingency					1,000	1,000	2,000
TOTAL:	342	9,535	15,475	14,766	14,493	5,407	60,000
BDG							
Construction		459	1,000	4,000	4,000	3,000	12,459
Support Commodities		100	100				200
Technical Assistance		12	12	12	12	2	50
REB Operating Expense		731	1,100	1,100	1,100	1,100	5,131
Contingency				500	460	500	1,460
TOTAL:		1,302	2,212	5,612	5,572	4,602	19,300

Source: REB

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON D.C. 20523

388-0070

ASSISTANT ADMINISTRATOR

11 AUG 1986

Sole Source Procurement
Initialed by GG
Waiver Control No. ANE/86/6/18/388-0070

ACTION MEMORANDUM FOR THE ADMINISTRATOR

FROM: AA/ANE, Charles W. Greenleaf, Jr.

SUBJECT: BANGLADESH - Rural Electrification III (388-0070)
Request for Waiver of Competition in the Procurement of Technical Services by Host Country Contract

Problem: The Administrator is requested to approve a waiver of competition to permit negotiation with a single source, the National Rural Electric Cooperative Association, to provide technical services for the Bangladesh Rural Electrification III Project (388-0070) under an AID financed host country contract, pursuant to Handbook 11, Chapter 1, Sections 2.4.2.a.5. Action by the Administrator is required because the estimated value of the procurement exceeds $1 million.

(a)	Cooperating Country:	Bangladesh
(b)	Authorizing Document:	Project No. 388-0070
(c)	Project Name:	Rural Electrification III
(d)	Nature of Funding:	Grant
(e)	Description of Services:	Technical and managerial services to the Rural Electrification Board for implementation of the Rural Electrification Program.
(f)	Approximate Value:	$13,500,000
(g)	Source/Origin:	U.S.A.

Background: The first AID-financed host country contract between the Bangladesh Government Rural Electrification Board (REB) and the American joint venture of the National Rural Electric Cooperative Association and Commonwealth Associates, Incorporated (NRECA/CAI) was signed in March 1978 for the Rural Electrification-I project (RE-I, No. 388-0021). Under this contract, NRECA/CAI provided services on all aspects of project

planning and implementation including electrical distribution system design, construction, operation and maintenance, institutional development, development of electric cooperatives, power use programs and training.

The NRECA/CAI joint venture team was initially selected through the competitive process to carry out the feasibility study for the RE-I project. The predecessor provision to the current Section 2.4.1.2 of Handbook 11, Chapter 1, allowed for non-competitive selection of a consultant for follow-on work in cases in which the firm had already been selected competitively for the feasibility study, provided the Commerce Business Daily advertisement and the Request for Proposal noted the possibility of additional work. Since these requirements of Handbook 11, Chapter 1 were satisfied, NRECA/CAI was awarded the subsequent technical assistance contract for RE I non-competitively.

In August 1981, the Rural Electrification II Project (No. 388-0054) was authorized to continue the development of rural electrification in Bangladesh during a six year period (1981 to 1987). Since the RE II implementation period overlapped RE I (1978 to 1984), a waiver of competition to permit negotiation with a single source (NRECA/CAI) was requested and approved (Waiver Control No. ASIA/81/G/19/388-0054).

Discussion: The rural electrification program in Bangladesh is patterned after the program developed by the Rural Electric Authority (REA) in the United States. The use of rural electric cooperatives (PBS's) has been adopted to provide electric power services to rural Bangladesh. The NRECA technical assistance (TA) team has been instrumental in instituting such a system because of their many years experience with rural electric cooperatives in the U.S. and developing countries.

The rapid growth of the PBS's to date has been primarily accomplished through the efforts of the TA team. In just eight years, some 20 PBS's out of a total of 33 are successfully functioning. The remaining 13 PBS's are in various stages of development. The success of the program can best be judged by the extent to which other donors are providing funding to this activity. Since AID began the program in 1978, the World Bank, Kuwait, Canada, Denmark, Finland and the Asian Development Bank have come forth with financing for the expansion of rural electrification. Most donors, the World Bank and Canada in particular, have pointed to the excellent TA services provided by NRECA as the primary reason for the level of success of rural electrification to date. Since the inception of the RE program in Bangladesh, AID has provided funding for all of the TA services

required for this activity. The coordination of the donors on this issue has been excellent and the use of only one TA team has avoided the pitfalls associated with advisory services provided by multiple consultants. NRECA has thus been essential to the institutional development of REB and the PBS's. The technical specifications adopted for Bangladesh are patterned after those established by the REA and have proven to be very successful. Training has been a major focus of NRECA during the past eight years, and both U.S. and in-country training activities have focussed on preparing the REB and PDS staff to provide electric utility services through cooperatives. NRECA's predominant capability in the use of rural electric cooperatives is recognized by the donor agencies.

A strong organizational bond has developed between REB and NRECA due to this long association and the sincere effort on the part of NRECA to transfer the managerial and technical expertise required for the operation of an electric utility. REB has requested that the services of NRECA be continued for the duration of the RE III project, which is a strong indication of the BDG's satisfaction with the services they have been receiving from the consultant.

This waiver would apply only to services to be provided by NRECA, not to the joint venture of NRECA/CAI. The engineering services which have been provided by CAI can be provided by other firms. In this case the Mission is asking NRECA for a subcontracting plan for these services of which at least 20 percent are to be furnished by minority firms, thus supporting Gray Amendment purposes.

Justification and Authority: Handbook 11, Chapter 1, Section 2.4.2.5 a provides that competition in the procurement of services may be waived and negotiation with a single source authorized when:

> "Adherence to competitive procedures would result in the impairment of the objectives of the United States foreign assistance program or would not be in the best interest of the United States."

The RE-III Project, like the predecessor RE-I and RE-II Projects, adopts the American model of rural electric cooperatives as the basis for design and operation of the PBS's in Bangladesh. The other several donors and the Bangladesh Government have agreed to fund the expanded rural electrification program in Bangladesh in large part because the NRECA consultants have consistently demonstrated the management and technical expertise necessary to introduce and develop the REA system of rural electric cooperatives in Bangladesh. The NRECA staff thus have the specialized skills required to apply the electric cooperative

model to rural Bangladesh and are recognized as predominant experts by both the BDG and the donors. The BDG has requested that NRECA continue to provide TA for the life of the RE-III contract, and any disruption in the continuing relationships which have been established could endanger the progress which has been made. Adherence to competitive procedures would cause disruption, even if the award were eventually made to NRECA. Such a disruption would impair the objectives of the foreign assistance program.

Recommendation: That you approve a waiver of competition to permit the Rural Electrification Board of Bangladesh to procure the required technical and managerial services for the Rural Electrification III project on a sole source basis from NRECA.

Approved: Marshall Brown

Disapproved: _____

Date: May 15, 1986

Clearances:
GC:HMFry — Date 5/12/86
M/AAA/SER:JOwens — Date 8/6/86

DRAFTED:ANE/PD:GGeorge:07/15/86:#0952n:EXT:647-2476
REDRAFTED by GC/ANE, JSilverstone:7/30/86:paj EXT 647-6504

Clearances:	
DAA/ANE:JNorris	
ANE/PD:PBloom	(draft)
ANE/PD:RVenezia	
ANE/PD/ENGR:AHotvedt	(draft)
ANE/PD/SA:PMatheson	(draft)
ANE/DP:BSidman	(draft)
ANE/TR:BTurner	(draft)
ANE/SA:PBoughton	(draft)
PPC/PDPR:LRosenberg	(draft)
SER/AAM:DMiller	(draft)

RURAL ELECTRIFICATION BOARD
BANGLADESH
ORGANIZATION CHART