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Mid-Term Evaluation of the Rural Electrification III Project in Bangladesh

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TABLE OF CONTENTS

List of Acronyms v

EXECUTIVE SUMMARY vi

FINDINGS AND RECOMMENDATIONS 1
- I. ECONOMIC AND SOCIAL IMPACTS 1
  - A. Introduction 1
  - B. Agriculture Sector 1
  - C. Industry Sector 2
  - D. Commercial Sector 3
  - E. Household/Domestic Sector 3
  - F. Social Services Sector 5
  - G. Democratization 5
  - H. Monitoring and Evaluation of Economic and Social Impacts 6
- II. INSTITUTIONAL ISSUES: FINDINGS AND RECOMMENDATIONS 7
  - A. Rural Electrification Board 7
  - B. Palli Bidyut Samity (PBS) 13
- III. REB AND PBS FINANCIAL VIABILITY AND SUSTAINABILITY 17
  - A. Introduction 17
  - B. Overview of Current PBS Financial Viability 17
  - C. Subsidies and PBS Financial Viability 19
  - D. Need for Continued Subsidies 19
  - E. Magnitude and Duration of Future Subsidies 20
  - F. Tariff Structures 21
  - G. Performance Target Agreement (PTA) 22
  - H. REB Financial Records 23
  - I. PBS Financial Records 23
- IV. TECHNICAL ISSUES 25
  - A. Introduction 25
  - B. Electrical Engineering 25
  - C. Installed PBS Plant 26
  - D. Materials 27
  - E. Procurement 27
  - F. Operation and Maintenance 28
  - G. Construction 29
  - H. Training 30
  - I. NRECA Technical Assistance 30
- V. DONOR ROLES 31
  - A. Introduction 31

MAIN REPORT 33
I. INTRODUCTION 33
A. Background 33
B. Program and Project Goals and Purpose 34
C. Evaluation Task, Objectives, and Approach 35
II. ECONOMIC AND SOCIAL IMPACTS OF RURAL ELECTRIFICATION . . 37
A. Introduction 37
B. Intended Impacts and Related Issues 37
C. Assessment of Available Economic and Social Data 39
D. Economic Impacts 40
E. Social Sector Impacts 45
F. Democratization 49
G. Monitoring and Evaluation of Economic and Social Impacts 50
III. INSTITUTIONAL ISSUES 55
A. Rural Electrification Board 55
B. Palli Bidyut Samity (PBS) 62
IV. REB AND PBS FINANCIAL VIABILITY AND SUSTAINABILITY 66
A. Introduction 66
B. Sources of Information Used For Financial Evaluation 66
C. Overview of Current Financial Viability of PBSs 67
D. Subsidies and Financial Viability 68
E. Need for Continued Subsidies 69
F. Magnitude and Duration of Future Subsidies 70
G. Assessment of Tariff Structures and Rates 71
H. PBS Dependence on BPDB Power Supplies and Transmission Service 71
I. Performance Target Agreement 72
J. REB Records 73
K. PBS Records 74
L. Conclusion 75
V. TECHNICAL/ENGINEERING ISSUES 76
A. Activities 76
B. Summary 76
C. Rural Conditions 77
E. PBS Operations 78
E. Maintenance 79
F. Theft of Equipment and Service 80
G. Construction 82
H. BPDB Considerations 83
I. External Influences 83
VI. BANGLADESH POWER SECTOR ISSUES 85
VII. DONOR INVOLVEMENT 86

LIST OF ANNEXES

ANNEX A Evaluation Scope of Work

ANNEX B Evaluation Methodologies

ANNEX C Socio-Economic Data Requested from PBS Sample Response from One PBS

ANNEX D Discussion of Employment Displacement Impacts of Mechanized Rice Hullers

ANNEX E Average House Wiring Costs for Domestic Consumers

ANNEX F Proposed Monitoring and Evaluation System for Social and Economic Impact of RE

ANNEX G Suggested Elements for REB Organizational Review

ANNEX H Women's Employment Statistics for REB

ANNEX I Responses of PBS Management staff on Issues and Directions of PBSs

ANNEX J PBS Financial Data

ANNEX K Selected PBS Annual Revenues and Costs

ANNEX L Jessore-2 PBS Performance Target Summary

ANNEX M Summary of PBS Annual Revenues 1985-92

ANNEX N PBS Substation/Line Construction
Annual Sector Energy Use 1981-92
Line Revenue
System Loss

ANNEX 0 Summary of Load Shedding and Interruptions of Power

ANNEX P Quantum Meter Data Collection/Display Capabilities

ANNEX Q List of Interviews

ANNEX R Resumes of Evaluation Team Members

ANNEX S Bibliography

LIST OF ACRONYMS

AAAC	all aluminum alloy conductor
ACRE	Area Coverage Rural Electrification
ACSR	aluminum conductor steel reinforced
ADB	Asian Development Bank
BDG	Government of Bangladesh
BPDB	Bangladesh Power Development Board
BSCIC	Bangladesh Small & Cottage Industries Corporation
CIDA	Canadian International Development Agency
CIF	Cost, insurance and freight
DANIDA	Danish International Development Assistance
DTW	deep tube well
FY	Fiscal Year
GDP	Gross Domestic Product
GM	General Manager
HYV	high yield variety (rice)
IDA	International Development Association
ISRT	Institute of Statistical Research and Training
KFAED	Kuwait Fund for Arab Economic Development
Km	kilometer
kV	kilovolt
kVa	kilovolt-ampere
kW	kilowatt
kWh	kilowatt-hour
LLP	low lift pump
M&E	Monitoring and Evaluation
MIS	Management Information System
MVA	megavolt-ampere
MW	megawatt
NGO	non-governmental organization
NRECA	National Rural Electrification Cooperatives Association
OCR	oil circuit reclosers
PBS	Palli Bidyut Samity (rural electric cooperative)
PTA	Performance Target Agreement
RE	Rural Electrification
REA	Rural Electrification Administration (U.S.)
REB	Rural Electrification Board
RPC	Rural Power Company
SFD	Saudi Fund for Development
STW	shallow tube well
TD	Training Directorate
Tk	taka (Bangladesh currency)
	Current exchange rate: US$ 1 = 40 taka

EXECUTIVE SUMMARY

Rural Electrification III (RE III) Project Purpose

In 1976 the Government of Bangladesh (BDG) undertook to extend electricity to rural areas. At that time, only approximately three percent of rural residents had access to electricity although 90% of the population lived in rural areas. The Rural Electrification Board (REB) was accordingly established in 1977 to implement this national rural electrification program. The REB, assisted by USAID-financed expertise from the National Rural Electrification Cooperative Association and Gilbert Commonwealth (NRECA/GC), developed a comprehensive rural electrification Master Plan. The updated plan envisaged the electrification of all rural areas in five phases by the year 2005. The plan adopted the Area Coverage Rural Electrification (ACRE) approach that involves the distribution of electricity through autonomous, member owned cooperatives, known in Bangladesh as Palli Bidyut Samitys (PBSs). All PBSs come under the aegis of the REB and required funds for establishing these are provided by the BDG and donors through the REB. The Master Plan sets a target of establishing 62 PBSs by 2005. As of 1993, 45 PBSs have been set-up with 40 currently operating.

USAID has funded three rural electrification projects, RE I, RE II and RE III, supporting the development of 17 PBSs. Since 1978, USAID's rural electrification projects have evolved in two important ways: 1) RE I and II provided technical assistance operating as direct supervisors and focused on development and construction of infrastructure. 2) RE III, which has as its purpose to develop the capability of the REB to establish self-sustaining, viable, and well managed and maintained rural electric cooperatives (PBSs), has evolved from a focus on infrastructure construction and electrical engineering to concentrate on institutional development and sustainability of the RE system. The RE III project was extended from 1991 to 1996 in order to provide the continued technical assistance needed to ensure that the REB and PBSs could become institutionally and financially viable. It was also intended that this extension would support the BDG's efforts under the fourth phase of its plan (1991-1996) to intensify service connections as well as expand into new areas.

The primary purpose of the USAID-supported RE program in Bangladesh was to develop the capability of the Rural Electrification Board to effectively provide the technical, engineering, and managerial capability and leadership necessary to establish a self-sustaining, financially viable rural electrification system of properly managed and maintained rural electric cooperatives providing reliable electric power at reasonable rates. The original project purpose was updated by USAID in 1991 to reflect system-wide rather than cooperative-specific financial and institutional sustainability.

Purposes of the Evaluation

The major purposes of the evaluation were to assess a) the impact of RE III in Bangladesh, and to the degree possible using available baseline and other data, the overall social and economic impact of RE III in promoting rural economic growth and poverty reduction, and in fostering democratic norms; and b) the managerial, financial and technical capacity of the Rural Electrification Board (REB) and its long-term viability and sustainability. The evaluation developed a set of prioritized recommended necessary actions, for USAID and REB to improve the short to medium term performance of the RE III project.

Evaluation Summary

The objectives of USAID in continuing to support technical assistance through 1996 to develop the management, financial and technical capabilities of REB and its associated rural electric cooperatives, the PBSs, are generally being met. The underlying institutional structures of the REB and the PBSs are sound, although key areas of REB management, finance and engineering need further strengthening. The financial picture of the entire system is steadily improving. Financial viability of the entire system will continue to depend on financial support from donors and the BDG for the foreseeable future.

Social and Economic Impacts of Rural Electrification

Electricity is an important factor in enhancing social and economic development in rural areas, but it is not the primary factor in the creation of new employment opportunities outside the irrigated agriculture sector. The employment creation impacts within the agriculture sector are widely varied. Although electricity is necessary as a catalyst, it is not by itself a sufficient condition for the creation of rural industries. In the household sector, relevant data does not exist to measure quality of life impacts. A direct causal link between electricity and family planning could not be established. The impact of the program on democratization at the local level has been limited thus far.

There are no mechanisms in place for the ongoing collection, analysis, and reporting of essential economic and social impact data, nor is there a plan or program for key studies, impact assessments, and program evaluations. USAID's technical assistance to date has not included support for the planning and setting-up of such a system. Baseline data collected in the 1980's was not useful and no follow-up was ever done. Monitoring and Evaluation (M&E) impacts information is essential to: a) financial forecasting; b) planning and priority setting; c) tracking and reporting benefits of the RE program; and d) case-building for government and donor funding.

- **The evaluation recommends creation of an active M&E program at REB.**

Democracy and Governance

An original intent of USAID's RE project was to encourage the process of democratization at the grassroots level through the development of PBSs. Although the institutional framework is in place to allow member involvement in the PBS, the impact of the program on democratization has been relatively limited thus far. This is consistent with the stage of evolution of the democratic experience in Bangladesh. Much of the emphasis in developing the PBSs has been given to organizational, financial and technical aspects. Ongoing PBS efforts to motivate and educate members are often focused on financial issues such as the consequences of theft on the cost of operating the PBS, or technical issues such as safety. As a consequence, members have a limited sense of the ownership concept or the democratization that is supposed to be developed through more active participation in the cooperative process.

• The evaluation recommends that the PBSs develop a more active program to promote member understanding and participation with the cognizance that cooperative member education is a long-term task.

REB/PBS Institutional Sustainability

REB has created a working system of rural electricity distribution organizations based on the Rural Electrification Administration experience in the US. REB provides critical support for the management, finance and technical operations of the PBSs. REB's management, training, finance and technical functions need strengthening to assure continued sustainability.

REB senior management report that they are functioning day-to-day in a crisis mode due to internal and external factors. The internal factors include a degree of decentralized authority among the three major departments that makes coordination difficult in some areas; high rotation rates for senior staff including at the Chairman level; the tendency of Directors to delegate decisions upward; and the lack of strategic management, analytic and forward planning skills. External factors include the refusal of the Bangladesh Power Development Board (BPDB) to turn over lines promptly and to provide sufficient and reliable power. Conditionalities sought by donors and an overall shortage of funds from internal and external sources have also slowed system development. While none of these factors alone jeopardize the viability of the organization, the combination reduces the effectiveness of overall operations. Recent proposals made internally that would increase overall personnel levels by more than 50% are largely unjustifiable and are strongly indicative of the need for an in-depth agency review.

• The evaluation recommends that REB conduct a formal, outside comprehensive organizational review to assist it in rationalizing its entire management, planning and operations functions.
• The evaluation recommends that staffing proposals (with exceptions noted in the finance, training and engineering areas) be suspended until the organizational review is completed.
• The evaluation recommends that REB with the assistance of the NRECA Advisors, initiate a substantive strategic planning process.

The PBS institutional structure and operating functions were developed from the experience of rural electricity cooperatives in the USA and are well designed for the task of distributing electricity. The PBS staffing pattern reflects an unusually efficient level of functionality when compared with power sector institutions elsewhere in the developing world. The priority need for additional staff is for increasing the number of bill collectors. The PBS General Managers (GMs) report that they would like to phase in more advanced training in personnel management, strategic planning and finance. PBS GMs would like additional local authority step-by-step. PBS management staff uniformly report that the tendency to centralize REB management functions seems to be increasing. A review of autonomy options for PBSs is currently underway at REB.

Financial Viability and Sustainability

Taken as a whole, the 40 PBSs are financially viable based on their total net income including earned interest. Based solely on operating margins, 13 PBSs are in the black and 28 are in the red. For USAID-funded PBSs alone, operating margins indicate that 11 are in the black and 6 in the red, but collectively all margins are positive when interest income is included.

Present financial criteria require annual revenues of US$ 1005 per kilometer (Km) of line. As a group the PBSs are averaging US$ 987. The actual average revenue from lines serving domestic consumers is US$ 313, leaving the balance to be made up by other customer classes. Increased intensification of existing PBSs is the priority for the near term. For further intensification of existing lines, requirements for the number of customers per Km of line have been increased from the present 22 to 50 domestic customers per Km. For expansion, these requirements have been doubled again. It is especially difficult for REB to reliably forecast whether or not these required levels can be reached due to a number of factors including the lack of detailed consumer data, the limited number of potential customers in some areas who have sufficient income to join the system, the lack of funds to procure the necessary equipment, and the continuing lack of sufficient supplies of electricity from BPDB for the existing customer base and for the entire nation.

Electricity tariffs at the PBSs average 6.5-7 U.S. cents/kilowatt-hour (kWh). Under current subsidies the average domestic consumer pays a US$ 2 per month bill. If the tariffs could be raised 30% in the 13 non-viable PBSs, they would become viable on operating

margins alone. Otherwise, the current annual subsidy required to bridge the margin gap for these PBSs is US$ 2 million. Cost of service studies should be conducted before future tariff adjustments are considered. It may be particularly difficult to raise tariffs for domestic customers given current low rural income levels. Subsidies in the form of low cost bulk power, low interest loans, and others have been required to establish the RE system and will continue to be needed for sustainability and growth of the system. At this time it is not possible to estimate the duration of subsidies from various sources for the system as a whole or PBSs individually. One recent study done by REB and NRECA indicates some PBSs may not reach break even points for 20+ years.

Management and Training

The Performance Target Agreements (PTA) that were established to provide targets for PBS management performance appear to be working well with the possible exception of the operation and maintenance (O&M) target. Since the distribution system is relatively new, there is little experience at the PBS level thus far in effectively estimating annual budget requirements for O&M, and there is a danger that the PBSs may underestimate their O&M target.

• The evaluation recommends that a summary PTA based on required and actual income be developed for use in making year-to-year comparisons of PBS achievement. Cost-of-service studies will be required in order to establish this summary PTA.

REB is understaffed and therefore unable to conduct a number of critical studies and analyses on rates, cost of service, financial forecasting, price elasticities and other topics.

• It is recommended that additional staffing and training requirements should be assessed as part of the recommended organizational review.

The REB training program for PBSs is comprehensive, but is limited by the lack of a full-time professional training staff and adequate training facilities. Training requirements for REB-PBS engineering activities are well developed.

• The evaluation recommends that additional attention be focused on operations and maintenance training.
• The evaluation recommends that as part of the organizational review, appropriate training curricula be developed to conduct a variety of financial, planning and engineering analyses.

REB-PBS Technical and Engineering

The technical and engineering functions of REB and PBS are performed with a high level of competence. Private sector consulting engineering firms have been developed to provide high quality design and construction services. The engineering environment is still

focused on system expansion and needs increasing orientation toward O&M as the PBS system ages.

• The evaluation recommends that REB conduct analyses of BPDB 33 kilovolt (kV) sub-transmission lines serving PBS substations; review BPDB grid substation capacities; and increase coordination of BPDB and PBS protective devices.

• The evaluation recommends that REB engineers receive specific training in electrical engineering applications related to network analyses, fault studies, relay protection coordination, and load flow.

The major PBS system operations problems are caused by weaknesses in BPDB's generating supply, transmission system, and substation system. As highly seasonal irrigation loads increase (representing 35% of total PBS peak demand) current problems are likely to intensify.

The materials procurement process is functioning, but is not effectively integrated from the initial system design process to the delivery of materials to the construction site. A detailed flow diagram of the procurement process is being prepared by NRECA.

• The evaluation recommends that following the completion of the flow diagram by NRECA, REB form a management oversight committee to monitor the entire procurement process on an ongoing basis and establish management performance criteria.

NRECA Technical Assistance

NRECA has successfully transferred a vast amount of information and skills to REB, PBSs and the private sector covering engineering, construction, operation, and maintenance. In addition, utility financial management skills including a sophisticated financial reporting system (Form 550) has been successfully adopted by REB and the PBSs. Most recently, NRECA has developed an accounting manual for REB. However, the development of the management and planning skills necessary to sustain the capacity of an organization to evolve and innovate over time in response to changing demands has been less successful. Progress has been slow in building the capacity within REB for strategic planning, policy, evaluation and analysis. NRECA is continuing its normal activities and has programmed updating of technical manuals and some new technical assistance activities prior to contract expiration. As PBS operations have stabilized, attention of the NRECA Advisors has been turned more to REB. NRECA has documented a number of management, finance and operations areas that need improvement.

Although the structure of the host country contract shapes the nature of the working relationship between REB and NRECA, there is a need for NRECA to refocus its efforts toward a more task orientated approach. The NRECA-REB relationship which has been very productive over the years is experiencing some difficulties that may reduce its effectiveness unless steps are taken to increase the effectiveness of communications with REB. Analyses conducted by NRECA staff should be shared and discussed with REB.

• The evaluation has recommended that NRECA become more proactive in its formal reporting and consulting process especially in the management and finance areas, and meet with REB staff on a significantly more frequent basis. USAID should monitor the situation closely to determine if communications are improving.

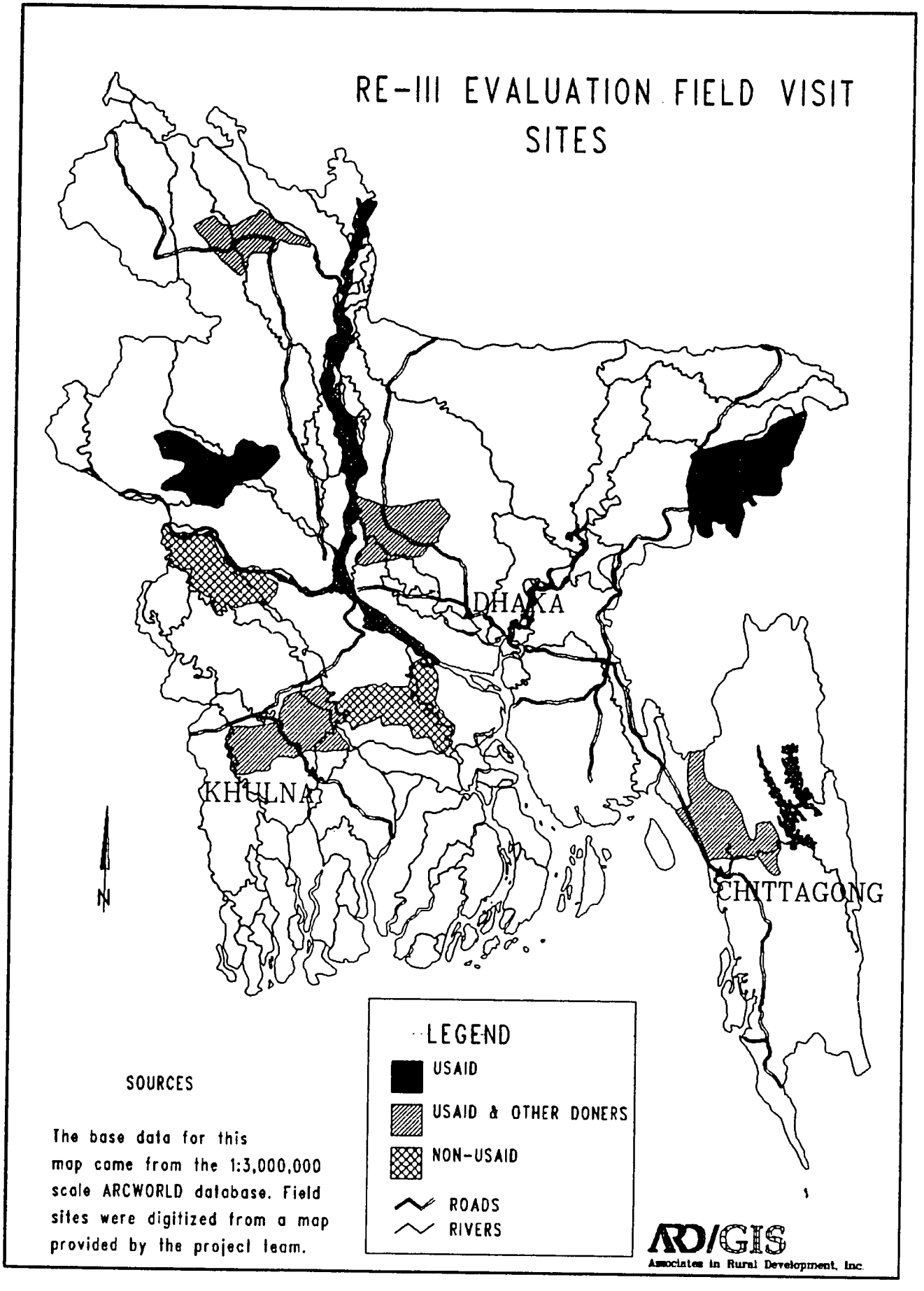
Government of Bangladesh (BDG)

BDG has limited resources with which to support the further development of the RE system nationwide. There is a process underway supported primarily by the World Bank to reorganize the power sector. Elements being addressed include unbundling BPDB into separate generation, transmission, and distribution agencies, and the development of private power. The BDG has not yet succeeded in rationalizing the BPDB and PBS distribution system to avoid wasteful investment in duplication of distribution facilities. REB has been trying to get BPDB to hand over agreed upon lines, but has been continually frustrated by BPDB inaction. The current demarcation of most industrial and municipal load centers to BPDB has significant negative financial impacts on PBS revenues.

Donors

Donor funding in the form of grants and loans for commodities continues to be critical for the development of the RE system. USAID's long-term commitment to technical assistance has been the single external key factor in the success of the REB-PBS program thus far. Internal factors have included a more or less hands-off stance by BDG and the decision to not allow unions to develop given the known impact of union activity on BPDB finance and system operation.

• The evaluation has recommended that USAID work with other donors to initiate a cooperative coordination process for ongoing monitoring of REB-PBS operations and to support continued technical assistance in the areas of REB management, training, planning, financial and engineering analysis, and PBS distribution system operations and maintenance.


RE-III EVALUATION FIELD VISIT SITES
DHAKA
KHULNA
CHITTAGONG
N
LEGEND
USAID
USAID & OTHER DONERS
NON-USAID
ROADS
RIVERS
SOURCES
The base data for this map came from the 1:3,000,000 scale ARCWORLD database. Field sites were digitized from a map provided by the project team.
AD/GIS
Associates in Rural Development, Inc.

FINDINGS AND RECOMMENDATIONS

The findings and recommendations in this report cover all aspects of REB and PBS organizations. The findings point to the need for key actions that should be taken to strengthen areas of institutional process and substance. As much as possible the recommendations have been designed to specify and therefore motivate practical action. Some of the recommendations described here have been suggested previously to REB by the NRECA Advisors. There are many more detailed recommendations that are contained in the Quarterly reports of the NRECA Advisors, especially as noted below in the recently completed study of the Tangail PBS. These recommendations indicate that a number of changes within REB and in the REB-PBS relationship should be made in order to further strengthen long-term institutional and financial sustainability for both organizations.

Priority recommendations are listed in **bold** typeface in each section.

I. ECONOMIC AND SOCIAL IMPACTS: FINDINGS AND RECOMMENDATIONS

A, Introduction

In providing electricity to rural areas, the BDG has addressed a mix of economic, social, development and equity objectives. The program's economic objectives were to stimulate economic growth and increase income and employment opportunities by providing needed infrastructure to support development in agriculture, small-scale industry and commercial sectors; its social objectives were to improve the quality of life in rural areas; and its equity objectives were to reduce rural-urban disparity. Although RE is a relatively high-cost development investment, economic, social and equity objectives are weighed against purely financial ones in deciding to extend electrification.

B. Agriculture Sector

Findings

- Electricity, by facilitating expanded use of irrigation technology, has resulted in increased agricultural productivity through: multiple cropping, net increases in irrigated acreage, and cost savings relative to diesel pumps. It has also contributed to crop diversification. Large and medium farmers have greater access to, and have benefitted to a greater extent from, electrified irrigation. Intensive agriculture has resulted in expanded employment opportunities.

- Electric powered irrigation has clear cost and convenience advantages over diesel-powered irrigation. This cost advantage is steadily shrinking due to rising tariffs. Future choice of electric vs. diesel irrigation technology and electricity consumption levels will be determined by: a) tariff levels; b) reliability of power supply during critical production periods; and c) costs incurred by consumers for replacement of stolen transformers.

Recommendations

I.B.1 That reduced cost options be developed jointly by REB/PBSs for off-season removal and storage of transformers. Costs of theft could be included in the tariff schedule rather than as a direct cost to the consumers.
Target completion date: third Quarter of Fiscal Year (FY) 93-94

I.B.2 That future tariff studies conducted jointly by REB/PBS take into account comparative cost analysis of diesel vs. electric irrigation technology, and address the differential impacts of tariff adjustments on affordability and consumption levels by different size categories of farmers. Comparative cost analyses that were done by the Directorate of Management and Operation should be reviewed and updated.
Target completion date: second Quarter of FY 94-95.

C. Industry Sector

Findings

- The majority of rural industries (other than textiles and metals) are resource-based, dependent upon proximity to sources of raw materials supply, and are located in areas where better infrastructure facilities exist. Although electricity is necessary, and acts as a catalyst, it is not by itself a sufficient condition for the creation of rural industries. This is demonstrated by the fact that a large number of electrified villages do not have a single industry.

- For certain types of industries electricity is the sole available energy option, for others it provides significant cost savings, greater operational efficiency and convenience relative to diesel as an alternative. For most smaller industries electricity accounts for, on average, 50 to 60 per cent of total operating cost. In the case of cottage industries, better lighting has extended working hours, improved product quality and contributed to increased output and profit. Given that most rural industries are small agro-processing units with few available employment opportunities, the overall employment impact of rural industrial growth is relatively small.

Recommendations

I.C.1 That future tariff studies jointly conducted by REB/PBS analyze the potential impact of upward tariff adjustments upon the viability of existing smaller industries and establishment of new industrial units.
Target completion date: second Quarter of FY 94-95.

D. Commercial Sector

Findings

- RE is not the prime factor in effecting establishment of growth centers, the initial setting-up of which depends primarily upon better road links and availability of government land for market development. RE has facilitated a significant net growth in the size of small commercial centers and in the sales of individual shops by allowing longer hours of business, attracting a number of small industries and a greater number of customers to the marketplace.

- Commercial units located in rural growth centers are typically small and their average electricity consumption is only slightly higher than that of average households. Small shop owners cannot afford the up-front wiring costs (REB reports that loans for house wiring were not successful in the past) and in a number of cases take side connections from meter-owners paying an amount higher than what their minimum bill would otherwise be. The shortage of meters throughout the PBS system for the past three years has also led to increased side connections. RE's impact on employment generation in commercial centers has been relatively small. Most of the commercial units are owner-operated and on average employ 1-3 people.

Recommendations

I.D.1 That REB reassess the interest and potential for commercial customers to take loans for wiring of shops.
Complete assessment: third Quarter FY 93-94

E. Household/Domestic Sector

Findings

Demand

- The extent of suppressed (i.e., unmet) demand on the part of rural households is vast, and large numbers of originally recruited PBS members are still waiting for connections.

- Electricity consumption by the majority of households is relatively small. On average, households consume 30-35 kWhs per month. Only affluent households, a very small percentage of the total, use any electric appliances.

Benefits

- Relevant data does not exist to measure quality of life impacts. Perceived benefits of electrification as identified by consumers were: a) better-quality lighting at a cost equivalent to or lower than that of kerosene; b) feeling of greater security and safety; c) extended study time for students; d) exposure to mass media communication and entertainment; e) opportunity for

small numbers of village women to engage in income generating activities; f) greater social status; and g) extended working hours for both women and men.

- A direct causal link between electricity and family planning could not be established. Exposure to mass media communication may have had some tangential impact.

Ability-to-pay

- In rural areas the demand for, and consumption of electricity by wealthier households is relatively price inelastic. In the case of poor households both demand for electric connections and consumption levels are highly sensitive to tariffs.

- The poorest of the poor, who constitute the majority of rural households, live below the poverty line and participate only marginally in the market economy. They do not have the ability to pay for either electricity connections or the monthly bill. Furthermore, the rate of reconnection in the case of those disconnected due to inability-to-pay was reported to be low.

Recommendations

I.E.1 In order to better assess RE impacts on quality of life and household standard of living a set of relevant indicators should be established and associated data collection and analysis undertaken as an integral component of the proposed monitoring and evaluation (M&E) system.
Target completion date: first Quarter of FY 94-95

I.E.2 That REB and PBSs reassess options for financing house wiring costs for domestic consumers.
Target completion date: first Quarter of FY 94-95.

I.E.3 Prior to any future adjustments in the tariff levels for domestic consumers, comprehensive analysis should be carried out jointly by REB and PBSs with respect to ability-to-pay of the poor and the consequent implications for consumer connections, consumption levels, and projected disconnections.
Target completion date: third Quarter of FY 93-94

I.E.4 With computerization, PBSs should set up improved monitoring of disconnections. This including: number, dates, and causes of disconnections; and number and dates of reconnection, by consumer category.
Target completion date: fourth Quarter of FY 93-94

F. Social Services Sector

Findings

- Direct and indirect social services impacts of RE are non-quantifiable. Major impacts as reported were: a) most of the secondary schools in electrified areas were electrified; primary schools were not. Electrification has not induced the operation of night schools; b) greater convenience for religious congregation in the mosques; c) few union level health centers were electrified, but the number of dispensaries in the growth centers have increased; d) an increase in the number of social and cultural clubs.

Recommendation

I.F.1 REB and the PBSs should work with Ministry of Education and Local Government to promote use of RE services to initiate night schools in existing institutions. Target completion date: fourth Quarter of FY 94-95.

G. Democratization

Findings

- Although an original objective of RE was to institute the process of democratization at the grassroots level through the development of PBSs, the impact of the program on democratization has been limited thus far. Involvement of PBS members has been confined to election of members to the Board of Directors from the 'elaka' (comprised typically of 3-4 unions which are the lowest administrative units) every third year, and participation at the annual general meetings. Attempts by PBS to motivate and educate members beyond financial and safety concerns have been limited and as a consequence, members have little sense of belonging to the PBS or participating in its affairs.

Recommendations

In order to increase member understanding and involvement in the PBS, the following structural changes should be considered:

I.G.1 Consumers in each union would elect a five member committee whose members would be trained in, and responsible for: a) educating and motivating consumers; and b) representing consumer interests at the annual general meeting.
Target completion date: first Quarter of FY 95-96.

I.G.2 Each 'elaka' would still elect a board member who would liaise with the union committee to better represent consumer interests. To develop more broad-based leadership, a system of rotational representation should be followed.
Target completion date: first Quarter of FY 95-96.

H. Monitoring and Evaluation of Economic and Social Impacts

Findings

- There are no mechanisms in place for the ongoing collection, analysis, and reporting of essential economic and social results data, nor is there a plan or program for key studies, impact assessments, and program evaluations. USAID's technical assistance to date has not included support for the planning and setting-up of such a system.

- Monitoring and Evaluation (M&E) impacts information is essential to: a) financial forecasting; b) planning and priority-setting; c) tracking and reporting benefits of RE projects; and d) "case-building" for BDG and donor funding.

- The evaluation unit within the REB Programme Planning Directorate is unable to undertake M&E functions due to its existing load of reporting requirements and other functions. The unit does not have sufficient professional staff capacity or necessary computer and technical support to carry out M&E tasks.

Recommendations

I.H.1 REB should establish an impact monitoring and evaluation system as described in Annex G.

I.H.2 That USAID and other donors make it a requirement for REB to submit a economic and social impacts report on an annual basis, and that USAID take the lead in specifying report format and content.
Target initiation date: first Quarter of FY 94-95.

II. INSTITUTIONAL ISSUES: FINDINGS AND RECOMMENDATIONS

A. Rural Electrification Board

1. Introduction

REB has created a working system of rural electricity distribution organizations based on the Rural Electrification Administration experience in the US. REB continues to provide support for the management, finance and technical operations of the PBS through a centralized management approach. REB's management, training, finance and technical functions need strengthening to assure continued sustainability.

2. General

Findings

- Although REB is able to carry out its day-to-day functions, by admission of the Chairman and Members, the organization would benefit from a formal organizational review. The current working relationship between REB and the NRECA Advisors can be character-ized as being mutually frustrating in some areas. Areas needing attention in REB planning and operations in management, finance and some engineering areas have been noted by NRECA Advisors and by a recent International Development Association (IDA) review.

- There has never been a formal, outside, comprehensive organizational/management review of REB including communications, functions, operations, and staffing requirements. NRECA Advisors have documented the need for increased coordination between REB directorates. Various departments and directorates within REB have prepared proposals for reorganization that will result in an overall increase in total REB personnel. There is insufficient justification for much of the proposed levels of staff increases without a prior organizational review.

- The original RE program goal envisioned the establishment of member-owner, locally controlled, autonomous cooperative organizations. There is little evidence of progress toward meeting this goal although REB is currently conducting a comprehensive review of the REB-PBS relationship and will consider options for increasing PBS autonomy. REB has legitimate concerns about increasing PBS autonomy. PBSs would like increased authority, but not necessarily full autonomy, in a number of areas.

- A recent in-depth study of the Tangail PBS by NRECA Advisors produced 79 recommendations for REB-PBS-action that illustrate the need for a fundamental review of the REB-PBS relationship in management, finance and technical areas, as well as highlighting areas of REB-PBS operations that need strengthening.

- Although a "Computerization Needs Analysis Report" was produced for REB and PBS in 1989, minimal follow-up has taken place at REB and no follow-up action has been taken at the PBS level.

- REB needs to increase its program for seeking donor funding for system expansion.

Recommendations

II.A.B.1 That REB senior management including Chairmen, Members and other selected staff, and with NRECA Advisors, initiate a series of working meetings to identify the strategic and program planning needs of REB in the management, finance and engineering areas. NRECA has already identified a number of issues and actions in these areas. These meetings should be facilitated with local outside professional assistance due to an acknowledged lack of a structured and productive meeting history by all concerned. Skilled local USAID personnel or local non-governmental organization could be utilized. The product of these meetings should be a detailed set of action plans identifying a schedule, responsibilities and personnel, training, and financial resources, required to develop strategic, program planning and financial capability in REB. The International Development Association (IDA) has requested that REB meet a target date of January 31, 1994 to present a program to increase its technical, financial and accounting capabilities. This team fully supports the IDA request and timeline. The working meetings should take place on a minimum once per week basis (perhaps more often initially) commencing immediately.
Initiate action plan development: immediately.
Complete action plan development: January 31, 1994.

II.A.B.2 That the Chairman of REB immediately direct the Members to put on hold proposed reorganization plans requiring the hiring of staff (with exceptions noted below) until there can be a competent outside review of staffing requirements either on an ad hoc basis or following the completion of a comprehensive organizational review.

II.A.B.3 That REB senior management meet with NRECA Advisors to identify and agree on the elements of a comprehensive organization review. The policy issue of PBS autonomy is central to this review since a policy toward increased PBS autonomy directly affects the structure, function and financial status of the entire REB organization. The REB organizational review should consider the introduction of performance standards for REB management, finance and operations personnel. NRECA and USAID, along with other interested donors, should assist REB management in identifying a qualified utility management consulting firm to conduct the agreed upon review. Funds from the REB-NRECA local counterpart or short-term specialist contract components, or from other donors, should be applied to this effort. A brief outline of suggested elements of this review is contained in Annex G.
Selection of Firm: early third Quarter FY 93-94
Initiate Review: start of fourth Quarter FY 93-94

II.A.B.4 That REB with the assistance of NRECA review the existing computer requirements of REB and the PBSs and develop an updated computerization action plan including budget, implementation schedule and training needs.
Target completion date: third Quarter FY 93-94

II.A.B.5 That REB and NRECA Advisors develop a marketing strategy, including budget requirements and identification of target markets, to increase REB's visibility among potential donors worldwide.
Complete strategy: early fourth Quarter FY 93-94
Implement strategy: first Quarter FY 94-95

3. Program Planning

Findings

- The Programme Planning Directorate has the responsibility to conduct the initial analysis of potential PBS sites including project proformas. The Directorate is understaffed and undertrained for its tasks. It has no staff currently dedicated to performing its program evaluation function. NRECA technical specialists funds could be allocated for specialized training consultants.

Recommendations

II.A.C.1 That the Planning Directorate work with NRECA Advisors to develop a workplan for increasing the capability of the Directorate including transfer of skills to prepare analyses for strategic planning, conduct M&E activities as recommended above, and to sharpen preparation of project formulation documents. This work should be coordinated and integrated with the process of the organizational review and the REB-NRECA workplan review.
Develop workplan: immediately

4. NRECA Technical Assistance Program

Findings

- Continued technical assistance by NRECA for the remaining life of the project appears critical in an number of management, finance, training and technical areas. Technical assistance has become most routinized in the technical areas. The engineering Advisors report that REB needs to expand operations and maintenance support to the PBSs. Resistance has developed at REB toward NRECA involvement in policy areas related to increased PBS autonomy. The REB-NRECA Quarterly reporting system is no longer useful. Local private sector technical assistance capability has been developed in the engineering area. No local private sector technical assistance capability has been developed in the management, training,

or finance area. Approximately US$ 350,000 remains unspent for this purpose and should be reallocated. In addition, US$ 400,000 remains unspent for short-term technical specialists.

Recommendations

II.A.D.1 That NRECA and REB should develop a new communication and reporting process in light of the large number of critical path action requirements noted above. Meetings on a variety of topics need to be held immediately on a minimum weekly basis and perhaps more frequently in the near term for some topics. Meeting agendas should be limited and agreed upon in advance. Specific meeting outcomes should be prepared for and action commitments clearly defined for both organizations.
Initiate action: immediately.

II.A.D.2 That NRECA Advisors and REB senior management should begin planning for the NRECA phase out by identifying the priority areas of REB and PBS policy, management, finance and technical activities that require NRECA assistance for the duration of the contract period. The NRECA effort should immediately be refocused toward a task orientation. A preliminary identification should be made of technical assistance requirements that are likely to be necessary after NRECA's departure.
Initiate action: immediately.

5. Training

Findings

- The staffing level of the Training Directorate (TD) has remained unchanged while at the same time the REB/PBS organization has grown from 500 to 5000 personnel; the TD cannot meet all of REB-PBS training demands. The TD with assistance from NRECA Advisors has prepared a comprehensive proposal and action plan including budget and schedule for strengthening the training program. At the core of the plan is the need for full-time professional training and curriculum staff. Continued rotation of experienced training personnel has a negative impact on training quality and effectiveness. There is an immediate priority need to bring in a Deputy Director and key staff for curriculum development. This appointment is critical because the NRECA Technical Advisor for Training is being phased out in less than one year. A new training facility is required. Some advanced training courses should be developed for personnel management, financial forecasting and management, and maintenance engineering.

Recommendations

II.A.E.1 That REB a) approve the action plan prepared by the Training Directorate and NRECA, and b) approve travel for appropriate REB personnel to visit distribution training centers in Malaysia and Pakistan to assess the equipment, curriculum and costs of operating such a training center.

II.A.E.2 That REB should authorize hiring of a) Deputy Director for curriculum development and key staff, and b) Deputy Director for logistics and staff as proposed by the Training Directorate so that training can be completed by the NRECA Advisor well before phase out.
Authorize hiring: immediately.

II.A.E.3 That REB undertake a renewed effort to secure a site for the new training facility nearer to Dhaka than Savar if possible. Other donors could be approached for financial assistance to cost share as required. If a suitable site cannot be identified near Dhaka, construction should begin immediately at Savar.
Initiate site search: immediately--to be concluded in a two month period.
Initiate facility floor plan design: immediately.
Begin facility construction: last Quarter FY 93-94

6. *Management Information Systems (MIS)*

Findings

- There is one full-fledged MIS at REB that was established to track PBS financial and energy data. It is functioning smoothly, given the large quantity of data that comes in monthly. The Training Directorate has developed an MIS to track employee training records and includes a classification system. The Engineering Department keeps computerized records of Quantum meter data, staking sheets, circuit extensions and some related data, but there is limited systematic utilization and analysis of the information that is collected for management and evaluation purposes.

Recommendations

II.A.F.1 That REB Directors work with NRECA Advisors to assess specific MIS needs for the entire organization including integration with PBS MIS needs. Some areas for MIS consideration at include: a) REB engineering should have an MIS to track a number of substation data including location, number, installation date, failure and repair information; b) REB engineering needs tracking of PBS-BPDB coordination requirements; and c) an MIS is needed to link REB procurement action with the construction and operation and maintenance schedules of PBS's. In addition, the current PBS-related MIS should produce and circulate to appropriate offices more graphical representation of data for easier monitoring and comparative analysis by management. The MIS assessment should be followed by development of data collection forms, management evaluation procedures, computer software and hardware requirements, budget and staff training requirements. The assessment should be integrated with the REB computer plan.
Assess MIS needs: 3 Quarter FY 93-94
Implement MIS systems: to be scheduled upon completion of assessment.

7. Women and Employment in REB

Findings

- Although REB has experienced a relatively high growth rate in total employment in the past several years, there is currently a lack of opportunity for upward mobility for the assistant Directors and Deputy Directors. There appears to be no specific gender bias related to this lack of mobility.

- In terms of Bangladesh social history, the current group of women in service in government agencies represents only the second generation of women to enter employment outside the domestic and agriculture sector. Although official government policy promotes an enhanced role for women in society and in the workplace, in reality, conditions for women at work are generally poor. Among several concerns, personal safety is the major factor for women considering employment in government and business organizations. REB is considered to have a relatively safe working environment for women. They also report that senior management attitudes toward women are generally more favorable than in other government organizations they are familiar with.

- REB currently has 1096 employees, 758 in approved positions and 338 in project based positions. Of the total staff, 82 or 7% are women. The minimum quota established for women in government agencies is 10% for positions above assistant director level and 15% for positions at the staff level. Based on total REB staffing levels, 6% of professional and 9% of staff level positions are held by women. Of the 82 women employed at REB, 51 or 62% hold clerk/typist positions. Of the 82 total women employees, 21 or 26% hold professional positions. Five women hold the post of Deputy Director.

Recommendations - None

8. Rotation of Staff

Findings

- There have been three REB Chairmen in the last three years. The typical three-year period of rotation of the Chairman serves to deny REB of any effective long term leadership. An analysis of the rotation period for the period 1988-1993 was conducted indicating an average tenure of 2.6 years at the Director, Deputy Director level and Assistant Director levels.

Recommendations

II.A.H.1 No practical recommendations are possible, since the rotation system is entrenched throughout the government civil service system

9. Compensation

Findings

- BDG sets the terms and conditions of REB's employee compensation package. The compensation package and general working conditions offered to REB employees appears generally to be sufficient to recruit and retain a sufficient number of staff. There are few jobs in the government sector and most people tend to stay where they are.

Recommendations - None

B. Palli Bidyut Samity (PBS)

1. Introduction

The PBS institutional structure was developed from the experience of rural electricity cooperatives in the United States. The original program objective of promoting democracy through the establishment of locally autonomous PBSs will only be achieved through an active program put forward by REB, assuming this goal is still desired notwithstanding current social conditions in Bangladesh. Without an affirmative decision by REB to support additional authority for the cooperatives, a number of the recommendations made in this report have no practical value.

2. General

Findings

- The PBS institutional structure and operating functions are well designed for the task of distributing electricity. The recently completed organization review of the Tangail PBS identifies a number of detailed recommendations for improving management, finance and technical operations that are transferable to all other PBSs. The PBS staffing pattern reflects an unusually efficient level of functionality when compared with power sector institutions elsewhere in the developing world. The only immediate needs for additional staff reported by the General Managers in PBSs visited by the Evaluation Team are for increasing the volume of bill collection and handling complaints that are usually related to accidental power outages. REB is taking action on the bill collection issue.

- REB exercises a centralized management relationship in most areas of PBS activity. Although consultations are held with PBS management and Boards about issues affecting PBS management, operations and finance, PBS management and Boards of Directors report frustration with the level of REB's operational control.

- Although a "Computerization Needs Analysis Report" was completed in 1989 for REB and PBS, no action has been taken at the PBS level. All record keeping and reporting is done by hand.

Recommendations

II.B.B.1 That REB Members and Directors review each recommendation contained in the NRECA Tangail report and then a) meet with the NRECA Advisors to discuss the potential impacts of each recommendation, b) agree on which are to be carried forward and which require additional study, c) prepare and implement action plans in consultation with PBS GMs, including responsibilities, schedules, personnel requirements, and budgets needed to implement those items that are agreed upon, and d) establish a schedule to decide on those items needing further consideration or analysis.
Initiate REB internal review of recommendations: immediately
Initiate meeting with NRECA: early 3 Quarter FY 93-94
Implement action plans: end of third Quarter Fy 93-94.

II.B.B.2 That REB review with NRECA Advisors and USAID the fundamental goal of PBS autonomy and determine the areas and schedule for which incremental authority may be granted to PBS on an individual basis. As noted in the REB Institutional Findings and Recommendations section, the resolution of this issue affects the entire REB organizational, management and finance structure.
Target completion: consistent with current REB review of PBS instructions

II.B.B.3 That REB and NRECA review the "Computerization Needs Analysis Report" and in consultation with PBS GMs, develop an action plan including budget, implementation schedule and training needs.
Complete plan: end of third Quarter FY 93-94
Implement plan: consistent with REB computerization plan.

3. Membership

Findings

- The member-owners of the PBS have limited awareness of the ownership concept that is supposed to be developed through participation in the cooperative process. There are programs to motivate member participation that are focussed on electrical safety, bill payments and illegal use of electricity. Members report dissatisfaction that they are held financially responsible for 50% of the costs of replacing PBS equipment damaged by environmental factors.

Recommendations

II.B.C.1 That REB, including the Training Directorate, and in consultation with PBS GMs and Boards, and NRECA initiate a planning process to develop a more effective member participation program to educate members about their full rights and responsibilities as owners of the PBS. The program would begin to prepare members for active and informed participation in all areas of PBS activity including policy and decisions on use of member equity. The program should include specific roles and responsibilities for REB and PBS staff and Board in carrying out this membership participation program. The program should be phased in over a 5-7 year period.
Initiate planning process: third Quarter of FY 93-94
Conclude planning process, : first Quarter FY 94-95
Begin program implementation: 2nd Quarter FY 94-95

4. Board of Directors

Findings

- Training for PBS Board of Directors covers all aspects of PBS operation, although only at the surface level. Some Board members report frustration that REB seems to make all major decisions affecting them as well as the PBS. They also report a lack of responsiveness at times from REB to Board requests or proposals.

Recommendations

II.B.D.1 Increased Board member participation will require that REB strengthen the training of existing and new PBS Board members to prepare them for a more active role in PBS governance, including increased training in management and financial evaluation techniques.
Initiate program development: early third Quarter FY 93-94
Implement program: mid-fourth Quarter FY 93-94

5. PBS Management

Findings

- PBS GMs are generally performing their responsibilities well. GMs reported that they would like more advanced training in personnel management, strategic planning and finance. PBS GM's would like to gain additional authority incrementally and have made specific recommendations to REB in the past which have not been approved. PBS management staff uniformly report that REB management centralization seems to be increasing.

Recommendations

See REB Recommendation B.2 above.

6. Women at PBS

Findings

- Typically, all three Lady Advisor positions within each PBS are not filled . There are at least two instances of women's involvement on the Board. The Lady Advisors did report that consumers in their communities approached them with problems and requests for connection.

- At the staff level, women are generally in positions of billing assistant, typist/clerk, and in some cases cashier, accounting for, on average less than one-seventh of PBS positions. Currently, there are several women Billing Supervisors.

Recommendations - None

7. Compensation

Findings

- Compensation packages for PBS employees are generally adequate to attract and retain staff. A number of GMs are concerned about the fact that although they have major responsibilities and accountability for all PBS operations they are treated as junior to all senior managers and engineers at REB. This is a factor that affects PBS employee morale.

Recommendations

II.B.G.1 That REB Member PBS and Member Finance review the compensation package for PBS employees to analyze the costs of instituting a daily allowance and/or travel allowance for extended PBS employee travel within the PBS service area. Consideration should be given to setting the PBS allowance at or near the same level as similar REB allowances.
Develop recommendation for REB Board review: end third Quarter of FY 93-94

III. REB AND PBS FINANCIAL VIABILITY AND SUSTAINABILITY:

A. Introduction

Remarkable progress has been made by the 40 PBSs which are currently supplying power towards collectively achieving financial viability. The 40 PBSs considered as a group are financially viable, earning a net margin of 10% on total operating revenue after all expenses. However, it cannot be concluded from these results that future financial sustainability is assured.

B. Overview of Current PBS Financial Viability

Findings

- The USAID financed PBSs are viable as a group for the fiscal year ending June, 1993. If PBS intensification and line expansion economic/financial criteria which were established by REB are observed and not set aside as a result of BDG political or socio-economic pressures, the USAID funded PBSs will remain financially viable in future also.

- The 40 currently operating PBSs demonstrated the following financial viability statistics based on June 1993 data. All 40 considered as a group are financially viable.

	Viable	Not Viable
17 USAID funded	13	4
8 KFAED funded	2	6
14 IDA funded	7	7
1 FINLAND funded	-	1

- Viability can be measured after income from interest earned on PBS deposits at local banks are factored in (net margins). Operating margins, i.e., net margins minus interest credit, are considerably worse for the total 40 PBSs, amounting to a loss of US$ 829,986 (or 1.7%) of operating revenues. By the criteria of operating margins, 28 PBSs are in the red and 13 are in the black. For USAID alone, operating margins indicate 11 in the black and 6 in the red. Seven of the 40 PBSs are not yet paying any interest on their long term debt. Interest earned is a legitimate source of income, so the net margin data is a valid indicator of financial viability. It is not, however, a dependable source of future income. Another important factor is the fact that several early PBSs were selected on the basis of their anticipated early viability, and the typical early PBS was less costly to construct, chiefly because of lower foreign equipment costs.

- Slightly over 48,000 Km of lines are now energized serving over 750,000 consumers. Due to disconnections, out of service connections and other temporary factors, only 622,000 consumers are served at present. Of this number, 80% are domestic consumers, resulting in a

density of only 10.5 domestic services per Km of line, and a monthly consumption of only 34 KWh or 408 kWh/year. Total system losses averaged 15% in 1993.

- The intensification and expansion phases are expected to improve the economic viability of the PBSs as a group and of most individual PBSs. Intensification is the current priority through the end of 1997. Expansion of PBSs will take place later in Phase IV, when eight PBSs will be added, and then an additional four or five more to reach a total of 53 or 54 PBSs.

- For the intensification phase, more stringent economic criteria have been developed than used at present to justify addition of consumers. At present the criteria are in terms of expected required revenues per Km of line, which average US$ 1000. The PBSs as a group are currently averaging US$ 987, resulting in a small negative operating margin of US$ 830,000, or 1.7% of annual revenues. This loss is not uniform over all PBSs. The annual average operating revenue per Km of lines from domestic accounts is US$ 313, leaving the balance to made up from other customer classes. For the intensification program required revenue criteria have been sharply increased, up from approximately 22 customers to 50 domestic consumers per Km, or one deep tubewell or four shallow wells per Km of additional line.

- For the expansion phase these requirements have been doubled to 100 domestic consumers per Km of additional line, two tubewells, or eight shallow wells. It is most likely that the present set of compromising factors will continue to impact the intensification and expansion phases.

- There are several unresolved issues that have impact on PBSs' finances. BPDB claims that they have received no payment for lines turned over to PBSs and that the amount due to them is US$ 10 million (400 million Tk). The value of these lines are under dispute by REB and BPDB. Also, BPDB claims that uncollected BPDB accounts are not being turned over to them by PBSs after line turn-over. PBS collect these accounts where possible and remit the funds to BPDB. Many BPDB lines are in need of total rehabilitation, which has to be financed by REB after being turned over to the PBSs.

Recommendations

III.B.1 That REB complete its review of the draft revolving fund submitted by NRECA Advisors and assess the benefits and costs of establishing a fund to utilize PBS surplus revenue for a number of investment options. Upon completion of the review, develop a detailed action plan for implementing the recommended approach.
Complete review: third quarter FY 93-94
Implement action plan: fourth Quarter FY-93-94

C. Subsidies and PBS Financial Viability

Findings

- There are five subsidies involved in transactions between BDG, REB and PBSs. These subsidies played a key role in establishing the RE program in Bangladesh and they must continue at some level to assure future financial viability for the overall program. These subsidies include:

  a) BPDB claims to sell power to REB below its cost of generation because it absorbs the exchange rate losses on its debt to the BDG. This subsidy is estimated to amount to 0.3 Tk/kWh or approximately US$ 5.8 million annually. If PBSs had to pay for this loss it would wipe out their positive net margin. REB disputes BPDB's costs and believes the PBSs are being overcharged.

  b) The 5-year grace period given by BDG to REB for loans that are on-lent to PBSs can be characterized as a subsidy.

  c) The low interest rate terms of the loans by the World Bank and other lenders are a subsidy.

  d) The loans from BDG to REB are at a fixed rate of exchange with the BDG absorbing the exchange losses.

  e) BDG makes local currency grants to PBSs for some incurred expenditures.

REB and PBSs continue to make debt service payments on some loans which have been converted to grants which could be viewed as a reduction in subsidies.

Recommendations - None

D. Need for Continued Subsidies

Findings

- A number of factors can adversely affect the future financial viability of PBSs during their further intensification and expansion plans for new PBSs. The key factors include:

  a) Very small monthly revenues are earned by PBSs from domestic consumers. In a typical PBS such as Chittagong-1, 80% of the consumers yield 20% of the revenues from the sale of electricity and 20% of consumers yield 80% of the revenues. The average consumer pays a monthly electric bill of less than US$ 2 (minimum monthly bill is US$ 0.89 or 35 Tk). Future service connections in increasingly economically marginal rural areas could worsen this pattern.

b) PBS load factors are very low, due to consumers having to economize on consumption of electricity and the shortness of the irrigation season (4-5 months). Irrigation loads are typically the largest loads (although seasonal) in many PBSs.

c) Declining, but still too high, loss ratios due to a variety of socio-economic problems including meter tampering, illegal connections, and non-payment of bills.

d) Inability to raise commercial and industrial power rates because these are already at fairly high levels by international standards (US$ 0.065-.07/kWh). In Dhaka, for example, large industrial users use the Dhaka power supply system for stand-by power and generate their own electricity because it is cheaper and more reliable for them to do so.

Recommendations - None

E. Magnitude and Duration of Future Subsidies

Findings

- Analysis of typical PBS rate schedules indicates that domestic and irrigation consumers are the most costly to serve, the former because they pay so little per domestic account and the latter because they have such a poor load factor. Examining a typical non-viable PBS (Pirojpur - Kuwait Fund for Arab Economic Development (KFAED) sponsored) indicates that it had a negative net margin of US$ 137,000 in 1993, or close to half of its operating revenue. Therefore, if it were possible to increase rate schedules by approximately 30% it would break even. But this may not be feasible due to low income levels of most domestic consumers. There are 13 PBSs with comparable deficits. The combined deficits of these 13 PBS require a an operating subsidy of approximately US$ 2 million per year that appears to be financed from depreciation allowances incorporated in the tariffs.

- There has been a slightly rising trend in annual revenues per Km of line per years. Yet this has not produced a sufficient number of financially viable PBSs. As more low monthly consumption domestic consumers and irrigation consumers with low annual load factors are added, the outlook is for the ratios of achieved revenues per Km of added line versus required revenues to worsen. The magnitude of this effect can only be estimated accurately as a result of cost of service studies for PBSs for which demographic and industrial development data is available.

- It is not possible to estimate the duration of subsidies for the system as a whole or individual PBSs. One study indicates no break-even point for an individual PBS for 20+ years. The original assumption that five years after their formation most PBSs would be viable, given the initial subsidies and a grace period, was optimistic. Any lasting improvement in PBS

financial viability can only be achieved as a result of growth in rural per capita Gross Domestic Product (GDP).

Recommendations

III.E.1 That REB test these assumptions through the studies which are noted below in the tariff section.

F. Tariff Structures

Findings

- Energy charges (kWh) are high by developed world standards but demand charges are very low or even nominal (US$ 0.25 or 10 Tk/kW/month) for both BPDB and PBSs. By comparison, typical demand charges in the U.S.A are in the US$ 5-10/kW per month range. BPDB does not impose any demand charge on its sale of energy to REB.

- PBSs utilize seven rate schedules as compared with nine for BPDB. There are significant differences between many of the individual PBS tariffs and each tariff is custom designed and updated annually. Since there are 40 PBSs and seven customer categories a large number of tariffs potentially need to be reviewed and fine-tuned annually. The two person REB Rate-Cell is greatly understaffed. The IDA review determined that the entire finance planning and forecasting capability of REB needed strengthening and has required action by January 31, 1994. The proposed reorganization of the REB Finance Directorate includes the formal establishment of a Financial Planning Directorate with appropriate staffing levels.

Recommendations

III.F.1 That REB Member Finance work with NRECA Advisors to develop an action plan to meet IDA requirements including a description of tasks, schedules, personnel, training and budget requirements.
Initiate action plan development: immediately
Complete action plan development: no later than January 31, 1994

III.F.2 That REB immediately approve the establishment of the Financial Planning Directorate, or if this not possible in the short-term, REB should staff-up the existing Rate Cell with seven new professional positions according to the currently proposed reorganization plan.
Target date for new staffing: third Quarter FY 93-94

III.F.3 That the existing Rate Cell (with additional staff) or Financial Planning Directorate initiate the following actions which are consistent with the major tasks that must be undertaken by the Financial Planning Directorate. The proposed organizational review should recommend detailed tasks for the Financial Planning Directorate:

a) **Cost-of-service studies for each PBS by rate category;**

b) **Financial forecasting in the 1-5 year range;**

c) **Price-demand elasticity and hurdle rate determination, i.e., hurdle rates are those at which large consumers use self-generation and co-generation if reliability and availability of power are adequate;**

d) **Required revenue optimization studies for each PBS, i.e., what does it cost to add customers who do not provide their share of the cost of serving them;**

e) **Stand-by power cost rates; and**

f) **Estimates of cost of subsidies for alternative PBS intensification and expansion scenarios.**

G. Performance Target Agreement (PTA)

Findings

- REB has developed a sophisticated and comprehensive set of performance targets numbering 16 for group I PBSs (most successful), 18 PTAs for group II and 6 for group III. The management of the PBSs generally acknowledge the usefulness of the PTAs. Statistically, more than 3/4 of PBSs are meeting their targets.

- There is one significant problem with the PTA for operation and maintenance: there is little experience at the PBS level to properly estimate annual budget requirements for O&M. Requirements for O&M spending may need to increase from year to year.

Recommendations

III.G.1 That REB develop a summary PTA for year-to-year comparisons that unifies the 16-18 PTA elements into a single number. The current PTA format does not give a good idea of the combined effect of the individual variables. This summary would involve a calculation of variance between revenue required from each customer class and actual obtained. This calculation should be done in constant Tk as well as current Tk. Constant Tk will show progress made from year to year in closing the required revenue gap and current Tk measures the actual deficit or surplus. This summary can only be implemented after cost-of-service studies in the PBSs for each of the seven classes of consumers have been completed. Initiate summary system: consistent with schedule to be determined for conducting cost-of-service studies.

H. REB Financial Records

Findings

- The accounting forms, methods used to collect the data and interpretation of results were all judged to be performed to high professional standards. Emphasis in all this accounting effort was on current data, historical data and annual data. Projected and forecasting analyses were lacking or only made for short periods ahead. REB voucher processing is now claimed to be up-to-date with 5000 vouchers being logged each month with no backlog.

Recommendations - None

I. PBS Financial Records

Findings

- Computerization is absent resulting in large volumes of stored paper records, less economical use of clerical labor and other resulting inefficiencies. PBS meter reader records were comprehensive and well designed. Billing procedures are prompt and thorough. Follow-up on unpaid accounts is limited in many PBSs due to insufficient collection staff, although REB is acting to increase staff. In many PBSs, thousands of delinquent accounts exist. Timely recording of procurement and continuing property records at the PBS level are satisfactory. Close-outs of construction contracts has apparently lagged, leading to postponement of depreciation accounting and other errors. Corrective action has been instituted recently.

- Annual operation revenues and expenses are sufficiently detailed and include breakdowns of all line items except PBS amortization payments which are combined with depreciation figures. It was not possible to follow loan repayments at the PBS level since amortization data was not disaggregated in the information reviewed. REB's records, however, show amortization amounts received from PBSs to be in the US$ 5 million/year range and will need to increase in future years. Balance sheet data show that total investment in total PBSs utility plants and other assets are in the US$ 325 million range, to which accumulated depreciation, work in progress by REB, but not yet transferred to PBSs, and working capital are added.

- While there is good agreement between balance sheet items in the PBSs records and the corresponding REB annual report line items and in the loan portfolio analysis of REB, there is no similar analysis of loans received from BDG to REB for the RE program. It was noted that REB's annual operating budget is US$ 2.25 million of which US$ 500,000 is obtained from the 1% mark-up in interest charged to PBSs for on-lent funds and US$ 1,750,000 comes from BDG authorized allocations from REB constructions projects prior to their being turned over to PBSs after completion.

Recommendations - None

IV. TECHNICAL ISSUES

A. Introduction

Starting with the first consumer in 1982 and building a viable, well-engineered and constructed distribution plant to serve 800,000 consumers in 1993 is a remarkable achievement, particularly in the rural areas of Bangladesh where climate and accessibility are formidable obstacles. In addition, the RE program has assembled and trained professional, technical staff at REB and PBSs, and developed private sector capabilities to engineer, construct, operate and maintain a vast electrical distribution plant.

B. Electrical Engineering

Findings

- The evaluation team found competent engineers in REB engineering directorates. Consulting (retaining) engineering firms are well informed and engaged in designing, surveying, staking and mapping PBS distribution lines and services. PBS engineers are not involved in line design and related activities. Logical system engineering is often hampered by BPDB service areas mixed within the PBS service area, resulting in duplication of lines and substations.

- Discussions with REB, PBS and consulting engineers indicated that engineering is focused on PBS distribution systems beginning at PBS substations and ending at consumer meters. More attention needs to be given to the BPDB grid substations and 33 kV transmission lines that provide electrical service to PBS substations. Just as REB has been forced to maintain and in some cases re-build BPDB 33 kV sub-transmission lines, it must now make a more comprehensive study of the capabilities of BPDB substations.

- Each PBS substation receives electric service from BPDB through a 33 kV sub-transmission line. In many instances, the 33 kV transmission lines cannot properly serve the PBS electrical loads for such reasons as excessive length and small wire sizes. Often, the 132 kV to 33 kV transformers in the grid substations do not have sufficient capacity to serve PBS loads.

- Electrical fault protection devices in the grid substations must coordinate with PBS fault protection devices. Fault protection devices include circuit breakers, fuses, oil circuit reclosers (OCRs). Protective devices must operate selectively, e.g. a 240 volt fuse in a home should 'blow' before an 6.35 kV transformer fuse 'blows'. The 6.35 kV transformer fuse should 'blow' before the OCR serving large numbers of transformers operates. Coordination studies are rarely done for interconnections between BPDB and each PBS substation.

Recommendations

IV.B.1 That the REB Systems Engineering and Planning Directorate analyze 33 kV sub-transmission lines serving PBS substations, review BPDB grid substation capacities, coordinate BPDB and PBS protective devices, and make recommendations for improvements.
Target Completion Dates: first analyses and report complete second Quarter FY 94-95
Complete analyses and reports: first Quarter FY 96-97

IV.B.2 That REB employ ten additional engineers to perform the above analyses.
Target completion date: third Quarter FY 93-94

IV.B.3 That NRECA develop a list and budget (with options) of recommended hardware and software for electrical engineering. Hardware includes PC type computers with Intel Pentium micro-processors, plotters, and laser printers. Software programs for electrical engineering applications include network analyses, fault studies, relay protection coordination, load flow, spread sheets, computer assisted design and drafting, data base, and statistical analyses.
Target completion date: third Quarter FY 93-94

IV.B.4 That NRECA and the REB Training Directorate should develop training programs and employ full-time trainers to train REB engineers in the use of hardware and software purchased for electrical engineering.
Target completion date: fourth Quarter FY 93-94

C. Installed PBS Plant

Findings

- PBS substations have sufficient capacity to serve existing loads with an allowance for future growth. Substation designs are robust and include provision for future additions. Quality of substation construction is good. Weaknesses include: use of three (3) each single phase oil circuit reclosers (OCRs) on three-phase feeder circuits; some 33 kV potential transformers (PTs) are installed on the line side of station incoming line load break switches. The use of 33 kV reclosers in lieu of power fuses in a new substation is an improvement as is the plan to install a shared Quantum meter to monitor 11 kV distribution feeder circuits from substations.

- 33 kV, 11 kV and 230/400 volt lines are installed to meet construction standards and good practice. In very few instances, inadequate clearances from 11 kV lines were noted over bazaar shops and fields. Service installations are adequate. Orderly service drops from poles to meters are difficult to attain in crowded bazaars. The method of connecting large numbers of service drops at a single service pole deserves additional design consideration of standard

service assemblies. Takeover of existing BPDB lines has been accompanied by upgrading, re-building, and converting to 4-wire operation from 3-wire operation.

- Records of PBS plant including maps, staking sheets, and transformer data cards are all satisfactory. Buildings and covered storage facilities are adequate and well maintained. Parts, materials, and equipment storage are organized by type and size. Storage facilities are secured with locks and have security lighting.

Recommendations - None

D. Materials

Findings

- The quality of materials is good. Exceptions to this general observation include meters and transformer finishes. The use of local wood poles has proved unsatisfactory. Material quantities are adequate for project funded construction, but are not adequate for continuing maintenance requirements. This is particularly true in the more mature PBS operations where the initial stock of spare parts has been utilized. Single phase residential meters are not available to connect new services. This problem has existed for about one year and is in the process of being resolved. A quantity of slow moving stock exists at PBSs. Political/commercial pressures and donor agency requirements have affected material specifications, supply, and use.

Recommendations

IV.D.1 That REB solicit a list of slow moving stock items and quantities from each PBS, provide a summary inventory of dead stock items to donor/lending agencies, and seek permission from respective donor agencies to distribute slow moving items to those PBS operations which can utilize slow moving items.
Target completion date: first Quarter FY 94-95.

E. Procurement

Findings

- In general, REB procurement is adequate. The entire system for procurement monitoring, tracking and planning purposes is not fully integrated, although some parts are well managed such as the materials accounting component, warehouse control and storage, and transportation to site. The entire process is influenced by external factors. The most serious procurement failure that has occurred has been the lack of meters to hook up thousands of PBS customers. Local meter manufacturers took legal action resulting in a court injunction barring the importation of foreign-made meters for almost two years.

• REB has requested that NRECA develop a flow diagram to illustrate the necessary relationships in the entire process, especially the activities that must occur in parallel to make the system function as intended. It is assumed that the typical procurement process takes about 14-18 months, which is not an unusual period of time for international procurement.

Recommendations

IV.E.1 That NRECA complete a flow diagram illustrating the entire procurement process including timing, decision and monitoring relationships.
Complete flow diagram: end of second Quarter FY 93-94

IV.E.2 That REB form a committee to monitor the entire procurement process and establish management performance criteria with the assistance of the NRECA Advisors.
Develop performance criteria: immediately
Establish monitoring process: beginning third Quarter FY 93-94

IV.E.3 That REB develop a fully computerized inventory control with computerized purchasing documents taken-off from distribution design drawings.
Target initiation: consistent with IV.E.1 above and computer action plan

F. Operation and Maintenance

Findings

• Operations suffer from excessive BPDB load shedding (blackouts) and excessive BPDB voltage fluctuations. Neutral conductor theft from 11 kV lines is a major deterrent to safe, proper operation of PBS electrical systems. Transformer theft is also a problem. Service disconnects are often delayed by abusive customers.

• Preventive maintenance is delayed during the monsoon season. Repairs required to maintain operation are not delayed. Repair problems are reported by consumers to complaint centers and meter readers are trained to recognize conditions requiring maintenance and/or repair. Efficient and timely dispatch of line crews is hampered by transportation and communication difficulties. REB has initiated a program to supply portable radios to line crews. One PBS annually programs 10% of its distribution lines for detailed inspection and maintenance (climbing poles, tightening hardware, replacing materials as necessary). This activity should be replicated in all PBS operation and maintenance (O&M) programs. This is recognized by the REB O&M Directorate which is preparing an O&M manual for PBS guidance. PBS preventive maintenance consists mainly of clearance activities along rights of way to keep plants and trees clear of 11 kV distribution lines.

• Each PBS should include 33 kV sub-transmission lines in maintenance programs. Maintenance repairs are currently done on a worst case basis where lines are severely deteriorated. REB should take responsibility for these lines to insure reliable service.

Substation maintenance is performed annually by REB with PBS assistance. The are 110 substations. REB does not have enough staff and equipment to perform detailed annual maintenance for all substations. New REB workshops for major equipment repair have been approved.

Recommendations

IV.F.1 That REB require PBSs to implement ground line inspections, supervise initial ground line maintenance and require PBS ground line maintenance reports. Target completion date: all poles should receive initial ground line inspection and required treatment 10 years after installation and no later than 12 years after installation.

IV.F.2 That REB review personnel and equipment requirements for annual detailed maintenance of all substations and provide needed personnel and equipment. That all substations receive thorough annual inspection, repair and maintenance. Target completion date: annual and ongoing

IV.F.3 That REB provide portable and base station radios to each PBS for line crew communication and dispatch.
Target completion date: first Quarter FY 94-95.

G. Construction

Findings

- The Projects Directorate has programmed nearly 6000 Km of line construction for this fiscal year the majority of which must be constructed during the five month dry season. REB executes unit price contracts of predetermined quantities for line construction with local contractors. Contractor personnel have been trained by REB and are pre-qualified by REB. Construction is performed in discrete increments defined by staking sheets. Staking sheets are prepared by consulting engineers. REB, PBS and consultants jointly participate in acceptance inspection and inventory of completed portions of contracts. Material disbursement/return is balanced against an inventory of installed material.

- In more mature PBSs where new construction is minimal, retaining engineering consultants may not be required on a full-time basis for system design. However, their services still provide an important function as a third party check in the design process. There is a small risk that if consultants are not retained, they may not be available when needed during times of increased work loads, although there appears to be sufficient numbers of engineering companies available to do the work. The option of letting some full time retaining engineers go may lead the way to the use of PBS personnel for design activities and construction as well.

Recommendations

IV.G.1 That REB utilize engineering staff and line crews at selected, mature PBSs for the design and construction of line and service extensions. The objective is to obtain cost and quality comparisons between PBS and private sector engineering and construction work. Target completion date: first Quarter FY 94-95.

IV.G.2 That REB consider the financial benefits and costs of introducing a modified contracting option for consulting engineers in PBSs with no active construction programs. Target completion date: consistent with Tangail report action plan development schedule in PBS Institutional Recommendation II.B.B.1

H. Training

Findings

- REB, with technical assistance from NRECA, has developed comprehensive technical training courses with discrete and general application for consultants, engineers and craftsmen. Training is well regarded by those trained. The Training Services Section, which deals with course development and student/facility logistics, is understaffed and numerous new positions are required and proposed.

Recommendations

IV.H.1 That REB approve the proposal and action plan prepared by the Training Directorate and NRECA.
Target date: schedule consistent with REB Training Recommendation II.A.E.1-3.

IV.H.2 That REB develop a program mix of offshore visits to utilities in various countries, local seminars, selected technical assistance, membership in international technical societies, attendance at international technical shows and conferences, subscriptions to technical and engineering periodicals, technical libraries, and similar activities to promote awareness of world wide electrical utility practices in engineering, operation, construction and maintenance. Target date: ongoing

I. NRECA Technical Assistance

Findings

- NRECA has successfully transferred a vast amount of information and skills to REB, PBSs and the private sector covering engineering, construction, operation, and maintenance. NRECA is continuing its normal activities and has programmed updating of technical manuals and some new technical assistance activities prior to contract expiration.

Recommendations - None

V. DONOR ROLES

A. Introduction

The initiation, operation, and future expansion of the RE system in Bangladesh is dependent upon continued bilateral and multilateral donors for the foreseeable future. Much of the donor community has depended upon USAID and its technical assistance provider NRECA, to monitor the ongoing operation of the REB-PBS system. With this support being phased out in 1996, other donors will need to reassess their involvement in continuing to monitor and evaluate progress of the overall system.

Findings

- USAID is the only donor agency that has maintained an ongoing relationship on a near daily basis with the REB-PBS system. The World Bank and IDA have conducted periodic reviews of the program in keeping with its monitoring and evaluation function related to its lending programs. Bilateral donors in general have focused their attention on the PBS level where their funds are being invested.

- During the period of this evaluation, IDA suspended US$ 25 million in unspent project funds with REB. IDA has requested a comprehensive action plan from REB as to how it will develop its technical, finance and accounting planning capabilities by January 31, 1994. It has also requested that REB complete its final version of the draft accounting manual by December 31, 1994. In addition, IDA has challenged the BDG over the issue of the continued duplication of BPDB and PBS distribution system. IDA has required that prior to future expenditures of its funds, it must review and will only approve investments in areas where duplication is not found.

- A recent draft report prepared by Danish International Development Assistance (DANIDA) consultants concluded that they would recommend an approximately US$ 20 million investment for intensification in two PBSs. DANIDA was also concerned about PBSs meeting their revenue requirements due to low revenue per customer and the need for cost-of-service studies and were continuing to examine the management environment at REB.

- The Asian Development Bank (ADB) has proposed an intensification project for US$ 30 million and a generation project. Several other donors do not support the ADB proposal for a generating company with REB involvement, believing it would divert REB attention and resources from its primary objectives.

Recommendations

V.A.1 USAID-Bangladesh should organize and host a meeting of major donors to discuss the implications of this report, the recent IDA Aide Memoire, and the DANIDA Aide Memoire. The meeting should include a detailed report given by the NRECA Advisors on

their work with REB to develop priorities for NRECA involvement during the phase-out period and what future technical assistance needs have been identified.
Hold donor meeting: early third Quarter FY 93-94

V.A.2 That all donors should cooperatively develop an ongoing monitoring mechanism to track progress on the operational effectiveness of the management, financial, and technical components of the REB-PBS system. Although structured donor cooperation is often difficult to achieve in practice, there must be an extra effort made by donors in this situation to work together given the need for REB institutional strengthening and the impacts of continued government and power sector evolution.
Complete development of donor monitoring system: March 1996
Implement monitoring system: July 1996

MAIN REPORT

I. INTRODUCTION

A. Background

In 1976 the Government of Bangladesh (BDG) undertook to extend electricity to rural areas. At that time, only approximately three percent of rural residents had access to electricity although 90% of the population lived in rural areas, and agriculture accounted for approximately 60% of the GDP and 75% of the labor force. It was intended that provision of this essential development infrastructure would significantly improve the quality of life of rural residents and stimulate growth of the productive economic sectors - agriculture and small industries. It was also expected that provision of electricity would reinforce various planned development programs aimed at poverty alleviation. These goals were also consistent with national energy policies to replace imported oil by indigenous gas or electricity. The program therefore addressed a mix of economic, social, and equity concerns.

The Rural Electrification Board (REB) was accordingly established in 1977 to implement this national rural electrification program. The REB, assisted by USAID-financed expertise from the National Rural Electrification Cooperative Association and Gilbert Commonwealth (NRECA/GC), developed a comprehensive rural electrification Master Plan. This plan envisaged the electrification of all rural areas in five phases by year 2005. The plan adopted the Area Coverage Rural Electrification (ACRE) approach that involves the distribution of electricity through autonomous, member owned cooperatives, known in Bangladesh as Palli Bidyut Samitys (PBSs). All PBSs come under the aegis of the Rural Electrification Board and required funds for establishing these are provided by the BDG and donors through the REB. The Master Plan sets a target of establishing 62 PBSs by 2005. As of 1993, 45 PBSs have been set-up.

USAID has funded three rural electrification projects, RE I, RE II and RE III, supporting the development of 17 PBSs. RE I and RE II focussed on development and construction, while RE III focuses on institutional development and sustainability. USAID's project was extended from 1991 to 1996 in order to provide the continued technical assistance needed to ensure that the REB and PBSs could become institutionally and financially viable. It was also intended that this extension would support the BDG's efforts under the fourth phase of its plan (1991-1996) to intensify service connections as well as expand into new areas.

While USAID was the sole donor financing RE at its start, the program's successes over the years and its obvious benefits have attracted a large number of donors. To date, other donors have committed more than US$ 357 million to the program, bringing donor commitments, including USAID's US$ 179 million, to more than US$ 630 million. In addition to USAID, IDA, KFAED, Finland, ADB, CIDA (Canadian International Development Agency), SFD (Saudi Fund for Development), and Japan are also active. Denmark is now considering investing in the program.

B. Program and Project Goals and Purpose

The overall goal of the RE III project is to improve the standard of living and quality of life in rural Bangladesh. The project purpose, (as updated in 1991) is:

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

USAID's programmed interventions have created two major shifts in program emphasis: 1) a shift from a direct supervisory role with USAID as the sole or main donor to a focus on technical assistance through a host country contract between REB and NRECA, with USAID as a minority donor and monitor, and 2) a refocussing of efforts from infrastructure and electrical engineering to a concentration on institutional strengthening and sustainability.

Until 1989 it was assumed that all rural electric cooperatives should be required to meet the same criteria for financial viability and managerial soundness. However, a USAID-sponsored review of the cooperatives financial policies and performance conducted in that year showed that the operating circumstances of cooperatives varied widely, making it possible for some to exceed uniform targets easily, while others struggled to achieve them on a regular basis. This finding led to a focus on achieving institutional and financial sustainability of the RE/PBS system as a whole rather than on a cooperative-by-cooperative basis.

The major purposes of the 1991 RE III supplement were to allow an extension of the technical assistance work by NRECA, update the project purpose to reflect system-wide realities as noted above, provide for two evaluations (in 1993 and 1996), provide for a series of financial reviews, and discuss life-of-project funding issues.

RE III is consistent with, and directly supportive of, USAID's overall program and strategy. The overall goal of the USAID Bangladesh program is one of poverty alleviation. Its program focuses on three related sub-goals, including achievement of: 1) sustainable economic growth and efficient resource use; 2) improvement and protection of the human capital base of the poor; and, 3) enhanced access to institutions of democratic governance.

The program objective for the first sub-goal is: increased productivity and competitiveness in agriculture, finance and industry. RE directly addresses this objective by providing rural infrastructure essential to support development of agriculture and small industry. The program objectives for the second are: increased availability of basic human services for the poor; and reduced fertility, infant and child mortality. RE indirectly supports these objectives by improving facilities of social and health care institutions, and enabling access to mass media communications. The program objective for the third is: increased accountability for a democratic government. RE supports this objective by supporting participation in decision making and the democratic process through the PBSs.

The project is on track to achieve its implementation goals. The requirement of in-country, intensive, long-term technical assistance by an experienced organization has been critical to the success of the project thus far. USAID's long term commitment to the project had also been critical to success. Assumptions made about the schedule on which the cooperatives were expected to achieve financial viability proved optimistic given rural social and economic conditions. Likewise, assumptions about the impact on democracy through participation in cooperative enterprises were optimistic given social, cultural and political conditions in Bangladesh. A major weakness of the program is the failure to effectively evaluate the socio-economic impacts of the RE program. Although studies have been initiated, no follow through has been carried out.

C. Evaluation Task, Objectives, and Approach

The evaluation task was to carry out a mid-term evaluation of RE III project impact and progress toward achievement of project purpose. The objectives of the evaluation were to:

1. Enable USAID and the REB to assess the progress and examine the results of the project to date in relation to project purpose and planned program outputs.

2. To assist USAID and the REB to identify short and medium term changes to project strategy, areas of focus and implementation activities that are essential to improving project performance and the institutional development and the long term sustainability of the REB.

3. To assist the Bangladesh Government in considering longer term directions and options for rural electrification in Bangladesh.

The team composition included five expatriates: one institutional analyst, two utility specialists, one financial analyst and one evaluation specialist and two Bangladeshis including one evaluation specialist and one utility specialist.

Evaluation work began in Dhaka September 22, 1993 by the two evaluation specialists with collection of materials and preparation of the evaluation framework. The full team began work in Dhaka on October 6. The overall approach used by the evaluation team included review of all relevant documents; meetings with USAID, REB and PBS officials and staff involved in program oversight and implementation; detailed discussions with NRECA team members; and field visits to eight PBSs that involved assessment in consultation with PBS management and staff as well as intensive meetings with various categories of consumers. The team also met with other donors and other government and private sector organizations involved directly of indirectly in electrification issues. The team completed its work in Bangladesh with briefings held at USAID on November 14, 1993 and with REB, NRECA and USAID on November 15, 1993.

II. ECONOMIC AND SOCIAL IMPACTS OF RURAL ELECTRIFICATION

A. Introduction

This chapter examines the economic and social impacts of RE. It first highlights the planned or intended impacts and raises related issues, followed by an assessment of the current situation in terms of availability and reliability of economic and social impacts data. Impacts in the agricultural, industrial and commercial sectors are then addressed by presenting findings based on field verification. At the household level, the analysis focuses on findings in relation to household quality-of-life impacts as well as the question of ability-to-pay and its implications for poverty alleviation.

B. Intended Impacts and Related Issues

In providing electrification to rural areas, the BDG has addressed a mix of economic, social development and equity objectives. The program's economic objectives were to stimulate economic growth and increase income and employment opportunities by providing needed infrastructure to support development in agriculture, small-scale industry and commercial sectors; its social objectives were to improve the quality of life in rural areas; and its equity objectives were to reduce rural-urban disparity. Although RE is a "high-cost development investment" due to the costs of serving dispersed rural communities, lower rural consumption levels, load factors, and high operating and maintenance costs, the economic, social and equity objectives are weighed against purely financial ones in deciding to extend electrification.

RE is only one of the infrastructure inputs essential to economic and social development. Other inputs include natural resources, roads, communications, and labor. The complementarity of these inputs makes it extremely difficult to isolate the impacts of RE alone on economic growth, living standards and quality-of-life in rural areas. Furthermore, RE's social and economic impacts are likely to be maximized only in areas where the general level of development has reached a point where the greater proportion of people have access to, and can consume significant amounts of electricity.

There are a number of issues (several of which are raised in both RE literature in other countries and earlier studies in Bangladesh) related to planned impacts and the potential for their achievement. These are briefly highlighted below on a sector by sector basis.

RE can potentially directly contribute to increased agricultural productivity through expanded irrigation. Electric pumps can provide significant cost and convenience benefits over use of diesel pumps for irrigation. Technology choices of electricity over diesel, and therefore, the impacts of RE on agricultural productivity, will, however, be sensitive to electricity connection costs and tariffs in relation to diesel costs. Access to electrified irrigation and hence productivity benefits is likely to be greater for large and medium farmers, because of their asset-holding pattern. In terms of agricultural employment, more extensive and intensive

irrigated agriculture is expected to provide employment opportunities for the rural poor. This agricultural employment is seasonal and mainly benefits rural men, with minor direct employment gains for women.

In the industrial sector, RE can potentially stimulate the development of new rural industries, particularly in cases where no economic energy alternative exists. Electricity provides comparative cost and efficiency advantages over diesel. It should encourage diesel-powered industries to shift to electricity and possibly expand their operations, and it is the obvious choice for most new industries. The majority of rural industries are small and resource-based. RE is likely to promote their growth depending upon both availability of raw materials and other rural infrastructure. With the exception of a few large industries, most of the growth in rural areas is likely to be based on micro agro-processing units that do not offer major employment impact.

The evaluation team believes that REB and the PBSs should consider initiating a process of identifying longer-term opportunities for both internal and external resource mobilization to support the development of Samity-owned, small-scale industries in cooperation with Bangladesh Small and Cottage Industries Corporation (BSCIC). This would complement and be part an overall strategic planning process designed to, among other things, consider investment options for PBSs as they become financially stronger and to support the government's development strategy through cooperative enterprise development.

RE can potentially make a significant impact upon expansion of rural commercial growth centers, particularly through allowing extended working hours, and attracting increased numbers of consumers. Initial establishment of a growth center, however, is mainly influenced by availability of locations close to better road links and industries. Connection costs may be a constraint for many small traders and shop-keepers. Since most shops are owner-operated, the overall employment impact of growth center expansion is likely to be small.

At the household level, demand for (and level of) use of electricity depends mainly upon the household's ability-to-pay. This is an especially important consideration in rural Bangladesh, where more than 60% of rural households are below the poverty line. Even relatively poor households may find it difficult to pay connection costs, and their consumption of electricity is likely to be very price-sensitive. Relatively rich rural households are likely to have greater access to electrification and its benefits.

The planned social impacts of RE relate to less tangible improvements in quality of rural life, the measurement of which is very difficult and depends upon people's perceptions of those benefits. These are mainly associated with the availability and extended use of high quality lighting. The expected impacts include: greater safety and security; decreased fuel costs; increased comfort and convenience; increased opportunity for income-generating activities; extended study time; increased access to mass media communications; greater social interaction and hence community cohesion, etc. Electrification of social institutions is also

expected to indirectly improve the quality of educational and health services. The potential impacts of RE on family planning, although often mentioned, are more questionable. Hard data in this area is difficult to obtain.

Intended RE impacts and the above-identified issues were accordingly taken into account and more fully investigated by the evaluation team.

C. Assessment of Available Economic and Social Data

A brief review of the history of data gathering with respect to economic and social impacts clarifies the reasons behind the current lack of availability of a coherent and reliable set of quantitative data on RE impacts.

Baseline data was collected early in the RE program: two baseline studies were undertaken, one in 1982, that included social and economic data for five PBSs. A second and more comprehensive study of eight PBSs, initiated by REB and USAID, was carried out by the Institute of Statistical Research and Training (ISRT) of the University of Dhaka with respect to a wide range of socio-economic characteristics of the PBSs. Impact evaluations were conducted in 1983 by USAID, with the assistance of the Evaluation Cell of REB Programme Planning Directorate, and again in 1987 another impact evaluation was conducted on behalf of REB. These impact studies did not utilize or update earlier baseline data.

The original studies, although both scientific and detailed, often included variables irrelevant to RE, were unwieldy in terms of follow-up, and many of the villages included were not subsequently electrified, making comparisons difficult. Since their usefulness was not readily apparent, neither USAID or REB made any effort to follow-up these studies to assess changes. In 1987, a brief study of the economic and social impact of rural electrification was carried out for USAID by the Oak Ridge National Laboratory. In 1988, an exploratory study of small-scale industrial and commercial development in newly-electrified areas was carried out by Bangladesh Center for Advanced Studies, but its findings, recommendations and issues raised were not followed-up. Then in 1989, USAID, before initiating yet another large-scale impact survey, conducted a preliminary assessment of RE, focussing on impacts (deLucia and Associates). This study recommended selected focussed studies on impacts in particular areas and an expanded M&E role for the REB's evaluation unit but was not followed up.

Since none of the above-mentioned studies were structured for consistent data collection or analysis, and no ongoing monitoring or evaluation activity was conducted by REB or any other agency, there is a complete absence of reliable time series quantitative data with which to conduct an analysis.

Data collection for this evaluation began prior to field study through the development of a list of data requirements related to RE and key economic and social indicators. This list was provided to each PBS prior to field visits in part to determine the capacity of the PBSs to collect such information (a copy of the list along with a sample of data provided by one PBS is

presented in Annex C). As was expected, there was a wide variation in PBSs' ability to complete the assignment. Although the PBSs have extensive knowledge of social and economic conditions in their service areas, there is no ongoing requirement to collect this kind of information on a systematic basis. It was also determined that the government statistical offices at the Thana level often do not base their data collection and reporting on actual field conditions. As a result of the conditions described above, the evaluation team had to rely mostly on qualitative information that could be verified by field assessment.

D. Economic Impacts

1. Agriculture

1.1 Electricity Use for Irrigation

Electricity is primarily used by the agricultural sector for irrigation purposes. RE has facilitated increased usage of irrigation technology and consequent impacts on:

- increased irrigated acreage;
- intensification of cropping and increased productivity;
- technology choice and cost savings;
- greater crop diversification; and,
- expansion in agricultural employment.

1.2 Increased Irrigation Acreage

According to REB figures, 636,225 acres have been brought under electrified irrigation since the program's inception. This figure includes both areas formerly irrigated by diesel pumps and replaced by electric pumps, and new areas irrigated by pumps installed due to availability of electricity. In fact, field findings based on interviews with farmers indicated that the largest proportion of this increased irrigated acreage was due to substitution of diesel-powered by electric-powered pumps.

1.3 Intensification of Cropping and Increased Productivity

It was found that irrigation promoted adoption of high-yielding varieties (HYVs) of crops during the dry season, and allowed for production of more than one to two crops per year depending on area-specific topography and soil conditions. The timely supply of water in combination with the more intensive application of other inputs has resulted in significant productivity increases.

REB claims that RE has contributed to an average annual increase of approximately one million tons in crop production. Again, due to lack of reliable data, it is not possible to isolate the impact of electrification on irrigated output, which is clearly dependent upon a complex set of factors of production.

1.4 Technology Choice and Cost Savings

Diesel-operated deep tubewells (DTWs), shallow tubewells (STWs) and low-lift pumps (LLPs) were the irrigation technologies used by farmers prior to electrification. Typically, these were owned by medium and large farmers who also sold water to small and marginal farmers. With the availability of electricity farmers have shifted their preferences in favor of electric pumps as a substitute for diesel pumps although the fixed cost of electric pumps is higher relative to that of available Japanese diesel pumps. This shift has been prompted by the significant variable cost advantage of electricity over diesel use due to historically lower unit costs of electricity (US$ 0.017/kWh or Tk 0.70) in 1980 combined with a five fold increase in diesel prices from US$ 0.069/liter (Tk 2.75) in 1980 to US$ 0.34/liter (Tk 13.70) in 1992-93.

This cost advantage has been steadily shrinking to the point where electric pumps currently provide very little variable cost savings relative to diesel. The average unit cost of electricity is presently US$ 0.059/kWh (Tk 2.35), or triple the cost in 1980. At present electricity costs for STW irrigation as percentage of total seasonal production costs (as provided by farmers) are approximately 22%.

While the availability of low-cost, Chinese-made diesel engines has encouraged large numbers of small and marginal farmers to invest in diesel, it has not significantly altered the preference of medium and large farmers in favor of electric pumps. This is primarily due to a number of other identifiable benefits of electricity use compared to diesel:

- More reliable and consistent water supply combined with greater surge;
- Fewer breakdowns and low maintenance costs;
- Convenience of monthly payment and including option of payment deferral until after harvest as opposed to frequent cash outlay for diesel purchase;
- Operational ease and handling efficiency involving: i) less supervisory time; ii) no need for fuel transport; iii) no risk of fuel theft by pump operators; and
- Longer hours (20-24 hours) of non-stop operation (without damage to the engine) as opposed to maximum 8-10 hours non-stop operating capacity of diesel engines.

On the other hand, irrigation electricity consumers also focused on the following problems that affected their efficiency and crop output:

- Frequent load shedding, particularly during critical crop flowering and ripening periods (this was particularly the case during 1990 and 1991 cropping year but has subsequently been reduced). The unpredictability of load shedding led to a sense of lack of control over water supply.

- Cost burden associated with payment of penalty equivalent to 50% of replacement cost for stolen transformers[1].
- Lack of alternative usage for electric engines during the off season where diesel engines have a comparative advantage. Diesel engines are alternatively used as motive power for country boats, tractors, threshers, sugar cane crushes, etc. The usage is area-specific, and is dependent upon revenue earning potential relative to operating cost.
- Rising tariffs, with increasing cost of other inputs, combined with depressed crop prices have resulted in financial squeeze for producers. Any future upward adjustments in tariff rates are, therefore, likely to significantly influence farmers' choice of technology (i.e., diesel vs. electric pumps.)

1.5 Greater Crop Diversification

Crop diversification as a result of irrigation has been primarily limited to a shift from traditional to HYV crops, and cultivation of cash crops such as vegetables, sugar cane, pulses, oil seeds, tobacco, etc. Sufficient data is not available to attribute this diversification to electrified irrigation alone.

1.6 Expansion in Agricultural Employment

Expanded irrigated acreage along with greater cropping intensity has generated significant production related employment opportunities for agricultural workers (micro studies have estimated this increase to be roughly 45%).

Demand for labor in areas of irrigation concentration has tended to pull agricultural laborers from adjacent economically depressed labor surplus areas. Farmers interviewed reported that their labor requirements have more than doubled due to the shift from traditional to HYV crops. For example, during harvesting larger farmers, on average, employ 20-25 laborers per household for a period of 20-25 days, each creating 400-625 person-days of employment.

The share of women in this expanded primary production employment is very small. This involvement is determined by social norms and values of specific geographic areas, and wherever applicable, is limited to winnowing, threshing, land levelling, irrigation drain-making and weeding.

[1] Cost of 5 kV transformer is Tk. 10,000 to Tk. 12,000 and Tk. 25,000 for 10 kV

2. *Rural Industry*

2.1 Structure of the Sector

The rural industrial sector in Bangladesh is still small and relatively undiversified. With the exception of a few large industries such as textiles, tea and tobacco processing, sugar mills, etc., most are comprised of very small agro-processing industries that include rice mills, flour mills, oil mills, and other industries such as saw mills, ice plants, metal engineering plants, cane and bamboo, and cottage industries, etc. Other than textiles and metal engineering plants, most of the industries are resource-based, i.e., dependent upon proximity to input sources.

2.2 RE as Development Catalyst

Rural electrification has resulted in: i) establishment of a large number of new small, mostly agro-processing industries; and ii) significant energy cost-savings for a large number of existing industries that were previously diesel-operated. According to REB's MIS report for September 1993, RE connections have been made to 16,918 industrial units that account for just over half of total electricity consumption.

While electricity is necessary, it is not by itself a sufficient input for setting up of industries in rural areas. It is in fact, one of several factors that influence the decision to establish rural industries. Other complementary factors are: the overall level of infrastructure development (roads, growth centers, communication, transport system, etc.) availability of raw materials, proximity to urban or semi-urban areas, banking, marketing and other service facilities.

While electricity has acted as a catalyst in rural industrial growth there are large numbers of electrified villages without a single industry, confirming the fact that electricity alone is not sufficient to promote industrial development. Further, a significant number of the industries presently operated by electricity were in existence and operating by diesel prior to RE. For the above reasons, it is neither possible to disaggregate the direct inputs/contribution of RE, nor can the claim that electrification is the prime mover in promoting rural industrial development be justified.

2.3 Cost Savings

Some industries could not have been established without the availability of electricity, for example, sawmills, cold storage, tobacco redrying, and ice plants. For other industrial units, diesel engines could be used as an alternative source of motive power. However, electric engines were chosen instead of diesel-powered units because of the following benefits:

- major cost-savings in operation and maintenance (for example, rice mills indicated savings in the order 40% from use of electricity in place of diesel);
- convenience and efficiency; and
- infrequent breakdowns.

For most of the smaller industries, the cost of electricity as a percentage of total operating costs is quite high and varies from industry to industry. For example, in the case of sawmills electricity cost was reported to be approximately 20-30%; for rice, flour and oil mills approximately 50-60%, and for cold storage and ice plants as high as 60-70% of total operating costs. Therefore, any upward adjustments in tariffs are likely squeeze the profit margins of existing smaller rural industries and act as a disincentive to the establishment of new ones.

In cottage industries, particularly handlooms, better lighting from electricity has: a) extended working hours that are now from 5 am to 10 pm; b) resulted in improved product quality; and c) promoted greater output and increased productivity.

2.4 Employment

- Despite the fact that RE has promoted growth of small industries, its impact in generating employment in rural industries has been relatively small, primarily because of limited scale of operation of most of these units.
- Rice hullers, which account for the majority of rural industries, have replaced "dhekis" that were used traditionally for rice processing and employed large numbers of poor rural women (replacement of one dheki displaces 2-3 employees). Total displacement is estimated to be in the range of six million. Although rice hullers and other small industries have generated some employment opportunities only some of the displaced labor has been absorbed (see Annex D).
- The few large industries that exist in rural areas, such as textiles and sugar mills provide few employment opportunities because of labor-saving, capital-intensive production processes. The exception is the tea industry where processing is automated but the overall process is labor-intensive.
- Cottage industries are mostly operated by family labor with the exception of few larger units that employ outside labor. Although RE has extended working hours for these industries, it has had little net impact on employment.

3. Commercial Sector

The commercial sector refers to growth centers that are characterized by: concentration of smaller shops, micro industries, and business units; serving the domestic, trade and agricultural sectors; mainly located on available government lands; and linked by better roads. Commercial units are typically small, and on average consume an amount of electricity only

slightly higher than that of average households. In most cases electricity is used for lighting purposes, utilizing 1-2 bulbs or fluorescent tubes.

As of September 1993, PBSs have connected a total of 106,494 commercial units that consume 7% of total RE electricity consumption. Some of these commercial centers were previously electrified by the Bangladesh Power Development Board (BPDB) which is the state-owned electric utility that provides all generation, transmission and much distribution in Bangladesh, and subsequently handed over to PBS. Consequently the net impact of RE on their development cannot be ascertained. However, consumers noted: a) a significant improvement in terms of less frequent load shedding and more stable electricity supply; and b) better quality service since PBS takeover of BPDB lines.

Although RE is not the prime mover in effecting the establishment of growth centers, it has facilitated a significant net growth in the size of small commercial centers. It has resulted in extended hours of business (2.5-3 additional hours daily) and attracted significantly larger numbers of consumers to the marketplace, particularly during the non-monsoon seasons, and a consequent net increase in sales and profits of individual shops. Small shop-owners find it difficult to make the one-time initial investment required for connection, and, in many cases, circumvent connection costs by taking side connections from large shop-owners, paying an amount higher than what their minimum bill would otherwise be.

RE's impact on employment generation in commercial centers has been relatively small, since most of the commercial units are owner-operated and on average employ only 1-3 people depending on the size and type of operation.

E. Social Sector Impacts

1. Household/Domestic Sector

1.1 Household Demand for Electricity

The RE Master Plan set a target of providing electricity to 1,750,000 households by the year 2005. As of September 1993, 668,702 households were electrified.

The number of domestic connections has increased at an average annual rate of 24% (1986-1993). This growth rate has declined in recent years however due to the expansion and intensification of the programs into less developed rural areas.

The extent of unmet demand on the part of rural households is vast. Large numbers of originally recruited members are still waiting for connections. Expectations have been further raised by recent political promises to supply electricity to every rural household by the year 2005.

1.2 Rural Household Electricity Uses

Electrification of rural households mainly includes lighting of rooms and courtyards. Normally a household uses 2-3 bulbs, and on average consumes 30-35 kWh/month. In the case of more affluent households consumption is much higher due to greater lighting and use of various appliances.

Uses of electricity in addition to lighting include: i) communications equipment, i.e., TV and radio; ii) fans; and iii) small appliances, i.e., irons, small cooking devices. Affluent households typically purchase first fans for comfort; TV as a status symbol, and then small appliances for convenience. Refrigerators are prohibitively expensive and rarely purchased. Electricity is used for cooking and parboiling of rice only in cases where illegal connections and meter tampering[2] are possible.

1.3 Benefits

One of the key objectives of RE is to improve the quality of life in rural areas. The quality-of-life indicators are not readily quantifiable. Assessment of benefits was, therefore, based upon field observation and perceived improvements in quality of domestic life as identified by consumers.

These benefits were identified as follows:

Quality of Lighting

Electricity significantly improved the quality of lighting at a cost equivalent to or lower than kerosene at the minimum level of consumption. Even at higher levels of consumption where the cost of lighting is greater, kerosene is not considered to be an equal substitute.

Security and Safety

Better lighting in households and courtyards has greatly enhanced villagers' feeling of safety and security. The incidence of theft was reported to be significantly reduced. At night women felt safer going outdoors.

Study Time

Enhanced quality of lighting encourages longer hours of study. Female students in particular reported additional hours of study after completing household chores. School teachers reported that the performance of average students from electrified households has slightly improved.

[2] Illegal connections are infrequent in PBS connections but more frequent in the case of BPDB connections.

Exposure to Mass Media Communications

The most affluent households own TVs, and men, women and children of the community gather together to watch these. Such gatherings have also contributed to better social relationships. In addition to TVs, a number of households own electricity-operated radio-cassette players. These together have provided not only entertainment, but also greater exposure to educational information, thereby enhancing rural people's level of awareness.

Other Income-Generating Activities

Better lighting has made possible longer working hours possible for both men and women and has allowed a small number of village women to engage in some income-generating activities (e.g., sewing in the case of relatively affluent households and 'kantha' stitching in the case of poor households). The extent of involvement of women in these activities is much greater in areas where non-governmental organizations (NGOs) are providing credit and other support.

Social Status

Purchase of electrical appliances, especially, TVs made possible by availability of electricity, has enhanced the already greater social status of the affluent households. Relatively poor households with electricity were also viewed with somewhat more esteem.

Time Availability for Leisure Activities

Electricity has extended hours of operation of village shops and growth centers that usually are focal points for leisure activities (card games, carom board playing) for men. The common view that electricity increases the efficiency of household tasks, thereby allowing greater leisure time for women, does not apply in rural Bangladesh. In fact, electricity has allowed women to stay awake longer and this time is typically used to complete unfinished household tasks.

Family Planning

A direct causal link between electricity and family planning and consequent reduction in fertility could not be established. Acceptance of family planning is influenced by a complex set of social, economic and development factors. Electricity may however, have had some tangential impacts on family planning through access to educational radio and TV programs.

1.4 Willingness and Ability-to-Pay

Availability of electricity in a community itself generates demand. The factors influencing this demand are:

- socio-economic conditions of the households (income, assets, education etc);

- extent of benefits perceived by households in terms of quality of life, cost savings on energy use, and improvements in relation to electrification costs; and
- social pressure/demonstration effect. This has often led to persuasion and informal payments by the richer households for the poor in order to expedite connections.

Costs to the household of electricity and its use include: (i) initial connection costs, (ii) appliance purchase, and (iii) monthly utility bill. Willingness-to-pay for these costs is typically used as a measure of the value the household places on use of electricity. The actual costs borne by the household in fact, underestimates this value. This measure is more relevant for decision-making prior to connection. But, once connected the households tend to place a much higher value on electricity. This is particularly true for wealthier households as indicated by purchase of various appliances.

In rural Bangladesh, demand for and consumption of, electricity by wealthier households appears to be relatively price-inelastic. Decisions by wealthier households with respect to connections and consumption levels are not likely to be influenced by wiring costs and monthly tariffs, at least up to a certain point. In the case of poor households, however, demand for electric connections and consumption levels are highly sensitive to wiring costs and monthly tariffs. In fact, the initial wiring cost (Tk 600-700) per household was identified by the majority of the households as the greatest constraint.

The poorest of the poor who live below the poverty line constitute the majority of rural households. They participate only marginally in the market economy and do not have the ability to pay the costs of either electricity wiring or the monthly bill. Despite comparatively similar costs of electricity and kerosene for lighting purposes, these people who allocate their meager income on a day-to-day basis find it impossible to save a sufficient amount to make a lump-sum electricity payment at month's end. Nor are they likely to have access to, and directly benefit from, electricity in the foreseeable future unless complementary development activities provide them with resources and income to do so.

The ability-to-pay on the part of the relatively poor whose households are electrified has been increasingly constrained by rising tariffs since 1981. Unit costs per kWh have increased four-fold, and minimum charges have trebled. This group of consumers, however, once used to the convenience of electricity, is unwilling to be disconnected until the costs of electricity become prohibitive relative to their income and cost of substitutes. Once disconnected, these people find it very difficult to reconnect. Although exact figures are not available, the rate of reconnection in the cases of those who are disconnected due to inability to pay was reported to be quite low.

Despite increased tariffs, the extent of latent demand for connections was found to be quite substantial in both electrified and non-electrified villages. Future costs for initial wiring and setting of tariffs will clearly be crucial in influencing household demand for electricity and consumption levels. This is particularly true for poor households.

2. *Social Services*

While outputs in the social services area are easy to quantify in terms of number of connections, direct and indirect impacts are non-quantifiable and qualitative in nature.

2.1 Electrification of Educational Institutions

The majority of high schools in RE areas have received electric connection while the majority of primary schools have not. Coverage within individual educational units has in most cases been limited to administrative facilities and does not include classrooms. Electrification has not induced the establishment of night schools that would have provided greater access to education for the poor, thereby furthering the achievement of BDG's stated literacy objective.

2.2 Electrification of Religious Institutions

Electrification has facilitated congregation in mosques, and greater convenience through the use of amplified loudspeakers to call the faithful to prayer.

2.3 Electrification of Health Centers

Most of the health centers are located at the thana headquarters level, lie within BPDB-served areas, and are electrified. The number of dispensaries providing medical care in rural areas has increased due to the expansion of growth centers supported by the availability of electricity. Better lighting and vibrancy of the growth centers have allowed for extension of operating hours, thereby enhancing the access of rural people to medical services. Due to cost constraints, availability of electricity has not promoted the use of refrigerators for storage of medicines and vaccines in the rural dispensaries.

2.4 Electrification of Community Centers

Electrification has contributed to an increase in the number of social and cultural clubs promoting greater community participation of young people in social, recreational and cultural activities. However, involvement in these activities almost never includes women. An indirect associated benefit, although not readily verifiable, is the reduction in anti-social activities on the part of rural youths.

F. Democratization

1. Overall Impact

Although one of the original objectives of RE was to support the process of democratization at the grassroots level through the development of PBSs, the impacts of the program on democratization have been limited thus far.

2. *Involvement of Members*

Involvement of members has been confined to: (i) electing one member from their respective 'elaka'[3] once every three years; and (ii) attending the Annual General Meeting. Membership turnout for electing Board Members was reported to be in the range of 40 to 50%. Participation in voting is almost exclusively by men since the number of women who are cooperative members is negligible.

Attendance at the Annual General Meeting is generally 5 to 10% of total membership. There is very little scope for active membership participation because proceedings include presentation of minutes and reports, with little scope for open forum discussion of issues and problems. PBS management require a few days prior notification, in writing, of members' questions or remarks. This effectively deters the members from active spontaneous participation.

3. *Awareness and Information*

Awareness of, and regular information flow to, members are essential preconditions for instituting democratic processes. Attempts by the PBS to motivate and educate members have been very rarely undertaken. As a consequence, members have little sense of belonging to the PBS or participating in its affairs. Elected Board Members do try to represent consumers' interests and concerns, but they report that most of the proposals they make to REB are rejected.

The existing administrative area of most PBSs is too large and one member cannot adequately represent consumer interests. In order to promote democratization there is a need for greater participation of consumers, allowing them to express their views and concerns. This could be accomplished by: i) each union electing a small (e.g., five member) committee that would be responsible for representing consumers' interests at the annual general meeting; ii) consumer education and motivation; and iii) facilitating institutional development for internal resource mobilization. Election of the Governing Board members could be carried out by elaka (as per the existing system). Governing Board members would discuss issues with, and be accountable to, the union committee.

G. Monitoring and Evaluation of Economic and Social Impacts

1. *Current Situation and Activities*

As mentioned earlier (See Section C), the original attempts initiated by REB and USAID to collect and manage impact data were not well-planned nor was there any substantive follow-through of these to assess RE progress and development results over time.

[3] An elaka is comprised of 3-4 unions used by PBS for its administrative purposes.

Neither are there currently mechanisms in place for the ongoing collection, analysis and reporting of essential economic and social data, nor is there a plan or program for key studies, impact assessments and program evaluations. USAID's technical assistance to date has not included support for the planning and setting-up of such systems. While other donors, in particular the World Bank, have highlighted the need for such information, donors have, in general, not focussed upon the need for hard data to validate the development benefits of their RE investments. Monitoring and evaluation of results/impacts and use of this information for planning and financial forecasting are critical management functions as the RE program moves into a more operational mode.

REB presently carries out a number of monitoring functions. In terms of performance/results monitoring, two of the most important of these are: i) the MIS report, produced by the Rate Cell (Finance Directorate), that includes supply of services and financial performance data as supplied by the PBSs based on Form 550, and, ii) the Performance Target Agreement (PTA), based on a set of annual targets with respect to management, technical, and financial progress/performance. The REB Evaluation Division of the Programme Planning Directorate was originally setup in order to assess the impact of completed projects on rural development. In fact, it: i) performs a coordinating function with respect to the preparation of more than one dozen periodic reports to various agencies; ii) assists in preparatory work for new projects; and iii) prepares pre-feasibility reports, and preparatory work for new PBS sites. In addition, it is frequently "deputed" to a variety of donor missions and other tasks. Evaluation staff positions include: one Deputy Director, two assistant Deputy Directors (presently unfilled), and one tabulator.

The consequence of these various reporting requirements, combined with lack of adequate staff, and lack of a functioning computer is that there is little professional capacity for undertaking any serious M&E work.

2. *Uses of M&E Information and System Criteria*

M&E impacts information is essential for strengthening efficiency of the following RE program operations:

- financial forecasting
- planning and priority-setting
- tracking/reporting benefits of RE projects
- case-building for BDG and donor funding

Three criteria have been taken into account in suggesting M&E mechanisms to address these needs: i) institution-building of M&E capability; ii) simplicity - i.e., based on minimum essential indicators/data; and iii) reliability based on readily-available and reliable data.

3. *M&E Results/Impacts Questions*

An M&E system would allow management to address key questions such as the following: i) To what extent has RE directly or indirectly contributed to increased output, incomes and employment in each of the economic sectors agriculture, industry, and commercial? ii) To what degree has RE contributed to improved standard of living of rural households and have the rural poor been able to share in the economic growth promoted by RE, iii) How effectively has the program performed in terms of reaching different target consumer groups, and to what degree has their consumption of electricity increased? iv) What are the future prospects in terms of reaching different categories of consumers and promoting positive development impacts, and what are the implications of this both for financial forecasting and program adjustments?

4. *Major M&E Areas*

The M&E system should include four major components:

- Planning stage data collection and analysis
- Ongoing results/impacts monitoring
- Special studies or surveys on selected key issues
- Internal and external progress evaluations

These are briefly outlined below. (Specific suggested related indicators and key variables are included in Annex F)

4.1 Planning Stage Data Collection and Analysis

The analysis presently undertaken by the retaining engineers is based on an area coverage approach where line construction recommendations are based on actual number of consumers by type, expected consumption, and therefore revenue. In order to better assess projected demand, and establish the baseline for future financial forecasting and impacts follow-up, minimum essential economic and social profile data is also required at both community and household levels. Collection and analysis of this baseline information would apply in the cases of expansion, intensification and PBS development. Data collection could be carried out by the retaining engineers, with the guidance of an outside research/survey agency. Analysis would be carried out by the REB Evaluation Division, assisted by an outside agency if needed. It would focus on documenting the key elements of the existing socio-economic characteristics of the area and the implications of these for access to electricity, demand and revenue levels both in the near term and medium-term.

4.2 Ongoing Results/Impacts Monitoring

In order to i) monitor or track development changes directly or indirectly caused by RE; and ii) project future changes with respect to consumer mix, potential demand and

revenue, selected key economic and social data should be collected and analyzed on an annual basis. For new PBSs, or areas of expansion or intensification, data collection would involve updating of the data collected during the initial planning stage, and also relating this to selected readily-available data on electricity consumption and expenditure, amounts paid, disconnections, etc. (in the case of presently-electrified areas this data would allow for an analysis of change from this point onwards). This data should be collected at the PBS level (with the assistance of an outside professional research/consultancy organization, if needed). Analysis, to be carried out by REB's Evaluation Division, (with the assistance of the Rate Cell and an outside firm, if needed), would focus on the type and extent of changes in each of the critical economic and social variables and the specific direct and indirect impacts of RE in effecting these changes. It would also identify the specific implications of these changes for program adjustments and financial forecasting.

4.3 Special Studies and Impact Surveys

Studies and surveys should include: a) A small number of micro studies on specific issues relevant to RE program development and effective PBS program implementation planned on an annual basis, and conducted by REB's Evaluation Division and the PBSs. (Examples of small studies needed in the near-term are also provided in Annex F); and b) periodic surveys - every three years - to address RE impacts at the household and community levels, the findings of which would be used for program development and external evaluation. REB's Evaluation Division would provide direction and oversight for these surveys that would be planned in detail and carried out by a local organization.

4.4 Internal and External Program Evaluations

There should be two types of evaluations based on the dta collected in the M&E program and surveys. These are:

a) an analysis of program progress and results should be carried out every second year by a team comprised of PBS representatives and representatives from each Directorate. This activity should be coordinated by the Evaluation Division, and b) an external assessment of RE progress and impacts should be undertaken jointly by donors and REB every three years. (USAID or other major donors would take the lead in organizing these evaluations).

5. Operationalizing the System

In order to enhance the institutional capabilities of the REB and PBSs to carry out M&E functions and operationalize M&E, the following are the minimum support requirements: i) filling the existing two vacant positions of assistant director (evaluation division) and augmenting staff by a third professional position, ii) short-term technical assistance from NRECA or other sources for a minimum of six months; iii) contractual arrangements with a local agency having expertise in M&E; iv) minimum computer facilities

for the evaluation division and PBSs per the proposed computerization plan; and v) financial support from USAID or other donors to operationalize the system.

III. INSTITUTIONAL ISSUES

A. Rural Electrification Board

1. General

REB has created a working system of rural electricity distribution organizations based on the Rural Electrification Administration experience in the United States. REB continues to provide critical support for the management, finance, and technical operations of the PBS through a centralized management approach. Although REB is able to carry out its day-to-day functions, by admission of the Chairman and Members, the organization would benefit from a formal organizational review that would help increase management efficiency. Within REB there is great interest in conducting structured, systematic planning for strategic, management and financial objectives.

Currently, there are 1096 permanent and project based employees overseeing REB internal operations and the management of 4000 PBS employees. Various departments and directorates within REB have prepared proposals for reorganization for internal REB review. The levels of staff increase in the proposed plans will result in more than a 50% expansion in total REB personnel.

There has never been a formal, outside, comprehensive organizational review of REB including communications, management functions, operations, and staffing requirements. NRECA can work with management at REB to identify and agree on the elements of a comprehensive organization review. A brief outline of suggested elements of this review is contained in Annex G. It has been recommended that an outside utility management firm conduct the review rather than the NRECA Advisors. Without a competent organizational review, there is insufficient justification for much of the proposed levels of staff increase. A hiring freeze, until the completion of this review, with the exception to fill vacancies of critical personnel, appears reasonable given a) current lack of efficiency in some management operations as documented by NRECA, b) the lack of detailed justification for the hiring, and c) an apparent lack of understanding of the organizational impact of such large increases in staff. In addition, NRECA Advisors believe that some REB engineering project staff costs are charged to the PBSs, but may not be tied to specific work loads. The magnitude of the impacts of this on PBS finances is not known.

A recent in-depth study of the Tangail PBS by NRECA Advisors produced 79 recommendations for REB-PBS action that illustrate the need for a substantial review of the REB-PBS relationship in management, finance and technical areas, as well as highlighting areas of REB-PBS operations that need strengthening. The Tangail report should serve as the basis for extensive working discussions between REB and NRECA in part as a backdrop to the NRECA phase out, and in part to deal with the results of a recent review conducted by the International Development Association (IDA) that strongly stated that REB needed to develop its capability for technical planning, finance and accounting. Another NRECA study

is planned for the Comilla-1 PBS that will additionally highlight organizational and management areas requiring attention.

Although a "Computerization Needs Analysis Report" was produced for REB and PBS in 1989, minimal follow-up has taken place at REB and no follow-up action has been taken at the PBS level. The need for computerization grows more important given the pressing requirements to conduct more sophisticated financial, procurement and engineering analyses for policy development and strategic planning. It is recommended that an updated computer needs assessment be conducted and an action plan developed for implementation.

REB should increase its existing efforts at seeking donor funding for system expansion, given strong competition worldwide among developing countries for increasingly limited donor funding for power sector development. Creative marketing is a powerful, legitimate tool available to the public sector to increase visibility and attractiveness. The marketing strategy would create a package of REB's organizational, financial and technical accomplishments in a way that is appropriate and meaningful to potential donors. Advice from private sector marketing firms should be sought in preparing marketing materials.

REB's relationship with NRECA has been marked by some controversy over a number of issues including NRECA's continued promotion of PBS autonomy, and perhaps a general feeling that REB wants to be free of consultants, although it still counts on the Advisors to help in day-to-day decision making. Some REB managers feel that NRECA Advisors need to concentrate on more practical recommendations. It will take an attitude change on both sides to improve the dynamic that has emerged. REB should decide what kind of assistance it wants from NRECA on the PBS autonomy issue.

2. *NRECA Technical Assistance Program*

The current socio-cultural environment in Bangladesh constrains the near-term development of democratic, autonomous electric distribution cooperatives. While cooperatives are not new to Bangladesh, experience with cooperative forms of ownership and governance is limited. NRECA's attempt to transfer the U.S. cooperative model could not succeed to the extent originally hoped for.

Often a major success of most technical assistance efforts directed to developing countries is on transferring technical capabilities. The Bangladesh RE program has succeeded thus far because the transfer has taken place over a reasonable period of time with intensive daily involvement of NRECA Advisors. However, the development of the management, planning and evaluation skills necessary to sustain the capacity of an organization to evolve and innovate over time in response to changing demands has received much less attention.

There are systemic problems that cannot be easily overcome that profoundly limit the ability of NRECA and REB to institutionalize the policy and planning skills that REB needs. One major factor lies within the rotation policy that is embedded in the Bangladesh civil

service system. In essence, every position is treated as a transit situation that undermines long-term commitment. Rapid rotation of staff at REB has served to reduce accountability at all levels, discourage individual initiative, prevent longer term capability development of professional staff, and reduce the overall effectiveness of management operations. At REB, it would be preferable to have a Chairman of sufficient status and experience, perhaps a retired private sector executive, to remain in the position for 5-7 years to give vision and direction to the organization.

Since status and authority are intertwined in Bangladesh, and individual initiative is generally not rewarded, lower level personnel in REB are reluctant to make decisions that results in an overload of paperwork at the Member level, severely limiting their time to consider higher order issues. Indeed, one REB Member has asked NRECA Advisors to develop an effective management system that will result in clearing the stacks of memos on his desk. While centralized management authority is cited as a basis of success of the RE development program, it may also have become the root cause of inefficiency. Although within a centralized system, the focused use of power by a strong individual can cut through and simplify problems brought about by the rigid application of procedures, ultimately the system resists any attempts that would alter the power relationships in the management hierarchy.

Depending on the progress made in the remaining NRECA contract period, continued technical assistance by NRECA for the remaining life of the project appears critical in an number of management, finance, training and technical areas. Technical assistance has become most routinized in the technical areas. The engineering Advisors report that REB needs to increase it attention to operations and maintenance. Since project inception the majority of NRECA technical assistance has focused on PBS development. More recently, the Advisors have become increasingly and necessarily involved in REB policy, management and finance issues.

Under its contract with REB, NRECA was to have helped establish local capability to carry on technical support after it departs. It has succeeded in the technical/engineering areas. No local private sector technical assistance capability has been developed in the management, training, or finance area. NRECA chose to not carry out this activity based in part on an assumption that no local firm could have sufficient credibility with REB to succeed. Approximately US$ 350,000 remains unspent for this purpose and should be reallocated to priority areas such as the organizational review. In addition, approximately US$ 400,000 remains unspent for short-term technical specialists. Given the needs identified for capacity building in a number of areas, these funds should be fully utilized based on the action plans recommended for development by REB and NRECA.

NRECA Advisors and REB senior management should begin planning for the NRECA phase out by identifying the priority areas of REB and PBS policy, management, finance and technical activities that require specific assistance for the remaining contract period. A preliminary identification should be made of technical assistance requirements that are likely

to be necessary after NRECA's departure. Although the structure of the host country contract shapes the nature of the working relationship between REB and NRECA, there is an urgent need for NRECA to refocus its efforts toward a task orientation, with all of its specific analyses and conclusions formally shared with REB. It is recommended that NRECA become more proactive in its formal reporting and consulting process especially in the management and finance areas, and to work with REB staff on a significantly more frequent basis.

3. *Program Planning*

The Programme Planning Directorate has the responsibility to conduct the initial analysis of potential sites for PBS development and prepare project proformas including rudimentary revenue and expense forecasts. It makes reports that are sent to the Ministry of Energy and Resources and it is supposed to conduct evaluations of the PBS program. Because of a lack staff and expertise, it does not carry out any program monitoring or evaluation work. The Planning Directorate is understaffed and is in need of training to conduct analyses to support long term strategic planning, program monitoring and evaluation, and to sharpen project formulation analysis. NRECA could provide assistance through its unspent funds for specialists to support the training needs of the Directorate.

4. *PBS Autonomy*

REB was established to provide support for the development of autonomous electric distribution cooperatives. A centralized control relationship was absolutely necessary at the outset in order to ensure the orderly, efficient and quality construction of a complex technological system. There was no alternative given the generally poor record of other government agencies in project development and management. This approach has succeeded in establishing a viable RE program.

The *Master Plan, Area Coverage Rural Electrification* published in 1982 states, that "...the concept of local PBS autonomy is central to the strategy for providing reliable electric service in rural areas. This concept must, of course be very carefully weighted against the REB's needs to sufficiently guide, monitor and control new PBSs under the terms of the development loans. As the PBSs develop with experience and achieve financial viability, the monitoring and assistance by REB will be reduced accordingly."

The original RE program goal envisioned establishment of member-owner, locally controlled, autonomous cooperative organizations. REB has transferred responsibility and accountability to the PBSs, but thus far limited authority. REB is currently reviewing the entire REB-PBS relationships with consideration being given to identifying areas of increased autonomy for individual PBSs that have reached a certain stage of development. Increased PBS autonomy will have major implications for REB management, operations and staffing requirements. For example, REB staff time is taken to re-approve capital budget items in the PBS budgets that have been previously approved. REB has legitimate concerns about increasing PBS autonomy, and REB provides oversight of PBS operations and finance. REB

also provides high quality training and technical services to the PBSs. REB is thus far the only source of funding for PBS development and has legal obligations to the government to pay back loans. REB provides the procurement function for purchase of imported materials.

The issue of PBS autonomy is receiving increased attention now that some PBSs are building up equity reserves. Five PBSs have had their equity reserves assigned by REB as investment capital in the ADB-backed power generating plant. Other PBSs are asking about the future and are interested in what they would have to learn in order to become more autonomous. A discussion in the NRECA Tangail report noted that the most effective means of increasing PBS financial viability through increased member participation would be to offer patronage dividends to members in good standing on their bills. PBSs would like increased authority, but not necessarily full autonomy, in a number of areas and have submitted proposals to REB as part of a current review of the PBS operating instructions.

5. *Training*

With ongoing NRECA assistance, the REB Training Directorate (TD) has developed a comprehensive program of training at all levels of REB and PBS staff. The staff level of the TD has remained unchanged while the REB-PBS organization has grown from 500 to 5000 personnel and the TD cannot meet REB-PBS training demands. A proposal for a Training Academy has been developed and should receive priority support from REB. At the core of the plan is the need for full-time professional training and curriculum staff, although it is difficult to know how this may be achieved because of the rotation problem. Continued rotation of experienced training personnel has an even more serious negative impact on training quality and effectiveness than in other directorates within REB.

There is an immediate priority need to bring in a Deputy Director and key staff for curriculum development. This appointment is critical because the NRECA Technical Advisor for training is being phased out in less than one year. Curriculum development has been hampered in part by the lack of full-time training staff There is also an immediate need for logistics support staff to handle required administrative tasks now being handled by an already overloaded training staff. A new training facility is obviously required. No significant action has been undertaken for three years on the new training facility since the proposed site at Savar was identified. Some advanced training courses should be developed for personnel management, financial forecasting and management, and maintenance engineering. There is no training program or materials for PBS consumer-members. Training materials that describe the authority and responsibility of PBS management and Boards of Directors are misleading, given the actual conditions of total REB control. Although a system for evaluating training personnel is in place, it is not fully utilized by TD management. This area needs attention, but has been a lower priority than the more pressing task of just keeping the training operation functioning.

6. *Management Information Systems (MIS)*

There is one full-fledged MIS at REB that was established to track PBS financial and energy data. It is functioning smoothly, given the large quantity of data that comes in every month. The Training Directorate has developed an MIS to track employee training records and includes a classification system. The Training Directorate suggested to the Personnel Department that they combine record keeping using a common classification system. In response, the Personnel Department set up its own rudimentary system using a different classification system. The Engineering Department keeps computerized records of Quantum meter data (see Annex P), staking sheets, circuit extensions and some related data, but there is little systematic utilization and analysis of the information that is collected for management and evaluation purposes.

REB should work with NRECA Advisors to assess specific MIS needs for the entire organization including integration with PBS MIS needs. Some areas for MIS consideration include: a) REB engineering should have an MIS to track a number of substation data including location, number, installation date, failure and repair information; b) REB engineering needs to tracking PBS-BPDB coordination requirements; and c) an MIS is needed to link REB procurement action with the construction and operation and maintenance schedules of PBS's. In addition, the current PBS-related MIS should produce and circulate to appropriate offices easy to read graphs and charts of data for easier monitoring and comparative analysis by management. The MIS assessment should be followed by development of data collection forms, management evaluation procedures, computer software and hardware requirements, budget and staff training requirements. The assessment should be integrated with the REB computer plan. REB will have to staff up the Rate Cell and engineering before it can develop and implement these additional MIS systems.

7. *Women and Employment in REB*

Although REB has experienced a relatively high growth rate in total employment in the past several years, there is currently a lack of opportunity for upward mobility for the assistant Directors and Deputy Directors. Some staff express frustration with the situation having been in their positions for 10 years. There appears to be no specific gender bias related to this lack of mobility. There are a fixed number of positions and no one is moving up. The intensity of frustration appears to be quite individualized and while it is a factor in creating lower morale, the overall situation does not pose a threat to the operating efficiency of the organization at this time.

In terms of Bangladesh social history, the current group of women in service in government agencies represents nearly the first generation of women since liberation in 1971 to enter employment outside the domestic and agriculture sector. Although official government policy promotes an enhanced role for women in society and in the workplace, in reality, conditions for women at work generally poor. Among several concerns, personal safety is the major factor for women considering employment in government and business

organizations. Based on interviews with women at professional and staff levels, REB is considered to have a relatively safe working environment for women. Younger women who more often reported that they are frustrated at the lack of upward movement within REB, state they are not sure where else they could go that would provide the same general level of security, stability and opportunity that is present at REB. They also report that senior management attitudes toward women are generally more favorable than in other government organizations they are familiar with. Women also report that there is less nepotism and the management style overall is less authoritarian than it is elsewhere within the government, but that there is room for improvement.

REB currently has 1096 employees, 758 in approved positions and 338 in project based positions. Of the total staff, 82 or 7% are women. The minimum quota established for women in government agencies is 10% for positions above assistant director level and 15% for positions at the staff level. There is no specific office responsible for meeting quotas. The Ministry of Energy inquires infrequently as to recruitment efforts, but there is no specific enforcement mechanism. Based on total REB staffing levels, quota compliance indicates 6% of professional and 9% of staff level positions are held by women. Of the 82 women employed at REB, 51 or 62% hold clerk/typist positions. Of the 82 total women employees, 21 or 26% hold professional positions. Five women hold the post of Deputy Director (see Annex H). No women are in higher positions. One woman is second in line based on tenure for promotion to Director level when an opening occurs. Due to social factors, it is not possible for women to hold certain positions in REB or other government agencies. These positions include driver, peon (guard/messenger), and gardener. Although women could be hired as engineers, there are none at REB and none would be considered for engineering positions requiring travel into the field. The reasons for this restriction are cited as cultural (women do not have public authority over men), absence from family responsibilities, and concern for personal safety.

8. Rotation of Staff

There have been three REB Chairmen in the last three years. The typical three-year period of rotation of the Chairman serves to deny REB of any effective long term leadership. An analysis of the rotation period for the period 1988-1993 was conducted by the Personnel Department. At the Director level for positions in administration, finance and technical areas the average rotation time was 2.1 years. At the Deputy Director level for the same positions, the average rotation time was 2.9 years. At the Assistant Director level, the average was 2.9 years. Rapid rotation of staff at REB has served to reduce management accountability, discourage individual initiative, prevent longer term capability development for professional staff, and reduce the overall effectiveness of management operations. Much has been written about this system and its negative impacts on all aspects of government operations.

9. *Compensation*

BDG sets the terms and conditions of REB's employee compensation package. BDG has increase government salaries by approximately 300% from 1977 to 1991. The compensation package and general working conditions offered to REB employees appears generally to be sufficient to recruit and retain a sufficient number of staff. As in many government organizations, the quality of professional staff is highly variable and a relatively small number of highly talented people do most the work. Staff turnover is not high in part as a response to few employment opportunities in the country, although staff are frequently transferred as noted elsewhere. Since 1988, only 82 employees have resigned, with the majority of professional resignations at the entry level Assistant Director and Assistant Engineer positions, and apparently due to choosing other government postings upon gaining entry into the government employment system.

The gap that existed between REB and PBS salaries has narrowed due to several government sponsored pay increases that have come to REB employees. Proportionately smaller increases have come to PBS employees. A full compensation review and comparison was beyond the scope of this evaluation.

B. Palli Bidyut Samity (PBS)

1. *General*

The PBS system was established to provide electricity to rural customers at reasonable cost. The PBSs as a whole are functioning well as intended, but a natural evolution of needs has emerged as PBSs have matured. For example, experienced GMs are interested in increased autonomy and five PBSs have accumulated equity reserves that are unavailable for use without REB permission. The PBS institutional structure was developed from the experience of rural electricity cooperatives in the US. PBS bylaws are for the most part copied from the U.S. Rural Electrification Administration (REA) model with the addition of the phrase, "...with prior approval of the Rural Electrification Board." In the US, member-owners through the elected Board of Directors have the final authority. This is not yet the case in Bangladesh. The original program objective of promoting democracy through the establishment of locally autonomous PBSs will only be achieved through an active program put forward by REB.

The PBS institutional structure and function is well designed for its task of distributing electricity. The organization review of the Tangail PBS completed by NRECA identifies a number of detailed recommendations for improving management, finance and technical operations that are applicable to other PBSs. The PBS staffing pattern reflects an unusually efficient level of functionality when compared with power sector institutions elsewhere in the developing world.

REB exercises a centralized management approach in most areas of PBS activity. In many ways, the PBSs operate as REB field offices with financial performance requirements. Because of this management structure there is no assurance that the PBS can supply electricity at the lowest reasonable cost because its members, Board of Directors and management presently have no authority over the use of member equity or PBS expenses.

It has been proposed that REB Members and Directors review each recommendation contained in the NRECA Tangail PBS-2 report and then a) meet with the NRECA Advisors to discuss the potential impacts of each recommendation, b) agree on which are to be carried forward and which require additional study, c) prepare and implement action plans in consultation with PBS GMs, including responsibilities, schedules, personnel requirements, and budgets needed to implement those items that are agreed upon, and d) establish a schedule to decide on those items needing further consideration or analysis. This review should take place within the current REB review of PBS instructions. The practical impacts of increased autonomy are described in the Tangail report. As noted in the REB Institutional Findings and Recommendations section, the resolution of this issue impacts the entire REB organizational, management and finance structure.

2. *Membership*

The member-owners of the PBS are mostly unaware of the ownership concept or the democratization that is supposed to be developed through participation in the cooperative process. There are programs to motivate member participation that are focussed on electrical safety, bill payments and illegal use of electricity. The most direct, cost-effective mechanism that could dramatically increase member interest and participation is suggested in the NRECA Tangail report. It recommends that PBSs with sufficient equity reserves, return some of the capital as refunds to members.

Those individuals that have some understanding of the system report being frustrated that REB seem to control everything and that there are no effective avenues for increased member participation. Member turnout for Board elections is reported to average 50% (higher in some cases) which is quite good given local travel conditions. Although members may submit questions ahead of time, their role in annual meetings is generally to listen to a report with limited opportunity for questions or discussion. The relationship between members and the Board is usually limited to members seeking adjustments on bills or making requests for service. There is understanding among members, especially with farmers, that all may suffer financially if electricity or distribution system equipment is stolen. Members are upset that they are financially responsible for 50% of the costs of replacing PBS equipment damaged by environmental factors.

If increased member involvement is desired an effective member participation program to educate members about their full rights and responsibilities as owners of the PBS must be developed and implemented. The program would begin to prepare members for active and informed participation in all areas of PBS activity including policy setting,

finances and decisions on use of PBS equity funds. The program should include specific roles and responsibilities for REB and PBS staff and PBS Board in carrying out this membership participation program. Some recommendations on this issue are contained in the Tangail report. The program should be phased in over a 5-7 year period.

Due to the size of the typical PBS membership of approximately 18-20,000, meaningful member participation in PBS activities is almost impossible. The approach to restructuring might include dividing areas of the PBS service territory into smaller units from which committees could be developed to represent the members of these smaller areas. Further discussion of this subject is found in the Democratization section II F above.

3. *Board of Directors*

Training for PBS Board of Directors covers all aspects of PBS operation. The training that is required for all Board members states that the Board has authority over PBS operations. Board members believe that the REB training is somewhat misleading with regard to the Board's actual role and authority. Some longer serving Board members received training many years ago and have not received updated training since. There is interest among some Board members for advanced Board training in policy, management and finance that would allow them to be more effective in supporting PBS operations.

There is little actual accountability from the Board to the members or to the PBS. Board members would like to be more involved with PBS policy and planning, but they mostly are concerned with getting new members hooked up. The Board consists of interested and concerned citizens who generally have a higher social status in their communities. Many board members serve multiple terms. Some members have served ten years. In the beginning stages of a PBS, REB selects all Board candidates and may exercise approval of candidates in subsequent elections. Informal criteria used by REB for Board member selection include their reputed honesty, record of community service, status in the community, and overall experience. Board members report continuing frustration with the consistent lack of responsiveness from REB to Board requests or proposals. One Board submitted a proposal to REB in July and as of mid-October had not received acknowledgement of receipt of the letter from REB. REB categorizes Board letters as those that can be handled within the current operating guidelines, those that require special attention, and those that are irresponsible. REB acknowledges that sometimes responses to Board inquiries are slow and is taking steps to increase its responsiveness. In some cases, Board members are invited to participate as members of policy formulation committees.

4. *PBS Management*

PBS GMs are generally performing their responsibilities well. There is a natural variation in the experience and capability among GMs that requires additional REB oversight in some PBSs. PBS GMs are accountable only to REB. Although the GM is theoretically accountable to the Board, he usually identifies more strongly with REB as the head office,

that put him in his position, judges his performance, and provides bonuses or penalties for his actions. GMs reported that they would like more advanced training in personnel management, strategic planning and finance. PBS GMs would like additional local authority and have adopted a wait and see attitude about the current REB-PBS review. In some cases, GMs are invited to participate as members of policy formulation committees.

5. Women at PBS

At the PBS Governing Board level, a maximum of three Lady Advisors may be appointed by the Board. All three advisory positions are not filled for all PBS boards, however. Women are not precluded from running in elections for representatives to the Board, and at least two instances of women's involvement as Board members were reported. However, because of social customs, women are rarely interested in contesting positions for Board membership. The actual degree of active participation of women in an advisory capacity depends on their position and social status in the community. The Lady Advisors did report that consumers in their communities approached them with problems and requests for connection.

At the staff level, women are generally in positions that include billing assistant, typist/clerk, and in some cases cashier, accounting for, on average less than one-seventh of PBS positions. There are several women Billing Supervisors. Because of the social constraints associated with women carrying out field work, women are not now considered for any positions involving field work. There are limited opportunities for upward mobility for women at the PBS level.

6. Compensation

Compensation packages for PBS employees are generally adequate to attract and retain staff. PBS employees are concerned that a) there has been no pension plan, although one is being developed; b) there is no travel or daily allowance regardless of distances traveled or time spent away from the PBS central office on business within the PBS service territory; c) it is difficult to find quality educational opportunities for children in some rural areas and no allowance is given; d) housing benefits are uniform for all PBS employees regardless of the quality, cost and availability of local housing for PBS staff not residing in PBS housing; and e) the original salary advantage provided to PBS employees compared with REB has narrowed due to government pay raises for REB employees which have totalled 300% since 1971.

IV. REB AND PBS FINANCIAL VIABILITY AND SUSTAINABILITY

A. Introduction

Remarkable progress has been made collectively by the 40 PBSs toward achieving financial viability. According to the summarization and pro-forma financial/management spreadsheets prepared by NRECA (October 31, 1993) and attached as Annex J, the 40 PBSs considered as a group are financially viable, earning a net margin of 10% on total operating revenue after all expenses. The USAID financed PBSs are more strongly viable as a group than all 40 PBSs together for fiscal year ending June 1993. If PBS intensification and line expansion economic/financial criteria that were established by REB are observed and not set aside as a result of BDG political or socio-economic pressures, the USAID funded PBSs will remain financially viable in future also.

Other donor-supported PBSs that were developed later and under less economically favorable circumstances will need modest subsidies in annually scheduled amounts that will need to increase each year as more domestic consumers are added to the service territory. The amounts and timing of these subsidies is highly speculative because there are many factors involved whose impact is hard to predict.

B. Sources of Information Used For Financial Evaluation

A wide variety of information was used to gather the information for this analysis and evaluation. These included field trips to selected PBSs, meetings with REB, BPDB, local offices of the World Bank, Asian Development Bank (ADB), DANIDA consultants, NRECA, and USAID. Reports and studies prepared by these agencies and their consultants in the last few years such as Coopers and Lybrand, ACRE, and individual PBS records, were reviewed and analyzed in detail. Historical, current and projected statistical data were obtained and evaluated including REB and BPDB's annual reports to reach conclusions. Whenever data was used whose complexity of formation prevented detailed evaluation of the underlying methodology, for example BPDB's long range power generation expansion plan and load flow studies of the transmission system, the evaluation included judgmental assessment of the competence with which they appeared to have been prepared. Areas of weakness in the completeness of the methodologies were noted, but they were invariably due to lack of resources to properly conduct analysis, not due to any lack of knowledge on the part of REB, PBS or BPDB staff.

C. Overview of Current Financial Viability of PBSs

The 40 currently operating PBSs demonstrated the following financial viability characteristics based on June 1993 data.

	Viable	Not Viable
17 USAID funded	13	4
9 KFAED funded	2	6
14 IDA funded	7	7
1 FINLAND funded	0	1

Seven of the 40 PBS are not yet paying any interest on their long term debt, while 33 are paying interest.

It should be noted that viability is measured after income from interest earned on PBS deposits at local banks are factored in (net margins). Based on this assumption, all 40 considered as a group are financially viable. Operating margins, which are net margins minus interest credit, are worse for the 40 PBSs (US$ 829,986). By the criteria of operating margins, 28 PBSs are in the red and only 12 are in the black. For USAID alone, operating margins are 11 in the black, 6 in the red, and collectively all are positive.

Financial Summary of Operating Revenue and Cost of Electric Service of 40 PBSs

Revenue and Expenses	1993 Total US$
Operating Revenue	$ 47,688,689
Interest Income	$ 5,563,931
Cost of Electric Service	$ 48,518,625
Net Margin	$ 4,733,995

Interest earned is a legitimate source of income so the net margin data is a valid indicator of financial viability. It is not, however, a dependable source of future income for these reasons. a) it depends on PBSs being able to maintain large deposits, e.g. unspent depreciation, customer deposits, etc. b) interest rates paid by commercial local banks are currently high at 12% per annum. If inflation in Bangladesh were to decline and as a result there were fewer changes in the rate of exchange, interest rates could drop nearer to current world standards of 6.5% (3-month money market interest rate average of 10 countries). This would decrease the amount of interest earned by PBSs. Or, if more funds had to be expended on O&M than at present, currently only 0.6% of assets versus 2.9% depreciation taken and included in operating expenses, then interest earnings could also decline. Another important factor that accounts for the relatively favorable current collective viability of the PBSs is that the early PBSs were presumably selected on the basis of their anticipated early viability e.g. Dhaka 1, Moulavibazar

and Hobigonj and Tangail, founded in 1981. The typical early PBS was less costly to construct than those started today chiefly because of lower imported equipment costs.

D. Subsidies and Financial Viability

There are five subsidies involved in transactions between BDG, REB and PBSs. These subsidies played a key role in establishing the RE program in Bangladesh, and they continue to be needed for future financial viability. These subsidies include:

1. BPDB says that it sells power to REB below its cost of generation because it absorbs the exchange rate losses on its debt to the BDG. BPDB estimates its cost of power at 4.2 cents/kWh (Tk 1.71) and sells to PBSs at 3.52 cents/kWh (Tk 1.41). This annual subsidy is therefore estimated to be US$ 0.0075/kWh (Tk 0.3) or approximately US$ 5.8 million annually (0.0075 $/kWh x PBS total annual kWh purchases). REB disputes BPDB's cost of power analysis. It believes that BPDB is overcharging the PBSs. If PBSs had to pay for this loss it would wipe out the positive net margins. Also, BPDB charges the Dhaka Electric Service Authority 3.95 cents/kWh (Tk 1.58) for power supplied at 132 kV, versus only charging 3.52 cents/kWh (Tk 1.41) to PBSs for power at 33 kV. Usually, power supplied at low voltage has a higher price.

2. The initial 5-year grace period for REB loans lent to PBSs can be characterized as a subsidy.

3. The low interest rate terms of the loans by the IDA and other lenders are a subsidy.

4. The loans from BDG to REB are at a fixed rate of exchange with the BDG absorbing the exchange losses.

5. BDG makes local currency grants to REB for some incurred expenditures.

REB and PBSs continue to make debt service payments on some commodity loans that have been converted to grants which amounts to a reduction in subsidies.

Only the exchange rate losses can be estimated realistically. Analyzing the remaining subsidies involves making assumptions about the interest rates BDG would have to pay from lenders other than IDA, donor-lenders, and others, which serves no purpose for this evaluation. These above noted subsidies and perhaps additional amounts will be required by PBSs if the RE program is to achieve its completion target of increasing electrification of Bangladesh from its present 45% to 100% by 2005.

E. Need for Continued Subsidies

There are a number of factors that adversely affect the future financial viability of PBSs during their further intensification and expansion phases including:

1. The PBS backbone distribution system consisting of 33/11 kV lines is now largely in place and many low voltage distribution lines are also in service. Slightly over 48,000 Km of lines are now energized serving over 750,000 consumers. Due to disconnections, out of service connections and other temporary factors, only 622,000 consumers are served at present. Of this number, 80% are domestic consumers, resulting in a density of only 10.5 domestic services per Km of line, and a monthly consumption of only 34 kWh or 408 kWh/year. These figures are calculated before total losses that averaged 15% in 1993 compared with a more desirable level of 10%.

The intensification and expansion phases are planned to improve the economic viability of the PBSs as a group and of most individual PBSs. Intensification is planned to begin soon and be completed at the end of 1997. Expansion of PBSs will take place later, in Phase IV, when eight PBSs will be added and later still 4-5 more PBSs will be added to reach a final total of 53-54 PBSs.

For the intensification phase more stringent economic criteria have been added than used at present to the justify addition of consumers to the system. At present these criteria are in terms of expected required revenues per Km of line, which average US$ 1005. The PBSs as a group are currently averaging US$ 987, resulting in a small negative operating margin of US$ 830,000, or 1.7% of annual revenues. This loss is not uniform over all PBSs, in fact quite the contrary and depends on the year of formation of the PBS, the mix of consumers, and many other factors. The annual average operating revenue per Km of lines from domestic accounts is US$ 313, leaving the balance to made up from the other customer classes. For the intensification program required revenue criteria have been sharply increased, from approximately 22 customers previously to 50 domestic consumers per Km, or one deep tubewell, or four shallow wells per Km of additional line.

Irrigation consumers currently have 34,000 deep and shallow wells and low lift pumps in service. They have been adding pumps at the rate of 5000 pumps per year for all 40 PBSs combined. Consumption of electrical energy is 150 gigawatt per year or approximately 19% of total annual energy consumption. However due to the short season this represents 35% of peak demand during the irrigation months, accounting for the need for frequent load shedding. Adding 5000 pumps each year will increase peak demand by an estimated 12 MW per year for PBSs. If this irrigation growth rate is confirmed by further studies the impact on peak demand and available supplies of power from BPDB will need evaluation.

For the expansion phase these requirements have been doubled to 100 domestic consumers per Km of additional line, or two tubewells, or eight shallow wells. However, setting requirements is one thing, being able to realize them and enforce them in the face of many obstacles and pressures is another. It is most likely that the present set of compromising factors (low GDP,

small loads, low load factors) will continue to impact the intensification and expansion phases. The economic and financial criteria will have to be adjusted as they have been in the past to the actual level of grants, subsidies and technical capability factors.

2. There are several unresolved issues that have impact on PBSs and therefore their finances and subsidies. BPDB claims they have not received payment for lines turned over to PBSs and that the amount due to them is US$ 10 million (Tk 400 million). These values are disputed by REB. Also, BPDB claims that uncollected BPDB accounts are not being turned over to them by PBSs after lines are turned over to the PBSs. In fact, PBSs make collections as they can from the former BPDB customers and turn the funds over to BPDB. Conversely, many BPDB lines are in need of expensive rehabilitation that has to be financed by REB after being turned over to the PBSs. Additional expenses may be incurred as REB is increasingly forced to repair BPDB sub-transmission and substations in order to increase operating reliability.

3. PBS load factors are low, due to consumers having to economize on consumption of electricity and the shortness of the irrigation season (4-5 months) and its high peak demand.

4. Inability of PBSs to raise commercial and industrial power rates because these are already at relatively high levels given local economic conditions. In Dhaka for example, large industrial users use the Dhaka power system for stand-by power and their self-generation as the principal source because it is cheaper for them to do so. If large-consumer rates were to be raised too high, self-generation and cogeneration would become even more economical, thus defeating the benefit of a tariff increase.

F. Magnitude and Duration of Future Subsidies

Many more millions of domestic and tens of thousands of irrigation consumers will need to be provided with electric service if the goals of complete rural electrification are to be met. The majority of the additional domestic consumers will be minimum consumption consumers who are the most costly to serve.

Examining a typical non-viable PBS (Pirojpur - KFAED sponsored) indicates that it had a negative net margin of $ 137,000 in 1993, or close to half of its operating revenue. Therefore, if it were possible to increase rate schedules by approximately 30%, it would break even. But this may not be feasible due to low income levels of most domestic consumers. There are 13 PBSs with comparable deficits. The combined deficits of these 13 PBSs require an operating subsidy of approximately US$ 2 million per year that appears to be financed from depreciation allowances incorporated in the tariffs.

At this time it is not possible to estimate the duration of subsidies from various sources for the system as a whole or PBSs individually. One recent study indicates some PBSs may not reach break-even points for 20+ years. A lasting improvement in PBS financial viability can only be achieved as a result of growth in rural per capita GDP. Growth in GDP is a slow process, and even at 3% annual per capita income growth it will take years before per capita domestic

electricity consumption will increase significantly and raise PBSs revenues. The original assumption that five years after their formation most PBSs would be viable, given the initial subsidies and a grace period, was wildly optimistic. Subsidies will be needed for much longer because the revenues available from domestic consumers, who are the majority, were overestimated, and the cost of serving them was underestimated and continues to rise.

G. Assessment of Tariff Structures and Rates

PBSs utilize seven rate schedules versus nine for BPDB. There are significant differences between many individual PBS tariffs, and each tariff is reviewed annually. PBS energy charges (kWh) are average by developed world standards and high compared with other developing countries that typically have tariffs 50% less than Bangladesh. Demand charges (kilowatts-kW) are comparatively low or even nominal at US$ 0.12-1.00/kW/month (Tk 5-40) for both BPDB and PBSs when compared with developed countries. Power factor charges are also low. Typically, demand charges in the U.S. are in the US$ 5-16/kW per month range, but at present BPDB does not impose any demand charge on its sale of energy to REB. The average domestic consumer bill is US$ 2 per month. The minimum monthly charge is US$ 0.89 (Tk 35).

Future plans for expansion and intensification and the creation of another 12 PBSs will likely require additional subsidies. Currently, 5-6000 Km of additional distribution lines are planned to be added each year for the next 12 years, adding to the present total of approximately 48,000 Km completed. Additional annual revenues of just under US$ 1000 per Km have actually been obtained in recent years in a few PBSs with US$ 313 coming from domestic customers and the remaining six categories of consumers, according to a recent NRECA analysis. In fact, there has been a slightly rising trend in annual revenues per Km of line per year. Yet this has not produced a sufficient number of financially viable PBSs. As more low monthly consumption domestic consumers and irrigation consumers with low annual load factors are added, the outlook is for the ratios of achieved revenues per Km of added line versus required revenues to worsen. The magnitude of this effect can only be estimated accurately as a result of cost of service studies for PBSs for which demographic and industrial development data is available.

H. PBS Dependence on BPDB Power Supplies and Transmission Service

Currently, and during the period 1994-1997 and probably longer, PBSs will depend on power generated and transmitted by BPDB. If the Rural Power Company (RPC) project being promoted by REB and supported by the ADB is implemented this dependence would decrease if a 180 MW combined cycle plant is completed in 1997. It will primarily benefit eight PBSs, five as investors and purchasers of power, and three as purchasers of power only.

PBSs presently purchase power at the very economical cost of 3.58 cents/kWh (Tk 1.41). This accounts for approximately half of their operating costs. The future availability and price of this power is therefore of crucial importance to the sustained viability of PBSs. Therefore, to evaluate the supply situation, the team evaluated BPDB's long range power expansion and

associated transmission system expansions plans. Discussions were also held with BPDB's System Planning Department concerning planning methodology used and current plans adopted.

As indicated above for PBSs, BPDB's long-range planning is also not demand driven, but is based on a number of planning criteria that include available funds, requirements for repayment of loans, and losses on exchange rate changes. Currently, the priority is rehabilitation of existing power plants, 800 MW of which are estimated to be in imminent need of rehabilitation or replacement out of a total installed capacity of approximately 2600 MW. BPDB's reserve margins (in percent of peak) have been historically very low necessitating continued load shedding and consistent shortfalls in firm capability in the integrated grid and in the East Zone. Examining BPDB generation expansion plan it is seen that the reserve margins in 1994 are estimated to be a satisfactory 16.7%. For 1995-1998, reserve margins are forecast to be much too low--at 7%, 8%, 9%, 11.7% respectively--for reliable power distribution .

Therefore, an overall negative impact on PBS's future financial viability is probable as the PBSs add more consumer loads in the presence of uncertain power supplies. The magnitude of this shortfall is uncertain. An estimate can be made from the operational outage reports available at PBS 33/11 kV substations. These substations are equipped with Quantum meters that indicate the following statistics for FY 1993: outages from load shedding and from forced outages during the wet season were six hours per substation per month or 1%. During the dry season when peak demand driven by irrigation needs is greatest, outages totalled 150 hours per month per substation, or 20%. This averages to 7% average throughout the year. This could translate to a 5-7% reduction in PBS's revenues since revenue hours lost to outage cannot be recovered through subsequent higher sales of electricity.

I. Performance Target Agreement

REB has developed a comprehensive set of performance targets numbering 16 for group I PBSs (most successful), 18 PTAs for group II and 6 for group III. Annex L shows the performance targets for Jessore PBS-2 which is now in group I. It should be noted that these PTAs are an artifact of REBs command and control system. The target set for operation and maintenance expenditures will require special attention since there is little experience at REB or the PBS level to properly estimate annual budget requirements for O&M. It is likely that O&M spending may need to increase from year to year. Appropriate levels of O&M expenditures are required to assure quality of service and lower cost.

The performance targets serve a dual purpose - motivating the GMs of each PBS to meet the targets and enabling them to earn a 15% salary bonus as well as providing feed-back to REB on individual PBS performance. Statistically, more than 3/4 of PBS are meeting their targets. This suggests that targets are set realistically. If half the PBS failed to meet their targets it would be too discouraging, if more than 3/4 passed it would be too lenient. NRECA Advisors suggest that the targets may be too low and discourage extra effort.

However, there is a need for a PTA that summarizes the 16 or 18 individual PTA's since the individual targets do not give a good idea of their combined effect. Based on cost of service studies for each customer class in each PBS, this new target would involve the calculation of variance between revenue required from each customer class and the actual revenues obtained. This calculation should be done in constant Tk as well as current Tk. Constant Tk would show progress made from year to year in closing the required revenue gap, and current Tk would measure the actual deficit or surplus.

Interviews with the staff of several PBSs concerning their evaluation of the usefulness of the PTAs indicated that they approved of the current system and saw no particular problems. Concerning the Board and PBS membership, attitudes were less favorable. Board members are elected to their office and although honorary, continued service is important to them. Some of their duties bring them into conflict with members for example, when there is theft of equipment, or grumbling by disconnected customers. Board members report not feeling comfortable in the role of village policeman and apparently many members of PBSs do not understand the connection between non-payment, theft of service, extension of bill payments and overall PBS performance. REB is cast at present as the "enforcer" of rules, hard and inflexible in its attitudes towards consumers. That may be necessary, but the Board may need to become more active in understanding the economic and financial impacts of unacceptable member behavior and explaining this to PBS members.

J. REB Records

An evaluation of all relevant REB and PBS records and accounting procedures was made. Selected BPDB records were also obtained and evaluated to the extent they overlap or have an impact on REB and PBS records. Most requested information was readily available from the above listed organizations. In a few cases, supplementary information was requested and promptly supplied. NRECA also provided key information, documents, and reports, including the PBS summary statistical data on the current fiscal year, the Tangail PBS evaluation and list of recommendations, the "flow-of-fund" proposal that would establish a revolving fund for use by PBSs for a variety of projects (only six or seven out of the 40 PBSs have sufficient margins and equity ratios to be characterized as clearly financially viable to consider them as lenders or donors of funds), and the analysis of distribution line required revenue versus actual revenue, on a per Km basis and consumer category. NRECA also provided invaluable assistance in interpreting and explaining line items in the records and the status of REB's voucher and tracking systems. NRECA has developed a general chart of accounts for REB. Voucher processing is now claimed to be up-to-date with 5000 vouchers being logged each month and there is no backlog. The three PBSs visited supplied statistical summaries and selected graphs of key variables, such as total revenues versus total expenses. These are shown in Annex K, for a viable PBS, one that could become viable in a few years, and one that will remain non-viable for the foreseeable future.

It is recommended that the REB Rate-Cell or Financial Planning Directorate initiate the following actions as necessary for rates and tariff planning and financial forecasting:

1. Cost-of-service studies for each PBS by rate category;
2 Financial forecasting in the 1-5 year range;
3. Price-demand elasticity and hurdle rate determination, i.e., hurdle rates are those at which large consumers use self-generation and co-generation if reliability and availability of power are adequate;
4. Required revenue optimization studies for each PBS, i.e., what does it cost to add customers who do not provide their share of the cost of serving them;
5. Stand-by power cost rates; and
6. Estimates of cost of subsidies for alternative PBS intensification and expansion scenarios;

In summary, with the noted exceptions the accounting forms, methods used to collect the data and interpretation of results were all judged to be performed to high professional standards. However, the emphasis is on current data, on historical data and on annual data. Projected and forecasting analyses were uniformly incomplete.

There is no computerization at the PBS level, resulting in large volumes of stored paper records, an uneconomical use of clerical labor and other inefficiencies. PBS clerical labor should be trained to perform forecasting functions, automated billing and other accounting functions based on being provided with inexpensive computers.

K. PBS Records

PBS meter reader records were comprehensive and designed to catch errors in the present system. Billing is prompt and thorough but follow-up on unpaid accounts needs improvement by setting up a delinquent account collection cell. Addition of staff to increase bill collection has been recommended in this report. PBSs report that over 50% of delinquent customers pay their bills when approached. With thousands of accounts typically in arrears, PBSs finances are noticeably affected.

NRECA's form 550, which was adapted and expanded by them at the initiation of the RE programs from the corresponding U.S. REA program, serves as the key PBS source document. This form includes seasonal data since it is on a monthly basis, but there is no time-of-day data because BPDB sells power to REB on a uniform per kWh basis. This will probably need to change if the RPC plan is implemented, especially after the second combined cycle phase is implemented. There is provision for a cyclone damage reserve fund. Timely recording of procurement and continuing property records at the PBS level are satisfactory. Close-outs of construction contracts has apparently lagged, leading to postponement of depreciation accounting and other errors. This has apparently been corrected recently.

Annual operation revenues and expenses are sufficiently detailed and include breakdowns of all line items except PBS amortization payments that are combined with depreciation figures. It was not possible to follow loan repayments at the PBS level since amortization data was not disagregated. REB's records however show amortization amounts received from PBSs to be in the US$ 5 million/year range and will need to increase in future years. Balance sheet data show that total investment in total PBSs utility plants and other assets are in the US$ 325 million range, to which accumulated depreciation, work in progress by REB but not yet transferred to PBSs, and working capital are added.

Also, while there is good agreement between balance sheet items in the PBS records and the corresponding REB annual report line items and in the loan portfolio analysis of REB, there is no similar analysis of loans received from BDG to REB for the RE program. It was noted that REB's annual operating budget is US$ 2.25 million of which US$ 500,000 is obtained from the 1% mark-up in interest charged to PBSs for on-lent funds and US$ 1,750,000 comes from BDG authorized allocations from REB construction projects prior to their being turned over to PBSs after completion.

L. Conclusion

Considering that REB has a staff of more than 1000 employees and performs the following functions, its total operating expenditure can be characterized as reasonable. These functions are:

- Wholesale power marketing organization
- Construction management and purchasing organization
- Banker of PBSs
- Auditor/controller
- Policy making institution
- Rate-making entity
- Training entity

As noted above, financial forecasting and budgeting capabilities are in need of substantial strengthening. Forecasting is essential to assist PBSs to achieve sustained viability in the presence of a perceived conflict between the social goals of the RE program and the strict terms of financial viability.

V. TECHNICAL/ENGINEERING ISSUES

A. Activities

The engineer members of the evaluation team visited four PBSs. The visits included discussions with PBS staff members, meetings with PBS Boards of Directors, and inspection of PBS plant and facilities. A visit was made to the Central Warehouse at Shiromoni in Khulna. Meetings were held in Dhaka with: Member Engineering, Chief Engineer Planning and Operation, Chief Engineer Projects, System Engineering and Design Directorate, Material Planning, Standard and Specification Directorate, System Operation Directorate, Procurement Directorate, Rates and Contracts REB/PBS, Training REB/PBS Directorate. Visits were also made to NRECA and the BPDB Director of System Planning.

B. Summary

The technical evaluators found a skilled and professional staff throughout REB directorates. REB is responsible for a major electrical distribution utility comprised of 45 separate cooperative organizations serving 800,000 consumers throughout Bangladesh. REB has organized the PBSs into a homogenous group with common goals, construction standards, reporting and organization. They are accomplishing the goal of providing electrical service to rural Bangladesh. Consumers served, facilities constructed and electrical use increases yearly.

In Fiscal Year 1993-94, REB will construct nearly 6,000 Km of new distribution lines and service for an estimated 108,000 new consumers. REB has a modern, relatively new, and well constructed plant to serve its consumers. Older sections of the plant are beginning to require more attention to maintenance. The number of substations increases yearly, and the total number is outstripping REB resources to service and maintain. The quality of electrical service from the transmission system that is owned and operated by BPDB is often poor. Extensive and frequent load shedding and service interruptions affect the entire national electricity distribution system. Capacities of BPDB lines and substations are often inadequate. BPDB lines are poorly maintained if at all.

These observations direct attention to future activities where REB needs to focus considerable attention and resources. To help accomplish these jobs, REB needs to secure an adequate supply of tools, materials, facilities and technology. These items range from linemen hand tools to hardware and software for engineers, compression connectors to residential meters, and radio communications to workshops. Regular, programmed effective maintenance will insure continued usefulness of its distribution plant. REB can attain maintenance goals by closely monitoring PBS maintenance operations and reports. REB needs to commit additional resources to substation maintenance. REB can sharpen maintenance practices. Attention must be given to small details during inspections and maintenance especially as the system continues to age.

REB must commit financial resources to improve the BPDB facilities that serve PBSs. It must also perform rigorous engineering studies of BPDB facilities that serve PBSs. Deficiencies

found in the BPDB facilities that affect REB operations must be corrected. Service areas must be rationalized to prevent duplication of facilities by PBS and BPDB.

Finally, REB must maintain and update the manuals, operating procedures, specifications, and designs developed with NRECA assistance. The skills and abilities of its professional and technical staff need continued updating. Technology changes at an ever increasing rate and electrical utility practices change correspondingly. REB must keep pace with these changes.

C. Rural Conditions

Travel in rural areas is made difficult by narrow and often crowded paths. Wet and submerged rice fields limit accessibility to distribution lines. There are no telephones for communication. Linemen travel by motorcycle. Poles are often transported on push carts and in some cases rafted together and floated across rivers and water bodies. Mold grows on insulators causing short circuits and pole top fires. Lightning is a frequent cause of service interruption and damage to distribution lines. Cyclones cause extensive damage.

These obstacles and other problems must be overcome to maintain service and construct distribution facilities. Portable radios for line crews will allow more efficient crew dispatch and overall operation requirements. REB has placed an initial order to purchase portable radios and base stations for this purpose. REB must provide line crews with sufficient tools to do their jobs. Providing sufficient and proper materials to effect repairs and replacement of failed devices is critical. It is reported that 100,000 service connection can be added immediately if single-phase residential meters were made available.

D. REB Procurement

In general, REB procurement is adequate, but there are areas of management that need strengthening. The entire process is influenced by external factors. These include: a) donor conditionalities that can affect material specifications and bid checking on non-low bid items that require clarifications to explain deviations; b) BDG requirements for approving all foreign purchases exceeding US$ 1.25 million, c) BPDB delay in turning over lines and continued failure of BPDB to reduce its system loss that results in lack of funds to strengthen the entire system; and d) political pressure from local manufacturers. The most serious procurement failure that has occurred has been the lack of meters to hook up thousands of PBS customers. Local meter manufacturers took legal action resulting in a court injunction barring the importation of foreign made meters for almost two years. The injunction was lifted finally, but the first shipment of 100,000 meters from China were deemed to not meet specifications, although the samples that were sent from the factory were satisfactory. Pre-shipment inspection was not able to be done. As noted in this report, the quality of other materials is generally high.

The entire system for procurement monitoring, tracking and planning purposes is not fully integrated, although some parts are well managed such as the materials accounting component, warehouse control and storage, and transportation to site. Computerized inventory control and

computerized purchasing documents taken-off from distribution design drawings should be considered. REB has requested that NRECA develop a flow diagram to illustrate the necessary relationships in the entire process, especially the activities that must occur in parallel to make the system function as intended. A performance management review process to evaluate each major procurement action should be developed and implemented.

It is assumed that the typical procurement process takes about 14-18 months, which is not an unusual period of time for international procurement. There may be opportunities to shorten this time period for some items, especially if local sources can be found, but it is unlikely that a significant reduction in time is possible.

E. PBS Operations

PBS responsibilities are focused on business activities, system operations, and maintenance of overhead lines and services. Engineering services relating to new construction and line extensions are performed by consulting engineering firms from the private sector. Construction is performed by contracting firms from the private sector. Construction administration is performed by REB Supervisory or Executive Engineers. Consulting engineers and REB Executive Engineers have offices in PBS headquarters buildings. Maintenance and repair of major equipment in PBS substations are done by REB with assistance from PBS staff.

PBS distribution lines and services are well constructed and conform to REB Construction Standards. In both relatively new PBSs and mature PBSs, new projects are being developed to complete area coverage. For example, the Chittagong PBS (about 5 years old) serves 5 of 8 thanas in its area. It is just now starting a new project funded by Finland to construct lines in the unserved 3 thanas. Jessore PBS, a mature PBS, is currently starting a new project to construct lines in thanas that will nearly double its serving area.

1. Quality of Service

BPDB service outages are extensive. REB Systems Operation Directorate estimates BPDB forced load shedding of 5,844 hours total from 1 January through 30 September 1993. During these hours load shedding caused an estimated gross revenue loss of US$ 1,000,000. For the period 1 January to 31 December 1992, total gross revenue loss is estimated to be US$ 2,900,000 (see Annex O). Additionally, BPDB caused 16,897 hours of service interruption other than load shedding. The System Operations Directorate did not offer an estimate of the cost of these additional service interruptions because they lack sufficient data for estimating the cost. The continuing severe loss of service from BPDB points out a requirement to thoroughly review capacity and capability of BPDB to serve PBSs through existing 33 kV lines and grid substations. Until these matters are thoroughly investigated and corrected, new generation cannot be effectively utilized by the PBS system.

2. *Demand for Service*

Annex N contains graphical representations of annual revenue and energy consumption for all consumers, as well as presenting annual energy consumption by consumer classification, construction of distribution lines, construction of substations and annual revenue per Km of line. These are plotted for the fiscal years 1980-81 through 1992-93.

Total installed substation capacity is 660 MVA. Total peak demand on substations is 353 MW. At 0.9 power factor, 353 MW represents 392 MVA. 392 MVA is the numerical total of individual substation demands and does not represent coincident demand. Minimum installed substation capacity available for load growth is 660 MVA - 392 MVA = 268 MVA.

3. *Material Shortages*

PBSs reported shortages of material for maintenance and repair, intensification, and operations. Maintenance/repair shortages were more critical at mature PBS operations where initial stocks of materials available as spares have been utilized. The more common shortages were compression connectors, fuses, fuse barrels or tubes, and certain transformer sizes.
Some PBS intensification programs are at a standstill for lack of materials. Lack of available funding is the main cause of this problem. BDG just released US$ 25 million that will help alleviate this problem.

Operations have suffered the most from a lack of meters for customer connections. This problem has existed for more than one year and should be resolved soon. Because of the missing meters, PTA's cannot be met as consumers cannot be connected or revenues collected. The evaluation team saw a number consumers wired and waiting for a meter.

E. Maintenance

1. *PBS Maintenance*

PBS preventive maintenance of lines is mainly composed of clearing rights of way along 11 kV distribution lines. Normal repairs include replacing spent fuses, repairing conductors downed by falling trees and limbs, and fixing snapped service conductors. Material shortages (commonly: compression connectors, climbing belts, climbing gaffs, hand tools, and automatic splices) hamper maintenance/repair activities. The locally-made climbing belts do not meet safety quality standards, although their price is lower. One retaining engineer commented on instances of sub-standard installations during the past two years that were not seen in the 1980's. This may be attributed to working around material shortages by making do with materials at hand.

The PBS systems are maturing, and particular attention is required for ground line inspection of poles and ground line treatment where necessary. A regular program of detailed inspection of pole top and other assemblies should be instigated. The PBS at Moulavibazar has linemen climb

poles, inspect hardware, tighten nuts and bolts, and replace damaged equipment. This thorough, detailed preventive maintenance is performed on a rotating program that inspects and repairs 10% of its system lines annually. This is an excellent preventive maintenance program and should be replicated at all other PBSs. REB should direct PBSs to undertake actions as outlined in its preventive maintenance manuals.

PBSs work on BPDB 33 kV sub-transmission lines on a worst-case basis, repairing lines in danger of imminent collapse and right of way clearance in the worst cases of overgrowth. PBS operations are dependant upon BPDB electrical service. BPDB has little interest in PBS operations, and in some instances is hostile towards PBS. PBS must recognize this attitude is reflected in the lack of maintenance of 33 kV lines solely serving PBS. PBS should include maintenance budgets and personnel for work on these lines in its regular maintenance program.

The REB O&M Directorate with PBS assistance performs annual maintenance of PBS substations. This is a formidable task as there are 110 substations scattered among 40 energized PBSs. REB does not have sufficient personnel and equipment to perform extensive maintenance for these substations on a yearly basis particularly as un-tanking oil-filled equipment in the field should not be done during the monsoon season. Maintenance should include filtering and testing oil in all oil-filled equipment, inspecting arcing parts at specified numbers of operations or months of operation, repair and replacement of damaged items, scraping rust and painting, cleaning equipment, cleaning insulators, checking operation of all meters and gauges, tightening hardware, reviewing PBS operation records, measuring load balance, and other related tasks. These and other required practices are included in REB maintenance manuals.

Power transformers damaged include: 1 each three (3) phase, 5 MVa, 33 kV to 11 kV, and 21 each single (1) phase, 1667 kilovolt-ampere (kVa), 33 kV to 6.35 kV. Total damaged capacity is 40 MVa. Minor maintenance and operation deficiencies were noted at substations, including missing and/or broken lighting fixtures, missing lightning arresters on a feeder circuit, ammeters that have never worked, no fence grounds, regulators by-passed because one regulator was broken, regulators furnished with 120 volt meters and set points when system utilization voltage is 240 volts, rusty apparatus casings, unbalanced loads on feeder circuits, no hook sticks in stations, no spare fuses, inoperative gauges, and others. None of these singly are critical problems, but in sum they reveal a tendency to ignore minor maintenance and operation items. Of all places on the system, substations should be free of minor and major defects. Failure to do this is will eventually reduce operating efficiency. Supervisors should demand attention to detailed items to reinforce the concept that REB is in business to stay and will do so in a proper manner.

F. Theft of Equipment and Service

1. Neutral Conductor

PBS distribution systems are 11 kV, 3-phase, 4-wire grounded wye system. The 4- wires are comprised of 3-phase wires and 1 neutral wire. The neutral wire is grounded to the earth. This

permits the use of 6.4 kV single-phase transformers that are connected from the phase wires to the neutral. These are less expensive than 11 kV transformers connected from phase wire to phase wire. Other cost advantages of the system include the use of single-phase primary circuits consisting of 1-phase wire and 1 neutral wire for extensions to light loads, and only one lightning arrestor is required at transformer installations. This system is common in the US.

PBSs are experiencing theft of the neutral conductor wire. This is a major problem. Villagers see neutral wires stolen and yet in many cases the lights still stay on. This is because the many ground connections in the system provide a return circuit through the earth to substitute for the missing neutral wire. However, the earth return does not provide an effective return circuit, as resistivity of the earth varies and grounding connections will vary in number and effectiveness. Without the neutral wire it is possible to expose consumers and their appliances to extremely high voltages. These high voltages can not only damage appliances, but they can seriously injure people as well. The loss of neutral wires will cause higher system losses, unbalanced voltages, and will hamper proper fault protective device operation.

Neutral wire conductor was specified as aluminum conductor steel reinforced (ACSR). Thieves strip the aluminum, which is melted and used for fabrication of household cookware. Material specifications have been changed to all aluminum alloy conductor (AAAC). The AAAC is fabricated using alloyed aluminum. This material has a much higher melting point than does the aluminum stripped from the ACSR conductor. Further, when cast after melting, the AAAC becomes brittle and breaks easily. Thieves will learn these things from experience, but thus far no effective program is underway to deter the theft. PBSs are using administrative procedures in an attempt to prevent neutral conductor theft, primarily rewards for information about thieves. An intensive education program might be of assistance in this regard. Consumers can be made aware of the serious safety considerations, manufacturers of aluminum goods should be informed of the unsuitability of AAAC, and local police administrations should take part by educating the public in crime reporting.

There are approximately 1600 to 2000 Km of neutral wires missing from 11 kV circuits throughout the PBS system. Purchase cost for AAAC replacement neutral conductor is US$ 129 per Km, CIF Central Warehouse, Khulna. Customs, local transportation, storage and other costs add about 30% to CIF cost, plus reinstallation costs. This is more than just an operational problem, it is also an expensive financial problem.

2. *Transformer Theft*

Transformers are stolen for the copper content. In particular, transformers serving irrigation pumps are stolen. They are favored because they are not used during the wet season. Many PBSs spot-weld the cover bolts to deny access to copper contents. Some PBSs report the thieves are clever enough to break through this security measure. The best security measure employed by some PBSs is to remove irrigation load transformers and store them at a PBS compound or at the farmers's house. REB has 3847 distribution transformers (sized from 5 kVa to 167 kVa) damaged from lightning and other causes. Transformers are valued at $30 to $15 per kVa from

smaller to larger sizes respectively. Assuming that 10% of transformer damage is caused by core/coil theft, then the approximate cost of theft related to CIF purchase price would be 3847 x 0.10 x 5 kVa (avg) x US$ 30/kVa = US$ 58,000.

3. *Electrical Energy Theft*

Theft of electrical energy is contained more or less by surveillance and administrative actions. Meter readers are trained to recognize tampering and improper connections. The meter readers have a check list to report improper measures used to steal energy. Tampering with meters results in a charge against the consumer for the cost of the meter plus an administrative fine. Energy theft by bypassing meters, if not caught by meter readers, is found in billing anomalies. If theft in an area persists, the transformer serving a group of meters is itself metered. Should the group of meters not add up to the total metered at the transformer, then the difference is billed to all the local consumers served off the transformer, plus an administrative fine. Consumers often solve this problem among themselves.

G. Construction

Construction is performed by private sector contractors under unit price contracts. Quantities are estimated and adjusted to provide contract totals of around US$ 12,500 (Tk 500,000). Bids are reviewed against estimated costs for reasonableness. Construction is initiated by work orders and staking sheet layouts. Contractors install materials supplied by REB/PBS. Payment is made against inventoried in-place construction. Material draws and returns are balanced against inventoried materials. Naturally, final contract quantities vary from what is initially estimated. No limits are placed in the contract on the amount of variance. This is nice for the owners. Contracts are closed out when the contract amount is utilized. Final inspection and inventory is made by REB, consulting engineers, PBS and the contractor's representative. Work orders are closed out after final inventory.

The overall construction program is extensive. Nearly 6000 Km of line will be constructed in FY 1993-94. This large construction program must be supported all along the way by such diverse activities as: planning, engineering, survey, staking, material estimating, procurement, international shipping, local transport, contracting, inspection, acceptance, accounting and a myriad of other details. The REB Projects group closely monitors construction and has an elaborate reporting system to assist in monitoring. These reports should be included in the MIS reporting system if for no other purpose than being located in a central archival point.

At more mature PBSs, the amount of construction work has substantially decreased since initial construction and subsequent line extensions. Consulting (retaining) engineering workloads are less and demands on the REB Executive Engineers are reduced. In such instances, PBS engineers and line crews could be utilized for minor engineering and construction work. Initially the work should be supervised and aided by the consultants and Executive Engineers. After gaining experience, mature PBSs may be able to assume a portion of engineering design and line construction. In this event, consultants should still be used on a certain portion of the work to

act as a third party check on engineering design as well as intermittently to update system maps, perform studies, make long range plans, do load surveys, and review work orders for standards conformance. It is important that consultants be kept on some sort of flexible retainer basis so that their services are available in times of need. It should be recognized that consultants not only bring skills and experience to the PBS, but also proper tools and equipment. PBSs will need to match these supplies if they are to take over some of the work. For major new projects, REB should still utilize the proven team consisting of consultant, contractor, and REB Executive Engineer for construction work.

H. BPDB Considerations

BPDB substation and lines are duplicated by PBS facilities in many instances. Logical engineering design of backbone and intensification distribution lines is complicated by being forced to work around BPDB services surrounded by PBS service areas. BPDB has been granted the major load centers and REB is given the rural primarily domestic areas. The World Bank recently told BDG that the present system of demarcation had no rational basis and will only increase the existing duplication and operational inefficiencies, and that it would no longer support distribution system expansion until a more rational plan was implemented.

PBS system engineering and operations are primarily concerned with the PBS substation to the last customer meter. Yet PBS is dependent upon BPDB electrical service from grid substations through 33 kV sub-transmission lines. Since this service is generally poor, REB should thoroughly review these BPDB facilities for adequacy. REB should try to insure proper coordination of BPDB and PBS facilities. REB must try to correct deficiencies if BPDB cannot or will not act. Ministry of Energy intervention will be necessary on some issues if REB cannot get BPDB cooperation.

I. External Influences

Materials supplied by donor funded construction projects are designated for the sole use of that project. Such materials are estimated and ordered well in advance of detailed engineering design and final construction. Naturally, overages do occur. These overages could be cataloged and offered for re-distribution among the various PBSs given donor permission.

An injunction brought by domestic meter manufacturers substantially delayed the importation of single-phase residential meters. These meters are partially assembled in Bangladesh from the parts and designs of an off-shore company, Landis and Gyr. These meters are not suitable for use by PBS as they are designed for indoor installation by BPDB, and do not meet the REB specification for outdoor meter installation. Attempts to get the manufacturers to make meters that meet REB requirements at a reasonable price have failed thus far.

Similarly, pressures exist for the use of local wooden power poles. These poles are quite dense and proper penetration of wood preservatives is not possible. The density of the wood also

makes them very difficult to transport and erect. They are extremely hard and are difficult to climb. In addition, deviations from a true center axis (they are too crooked) are excessive.

BDG favors the use of locally fabricated concrete poles. This should not lead to a ban on the import of wood poles for the simple reasons of weight and transportability. Concrete poles cannot be floated across water courses or easily carried into paddy fields. Concrete poles have additional disadvantages as they cannot be climbed readily and will require new structural designs. Presently, all pole top assemblies, guy attachments, secondary assemblies and numerous other design details are standardized throughout all PBSs with the attendant advantage of standard stocking requirements. It is interesting to note that the concrete poles are fabricated using imported cement and imported high-strength steel reinforcing rod.

REB single-phase meters have been specified and furnished with die-cast zinc alloy bases and glass covers. IDA requested changes to "any hard material" for bases and to clear plastic covers in lieu of glass covers. Plastics and thin metal were judged to be a "hard material". Plastics may not be suitable for outdoor use due to ultraviolet degradation and they are easily penetrated to allow the stopping of meter operation. The internal REB committee that reviews all material specification did not notify the NRECA technical advisor to the committee about its decision to make the requested change until after it was taken. Shortly after the specification change a large quantity of meters from the People's Republic of China were received. The meters had plastic gears that failed prematurely. The meters could not be inspected in China and were rejected after inspection at the Khulna warehouse.

PBS Boards of Directors report that pressure from politicians is placed on REB to request line extensions to villages that qualify for the investment, but are on a lower priority list. In some instances it would be preferable if facilities demanded by politicians could be constructed in sequence with other planned construction. In any event, this outside pressure defeats logical planning and construction policies. It is also a small step from this to overruling other policies such as forgiveness of debt, reduction of deposit security and other key cornerstones of REB-PBS operations. This is a difficult situation for REB and PBSs, but the costs must be evaluated.

VI. BANGLADESH POWER SECTOR ISSUES

BDG has limited resources with which to support the further development of the entire power sector and the RE system nationwide. The multilateral banks have suspended major lending to the power sector in part because of continuing BPDB high non-technical system losses (just under 40%). There is a process underway led by the World Bank to support a reorganization of the power sector. Elements being addressed include unbundling BPDB into separate generation, transmission, and distribution agencies, and the entry of private power.

The Bank is also putting strong pressure on BDG to rationalize the BPDB and PBS distribution system to avoid wasteful investment in duplication of distribution facilities. The current demarcation system has created islands of BPDB networks amidst the PBS systems. The Bank estimated that more than 250 Km of distribution system lines were duplicated, along with 15 substations. In November 1993, the Bank suspended a US$ 25 million loan until steps are taken by BDG and BPDB to rationalize the demarcation of BPDB and PBS service territories. The current allocation of most industrial and municipal load centers to BPDB assures that PBS revenues will be constrained.

The ADB has proposed support for a new power plant that would be operated as a parastatal company with funds coming from REB, some PBSs and other investors. The plant would partly serve loads for eight PBSs through a wheeling agreement with BPDB. USAID, the World Bank and NRECA have expressed concern that REB involvement in the project would distract REB from its primary mission of serving the PBS distribution system. REB sees the plant as necessary to obtain reliable power supplies for the PBSs. It maintains that it would not be involved in the plant except financially since a private company is being established. The plant is problematic in part because the cost of power is estimated to be 21% higher than the current cost that PBSs pay BPDB for purchasing bulk power. Price sensitivities of retail consumers may be high.

VII. DONOR INVOLVEMENT

The initiation, operation and future expansion of the RE system in Bangladesh is dependent upon continued financial support from bilateral and multilateral donors for the foreseeable future. USAID's long-term commitment to technical assistance has been the single key external factor aside from low interest financing in the success of the REB-PBS program thus far. Internal factors positively impacting program development have included a more or less hands-off stance by BDG and the decision to not allow unions to develop given the known impact of union activity on BPDB finance and system operation. Much of the donor community has depended upon USAID and its technical assistance provider NRECA, to monitor the ongoing operation of the REB-PBS system. With the end of the NRECA project in 1996, other donors will need to assess their involvement in continuing to monitor and evaluate progress of the overall system, and to support necessary technical assistance.

USAID is the only donor agency that has maintained an ongoing relationship on a near daily basis with the REB-PBS system. The World Bank and IDA have conducted periodic reviews of the program in keeping with their monitoring and evaluation function related to their lending programs. Bilateral donors in general have focused their attention on the PBS level where their funds are being invested, not at REB.

During the period of this evaluation, IDA suspended US$ 25 million in unspent PBS project funds. IDA has requested a comprehensive action plan from REB by January 31, 1994 detailing how it will develop its technical, finance and accounting planning capabilities. It has also requested that REB complete its final version of the draft accounting manual by December 31, 1993. In addition, IDA has again challenged the BDG over the issue of the duplication of BPDB and PBS distribution system. IDA has now required that prior to future expenditures of its funds, it must review and will only approve investments in areas where duplication is not found. IDA wants BDG to solve the demarcation issue (the allocation of rural service territory) without further delay.

A recent report prepared by DANIDA consultants concluded that the Danish government should consider an investment of approximately US$ 20 million for intensification in two PBSs . They were also concerned about PBSs meeting their revenue requirements due to low revenue per customer and the need to conduct cost-of-service studies, and the consultants were continuing to examine the institutional situation at REB.

USAID-Dhaka should organize and host a meeting of major donors to discuss the implications of this report, the recent IDA Aide Memoire, and the DANIDA Aide Memoire. The meeting should include a detailed report given by the NRECA Advisors on their work with REB to develop priorities for NRECA involvement during the phase out period, and what future technical assistance needs have been identified.

All interested donors should cooperatively develop an ongoing monitoring mechanism to track progress on the operational effectiveness of the management, financial, and technical components

of the REB-PBS system. Although structured donor cooperation is often difficult to achieve in practice, there must be an extra effort made by donors in this situation to work together given the potential for continued institutional weaknesses and the unknown impacts of BDG and power sector evolution. Additional technical assistance will likely be necessary after the NRECA project is completed. It is likely that donors will need to coordinate ongoing technical assistance to support the program in the areas of REB management operations, strategic planning, financial and engineering analysis, distribution system operations and maintenance, and perhaps additional areas.

REPORT ANNEXES

EVALUATION SCOPE OF WORK

MID-TERM EVALUATION, RURAL ELECTRIFICATION III PROJECT

I. ACTIVITY IDENTIFICATION

The activity to be evaluated is the Rural Electrification III Project. The task is to carry out a mid-term evaluation of project impact and progress towards achievement of the project purpose.

II. PURPOSES OF THE EVALUATION

- To enable USAID and the Rural Electrification Board (REB) to assess the progress and examine the results of the project to date in relation to project purpose and planned program outputs.

- To assist USAID and the REB to identify short and medium term changes to project strategy, areas of focus and implementation activities which are essential to improving project performance and the institutional development and long term sustainability of the REB.

- To assist the Bangladesh Government (BDG) in considering longer term directions and options for rural electrification in Bangladesh.

III. PROJECT BACKGROUND

Over 84% of Bangladesh's population live in rural areas, and agriculture is the backbone of the economy, accounting for close to 50% of its GDP 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 to stimulate economic growth through the development of agriculture and small-scale agro-industries. Following that decision, the National Rural Electrification Cooperative Association (NRECA), funded by USAID, developed a comprehensive rural electrification master plan. The plan envisages the electrification of all rural areas in five phases by the year 2005.

Rural Electrification under the master plan is based on the concept of "Area Coverage Rural Electrification" (ACRE), involving the design of a basic distribution, or backbone, system that can accommodate rapid increase 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 to 500 square miles. On average, a PBS system 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 rural electrification master plan envisages the creation of 62 PBSs by the year 2005. All PBSs come under the aegis of the semi-autonomous Rural Electrification Board (REB) in Dhaka, which sets national rural electrification policy and standards, represents the interests of the PBSs and the RE movement, and acts as financier for the PBSs. All funds required for construction and start up -- except for technical assistance -- are provided through the REB by the BDG and donors in the form of low-interest loans or grants. Technical assistance costs are provided as grants.

Since 1978, USAID's rural electrification projects, RE I, RE II and RE III have evolved in two important ways. First RE I and II provided technical assistance operating as direct supervisors and focused on development and construction of infrastructure. RE III, which has as its purpose to develop the capability of the REB to establish self-sustaining viable and well managed and maintained rural electric cooperatives, has evolved from a focus on infrastructure construction and electrical engineering to concentrate on institutional development and sustainability of the RE system.

Furthermore, while USAID was the sole donor financing RE at its start, the program's success over the years and its obvious benefit to the country have attracted a large number of other donors. To date other donors have committed over $357 million to the program, bringing donor commitments, including USAID's $179 million, to over $536 million. In addition to USAID, the following donors are active in the program: IDA, KFAED, Finland, ADB, CIDA, SFD (KSA) and Japan.

A five-year $105 million World Bank loan was approved in 1990, with a condition stipulated that expatriate technical assistance would be provided for the 1991-1995 period. Because of its effectiveness and unique expertise in developing a cooperative-based rural electrification programs, the World Bank expressed a strong preference for NRECA, a preference concurred in by other donors and the BDG, to provide the guidance necessary to face the managerial and institutional development challenge of the RE program.

The current direction of the RE program realizes that, ultimately, the success of the rural electrification program in Bangladesh will not be simply a matter of continuing to build the necessary physical infrastructure; sustained provision of electricity to the rural areas will depend on the PBSs' ability to achieve financial, institutional, and managerial viability.

IV. STATEMENT OF WORK

A. This evaluation will review the progress of Rural Electrification III, and will address two key areas of inquiry: the impact of RE III and rural electrification in Bangladesh, and the managerial, financial and technical capacity of the Rural Electrification Board and its long-term viability and sustainability.

IMPACT

To the degree possible using available baseline and other data, assess the overall social and economic impact of RE III in promoting rural economic growth and poverty reduction, and in fostering democratic norms. To the degree possible all data should be gender disaggregated. Specifically, the evaluation should review the degree to which the project has positively or negatively contributed to:

Increased electric irrigation based on number of irrigation hook ups and number of MWH of power supplied for irrigation.

Increased grain production, increased crop diversification, and/or increased acreage under irrigation (i.e., new acreage being double or triple cropped).

Increased farm and agricultural processing employment.

Increased number of small, medium, and large industries, and new employment opportunities.

Improvements in household quality of life, including increased security, more free time and study time, more entertainment, more comfort etc.

Increased contraceptive use and fertility reduction.

The development of communities and their social services such as schools, health facilities, religious centers, markets, etc.

Enhanced democratic norms and equity in RE Coop areas.

Improvements in conditions for women including employment, income, participation, and general quality of life.

Assess the present and potential impact of the existing problems and constraints in Bangladesh's power sector on the short and long term viability of rural electrification and the REB and PBS's.

Assess the role of the USAID-funded project in stimulating donor interest in and contributions to rural electrification, as well as the future scope of donor coordination in RE.

Assess the economic cost/benefit of RE III and rural electrification in Bangladesh. Consider the long term viability of rural electrification in Bangladesh given its overall development and low income levels.

Recommend whether further baseline and impact studies of RE are needed, and how further baseline and impact data can best be collected and analyzed.

INSTITUTIONAL DEVELOPMENT

Assess the REB's and the PBS's progress in achieving managerial and administrative effectiveness, viability and sustainability. Consider the actions which need to be taken during the remainder of the project to ensure viability and sustainability in these areas. Particular attention should be given to the following questions and issues:

The REB's ability to organize consumers into PBS's and prescribe their by-laws.

The REB's capability to prepare, review, implement, and update Policies and Procedures.

Does the REB have a fully functional sanctioned professional service with salaries, allowances, training, and professional opportunities favorable to attract and retain capable personnel? Are its personnel policies adequate to recruit, train and retain technically and managerially qualified staff? Has rapid rotation of senior management been contained?

Do Boards of Directors of each PBS function smoothly, continue to participate in training courses, and give sound direction to PBS General Managers? Do PBS Board Members equitably represent entire membership? Have they developed their knowledge and skills as Board Members, and have a sense of commitment to the PBS?

Is the PBS Member Service and Power Use program effective as measured by increased kWh sold and paid for, and by satisfaction of customer members?

Has Annual Meeting attendance increased each year, and do members actively participate in affairs of their member- owned PBS?

Do the PBS's and Board assume leadership role to encourage development of the agricultural, commercial and industrial potential of its service area?

Are PBS's able to plan and implement expansion of local distribution systems with financial and technical assistance from REB?

Assess the quality and sustainability of managerial, financial, and technical training. Is the Training Directorate able to produce course curriculum, conduct evaluate, and update training with little outside assistance?

Assess REB's strategic and forward planning capacity, and its medium and long range development objectives.

Assess REB's monitoring and evaluation capacity, its ability to monitor impact and change over time, and its relation to strategic planning. Consider ways to strengthen it by the end of the project.

Are REB System personnel able to obtain relevant operating data from PBS's, conduct data analysis, determine problems, and recommend remedial action?

Assess the role of women in PBS and REB management. What are current constraints as well as potential options for increasing women's participation in RE management? Include consideration of incorporating monitoring of women's participation and community socio-economic impact through the MIS.

Assess the REB and PBS's progress in achieving technical capability, viability, and sustainability. Consider the actions which should be taken during the remainder of the project to strengthen the technical capacity of REB and the PBS's. The following issues and questions should be addressed:

Are PBS's able to provide TA to help consumers for wiring and acquiring and installing electric connections, machinery and appliances? Is financial assistance available in some degree from PBS's, but also primarily from the credit markets, particularly rural branch Banks?

Is each PBS providing enough operational level training for staff, and/or using special training conducted by REB as necessary to achieve a self-training capacity?

Have 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? Are they also capable of meeting demands of PBS customers for transformers, electric motors and the like?

Assess the success of the project in achieving the following outputs: the number of miles of lines added in 17 PBSs; the number of substations installed and functioning; additional household, irrigation, commercial hookups, MWH provided, etc; annual average kWh used per connection.

Are PBS's able to carry out meter reading, billing, and collection? Are disconnections because of bills outstanding for more than 90 days kept to 1 or 2% of customer base in any month?

Are REB and PBS personnel able to oversee properly the construction of new distribution systems and the rehabilitation of existing ones?

Are REB Systems personnel competent in equipment repair, able to perform substitution component dielectric testing, visual inspections and mechanical testing?

Does each PBS carry out an effective maintenance program, with minimum response time for repairs, and the ability to test and repair meters?

At each PBS are planned and emergency outage times within country wide norms?

Does REB have an adequate system for procuring, storing and controlling the distribution and use of its essential equipment and commodities?

Assess REB and the PBS's progress in achieving financial viability and sustainability. Consider what steps need to be taken during the remainder of the project to achieve financial sustainability. The following issues and questions should be addressed:

Do the PBS's operate on a sound financial basis so as to meet all present and future obligations?

Is there measurable progress in the PBSs towards financial sustainability?

Are appropriate REB and PBS records prepared to ensure suitable budgetary control and timely recording of procurement and other transactions?

Are annual audits of each PBS satisfactorily carried out by REB audit office? Do outside audits of REB and PBSs conducted periodically show mature and financially sound organizations?

Assess the impact of subsidies on RE development and sustainability.

Assess the suitability of tariff structures and rates, and the means for changing or adapting them. Are PBS's able to develop simplified, equitable, financially sound retail rates for each PBS?

Are the Performance Target Agreements (PTA) uniformly and equitably negotiated with all PBSs? Are the target indicators tracked for each of the three PBS group levels correct measures of progress to PBS financial self-sufficiency?

Are there critical progress indicators that are not now in the PTAs which should be?

Does the negotiation of the PTA facilitate or strain communications between the PBS (i.e., General Manager, Board and membership) and the REB?

The commodity procurement element of the project is substantial, and has required considerable attention of the REB staff and the technical assistance advisors. USAID and the REB will be conducting an end-use check of commodities later. However, this evaluation should assess commodity procurement from a technical and managerial perspective.

Assess the adequacy, timeliness and quality of the equipment and commodity procurement under the project. Assess REB's capability to manage procurement, storage, distribution and control of commodities on a sustainable basis.

Are the current mix of commodities on order appropriate to advancing REB Phase IV development?

How long is the procurement process taking and is this procurement period appropriate?

Are delays in procurement causing delays in PBS extension and/or expansion?

Is the REB procurement process complete according to A.I.D. Handbook 11 regulations?

Is REB commodity procurement monitoring or tracking adequate?

Is the exchange of information between REB offices (i.e., Procurement Directorate, Accounting Directorate, and the Clearance, Storage and Movement Directorate) systematic, timely, and relevant for control and planning purposes.

B. Recommendations: Based on detailed findings and conclusions concerning project performance in the above areas, and considering the overall context, needs and opportunities to improve performance, institutionalization and sustainability of rural electrification, the evaluation team shall develop:

1. A set of prioritized recommended necessary actions, for USAID and the REB to improve the short to medium term performance of the RE III project. The team should indicate what significant changes should be undertaken in the next six months to one year to strengthen the efficiency and effectiveness of project implementation in achieving planned outputs and purpose.

2. A set of prioritized recommendations for the REB and the Bangladesh Government to improve the longer term effectiveness and sustainability of the rural electrification program.

V. METHODOLOGY AND DATA SOURCES

The Contractor shall be responsible for determining appropriate evaluation methodology of suitable analytic rigor. USAID/Bangladesh suggests that the study approach include the following:

-- An initial two week consultancy to identify, assemble and preliminarily review documents, information and data relevant to evaluation of project impact and institutionalization outlined above in Section IV.

-- Review of project reports, Project Agreements and Amendments, and relevant documents including inter alia: the Project Paper and Supplement, past evaluations, baseline studies and impact assessments, NRECA contract and subcontracts, quarterly and annual reports, and pertinent REB reports such as the management information report;

-- Interviews with USAID, REB, NRECA project staff, including;

-- Review of REB management information system;

-- Interviews with key Bangladesh Government officials and with officials of other donor organizations involved in rural electrification in Bangladesh;

-- Field visits to selected PBSs.

VI. TEAM COMPOSITION

USAID/Bangladesh believes that the sum of the skills and background outlined below will be essential for conducting this evaluation. However, the Contractor may propose an otherwise strong candidate for a position who does not meet all qualifications listed for the position, so long as the missing qualification is filled by a team member proposed for another position. For example, it would be acceptable to propose an Institutional Analyst lacking significant experience in MIS, if the proposed Evaluation Expert had qualifications in MIS.

The Contractor is wholly responsible for identifying, contacting, and obtaining the services of Bangladeshi team members and other Bangladeshi support and/or professional services it needs.

Team members and skill areas are as follows:

Institutional Analyst: S/he should be a senior expatriate with significant and substantial experience in organizational and institutional analysis and evaluation of entities similar to RE in developing countries. S/he should have experience in development management and administration, and be familiar with sustainability issues pertinent to developing country entities similar to RE. Should possess strong skills and have experience in the development and use of Management Information Systems (MIS).

Evaluation Expert: S/he should be a senior expatriate social scientist with substantial experience in developing evaluation systems and plans and in conducting evaluations in developing countries. S/he should have experience in assessing project and/or institutional achievements against indicators, and in evaluating the impact of development efforts similar to RE-III. S/he should also have experience in developing evaluation systems for entities similar to RE. A background in rural development is essential, and familiarity with Bangladesh, and/or South Asia would be an advantage.

Engineer (Systems): S/he should be a senior expatriate engineer with expertise in institutional/systems analysis from an engineering perspective. S/he should have significant experience in planning, developing and/or assessing the engineering system of developing country entities similar to the RE system. S/he should be able to assess PBS's from a technical perspective and evaluate the appropriateness, quality and function of the technical system.

Engineer (Construction/Commodities): S/he should be a senior expatriate engineer with expertise to evaluate the appropriateness, timeliness and quality of the construction and commodities provided under the project. S/he should be capable of assessing the degree to which sustainable systems for future procurement and management of construction and commodities have been developed in REB and the PBSs. S/he should have significant experience in working with entities similar to the RE system in developing countries.

Either one or both of the expatriate engineers should have significant expertise in training in order to evaluate the appropriateness, timeliness and calibre of technical training conducted under the project, and to assess the degree to which high quality technical training has been institutionalized in the system.

Financial Expert: S/he should be a senior Expatriate with substantial experience in assessing financial management systems and the financial sustainability of entities similar to RE in developing countries. S/he should be capable of analyzing the appropriateness, efficiency and effectiveness of RE financial and accounting systems. Specific expertise in the financial aspects of rural cooperatives would be an advantage. Expertise in management complementing that of the Institutional Analyst might also be useful.

Bangladeshi Institutional Analyst: S/he should have a background complementary to that of the Expatriate Institutional Analyst, although possibly at a more junior level. Skills and experience in cooperative development, management, and/or finance would be an advantage.

Bangladeshi Evaluation Specialist: S/he should be a social scientist with experience in evaluation of rural development projects and programs similar to RE. S/he should have qualifications and skills complementary to those of the Expatriate Evaluation Expert, although possibly at a more junior level. S/he should have had experience in planning and conducting impact assessments.

Bangladeshi Engineer: The Bangladeshi Engineer should have qualifications and experience to complement that of the two expatriate engineers, although perhaps at a more junior level.

All team members should have experience in conducting evaluations in developing countries. All should have excellent analytic ability and writing skills.

Team Leader: Depending on the people proposed, their skill mix, and areas of responsibility in the evaluation, the Contractor shall propose one of the Expatriate Team Members to be Team Leader. The Team Leader will be responsible for coordination and management of the team in the conduct of the evaluation, and will lead the production of the report. Consequently, s/he should have significant experience in evaluations, and should possess excellent interpersonal, managerial and writing skills.

VII. PERFORMANCE PERIOD AND LEVEL OF EFFORT

The evaluation should begin in Bangladesh in June 1993 with two weeks of initial data gathering and review. The expatriate and Bangladesh Evaluation Experts will conduct this initial review approximately four weeks before the start of the full evaluation. The purpose of this initial data gathering will be to assemble material for review, identify gaps, give the team a head start in developing its workplan, and, generally, improve the efficiency of the evaluation.

The full evaluation will begin in Bangladesh in July.

The Team Leader will be authorized an additional two work weeks in Bangladesh and/or the U.S. for report finalization.

A six-day work week is authorized for all consultants.

Expatriate Institutional Analyst	36 work days
Expatriate Evaluation Expert	48 work days
Expatriate Systems Engineer	36 work days
Expatriate Construction Engineer	36 work days
Expatriate Financial Specialist	36 work days

Team Leader (one of above experts)	12 work days
Bangladeshi Institutional Specialist	36 work days
Bangladeshi Evaluation Specialist	48 work days
Bangladeshi Engineer	36 work days

VIII. REPORTING REQUIREMENTS

The Contractor shall submit the final version of the **Evaluation Report** to USAID in 30 copies within three weeks of receiving USAID's and REB's comments on the final clearance draft of the report. Drafts of the report shall be submitted per Section I below. The report shall contain the following:

-- Executive Summary: Approximately 3 - 5 single spaced pages.

-- Statement of Findings, Conclusions and Recommendations: Findings and Conclusions shall be succinct, with the topic identified by a short sub-heading related to the area(s) of investigation identified in the Statement of Work (Section IV). Recommendations shall correspond to major findings, be prioritized, and specify who or which agency should take recommended action. (The Statement of Findings, Conclusions and Recommendations may be included as part of the Executive Summary.)

-- Body of the Report: The report shall provide the evidence and analysis to support the findings and conclusions. Data presented in the report shall be aggregated by gender to the extent possible. The report shall not exceed 40 single spaced pages, unless otherwise agreed by USAID in advance.

-- Annexes: Shall include <u>at least</u> the following:
- Evaluation Scope of Work
- Resumes of Evaluation Team Members
- Full description of evaluation methodology
- Bibliography of documents consulted
- List of people/agency representatives interviewed
- Selective tabular presentations of quantitative data
- Selective presentation of qualitative information

AID Evaluation Summary: The Contractor shall complete Section H, "Evaluation Abstract" and Section J "Summary of Findings, Conclusions, and Recommendations" of the AID Evaluation Summary, and submit these to USAID/Bangladesh with the Evaluation Report.

IX. TEAM MEETINGS AND DEBRIEFINGS

The evaluation team shall meet upon arrival with the Director of the Office of Project Development and Engineering, the RE III Project Officers and the Mission Evaluation Specialist. The team will also meet with the Rural Electrification Board Chairman and key staff members.

The team shall present a workplan and outline of the final report to USAID for approval by the Project Officer and Evaluation Specialist within one work week of arrival.

The team leader and other team members, as appropriate, shall meet weekly thereafter with the Project Officer and the Evaluation Specialist to provide verbal reporting on the progress of the evaluation.

The team leader shall conduct a formal debriefing for USAID/Bangladesh and REB prior to departure from Bangladesh. S/he shall submit a draft version of the evaluation report three days prior to this debriefing.

USAID and REB officials will review the draft report and will convey comments on it, in writing, to the Contractor no later than 10 working days after receipt of the draft. As noted in Section VIII, the Contractor shall submit the final version of the report to USAID within 3 work weeks of receipt of comments.

X. LOGISTICS

The Contractor shall be responsible for organizing the logistics of the evaluation. This includes arranging for accommodation, office space, computer rental, secretarial and other support services, transportation, and interview scheduling. USAID and REB staff will provide advice and assistance wherever possible to facilitate logistics.

Methodology
Evaluation of Social and Economic Impacts

Evaluation of RE's social and economic impacts included an assessment of its impacts in relation to: 1) increasing income and employment opportunities for the rural poor; 2) improving the quality of life of rural people; 3) instituting the process of democratization.

The methodology for the study involved a mix of evaluation techniques and also provided for an analysis of the differential impacts of RE on men and women. Since a preliminary assessment of the available data showed that reliable baseline and follow-up data were not available with respect to economic and social variables, the approach used included: i) intensive review of relevant documents and studies to identify the key issues identified and related findings; ii) field study in six PBSs, the selection of which was based on a set of objective criteria as well as consultation with REB, USAID and NRECA. Criteria included: 1) age of PBS; 2) concentration of service connections (domestic, irrigation, commercial, industry and others; 3) status of system loss; 4) status of bill collection; 5) donor funding (i.e., representing USAID and other donors; and, 6) geographic and socio-economic situation of areas. (August 1993 MIS report was used for relevant information.)

Field Study:

1. Prior to field visits a detailed set of socio-economic data requirements was provided to PBSs as a means of i) data-gathering, and ii) assessing the quality of readily-available data at the field level and the capability of the PBS to provide such data. This data was then reviewed with PBS management.

2. Based on a listing provided by the PBSs of villages where concentrations of domestic, irrigation, industrial and commercial occurred, villages were randomly selected for consumer interviews.

3. A questionnaire containing guided questions on various social and economic varibles for each consumer group was developed. Informal and intensive group meetings with the various consumer groups were held, using participatory techniques. Interviews with individual consumers were also conducted. Key informant interviews were also carried out with community leaders. (Fifteen days were spent in the field visiting these six PBSs.)

A summary assessment of quantative and qualitative social and economic impacts was then made based on both secondary information and field verification.

Essential data requirements for effective future monitoring and evaluation of social and economic impacts were also outlined as well as mechanisms identified for "operationalizing" an impacts monitoring M&E system.

Methodology for Institutional Evaluation

The major objectives of the institutional evaluation of the REB and PBS's are to a) determine the level of institutional capability development in terms of the effectiveness of management policies and operational systems; b) assess the sustainability of the REB and PBS institutions over time; c) identify priority areas that require strengthening; and d) make recommendations as to actions that can be taken in the next 6-12 months.

Methodologies will include a review of REB and PBS policies and procedures including personnel policies, management systems, management information systems, training programs, decision making procedures, and linkages to other government agencies. Appropriate materials and reports produced by NRECA, multi-and bi-lateral donors and other agencies will also be reviewed.

Based on the information gathered above and the tasks specified in the project statement of work, an interview questionnaire will be developed for use in interviews that will be conducted with REB and PBS staff at senior and junior management, and staff levels. Appropriate staff of NRECA and other agencies will also be interviewed.

Based on interviews and existing materials, a cursory comparison will be made between REB and PBS management and operations with other similar Bangladeshi agencies to determine local norms.

Extensive, ongoing discussions will be held with other Evaluation Team members as their findings are developed.

Methodology
Financial Evaluation

The evaluation methodology including review of documents, analysis of financial data, and interviews, will be applied to determine PBS performance and potential including 1) PBS viability; 2) soundness of financial operations; 3) impact of subsidies; 3) tariff structures; 4) audit and control procedures; 4) Performance Target Agreements. The methodology will also be applied similarly to REB financial performance and potential including 1) soundness of financial operations; and 2) audit and control procedures.

The major objectives of the financial evaluation are to:

a) evaluate the soundness and completeness of the methods used to record and document monthly and summary financial data for each PBS and its reporting systems to the REB.

b) evaluate the progress made by each PBS and all PBSs together in meeting the planned targets toward achieving early and sustained financial viability, and the adequacy of the methods used to track progress and variances.

c) evaluate the impact of changes of parameters, economic assumptions or data on the rural electrification program from a variety of causes such as changes in tariffs, changes in demand for power, loss ratios, schedules, and determine if presently-used indicators are adequate for this purpose.

Methodology
Engineering Evaluation

The major areas of investigation of the engineering technical assistance assessment task are: 1) performance in relation to technical output targets; 2) technical capability of RE staff; 3) technology transfer to private sector engineering firms; 4) construction oversight and technical supervision; 5) technical capacity and consumer service performance; 6) operations, maintenance and testing; and 7) management and control of storage and supply of materials and equipment.

The evaluation approach will include:

1) a review of REB technical policies, procedures and relevant technical manuals;

2) a review of existing available technical studies and data with respect to REB's technical performance;

3) interviews with NRECA technical support staff in the areas of engineering,construction, distribution and technical training.

4) interviews with REB Engineering Directors, Chief Engineers, Superintending Engineers and key staff.

5) interviews with USAID engineering staff

6) interviews with, and inspection of, the work of private sector engineering firms providing technical RE services.

7) field visits to PBSs which address a detailed set of pre-established technical information requirements and also use an informal questionnaire for GMs and technical staff.

8) field visits to the Khulna warehouse and the Chittagong warehouse to assess the efficiency of procurement, storage and supply of equipment and materials.

ANNEX C - SOCIAL AND ECONOMIC DATA REQUESTED FROM INDIVIDUAL PBSs

To make available to the extent possible the following information:

Domestic

a) No. of domestic connections made over time (1981-93).
b) Asset holding (land) of domestic customers.
c) Approximate levels of annual income of domestic customers (please prepare a table by different income categories - <Tk. 12000, - Tk. 18000, >Tk. 24000).
d) Trend in the purchase/use of electric operated equipments and appliances such as TV, fan, iron, heater etc. (please specify the approximate number within the PBS areas).
e) Annual number of disconnections made and reasons.
f) Annual number of reconnections made.
g) Projected number of households to be electrified by the year 2000 and the basis for such projection.

Agriculture

a) No. of diesel power DTW, STW and LLP operating within the PBS area prior to electrification.
b) No. of electric pumps replacing diesel powered pumps after electrification.
c) No. new electric pumps installed.
d) Area under irrigation prior to electrification.
e) Increase in area under irrigation after electrification.
f) Estimated increase in the production of rice and other crops as a result of electrification.
g) Change in cropping pattern (please specify by different crops grown) after electrification.
h) Change in employment opportunities since electrification (please specify various types of employment created, if possible).
i) Projected estimate with respect to area coverage under irrigation, production of rice and other crops, and employment creation by the year 2000 and state the basis of such projection.

Industry

a) No. of dhenkis in operation within the PBS area prior to, and after electrification.
b) No. and type of cottage and other small industries in operation prior to and after electrification.
c) No. of jobs for men and women created due to expansion of industries.
d) No. of jobs lost for men and women due to displacement of dhenkis by electrified rice hullers.
e) Project no. and type of new industries likely to be established because of availability of electricity to year 2000 and basis for such projection.

Commercial

a) No. of growth centers in existence prior to and after electrification.
b) No. and type of new commercial units established because of availability of electricity.
c) Estimate increase in income and employment of men and women due to growth of new commercial establishments.
d) Projected trend in the growth of new commercial activities to year 2000.

Social Services

a) No. of education institutions and health centers in existence prior to and after electrification.
b) No. of education institutions and health centers electrified to date.
c) No. of social/cultural clubs in existence prior to and after electrification.

SELECTED ECONOMIC AND SOCIAL DATA AS PROVIDED BY ONE PBS - TANGAIL

(Based on PBS records, estimates, projections and other agency data)

Domestic Sector

a) Increased in number of domestic consumers (1981-93): 21151

b) Landholding of domestic consumers (estimates) by electricity use:

Use	Landholding
Minimum (31.95%)	0-1 acre (3 bighas)
40-60 kWh (56%)	1-3 acres (10 bighas)
60-100 kWh (9.95%)	3-15 acres (40 bighas)
Above 100 kWh (2.1%)	20-24 acres (70 bighas)

c) Estimated annual level of income:

Electricity Consumption	Estimated Annual Income Tk. '000
Minimum bill	7-8
Up to 60 units	25-30
60-100 units	50-60
Above 100 units	100

d) Appliance ownership (% of consumers):

Type of Appliance	% of Consumers
Television	5
Electric iron	5
Radio	15
Heater	6
Cassette	10
Electric Fan	10
Fridge	2

e) No. of disconnections (annual average): 1195

Reasons: Non-payment, shifting of house location, house repair

f) No. of reconnections (annual average): 1103

g) Projected number of consumers to year 2000:

Analysis: Based on the present trend of 20 Km extension per year, 140 Km of additional lines are expected to be built by 2000. Based on an estimated number of 50 eligible consumers per Km, a total 1000 additional consumers may be connected by 2000. When all lines are constructed 3000 more consumers may be connected (i.e., a net increase of 10,000 by 2000).

Agriculture

a, b & c) Electric vs. Diesel Pumps

	Number in 1980	No. of Electric Pumps Replacing Diesel	Net Increase in Number of Irrigation Pumps due to Electrification
DTW	680	484	54
STW	2850	1375	1049
LLP	340	60	12

d,e) Increase in irrigated acreage

Prior to electrification	:	47,280
Net increase due to electrification	:	17,220

f) Net increase in production of rice and other crops due to electrification (based on output/acre data of Agriculture Department)

Crop	Net Increase in Production (metric tons)
Rice	150,000
Mustard	8,250
Wheat	1,600
Sugarcane	72
Potatoes	4,550
Vegetables	3,640

g) Changes in cropping pattern as a result of electrification

Cropping pattern now includes HYV Boro, T-Aman, mustard, wheat, potatoes, vegetables, sugarcane and onion (latter four are intermediary crops).

Diversification

Prior to electrification only one variety of rice (broadcasted Aman) and jute were being cultivated. After electrification, increased irrigation facilities are available. As a result, HYV boro, T-Aman and mustard are cultivated alternately on the same land. In addition, wheat, potatoes, sugarcane, vegetables, onion and other spices are produced as intermediary crops.

Based on the present trend of 20 Km extension per year, it is expected that 140 Km of new lines will be constructed by the year 2000. It is estimated that 40 DTWs, 500 STWs and 15 LLPs may be connected. In addition, when all lines are fully completed, 10 DTWs, 300 STWs and 7 LLPs are expected to be electrified.

Area coverage under irrigation: 16,940 (DTW-45, STW-15 and LLP-20)

Net increase in production of rice and other crops to year 2000:

Crop	Net Increase (metric tons)
Rice	25,293
Mustard	2,023
Wheat	417

h) Net estimated increase in employment due to electrification: 140,000

i) Projected increases in numbers of electrified DTWs, STWs and LLPs

Industry Sector

a) Number of dhekis prior to electrification: 70,000 - 75,000
Number of dhekis after electrification: 500

b) Number and type of industries prior to electrification

Cottage

Pottery	40
Handloom	1,200
Handicraft	350
Carpentry	20

Small Industry

Rice mills	30

Number and type of industries electrified:

Cottage

Handloom	1,000
Basket, Cane & Bamboo	1
Shuttle	1
Carpentry	1

Small Industry

Rice mill	386
Oil mill	14
Saw mill	31
Flour mill	7
Ice factory	15
Textile mill	5
Plastic factory	1
Rubber industry	2
Sugarcane crusher	3
Tyre retreading factory	1
PVC sheet	1

c) Job creation resulting from industry expansion

Males	:	28,000
Females	:	2,500

d) Reliable data not available

e) Projected new industries by type:

Basis: 1) Planned Industrial Estate - Bangladesh Small and Cottage Industries Corporation
2) Jamuna Bridge completion by 1996

New industries: Leather: 4, Cold storage: 4, Electrical appliance assembly: 2, Artificial jewelry: 5, Soap factories: 10, Cosmetics: 5, Chemical factories: 5, Cylinder gas: 2, Textiles: 5, Aluminum: 2, Precision tools manufacture: 5, Irrigation spare parts: 5, Vehicle spare parts: 2, Medicine: 2, Poultry: 20, Dairy products: 2, Mini sugar mill: 2.

Commercial

a) Increase in number of growth centers:

Prior to electrification	:	23
After electrification	:	67

b) Number and types of new commercial units established because of electrification:

Type	Number
Shops	2,082
Offices	115
Bazar	30
Small workshops	50
Jewelry	20

c) Net employment increase of men and women due to expansion of growth centers:

Men	3,338
Women	834

d) Projected trend in the growth of new commercial industries to year 2000:

Type of Units	Projected No.
Bazar	20
Shops	500
Offices	15

Social Services

a) Number of education institutions

Institution	Prior to Electrification	After Electrification
Education	469	631
Health Centers	5	43

b) No. of educational institutions electrified : 45
No. of health centers electrified : 21

c) No. of social clubs prior to electrification : 30
No. of social clubs after electrification: 72

ANNEX D

Displacement of "Dheki" by Rice Hullers and its Impact on Employment

The economic impacts of rural electrification (RE), among others, have included: i) promoting intensive agriculture; and ii) effecting the growth of rural industries. Intensive agriculture has created significant employment opportunities in rural areas for the landless and marginal farmers. Post harvest processing activities involve a large proportion of this labor force which, in case of rice, is estimated to be at least 25% of those required during the production processes.

Crop processing, particularly in case of rice, provides an important source of income and employment opportunities for the rural poor, and it serves as one of the few opportunities that is open to poor rural women. Post-harvest operations involve a number of steps, but soaking, parboiling, husking and winnowing operations are most labor intensive. Traditionally, rice husking was done at the household or farm-level using "dheki" (a foot-operated mortar and pestle). The process involved manual operation using 2-3 persons. It was labor intensive, low-cost, but provided low returns to labor. Since 1960, the introduction of mechanized diesel-operated rice hullers has resulted in gradual displacement of these dhekis and the process has been accelerated by the availability of low-cost electricity provided under the government's RE program.

The choice of mechanized technology was influenced by comparatively low cost, convenience, greater output, increased profit, and higher return to capital for the huller owners. In 1977, the energy cost of milling one mound of rice was Tk 0.61, and inclusive of all costs, was Tk 1.0, as opposed to Tk 12 needed for milling the same quantity of rice by dheki. The significant cost differential made mechanized milling more attractive and economic. With the rising costs of energy the milling costs increased significantly. A survey of 50 mills conducted in 1980 showed a three-fold increase in milling costs to Tk 3 per mound in the case of electric-operated hullers and five to seven-fold increase to Tk 5-7 in the case of diesel-operated ones. Even with increased cost of electricity the electric hullers enjoy greater profit margins since they pass on the increased costs to the customers. The profitability of the electric hullers has in fact resulted in replacement of a portion of the diesel-powered units by electric hullers. This was substantiated during the field visits by the evaluation team. In all the areas visited most of the rice hullers were found to be operating with electricity, many of them converted from diesel. PBS data indicated a sharp rise in the growth trend of these hullers.

While mechanization had a positive impact on rice output at a relatively low cost, its impact on rural employment for women has been negative. It is estimated that each diesel- or electricity-powered mill operating at capacity displaces 123 dhekis, each of which provides employment to 2-3 women. In theory, this means that each huller could displace 246 to 269 women. Given that 21,951 mechanized hullers[4] are in operation now, it would imply that roughly six million

[4] There were 7,317 rice husking mills in 1981, and assuming that the number has trebled by 1993, the figure would be 21,951.

women have been rendered unemployed due to the proliferation of mechanized rice hullers. Even considering the utilization capacity of these hullers to be 50 per cent, the number of women displaced would be three million.

It is often argued that jobs created by intensive agriculture and the rice hullers provide employment opportunities for the displaced women. In agriculture, opportunities for women are limited by the nature of work, and the cultural norms, which in many places bar women from doing work in the field. Rural rice hullers have created some jobs, but the number of jobs created appears to be few compared with overall displacement. Typically, each huller employs 2-3 women for winnowing husk. Some hullers with boiler operations use women for soaking, parboiling, drying and winnowing, but in recent years the number of women employed is only a few. In fact, in many places such tasks have been taken over by men, giving women the peripheral task of winnowing only. The number of jobs created in the hullers is only a fraction of the number displaced.

The impact of hullers viewed from the perspective of labor displacement only tends to overlook the far reaching implication on the household economy of poor women who were engaged in dheki operation. Women operating dheki used to get a portion of the husk, rice bran, and the broken rice. The husk was used as fuel for cooking, rice bran for raising poultry birds and goats, and the broken rice as reserve for difficult times. The whole process fitted well to their survival strategy. With the displacement of dheki they have not only lost their employment, but also other opportunities which provided a cushion in their survival strategy.

The above argument is made not in promoting a return to dheki or to claim that RE is the primary cause of the job loss, but to amplify the impact that displacement has had on the life of the poor who perpetually struggle at near survival level. Credit support from NGOs has enabled many of their organized women groups to earn significant income from rice processing using the hullers. But poor women who are not associated with NGOs do not have access to institutional credit, and the operation is also limited in terms of employment generation. In fact, there is an urgent need to explore varied areas of intervention which will create expanded employment opportunities for those poor women displaced through mechanization.

ANNEX E

Average Wiring Costs for Domestic Consumers
(1993)

	Items	Cost (Tk)
1.	Wire clip	12
2.	Single core wire	
	- 3/0.036 red	30
	- 3/0.036 black	28
	- 3/0.029 red	34
	- 3/0.029 black	24
3.	Double core wire (3/0.036)	24
4.	Fuse wire (10 amp)	1
5.	Disconnect box (15-30 amp) 250 volt	120
6.	Mounting board	30
7.	Screws (3/4", 1/4")	15
8.	Wooden batten (3/4")	9
9.	Tumbler switch (5 amp) 250 volt	27
10.	Two-in socket (5 amp) 250 volt	7
11.	Lamp socket/holder	16
12.	Plastic tape	12
13.	Ground rod	120
14.	Bamboo pole	120
15.	G.I. nut	3
16.	G.I. wire	12
17.	Meter board	18
18.	Wiring charge	120
	Total connection cost:	779 Tk

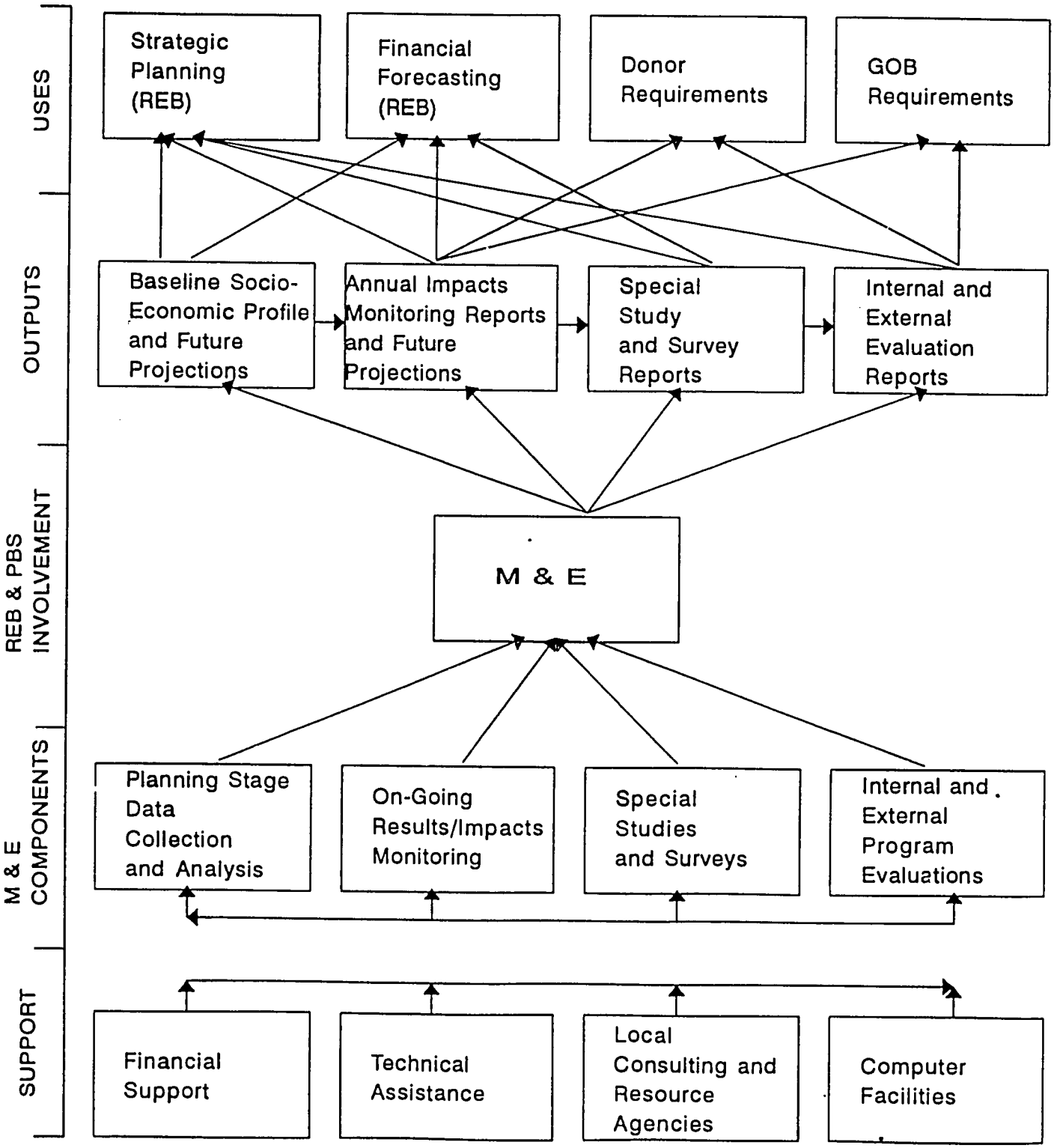
Average Electricity Unit Costs for Domestic Consumers
(1981 - 1993)

Year	Unit Cost/kWh	Minimum Charge Tk
1981	0.50	15
1982	0.80	25
1986	1.25	35
1988	1.50	45
1989	1.90	45
1990	2.02	45
1993	2.02	45

ANNEX F

Proposed M&E System for Social and Economic Impact of RE

OPERATION OF THE M&E SYSTEM



MONITORING AND EVALUATION SYSTEM
OUTLINE OF INFORMATION REQUIREMENTS, DATA SOURCES, ANALYSIS AND RESPONSIBILITIES

SYSTEM COMPONENT	DATA REQUIREMENTS	DATA COLLECTION METHODS	ANALYSIS	RESPONSIBILITIES AND SUPPORT NEEDED
I. PLANNING STAGE DATA AND ANALYSIS (For expansion/intensification or new PBS establishment) Area-specific economic and social profile data	ECONOMIC AND SOCIAL PROFILE DATA AT HOUSEHOLD AND COMUNITY LEVELS 1. Household Level a) Demographic: Family size, marital status, school-age children b) Social o Size of House/Type of structure o Appliance ownership o Educational status c) Economic o Asset-holding, land ownership o Occupation o Income levels o Irrigated acreage o Use of irrigation equipment by type o Crop production levels o Employment by household o Cottage industries - by type, employment, output and sales 2. Community Level a) Micro industries o Number by type of industry o Employment o Output and sales o Power use - type of b) Large industries o Number by type of industry o Employment o Output/sales o Power use - type of c) Growth centres o Number of o Types/number of commercial units d) Social Institutions, Health Centers: No. by type Schools/colleges: No by type	Selected key data to be collected by structured survey at household and community levels to cover: households, cottage industries, irrigation, small and large industry, commercial centers and social institutions.	1. Area-specific profiles of economic and social structure - for areas planned for electrification 2. Baseline data and report 3. Analysis of implications of household and community-level data for future electricity demand and projected revenue	Initial planning: o Technical assistance from NRECA or other organizations o Support by local research/ consultancy firm o Data collection: retaining engineers assisted by research/ consultancy firm o Analysis plan to be developed by outside TA o Analysis to be conducted by evaluation unit, assisted by Rate Cell and local research/ consultancy firm.

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MONITORING AND EVALUATION SYSTEM
OUTLINE OF INFORMATION REQUIREMENTS, DATA SOURCES, ANALYSIS AND RESPONSIBILITIES

SYSTEM COMPONENT	DATA REQUIREMENTS	DATA COLLECTION METHODS	ANALYSIS	RESPONSIBILITIES AND SUPPORT NEEDED
I. PLANNING STAGE DATA AND ANALYSIS (Cont'd)	e) Social clubs o No. of f) NGOs o Name, type of activity g) Planned infrastructure investments and area			
			PBS & Overall: Annual M&E Report Summary analysis for individual PBSs and overall program: assessment of social and economic impacts of RE & linking this analysis with actual RE service and consumption data	o Initial planning of data required forms, etc. as well as analysis support to be provided by NRECA or other technical assistance.
II. ONGOING RESULTS/IMPACTS MONITORING	SELECTED CONSUMER SOCIAL, ECONOMIC AND ELECTRICITY CONSUMPTION DATA			
	1. Household Level Number of consumers a) Demographic - update characteristics, family size, marital status, school-age children b) Social o Level/change in housing standard o Level/change in appliance ownership o Level/change in educational status o Identified changes in selected quality-of-life indicators c) Economic o Level/change in asset holding o Level/change in income levels o Level/change in irrigated acreage o Use of irrigation equipment - diesel vs electric and whether changed from diesel o Crop production levels/patterns/ changes o Employment by household o Level/change in number, type of cottage industries, working hours o Electricity consumption levels o Monthly bill amount o Disconnections/reconnections and reasons	1. Household Small scale survey based on small representative sample of household consumers - to collect data on households, irrigation and cottage industries.	Household Level: e.g. o Analysis of household-level data, changes influenced by RE and relate this information to service and consumption levels o Assessment of extent to which socio-economic groups are accessing elctricity and their ability-to-pay o Analysis of extent of suppressed demand: Nos. of consumers waiting for disconnection o Analysis of change in irrigation method or new RE irrigation and impacts etc.	o Household data to be collected by local research/consultancy firm

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MONITORING AND EVALUATION SYSTEM
OUTLINE OF INFORMATION REQUIREMENTS, DATA SOURCES, ANALYSIS AND RESPONSIBILITIES

SYSTEM COMPONENT	DATA REQUIREMENTS	DATA COLLECTION METHODS	ANALYSIS	RESPONSIBILITIES AND SUPPORT NEEDED
II. ONGOING RESULTS/IMPACTS MONITORING (Cont'd)	2. Community Level a) Micro industries: o Number and type of changes in o Employment levels & changes in o Output and sales: level and change in o Electricity consumption by industry type o Electricity revenue by type b) Large industries o Number and type of changes in o Employment: Levels & changes in o Output and sales: level and change in o Electricity consumption by industry type o Electricity revenue by type c) Commercial o Number of commercial, level and changes in size of o No. of commercial units by type o Employment by commercial centers o Electricity consumption by of commercial centors d) Social institutions o Changes in number, type of electrified institutions o Electricity consumption e) NGOs o Numbers, activities in electrified villages	2. Comunity Level o Micro and Large industries - Follow-up data to be collected on individual industrial unit basis for each PBS o PBS records Commercial Data on growth center characteristics to be collected by a small survey of growth in each PBS o PBS records Records maintained and updated annually by PBS field staff on an industry - by industry basis. Records maintained and updated by PBS on commercial centers; small survey PBS records or social institutions, small survey	Community Level 1. Analysis of net changes in the structure, and numbers of small, large industries - extent to which new industries established or existing ones expanded due to RE; employment and output impacts. 2. Analysis of growth of commercial centers as result of RE o Empoyment impacts o Output impacts 3. Analysis of impacts of RE in terms of electrifying social institutions. 4. Identification of implications of planned new investments in area 5. Project future changes (2 yrs) in number and types of consumers based on community level analysis, requests for connection and new investments planned	Comunity Level Data to be collected by the PBS with support from local research/consultancy firm if needed o Analysis to be carried out by Evaluation Division, with support fram Rate Cell and local research/consultancy firm if needed. o First analysis and report to be assisted by outside TA

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MONITORING AND EVALUATION SYSTEM
OUTLINE OF INFORMATION REQUIREMENTS, DATA SOURCES, ANALYSIS AND RESPONSIBILITIES

SYSTEM COMPONENT	DATA REQUIREMENTS	DATA COLLECTION METHODS	ANALYSIS	RESPONSIBILITIES AND SUPPORT NEEDED
III. SPECIAL STUDIES AND IMPACT SURVEYS 1. Micro studies on specific problems and issues	1. Micro Studies Data dependent upon specific study program. Examples of studies: a) disconnections, numbers, reasons and reconnections b) Costs of electrified vs diesel powered electrification. c) Demand sensitivity of households to tariff adjustments	1. Micro Studies Data collection method is study-specific to include: a) PBS records b) Collelction of field information as needed	1. Micro Studies Study-specific brief report to include: o Data summary o Findings o Identification of implications for financial projections and program adjustment	Special Studies Evaluation Division to prepare annual study program. Studies to be carried out by Evaluation Division and PBS Member Service
2. Periodic impact surveys	2. Surveys Selected key economic and social data at household and community levels, data requirements dependent upon the particular survey, subject area and purpose	2. Surveys Sample surveys of small numbers of consumers in each consumer category.	2. Surveys Analysis of specific impact areas - individual PBS and overall: o Data summary o Findings o Implications for program adjustment and strategic planning	2. Surveys o Overall survey program to be developed by Evaluation Division. o Actual survey, analyses and report to be carried out by local consulting/research agency.
IV. INTERNAL AND EXTERNAL PROGRAM/PROJECT EVALUATION (Internal: RE/PBS - every 2 years)	1. Internal o Selected key data on progress and results in each area of operations o Selected key data on social and economic impacts.	1. Internal o Use of data as generated by various monitoring systems o Review of study results o Interviews with management and consumers o PBS administrative records o PBS reports	1. Internal 1. Summary: Outputs, progress, results and impacts 2. Implications for financial forecasts 3. Implications for institutional and for program adjustment.	1. Internal o REB Evaluation Division to co-ordinate, prepare terms of reference etc. o Representatives from each directorate be included in study. o Outside TA to initially plan 1st evaluation
(External: Donor Evaluations every 3 years)	2. External o REB/PBS records o Program reports, studies o Annual results/impacts data monitoring data o Consumer, consumption data o Selected institutional, financial and technical data, etc.	2. External 1. External evaluations would also be based on donor records 2. Results of internal evaluations 3. Field verfication	2. External Summary of 1. Outputs, progress, results, impacts 2. Implications for institutional, financial, technical sustainability 3. Assessment of results of donor-specific interventions 4. Implications for future programming and funding	2. External o Donor-funded, organized and managed o Evaluation Division to act as 'clearing house' for donor studies i.e. division would perform a co-ordinating role.

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114

ANNEX G

Suggested Elements for REB Organizational Review

- Review of REB Ordinance of 1987
- Review of REB and PBS Bylaws
- Review of Instructions
- Review of operating policies of REB and PBSs
- Review of REB Board of Directors
- Review of current and long-term personnel requirements
- Review of current and long-term organization design
- Review of employee selection process
- Review of personnel policies and recruitment procedures
- Review of position description and job specifications
- Review of performance appraisal system for employees
- Review of compensation program
- Review of corporate strategic planning documents
- Review of REB and PBS workplan and budget process
- Review of REB accounting procedures
- Review of procurement in the construction, operations, and maintenance programs
- Review of warehousing and inventory control process
- Review of the engineering process used in planning and building a PBS
- Review of the purpose and value of retaining engineers
- Review of working relationship between PBSs and REB
- Review of authority and autonomy options for the PBSs
- Evaluate the Member Service and Public Relations programs of REB and the PBSs
- Evaluate the effect of rapid rotation of the Chairman and personnel
- Evaluate the future need for technical assistance advisors
- Evaluate linkage between performance and the ability for REB to attract donors

ANNEX H

REB WOMEN'S EMPLOYMENT STATISTICS

NAME OF POSITION		PROJECT	TOTAL
Deputy Director - Administration	3	-	3
Deputy Director - Finance	2	-	2
Assistant Director - Administration	10	-	10
Assistant Timber Product Specialist	4	1	5
Accountant	1	-	1
Assistant Accountant	4	1	5
Librarian	1	-	1
Drafting	1	-	1
Typist/Clerk	39	12	51
Telephone Operator	2	-	2
Organizational Total	67	14	82

Notes:

1. No women employed as engineers
2. Number of women resigned from REB 1987-1992: 6% of total resignations.

REB EMPLOYMENT BY GENDER

	Approved	Project	Total
Women	67	15	82
Men	691	323	1014
Total	758	338	1096

Notes:

1. Approved positions are those sanctioned by the government. Project positions are tied to specific project activity. Upon project completion some positions become approved while others terminate. Most personnel are redeployed to new project positions.

ANNEX I

Responses of PBS Management Staff On Current Status and Future Directions of PBS

In each PBS, a workshop was held with the management staff where they were given a set of questions to answer. The objective of the exercise was to allow the staff members to express their opinion on the current status and future directions of PBS. The staff members were asked to write their individual opinions without discussing with their fellow colleagues. The set of questions served were:

- what are the five areas of achievement of PBS?
- What are the five areas of failure of PBS?
- What are the strengths (list any five) of PBS?
- What are the weaknesses (list any five) of PBS?
- In what ways can PBS be strengthened further?
- What do you understand by autonomy of PBS, and what can be done to increase the autonomy of PBS?
- What should be the relationship between the PBS Board and the PBS management?

The responses of the staff members were analyzed, and the most frequently-mentioned ones were chosen. The results are presented below.

Five areas of PBS achievement

1. Reduction in system loss.

2. Greater revenue collection.

3. Food self-sufficiency through increased food production effected by expanded irrigation.

4. Improved socio-economic condition of the people in rural areas.

5. Promotion of micro-industries in rural areas.

6. Expanded employment opportunities both in the agriculture and industrial sectors.

7. Efficient consumer service.

Five areas of failure

1. Failure to take over PDB lines which would have provided greater income to PBS.

2. Inability to construct new lines and give connection to greater number of consumers due to shortage of materials.

3. Failure to stop pilferage.

4. Inability to keep system loss within limit.

5. Failure to ensure steady supply of electricity due to PDB control and actions.

6. Not being able to educate consumers, develop their awareness and actively involve them in PBS activities.

Strengths of PBS

1. Presence of skilled, dedicated and honest staff.

2. Prompt response to consumers' complaints and delivery of efficient service.

3. Good relationship with consumers.

4. Commendable performance in bill collection and revenue-earning.

5. Promotion of socio-economic development in rural areas.

Weaknesses

1. Increased control of REB and delay in decision-making which affect PBS operation.

2. Inadequately trained staff and lack of sufficient training opportunities.

3. Inadequate supply of materials for new connections.

4. No delegation of authority to PBS by REB.

5. Lack of control over the supply of electricity by PDB.

6. Inability to avoid political influence over construction of line in revenue rich areas.

7. Insufficient staff to respond to consumer demand affecting service delivery efficiency.

Steps to be taken to strengthen PBS

1. Taking over of PDB lines covering BSCIC and other high-load areas.

2. Provision of need based training to PBS staff.

3. Delegation of more administrative, management and decision-making power to PBS.

4. Ability to generate own power and have control over its distribution.

5. Increase in staff strength.

6. Legal support to deal with illegal connections. PBS staff should be granted indemnity.

7. Provision of training for PBS Board members.

8. Installation of modern distribution systems.

9. Cooperation with NGOs and other agencies to promote development efforts which will increased electricity use.

Autonomy of PBS

1. Ability of the PBS to implement programs and perform certain administrative and management functions independent of REB control.

2. Since PBS is responsible for debt service it should have control over, or have say on all costs borne by PBS. It should know the detailed costing of all fixed assets and the costs to be incurred on those.

3. PBS should be given the authority to identify its needs and take necessary action, i.e., set up its own workshop, or have its own engineering section instead of having retaining engineers.

4. PBS should be allowed to set up a forum like NRECA which will facilitate cross fertilization of ideas, information and experiences and thereby strengthen PBS.

Relationship between PBS management and the Governing Board

1. Governing Board should be responsible for policy making while the PBS management should be responsible for the implementation of such policies. The management will be accountable to the Board for all its actions. The Board will not interfere with the day-to-day administration and management functions of PBS.

2. There should be a clear understanding between the Governing Board and the PBS management.

3. There should be a policy guideline defining the roles and functions of the Board and the management.

4. The Board should give feedback to the management on consumer needs and interests, and jointly determine PBS policies and programs.

ANNEX J

PBS Financial Data

ANNEX J

Financial Data for Operating PBSs

These proforma financial and operating data spreadsheets were prepared by NRECA for the fiscal year ending June 1993. The source data used were taken from REB Form 550 which summarizes monthly and cumulative year-to-date financial and operating data for each of the 40 presently operating PBSs. Financial and Operating Ratios were also computed by NRECA from this summary data.

Statement of Revenue and Expenses REB Form 550 June 30, 1993		Dhaka-1 U.S. AID Taka	Moulvibazar U.S. AID Taka	Hobigonj U.S. AID Taka	Tangail U.S. AID Taka	Comilla-1 U.S. AID Taka	Chandpur U.S. AID Taka	Pabna-1 U.S. AID Taka	Pabna-2 U.S. AID Taka	Sirajgonj U.S. AID Taka	Jessore-1 U.S. AID Taka	Jessore-2 U.S. AID Taka	Natore-1 U.S. AID Taka	Natore-2 U.S. AID Taka
R&E 3	Total Operating Revenue	232043863	83701384	73051534	98934741	108893560	45699610	36116444	30277724	68968030	74040484	77273887	54916789	56925300
R&E 4	Cost of Purchased Power	141649702	43790670	37605516	58380545	60040074	23694955	20644850	17181174	40599731	40844610	42157630	30875330	32086226
R&E 5,6	O & M Expense	4467064	3341659	3622117	4596398	5143063	3551589	3005758	3468454	3317327	3095139	3283455	2912263	2997593
R&E 7,8,9	Consumer Accts, Serv & Sales Expense	4925228	2697555	2298717	2912174	4016595	2542595	1613797	1559322	2253989	3057065	2404487	2011808	2406399
R&E 10	A & G Expense	6470142	3678236	3958270	4299949	5581117	3640035	2456295	3425953	3525900	4055827	4230232	4145254	4255537
R&E 11	Total Operating and Main Expense	157512136	53508120	47484620	70189066	74780849	33429174	27257701	25634903	49696545	51052641	52074196	39944655	41745755
R&E 12	Depreciation & Amortization Expense	11748236	6418836	6326252	10648561	11446675	7523350	5657727	5016736	6675615	8778671	5391496	6930326	6437159
R&E 14	Interest on Long Term Debt	8236000	3680000	3715000	11950000	6579000	6874548	5454000	5160000	5082000	7378000	5152000	6246000	5700100
R&E 16	Total Cost of Electric Service	177843832	63734024	57650140	92984708	93001291	47938945	38481818	35940439	61668611	67415851	62878543	53255274	54104984
R&E 17	Operating Margins	54200001	19967360	15401394	5950033	15892269	-2239335	-2365374	-5662715	7299419	6624633	14395344	1661515	2820316
R&E 22	Net Margins	77049791	34616110	20863239	12291351	28945301	3307457	118814	-2321612	10884204	9987458	19218502	4554238	6161083
Balance Sheet														
BS 3	Total Utility Plant	422851414	229422873	242830184	370956440	403476981	292208396	192305538	190329214	231126589	337926919	250561138	243018809	225764988
BS 8	Total Investments	43043216	20854134	20340324	30381247	32958155	21685172	15444979	18596200	19522984	26677881	22143367	20371455	19054796
BS 9,12	Cash & Temporary Investments	176304579	91386082	23259968	183124525	45650911	24285994	7282098	28999547	14933100	4285850	17521376	10251088	12356502
BS 20	Total Current & Accrued Assets	303179206	152727975	91552772	83495655	106208053	55828434	39190066	55030329	57738994	67410282	84681928	42602117	50637411
BS 24	Total Assets and Other Debits	704822531	372771102	319648422	421430092	478595207	320234184	211324844	234174824	267738112	374180753	313845421	281027072	260000702
BS 32	Total Margins & Equities	391678262	191115368	122755442	95035315	145355100	13865827	23710025	46852600	84035595	79043455	111992743	43210334	54885593
BS 37	Total Long Term Debt	269714233	163668464	173493974	271239666	296729600	218469667	141281951	133902605	162614706	273590589	182878423	172318942	172043116
BS 44	Total Current-Accrued Liabilities	36602216	14796402	18192488	48221757	22760015	86469850	43148316	51030494	15174635	18796467	16885174	53575093	26812890
BS 49	Total Liabilities & Other Credits	704822531	372771102	319648422	421430092	478595207	320234184	211324866	234174824	267738112	374180753	313845421	281027072	260000702
E7,YTD	Total KwH Purchased	100440640	31047000	26663770	41391025	42571400	16794720	14638333	11740840	28787042	28961000	29892220	21886795	22749380
E8,9YTD	Total KwH Sold and Used	86932725	28108981	23944446	35205281	37275968	14326847	12664052	10190969	24960690	25355953	26429482	18557520	19018626
E11,YTD	KwH Loss	13507915	2938019	2719324	6185744	5295432	2467873	1974281	1549871	3826352	3605047	3462738	3329275	3730754
F3	Services In Place	32778	22996	25711	27025	42301	30944	14343	20731	22279	28621	21121	21481	25341
F5	Services Energized	25927	20493	19579	17920	34741	26691	11193	13638	16816	25183	17538	15435	16571
F14	Total KM of Lines Energized	1620	1115	1247	1798	1891	1471	1016	1022	1157	1640	1200	1267	1201
B8d	Number of Accounts Over 30 Days	15806	11658	10698	10502	14339	7204	6585	7113	8790	6599	6386	9639	9694
B8e	Amount of A/R Over 30 Days	29003562	7133534	6013316	20438002	12266280	4210375	8619999	9465721	13079487	6536801	8336732	11879137	11899609
B8a	Total Receivable Amount Outstanding	43340850	11655315	11255747	23934424	19917514	6406647	10288953	11647181	16840345	10974759	13376690	15034300	15446362
B11h,YTD	Months Revenue Outstanding	2.32	1.73	1.93	3.06	2.34	1.74	3.64	4.91	3.12	1.87	2.13	3.48	3.39
B1a4	Number of Employees	170	123	129	133	193	131	90	102	115	138	117	119	109
Financial and Operating Ratios														
	Net TIER (Times Interest Earned Ratio)	10.4	10.4	6.6	2.0	5.4	1.5	1.0	0.6	3.1	2.4	4.7	1.7	2.1
	DSC (Debt Service Coverage)	4.9	4.4	3.1	1.5	2.6	1.2	1.0	0.8	1.9	1.6	2.8	1.3	1.5
	Operating Revenue Per KM of Line	143237	75069	58582	55025	57585	31067	35548	29626	59609	45147	64395	43344	47398
	Total Cost Per KM of Line	109780	57161	46231	51716	49181	32589	37876	35167	53300	41107	52399	42033	45050
	Operating Margins Per KM of Line	33457	17908	12351	3309	8404	-1522	-2328	-5541	6309	4039	11996	1311	2348
	O & M Expense Per KM of Line	2757	2997	2905	2556	2720	2414	2958	3394	2867	1887	2736	2299	2496
	A & G Expense Per Service in Place	197	160	154	159	132	118	171	165	158	142	200	193	168
	Plant Revenue Ratio	4.7	5.7	6.9	9.1	8.3	13.3	12.4	14.5	8.1	10.2	7.1	10.1	9.1
	Margins & Equity as % of Total Assets	55.6	51.3	38.4	22.6	30.4	4.3	11.2	20.0	31.4	21.1	35.7	15.4	21.1
	LTD as a Percent of Total Utility Plant	63.8	71.3	71.4	73.1	73.5	74.8	73.5	70.4	70.4	81.0	73.0	70.9	76.2
	Current Ratio	8.3	10.3	5.0	1.7	4.7	0.6	0.9	1.1	3.8	3.6	5.0	0.8	1.9
	System Loss	13.4	9.5	10.2	14.9	12.4	14.7	13.5	13.2	13.3	12.4	11.6	15.2	16.4
	Services In Place Per Employee	193	187	199	203	219	236	159	203	194	207	181	181	232
	Cost of Purchased Power Per KwH	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.46	1.41	1.41	1.41	1.41	1.41
	Average Revenue Per KwH Sold & Used	2.6692	2.9777	3.0509	2.8102	2.9213	3.1898	2.8519	2.9710	2.7631	2.9200	2.9238	2.9593	2.9931

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Statement of Revenue and Expenses REB Form 550 June 30, 1993		Rangpur-2 U.S. AID Taka	Jamalpur U.S. AID Taka	Chitta-1 U.S. AID Taka	Borga U.S. AID Taka	1993 Total U.S. AID Taka	1993 Total U.S. AID U.S. $	Rangpur-1 KFAED Taka	Satkhira KFAED Taka	Feni KFAED Taka	Mymensingh KFAED Taka	Dinajpur-1 KFAED Taka	Kushtia KFAED Taka	Joypurhat KFAED Taka
R&E 3	Total Operating Revenue	35698685	32349214	27428738	59869589	1196189576	$29,904,739	50144435	40264406	49339694	60658745	61696879	30551577	32049824
R&E 4	Cost of Purchased Power	19378912	17878308	19678841	34283896	680770970	$17,019,274	26424053	22265253	28668823	33675938	32503946	17612076	16970965
R&E 5,6	O & M Expense	2381519	2531011	2545479	3432878	57692766	$1,442,319	2122239	2473140	3139425	3103643	3524481	2213249	2954451
R&E 7,8,9	Consumer Accts, Serv & Sales Expense	1733033	1261464	1995844	1812969	41503041	$1,037,576	1903781	1732297	2654761	2156207	2460145	2343294	1341405
R&E 10	A & G Expense	2309158	2631408	3122813	3139304	64925430	$1,623,136	2967908	2677823	3839023	3585730	3085395	2739701	2658216
R&E 11	Total Operating and Main Expense	25802622	24302191	27342977	42669047	844427198	$21,110,680	33417981	29148513	38302032	42521518	41571967	24908320	23925037
R&E 12	Depreciation & Amortization Expense	7860150	7738880	9776783	8118897	132494350	$3,312,359	11005402	5862335	9619065	13227462	11938336	7206121	7434122
R&E 14	Interest on Long Term Debt	8327000	9000000	953000	5190000	104676648	$2,616,916	13599000	6678000	6688772	17000000	10000000	9442197	9407000
R&E 16	Total Cost of Electric Service	42058447	41119955	38087760	56074413	1084239065	$27,105,977	58138216	41828523	54701203	72827722	63600201	41630478	40831204
R&E 17	Operating Margins	-6359762	-8770741	-10659022	3795176	111950511	$2,798,763	-7993781	-1564117	-5361509	-12168977	-1905322	-11078901	-8781380
R&E 22	Net Margins	-2343986	-4390008	-302420	8973859	227613381	$5,690,335	-3731463	988946	-1758105	-5450709	3241267	-8490087	-5843845
Balance Sheet														
BS 3	Total Utility Plant	268930959	269171900	377557112	379346574	4927796028	$123,194,901	422973261	226192197	365152754	537859914	461795386	307860449	285420840
BS 8	Total Investments	19582644	18917834	21882940	24576204	396033532	$9,900,838	25996232	16452899	26705647	31756896	30148870	21690032	18617462
BS 9,12	Cash & Temporary Investments	11784055	6794305	9136065	19754118	687110163	$17,177,754	9314723	6719282	9621832	5275947	23514570	1983350	7051256
BS 20	Total Current & Accrued Assets	39674599	36801655	68003061	82829962	1417592499	$35,439,812	117614208	40709442	49955878	64234726	75381929	508454341	51652724
BS 24	Total Assets and Other Debits	293079313	294773926	446820457	462595378	6057062340	$151,426,559	528357881	252105227	395089658	598897740	524870778	350524622	318744961
BS 32	Total Margins & Equities	11991636	5277767	16324041	46185001	1483314104	$37,082,853	3848473	18032453	7240827	-790111	34383586	217019	224561
BS 37	Total Long Term Debt	241011443	245219096	411803073	377126170	3907105718	$97,677,643	446036436	200666622	312553893	497804718	403670421	287239518	274156108
BS 44	Total Current-Accrued Liabilities	37768121	39551396	17656824	11376441	558818579	$13,970,464	71397814	32016578	73420590	75378327	68187305	60491122	38709276
BS 49	Total Liabilities & Other Credits	293079313	294773926	446820457	462595378	6057062362	$151,426,559	528357881	252105227	395089658	598897740	524870778	350524622	318744961
E7,YTD	Total KwH Purchased	13737101	12670573	13946978	24304040	482222857	482,222,857	18651880	15784719	20325690	23870878	23027902	12480905	12029355
E8,9YTD	Total KwH Sold and Used	11022927	11209914	9585376	20247840	415037597	415,037,597	15959457	13311043	16632874	19914760	19606865	10079453	10570609
E11,YTD	KwH Loss	2714174	1460659	4361602	4056200	67185260	67,185,260	2692432	2473676	3692816	3956118	3421037	2401452	1458746
F3	Services In Place	14431	11775	21278	25651	408807	408,807	18567	18669	28961	21624	19263	18980	14779
F5	Services Energized	10270	8721	19629	22684	323029	323,029	12249	15768	26925	15162	15803	15245	12243
F14	Total KM of Lines Energized	1376	1142	1192	1635	22990	22,990	1746	1047	1388	2041	1818	1254	956
B8d	Number of Accounts Over 30 Days	10287	5275	12616	13463	166654	166,654	7304	6614	7087	8525	5426	6279	5261
B8e	Amount of A/R Over 30 Days	9209142	5622469	7413010	8642756	179769932	$4,494,248	13316235	6044423	5666587	13860849	6904702	3709615	2920160
B8a	Total Receivable Amount Outstanding	11835198	6924551	9397105	12811962	251087903	$6,277,198	16534034	8483178	8509197	16844015	11117706	6165564	5648195
B11h,YTD	Months Revenue Outstanding	4.29	2.75	4.55	2.78	2.94	2.94	4.18	2.67	2.25	3.61	2.23	2.63	2.23
B1a4	Number of Employees	84	72	98	96	2019	2019	92	83	135	105	108	114	81
Financial and Operating Ratios														
	Net TIER (Times Interest Earned Ratio)	0.7	0.5	0.7	2.7	3.2	3.2	0.7	1.1	0.7	0.7	1.3	0.1	0.4
	DSC (Debt Service Coverage)	0.9	0.7	1.0	1.7	2.0	2.0	0.8	1.1	0.9	0.8	1.1	0.5	0.7
	Operating Revenue Per KM of Line	25944	28327	23011	36617	52031	$1,300.77	28720	38457	35547	29720	33937	24363	33525
	Total Cost Per KM of Line	30566	36007	31953	34296	47161	$1,179.03	33298	39951	39410	35682	34984	33198	42710
	Operating Margins Per KM of Line	-4622	-7680	-8942	2321	4870	$121.74	-4578	-1494	-3863	-5962	-1048	-8835	-9186
	O & M Expense Per KM of Line	1731	2216	2135	2100	2509	$62.74	1215	2362	2262	1521	1939	1765	3090
	A & G Expense Per Service in Place	160	223	147	122	159	$3.97	160	143	133	166	160	144	180
	Plant Revenue Ratio	16.5	18.6	48.7	14.8	9.6	9.6	17.8	12.6	17.7	19.9	15.8	23.8	18.9
	Margins & Equity as % of Total Assets	4.1	1.8	3.7	10.0	24.5	24.5	0.7	7.2	1.8	-0.1	6.6	0.1	0.1
	LTD as a Percent of Total Utility Plant	89.6	91.1	109.1	99.4	79.3	79.3	105.5	88.7	85.6	92.6	87.4	93.3	96.1
	Current Ratio	1.1	0.9	3.9	7.3	2.5	2.5	1.6	1.3	0.7	0.9	1.1	8.4	1.3
	System Loss	19.8	11.5	31.3	16.7	13.9	13.9	14.4	15.7	18.2	16.6	14.9	19.2	12.1
	Services In Place Per Employee	172	164	217	267	202	202	202	225	215	206	178	166	182
	Cost of Purchased Power Per KwH	1.41	1.41	1.41	1.41	1.41	$0.0353	1.42	1.41	1.41	1.41	1.41	1.41	1.41
	Average Revenue Per KwH Sold & Used	3.2386	2.8858	2.8615	2.9568	2.8821	$0.0721	3.1420	3.0249	2.9664	3.0459	3.1467	3.0311	3.0320

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Statement of Revenue and Expenses REB Form 550 June 30, 1993		Pirojpur KFAED	1993 Total KFAED	1993 Total KFAED	Madaripur IDA	Barisal-2 IDA	Bagerhat IDA	Chitta-2 IDA	Noakhali IDA	Meherpur IDA	Narsingdi-1 IDA	Kishoregonj IDA	Narsingdi-2 IDA	Naogaon IDA
		Taka	Taka	U.S. $	Taka	Taka	Taka	Taka	Taka	Taka	Taka	Taka	Taka	Taka
R&E 3	Total Operating Revenue	11436891	336142451	$8,403,561	28452813	29996950	16480828	38343459	27117291	25815995	81454125	16887472	13940949	34298590
R&E 4	Cost of Purchased Power	6968247	185089301	$4,627,233	16641954	20518145	8698155	36473053	15371530	13752911	44215796	8858259	8665170	18479478
R&E 5,6	O & M Expense	2077955	21608583	$540,215	2166965	2083634	1766335	3094380	2008082	2023628	2601434	1592275	1504147	2175553
R&E 7,8,9	Consumer Accts, Serv & Sales Expense	1264528	15856418	$396,410	1591185	284135	1424244	2298840	2316224	1998260	1780828	1086888	601660	1028698
R&E 10	A & G Expense	2537836	24091632	$602,291	2317839	2663528	2764112	3323500	3184065	2285883	2697868	1978506	1933145	2528303
R&E 11	Total Operating and Main Expense	12848566	246643934	$6,166,098	22717943	26653194	14652846	45189773	22879901	20060682	51295926	13515928	12704122	24212032
R&E 12	Depreciation & Amortization Expense	5259704	71552547	$1,788,814	6369268	7059767	6288700	8269131	7031849	8214992	7851196	6695538	4743116	8559877
R&E 14	Interest on Long Term Debt	3334000	76148969	$1,903,724	5433000	8508000	5882000	6623000	6157000	15040000	8434000	0	0	0
R&E 16	Total Cost of Electric Service	21465430	395022977	$9,875,574	34644236	42254673	26885810	60168952	36253990	43390979	67671458	20258476	17492161	32831227
R&E 17	Operating Margins	-10028539	-58882526	($1,472,063)	-6191423	-12257723	-10404982	-21825493	-9136699	-17574984	13782667	-3371004	-3551212	1467363
R&E 22	Net Margins	-5477124	-26521120	($663,028)	1974988	-946748	-4726570	-19376625	-2695922	-12544171	19217135	1973528	474944	4580416
Balance Sheet														
BS 3	Total Utility Plant	198007084	2805261885	$70,131,547	220918422	233139847	204264512	290169900	234452880	266139437	287431490	231107882	245836005	344704410
BS 8	Total Investments	12286500	183654538	$4,591,363	16254052	17510661	15170990	16008337	19706515	18889355	26343094	12749280	5743286	24414010
BS 9,12	Cash & Temporary Investments	2104683	65585643	$1,639,641	3588804	3162670	4514682	2640280	14612467	18227754	25104297	3106587	6446704	4700892
BS 20	Total Current & Accrued Assets	29926535	937929783	$23,448,245	44071006	54877059	45850841	49333917	65183695	60167111	70851902	12635296	14537232	13602258
BS 24	Total Assets and Other Debits	225215282	3193806149	$79,845,154	251401302	279879279	233007348	339322323	297000032	306354383	360832166	247726826	267409504	368605730
BS 32	Total Margins & Equities	-9451637	53705171	$1,342,629	10375391	3377796	4460674	-21797630	7804879	5812464	42601261	4746423	1712584	7763062
BS 37	Total Long Term Debt	196984830	2619112546	$65,477,814	213790569	236320776	204330011	287212361	246982978	278783845	287992722	233714239	250006325	347292128
BS 44	Total Current-Accrued Liabilities	36685292	456286304	$11,407,158	23823508	38246167	23363837	52191732	36443816	19898552	26707643	3938411	4592850	7986383
BS 49	Total Liabilities & Other Credits	225215282	3193806149	$79,845,154	251401302	279879279	233007348	339322323	297000032	306354383	360832166	247726826	267409504	368605730
E7,YTD	Total KwH Purchased	4811334	130982663	130,982,663	11799400	14544500	6165500	25858336	10898390	9743625	31348508	6272241	6137000	12821825
E8,9YTD	Total KwH Sold and Used	3518785	109593846	109,593,846	10123623	12357688	5138060	14322232	8931247	8476695	27127134	5076162	4495172	11405886
E11,YTD	KwH Loss	1292549	21388826	21,388,826	1675777	2186812	1027440	11536104	1967143	1266930	4221374	1196079	1641828	1415939
F3	Services In Place	8877	149720	149,720	15163	16655	12298	29924	24412	20316	14133	9023	8018	13858
F5	Services Energized	7570	120965	120,965	12911	14288	10454	28682	20888	17326	12918	8050	7359	13287
F14	Total KM of Lines Energized	841	11091	11,091	951	1035	957	1164	1283	1044	1025	959	789	1079
B8d	Number of Accounts Over 30 Days	3826	50322	50,322	3735	3932	4220	13740	6265	8028	3394	4679	3179	5493
B8e	Amount of A/R Over 30 Days	2355461	54778032	$1,369,451	3143859	1938210	1892535	8745467	3343006	2482709	4031140	3518066	2813997	3222897
B8a	Total Receivable Amount Outstanding	3053298	76355187	$1,908,880	4629494	4361833	3046609	11834393	5310033	4264357	10013979	4857273	3946562	5683978
B11h,YTD	Months Revenue Outstanding	3.37	2.90	2.90	2.07	1.87	2.35	4.18	2.57	2.11	1.56	3.75	3.72	2.1
B1a4	Number of Employees	72	790	790	82	86	72	126	111	84	88	74	58	77
Financial and Operating Ratios														
	Net TIER (Times Interest Earned Ratio)	-0.6	0.7	0.7	1.4	0.9	0.2	-1.9	0.6	0.2	3.3	ERR	ERR	ERR
	DSC (Debt Service Coverage)	0.4	0.8	0.8	1.2	0.9	0.6	-0.3	0.8	0.5	2.2	1.3	1.1	1.5
	Operating Revenue Per KM of Line	13599	30308	$757.69	29919	28983	17221	32941	21136	24728	79467	17609	17669	31787
	Total Cost Per KM of Line	25524	35617	$890.41	36429	40826	28094	51692	28257	41562	66021	21125	22170	30427
	Operating Margins Per KM of Line	-11925	-5309	($132.73)	-6510	-11843	-10372	-18750	-7121	-16834	13447	-3515	-4501	1360
	O & M Expense Per KM of Line	2471	1948	$48.71	2279	2013	1846	2658	1565	1938	2538	1660	1906	2016
	A & G Expense Per Service in Place	286	161	$4.02	153	160	225	111	130	113	191	219	241	182
	Plant Revenue Ratio	44.3	18.6	18.6	18.7	24.6	26.2	155.1	20.0	22.1	7.7	28.8	46.6	21.8
	Margins & Equity as % of Total Assets	-4.2	1.7	1.7	4.1	1.2	1.9	-6.4	2.6	1.9	11.8	1.9	0.6	2.1
	LTD as a Percent of Total Utility Plant	99.5	93.4	93.4	96.8	101.4	100.0	99.0	105.3	104.8	100.2	101.1	101.7	100.8
	Current Ratio	0.8	2.1	2.1	1.8	1.4	2.0	0.9	1.8	3.0	2.7	3.2	3.2	1.7
	System Loss	26.9	16.3	16.3	14.2	15.0	16.7	44.6	18.0	13.0	13.5	19.1	26.8	11.0
	Services In Place Per Employee	123	190	190	185	194	171	237	220	242	161	122	138	180
	Cost of Purchased Power Per KwH	1.45	1.41	$0.0353	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.44
	Average Revenue Per KwH Sold & Used	3.2502	3.0672	$0.0767	2.8105	2.4274	3.2076	2.6772	3.0362	3.0455	3.0027	3.3268	3.1013	3.0071

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123

Statement of Revenue and Expenses REB Form 550 June 30, 1993		Sylhet IDA Taka	Laxmipur IDA Taka	Barisal IDA Taka	Patuakhali IDA Taka	Manikganj IDA	Comilla 2 IDA	Cox's Bazar IDA	Dinajpur 2 IDA	1993 Total IDA Taka	1993 Total IDA U.S. $	Thakurgaon FINLAND Taka	1993 Total FINLAND U.S. $	Netrokona JDRG Taka
R&E 3	Total Operating Revenue	10002470	7080797	5768658	337683					335978080	$8,399,452	39237450	$980,936	
R&E 4	Cost of Purchased Power	5825699	3975332	3216655	177007					204869144	$5,121,729	21945044	$548,626	
R&E 5,6	O & M Expense	1221395	933891	988200	717736					24877655	$621,941	2681800	$67,045	
R&E 7,8,9	Consumer Accts, Serv & Sales Expense	722511	686532	637023	240396					16697424	$417,436	1897120	$47,428	
R&E 10	A & G Expense	2285599	1749645	1825568	881376					32418937	$810,473	2847662	$71,192	
R&E 11	Total Operating and Main Expense	10105204	7345400	6667446	2016515					280016912	$7,000,423	28921626	$723,041	
R&E 12	Depreciation & Amortization Expense	4620463	2355030	2309126	793136					81161189	$2,029,030	7968554	$199,214	
R&E 14	Interest on Long Term Debt	0	0	0	0					56077000	$1,401,925	6246000	$156,150	
R&E 16	Total Cost of Electric Service	14813579	9756566	9009743	2810117					418241967	$10,456,049	43241000	$1,081,025	
R&E 17	Operating Margins	-4811109	-2675769	-3241085	-2472434					-82263887	($2,056,597)	-4003550	($100,089)	
R&E 22	Net Margins	-225499	801493	343082	-513942					-11663891	($291,597)	-68554	($1,714)	
Balance Sheet														
BS 3	Total Utility Plant	184796423	80520302	81756092	43836068					2949073670	$73,726,842	356547407	$8,913,685	
BS 8	Total Investments	7110046	6582742	4901655	1081500					192465523	$4,811,638	23088371	$577,209	
BS 9,12	Cash & Temporary Investments	2288386	3223040	1770376	540682					93927621	$2,348,191	24274805	$606,870	
BS 20	Total Current & Accrued Assets	5461088	6357590	4940246	2180008					450049249	$11,251,231	49751854	$1,243,796	
BS 24	Total Assets and Other Debits	177999345	87793485	88010379	47197286					3352539388	$83,813,485	391623456	$9,790,586	
BS 32	Total Margins & Equities	-901448	1832757	796317	-190733					68393797	$1,709,845	8537284	$213,432	
BS 37	Total Long Term Debt	174294840	83004217	84325262	46266692					2974316965	$74,357,924	343259197	$8,581,480	
BS 44	Total Current-Accrued Liabilities	3899706	2788853	2514760	1065679					247461897	$6,186,547	34313763	$857,844	
BS 49	Total Liabilities & Other Credits	177999345	87793485	88010379	47197286					3352539388	$83,813,485	391623456	$9,790,586	
E7,YTD	Total KwH Purchased	4124042	2815980	2216697	122700					144868744	144,868,744	15428350	15,428,350	
E8,9YTD	Total KwH Sold and Used	3390272	2288009	1857651	93627					115083458	115,083,458	13258876	13,258,876	
E11,YTD	KwH Loss	733770	527971	359046	29073					29785286	29,785,286	2169474	2,167,474	
F3	Services In Place	7954	7329	6915	1109					187107	187,107	12297	12,297	
F5	Services Energized	7490	6866	6729	1082					168330	168,330	9823	9,823	
F14	Total KM of Lines Energized	685	601	479	205					12256	12,256	1953	1,953	
B8d	Number of Accounts Over 30 Days	2120	1507	545	21					60858	60,858	7476	7,476	
B8e	Amount of A/R Over 30 Days	589891	529505	189864	1409					36442555	$911,064	3211446	$80,286	
B8a	Total Receivable Amount Outstanding	1497673	1125004	701634	29535					61302357	$1,532,559	5582485	$139,562	
B11h,YTD	Months Revenue Outstanding	1.99	2.16	1.63	1.06					2.37	2.37	1.73	1.73	
B1a4	Number of Employees	60	50	54	40					1062	1,062	79	79	
Financial and Operating Ratios														
	Net TIER (Times Interest Earned Ratio)	ERR	ERR	ERR	ERR					0.8	0.8	1.0	1.0	ERR
	DSC (Debt Service Coverage)	1.0	1.3	1.1	0.4					0.9	0.9	1.0	1.0	ERR
	Operating Revenue Per KM of Line	14602	11782	12043	1647					27413	$685.33	20091	$502.27	ERR
	Total Cost Per KM of Line	21626	16234	18809	13708					34125	$853.14	22141	$553.52	ERR
	Operating Margins Per KM of Line	-7024	-4452	-6766	-12061					-6712	($167.80)	-2050	($51.25)	ERR
	O & M Expense Per KM of Line	1783	1554	2063	3501					2030	$50.75	1373	$34.33	ERR
	A & G Expense Per Service in Place	287	239	264	795					173	$4.33	232	$5.79	ERR
	Plant Revenue Ratio	44.2	25.9	32.0	272.8					22.5	22.5	20.6	20.6	ERR
	Margins & Equity as % of Total Assets	-0.5	2.1	0.9	-0.4					2.0	2.0	2.2	2.2	ERR
	LTD as a Percent of Total Utility Plant	94.3	103.1	103.1	105.5					100.9	100.9	96.3	96.3	ERR
	Current Ratio	1.4	2.3	2.0	2.0					1.8	1.8	1.4	1.4	ERR
	System Loss	17.8	18.7	16.2	23.7					20.6	20.6	14.1	14.0	ERR
	Services In Place Per Employee	133	147	128	28					176	176	156	156	ERR
	Cost of Purchased Power Per KwH	1.41	1.41	1.45	1.44					1.41	$0.0354	1.42	$0.0356	ERR
	Average Revenue Per KwH Sold & Used	2.9503	3.0947	3.1054	3.6067					2.9194	$0.0730	2.9593	$0.0740	ERR

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Statement of Revenue and Expenses REB Form 550 June 30, 1993		1993 Total JDRG U.S. $	1993 Total Taka	1993 Total U.S. $
R&E 3	Total Operating Revenue	$0	1907547557	$47,688,689
R&E 4	Cost of Purchased Power	$0	1092674459	$27,316,861
R&E 5,6	O & M Expense	$0	106860804	$2,671,520
R&E 7,8,9	Consumer Accts, Serv & Sales Expense	$0	75954003	$1,898,850
R&E 10	A & G Expense	$0	124283661	$3,107,092
R&E 11	Total Operating and Main Expense	$0	1400009670	$35,000,242
R&E 12	Depreciation & Amortization Expense	$0	293176640	$7,329,416
R&E 14	Interest on Long Term Debt	$0	243148617	$6,078,715
R&E 16	Total Cost of Electric Service	$0	1940745009	$48,518,625
R&E 17	Operating Margins	$0	-33199452	($829,986)
R&E 22	Net Margins	$0	189359816	$4,733,995
Balance Sheet				
BS 3	Total Utility Plant	$0	11038678990	$275,966,975
BS 8	Total Investments	$0	795241964	$19,881,049
BS 9,12	Cash & Temporary Investments	$0	870898232	$21,772,456
BS 20	Total Current & Accrued Assets	$0	2855323385	$71,383,085
BS 24	Total Assets and Other Debits	$0	12995031333	$324,875,783
BS 32	Total Margins & Equities	$0	1613950356	$40,348,759
BS 37	Total Long Term Debt	$0	9843794426	$246,094,861
BS 44	Total Current-Accrued Liabilities	$0	1296880543	$32,422,014
BS 49	Total Liabilities & Other Credits	$0	12995031355	$324,875,784
E7,YTD	Total KwH Purchased		773502614	773,502,614
E8,9YTD	Total KwH Sold and Used		652973777	652,973,777
E11,YTD	KwH Loss		120528846	120,526,846
F3	Services In Place		757931	757,931
F5	Services Energized		622147	622,147
F14	Total KM of Lines Energized		48290	48,290
B8d	Number of Accounts Over 30 Days		285310	285,310
B8e	Amount of A/R Over 30 Days		274201965	$6,855,049
B8a	Total Receivable Amount Outstanding		394327932	$9,858,198
B11h,YTD	Months Revenue Outstanding		2.70	2.70
B1a4	Number of Employees		3950	3,950
Financial and Operating Ratios				
	Net TIER (Times Interest Earned Ratio)	ERR	1.8	1.8
	DSC (Debt Service Coverage)	ERR	1.4	1.4
	Operating Revenue Per KM of Line	ERR	39502	$987.55
	Total Cost Per KM of Line	ERR	40189	$1,004.73
	Operating Margins Per KM of Line	ERR	-688	($17.19)
	O & M Expense Per KM of Line	ERR	2213	$55.32
	A & G Expense Per Service in Place	ERR	164	$4.10
	Plant Revenue Ratio	ERR	13.5	13.5
	Margins & Equity as % of Total Assets	ERR	12.4	12.4
	LTD as a Percent of Total Utility Plant	ERR	89.2	89.2
	Current Ratio	ERR	2.2	2.2
	System Loss	ERR	15.6	15.6
	Services In Place Per Employee	ERR	192	192
	Cost of Purchased Power Per KwH	ERR	1.4126	$0.0353
	Average Revenue Per KwH Sold & Used	ERR	2.9213	$0.0730

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135

ANNEX K

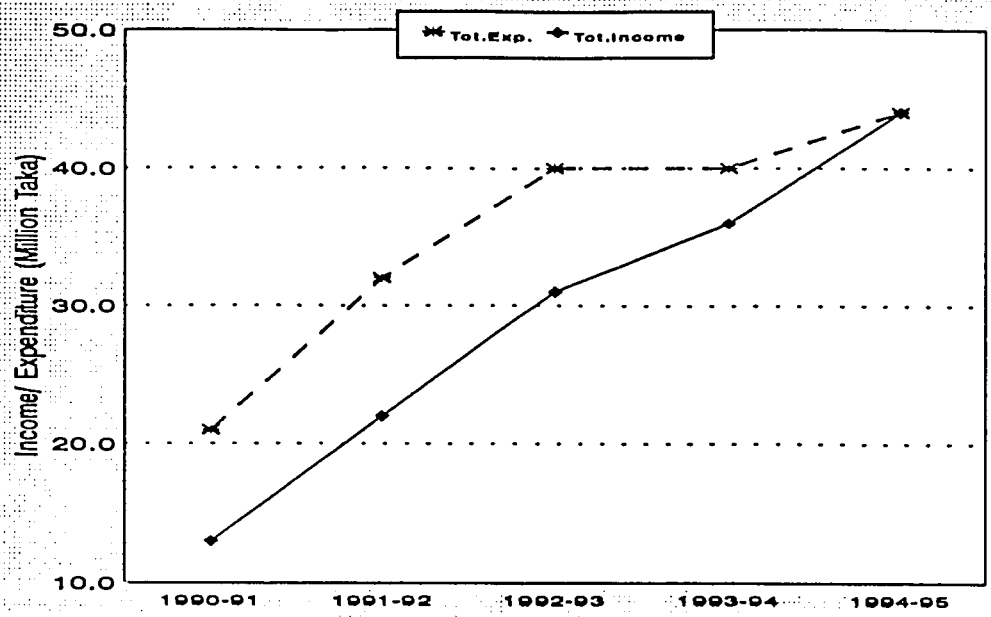
Selected PBS Annual Revenues and Costs

ANNEX K

Annex K shows the annual revenues and costs for the last five years of three PBSs selected to illustrate the following stages of PBS financial development:

- Financially viable: Jessore-2 PBS
- Not presently viable but expected to reach financial viability near-term: Chittagong-2 PBS
- Not viable and not projected to become financially viable near-term (2-5 years): Kushtia PBS

CHITTAGONG PBS-2

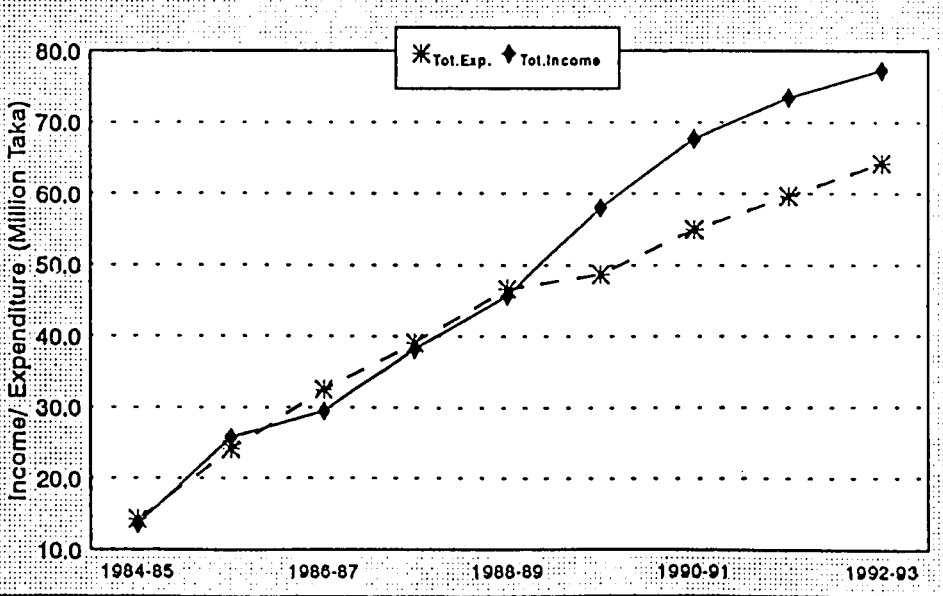


Tot.Exp.	21.0	32.0	40.0	40.0	44.0
Tot.Income	13.0	22.0	31.0	36.0	44.0

Fiscal Year (93-94,94-95:Projected Value)

Rate cell, REB

JESSORE PBS-2

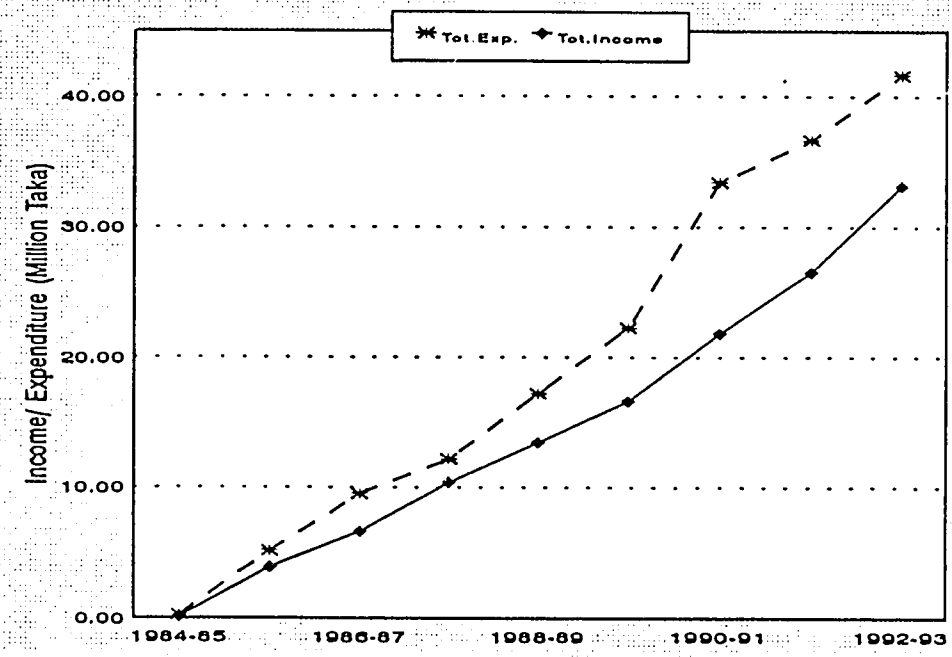


Tot.Exp.	14.3	24.1	32.5	39.1	46.7	48.7	55.0	59.7	64.3
Tot.Income	13.6	25.8	29.5	38.3	45.8	58.1	67.7	73.5	77.3

Fiscal Year

Rate cell,REB

KUSHTIA PBS



Tot.Exp.	0.25	5.15	9.52	12.18	17.19	22.26	33.41	36.65	41.64
Tot.Income	0.10	3.88	6.61	10.37	13.44	16.62	21.83	26.51	33.14

Fiscal Year

ANNEX L

Jessore-2 PBS Performance Target Summary

Jessore-2 PBS Performance Target Summary

This table shows the results of 18 performance targets with a comparison of achievement versus targets for the last four years for Jessore-2, a USAID-financed PBS that is financially viable. This table illustrates the status of the key variables that together define financial viability and measure progress towards achieving it.

	Key indicators	FY 1989-90 ACTUAL POSITION	FY 1990-91 ACHIEVEMENT / TARGET	FY 1991-92 ACHIEVEMENT / TARGET	FY 1992-93 ACHIEVEMENT / TARGET
01.	System Loss (%)	12.62	12.25 / 12.80	11.86 / 12.00	11.58 / 11.60
02.	Bill Collection (%) Accounts Receivable (Month)	96.41 1.37+1	98.65 1.35+1 / 1.47+1	98.93 2.27 / 2.30	100.30 2.13 / 2.10
03.	Accounts Payable (Month)	1.00	1.00 / 1.50	1.00 / 1.00	1.00 / 1.00
04.	Debt Service Coverage	2.44	2.78 / 2.50	2.98 / 2.80	2.82 / 2.70
05.	Plant Revenue Ratio	6.99	6.85 / 9.65	6.55 / 9.65	7.14 / 6.00
06.	Equity Status (%)	15.29	28.36 / 15.00	34.32 / 32.00	37.98 / 37.00
07.	Prepayment on DSL		02 INSTL.* / 02	02 INSTL. / 02	02 INSTL. / 02
08.	Payment of DSL	YES	02 INSTL. / 02	02 INSTL. / 02	02 INSTL. / 02
09.	Annual Load Factor (%)	32.95	48.64 / 40.00	46.90 / 50.00	48.66 / 49.00
10.	Revenue per Km of Line (Tk)	53250/-	59230/- / 55000/-	62191/- / 62000/-	64343/- / 66000/-
11.	Total Expenses per Km of Line (Tk)	44240/-	47610/- / 45000/-	50493/- / 52000/-	52356/- / 53000/-
12.	O&M Expenses per Km of Line (Tk)	1970/-	1800/- / 2500/-	2036/- / 2100/-	2733/- / 2750/-
13.	Administrative/General Expenses per Consumer (Tk)	205.94	185.62 / 160.00	192/- / 200.00	200/- / 202/-
14.	Billing and Sales Expenses per Consumer (Tk)	143.58	101.48 / 80.00	124/- / 101/-	114/- / 115/-
15.	(%) of Total Consumer Billed Each Month	98.86%	100.11% / 90.00%	101% / 100%	102% / 100%
16.	Annual Growth in Consumer (Cumulative)	11.89	18260 / 17452	19572 / 19500	21121 / 20700
17.	Annual Growth in MWH Sold	-	23298 / 23462	25336 / 25600	26425 / 26500
18.	Reconnected Consumer	-	21.61% / 10%	23.34% / 23.00%	1427** / 589

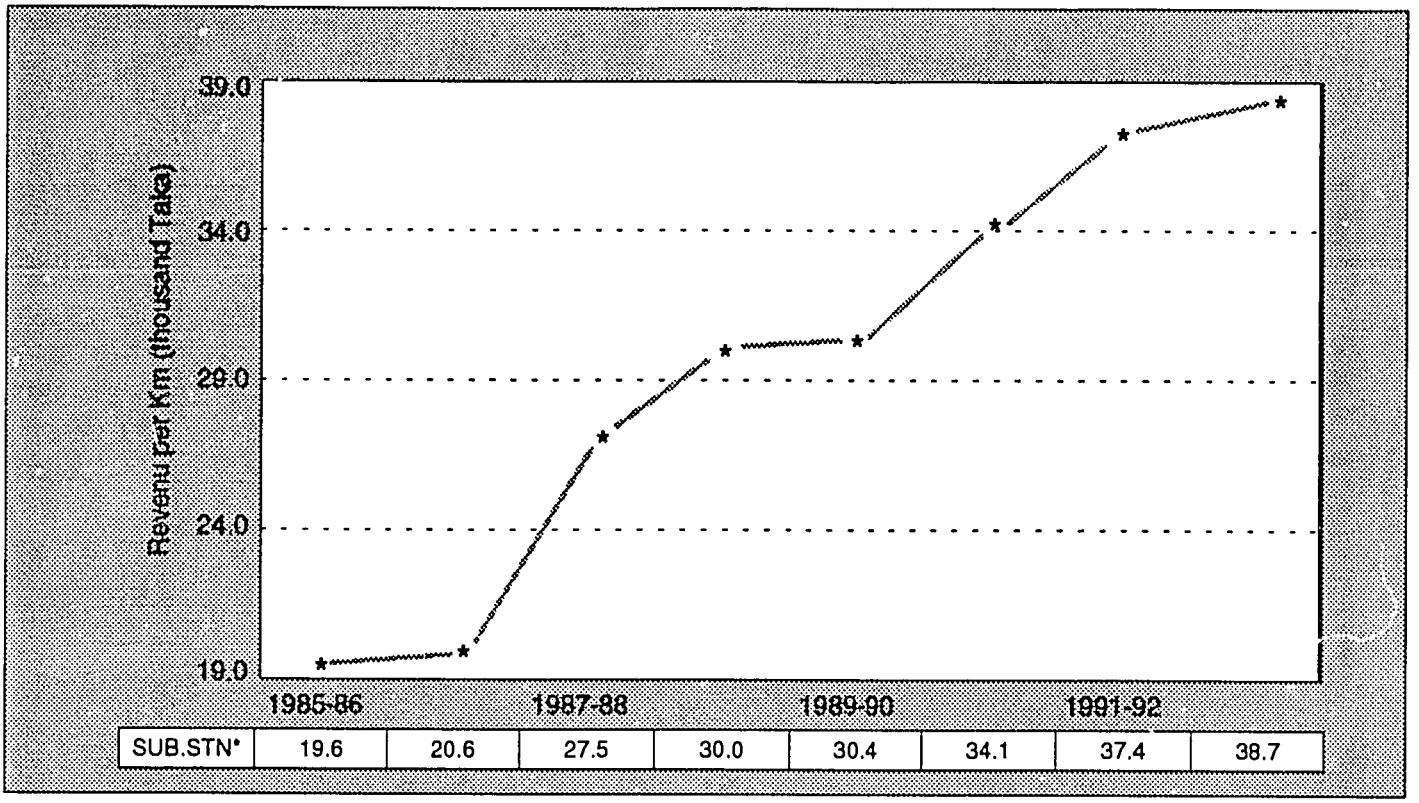
* Installments

** Target changed from a percentage to units

ANNEX M

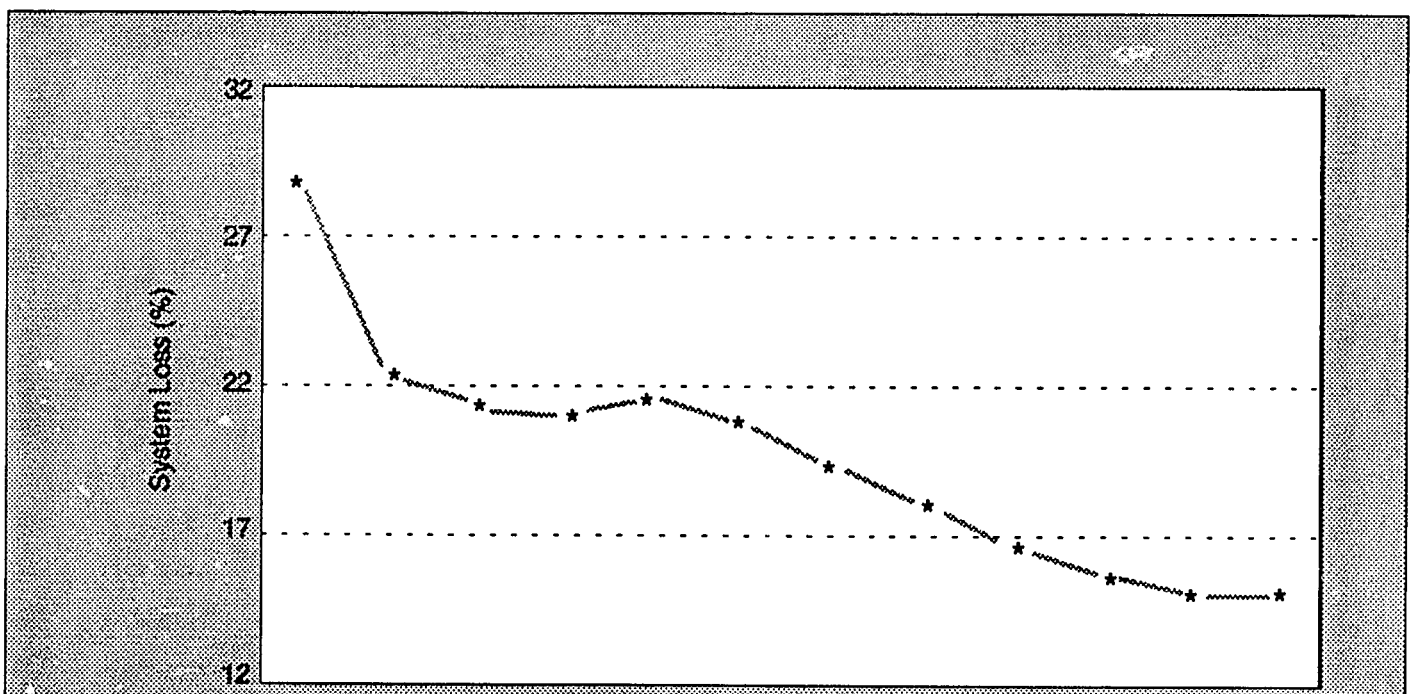
Summary of PBS Annual Revenues 1985-92

ANNUAL REVENUE PER Km OF LINE
ALL PBSs



SUB.STN*	19.6	20.6	27.5	30.0	30.4	34.1	37.4	38.7

ANNUAL SYSTEM LOSS (%)
ALL PBSs

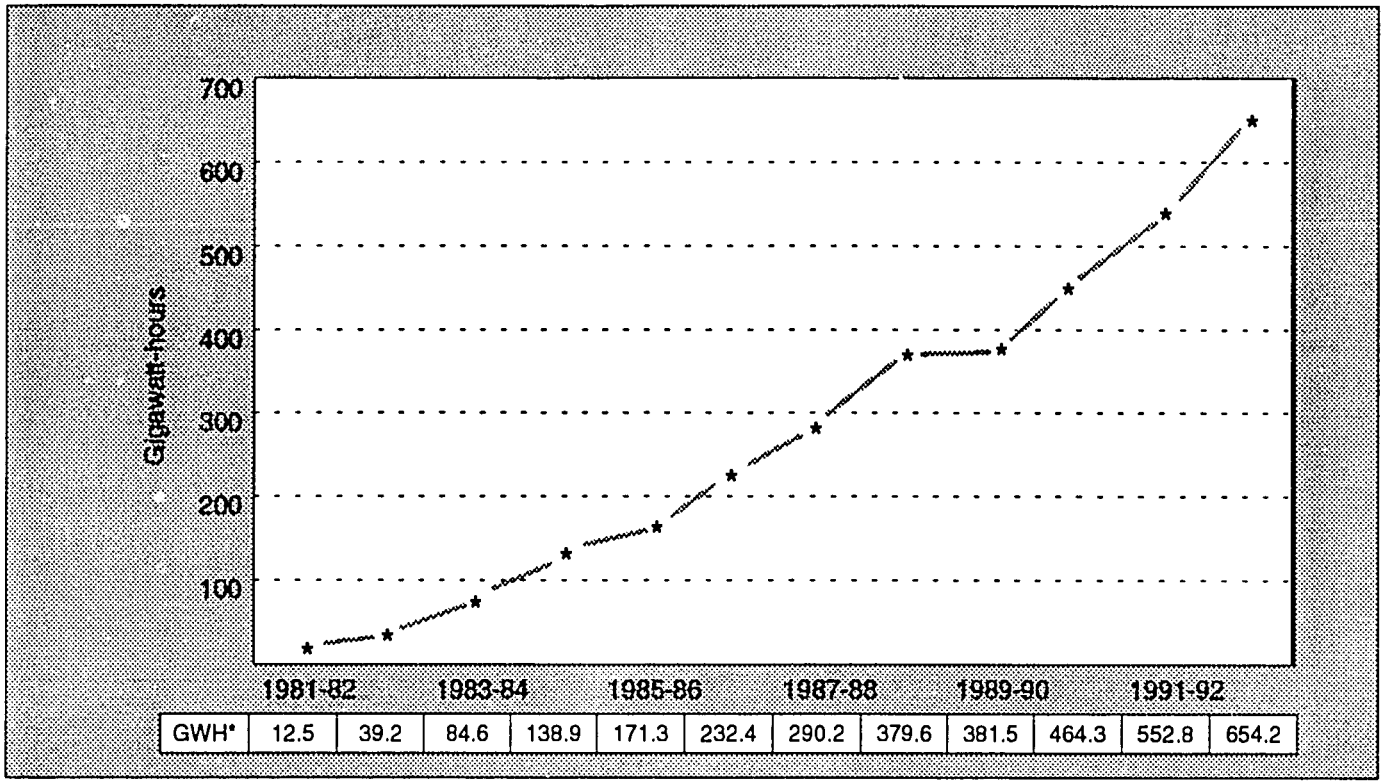


Sys. Loss*	28.8	22.6	21.2	20.6	21.6	20.2	19.2	18.3	16.8	16.3	15.7	15.6

ANNEX N

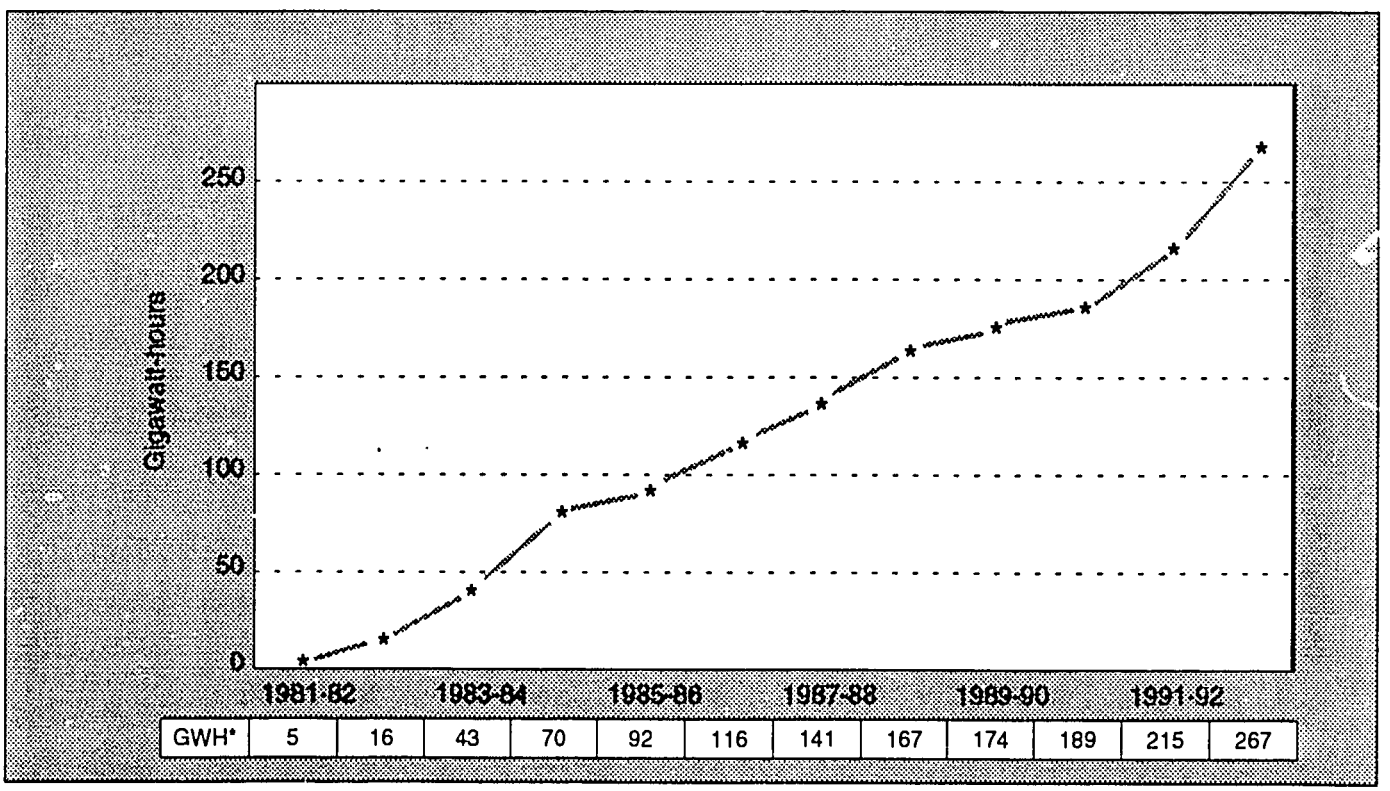
PBS Sub-Station/Line Construction
Sector Energy Usage
Line Revenue
System Loss

ELECTRICAL ENERGY USE
TOTAL CONSUMERS
ALL PBSs



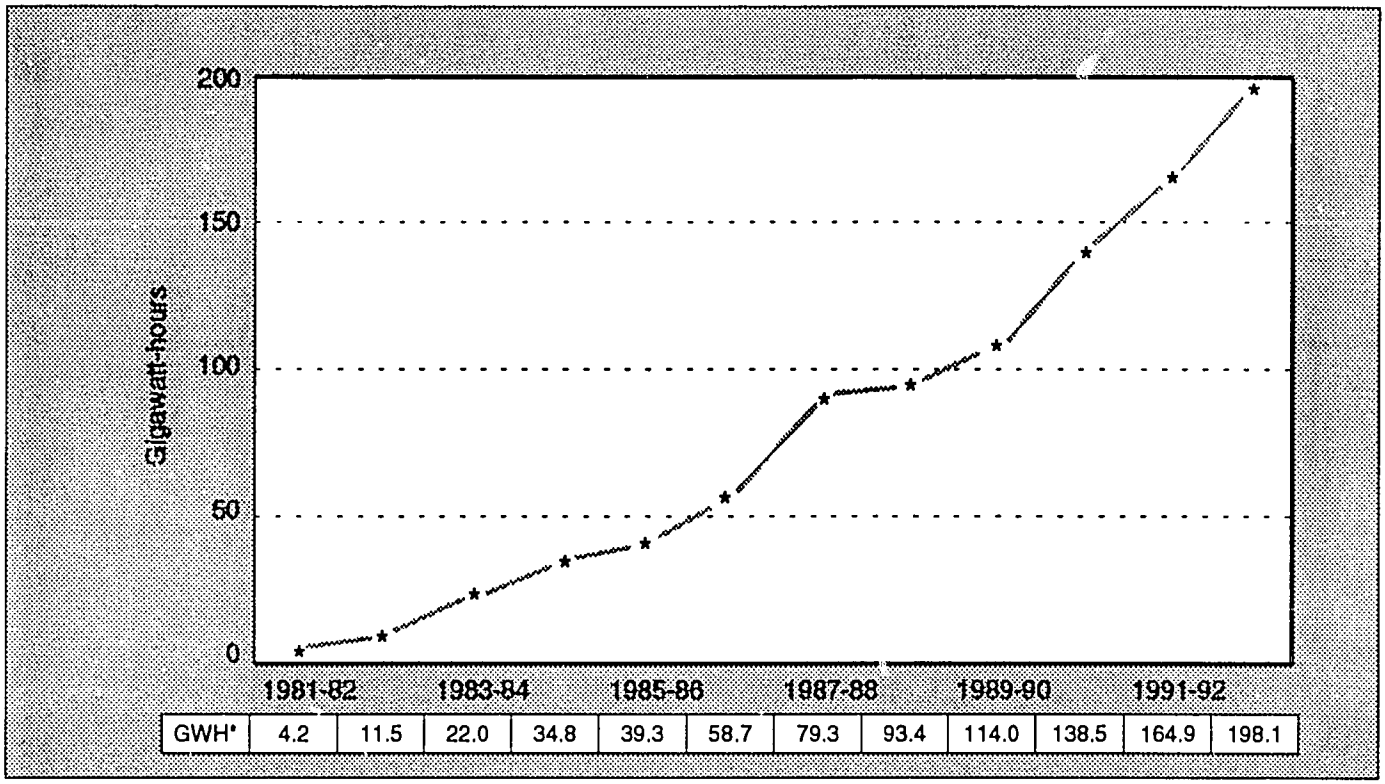
GWH*	12.5	39.2	84.6	138.9	171.3	232.4	290.2	379.6	381.5	464.3	552.8	654.2

ELECTRICAL ENERGY USE
INDUSTRY CONSUMERS
ALL PBSs



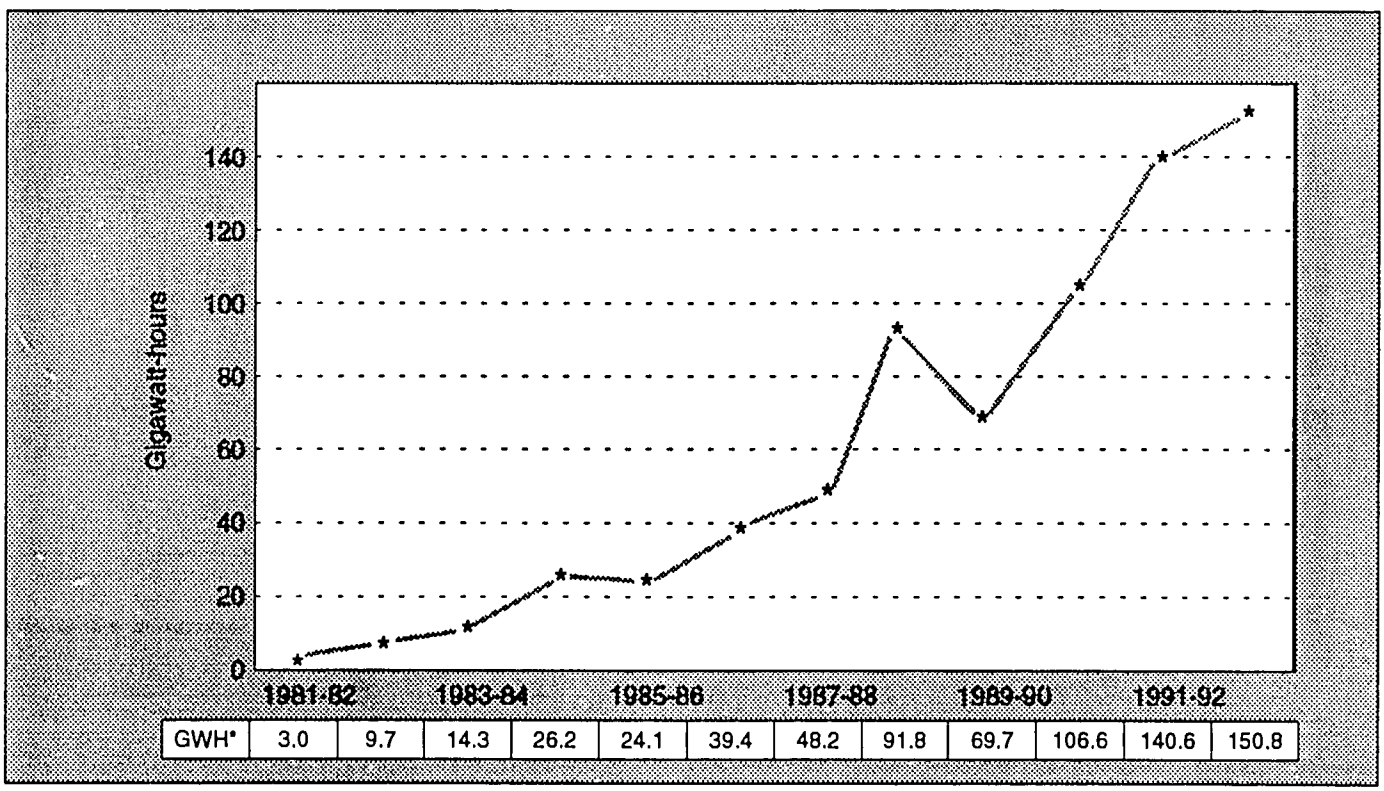
GWH*	5	16	43	70	92	116	141	167	174	189	215	267

ELECTRICAL ENERGY USE
DOMESTIC CONSUMERS
ALL PBSs



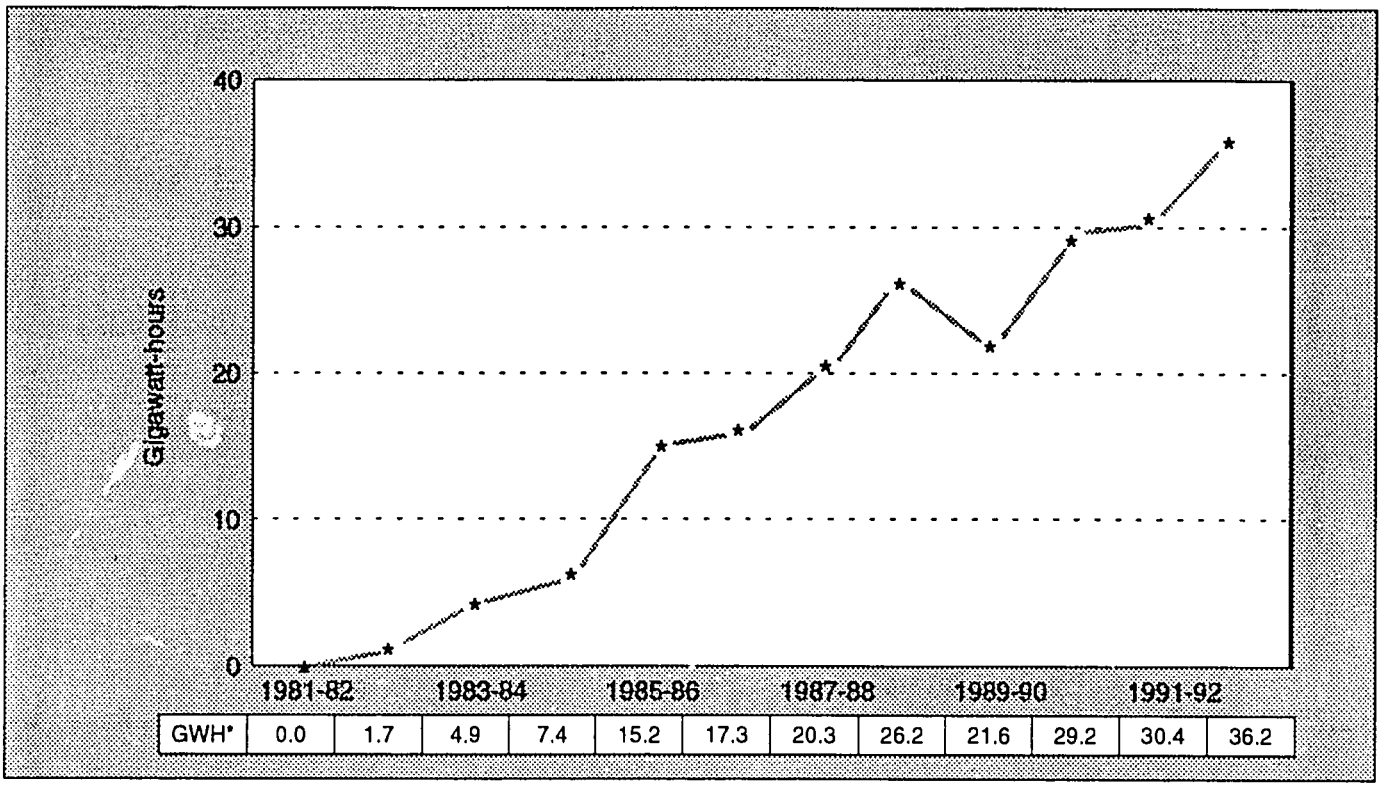
GWH*	4.2	11.5	22.0	34.8	39.3	58.7	79.3	93.4	114.0	138.5	164.9	198.1

ELECTRICAL ENERGY USE
IRRIGATION CONSUMERS
ALL PBSs



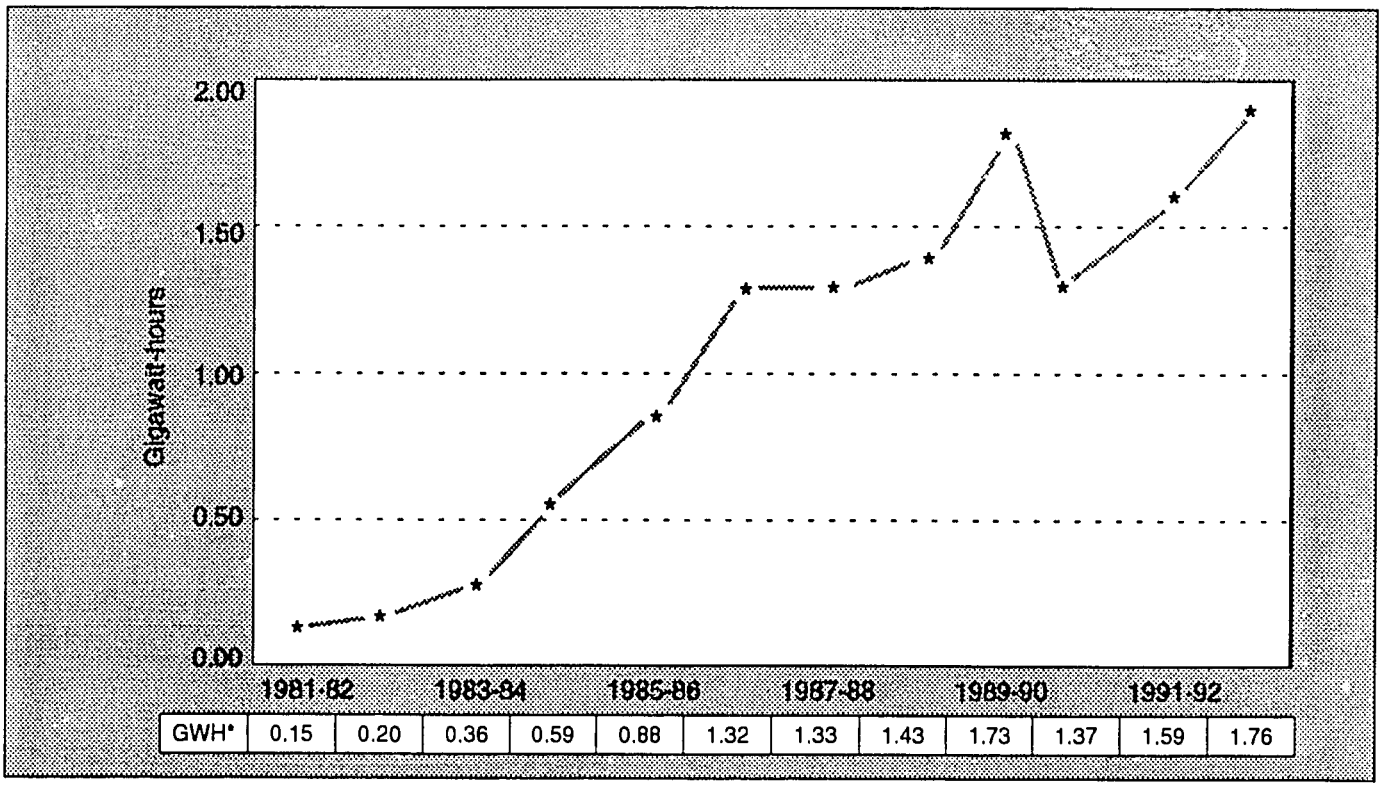
GWH*	3.0	9.7	14.3	26.2	24.1	39.4	48.2	91.8	69.7	106.6	140.6	150.8

ELECTRICAL ENERGY USE
SMALL COMMERCIAL CONSUMERS
ALL PBSs



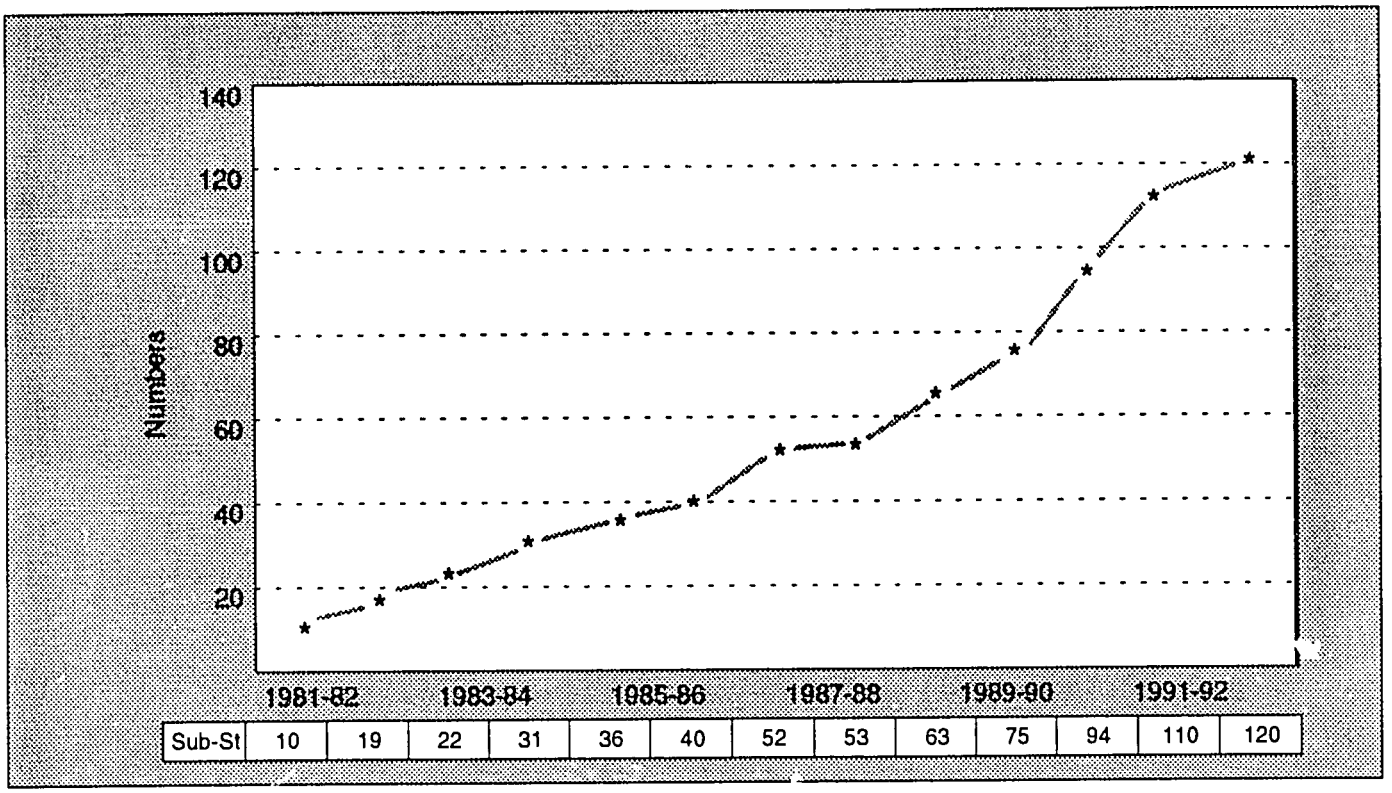
GWH*	0.0	1.7	4.9	7.4	15.2	17.3	20.3	26.2	21.6	29.2	30.4	36.2

ELECTRICAL ENERGY USE
OTHER CONSUMERS
ALL. PBSs



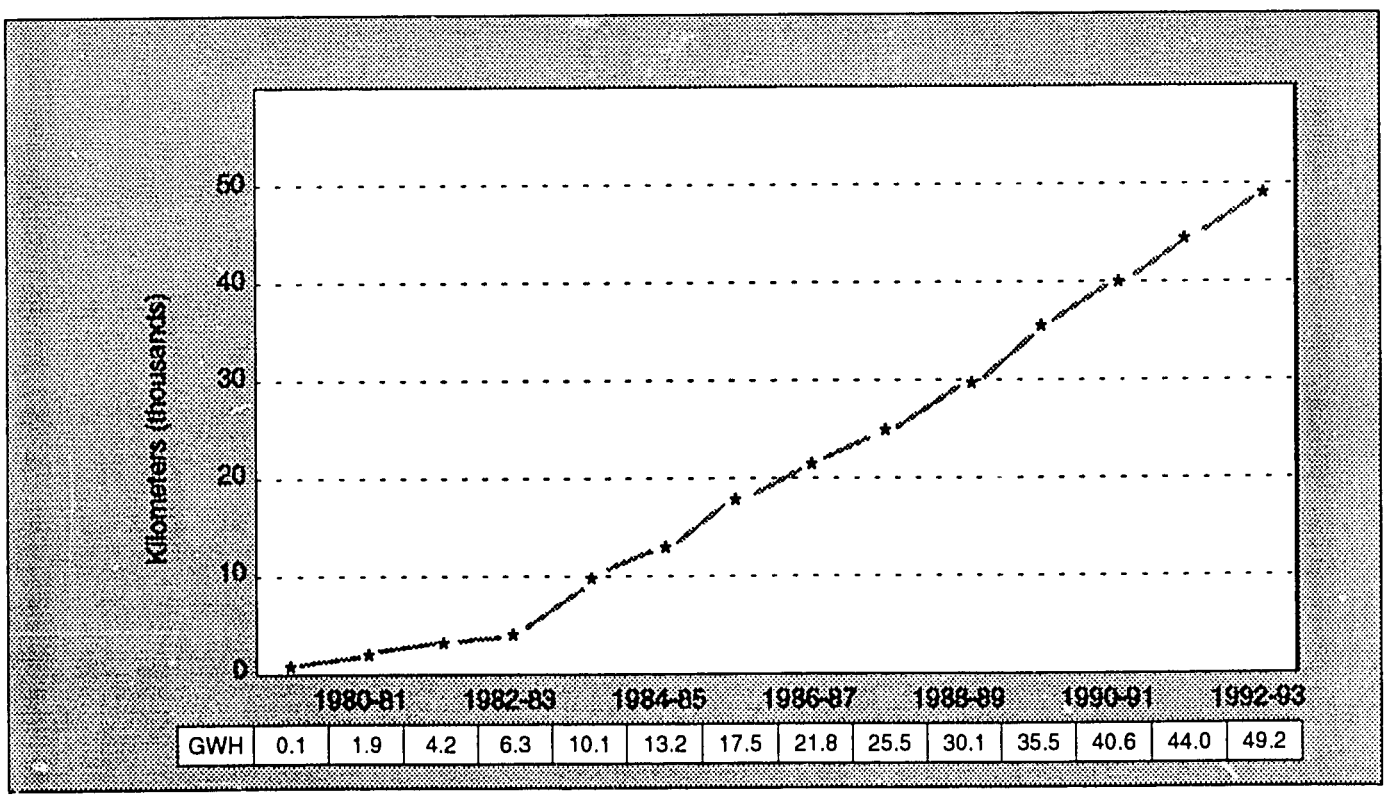
GWH*	0.15	0.20	0.36	0.59	0.88	1.32	1.33	1.43	1.73	1.37	1.59	1.76

CONSTRUCTION OF 33/11 KV SUB-STATIONS
(CUMULATIVE)



Sub-St	10	19	22	31	36	40	52	53	63	75	94	110	120

CONSTRUCTION OF DISTRIBUTION LINES
(CUMULATIVE IN KM)



GWH	0.1	1.9	4.2	6.3	10.1	13.2	17.5	21.8	25.5	30.1	35.5	40.6	44.0	49.2

ANNEX O

SUMMARY OF
LOAD SHEDDING AND INTERRUPTIONS OF POWER

SUMMARY OF LOAD SHEDDING DUE TO INTERRUPTIONS OF POWER BY BPDB

Period	No. of Load Sheddings	Duration	Gross Revenue Loss in US$
Jan-Sep 93	5444	5834 hrs.	1,000,000
Jan-Dec 92	24828	35462 hrs.	2,923,275

SUMMARY OF INTERRUPTION OF POWER ALL PBSs

Period	No. of Interruptions	Duration of Interruptions
Jan-Sep'93	12397	16897 hours

Note: A new 210 MW generating station began service to the BPDB grid in April 1993. The additional capacity reduced 1993 load shedding from that in 1992. 1993 data is for 9 months and 1992 data is for 12 months.

ANNEX P

QUANTUM METER DATA COLLECTION/DISPLAY CAPABILITIES

Identification Code	Parameter	Description
01	Unit	Meter Identification No.
02	rt	Real Date & Time
03	MWh d	Megawatt-hour delivered
04	Mvarh d	Megavolt-ampere-reactive-hour delivered
05	Mvarh r	Megavolt-ampere-reactive-hour received
06	MVsqh	Megavolt-square-hour of phase a
07	ins kW d	Instantaneous kilowatt
08	ins kvar	Instantaneous kilovolt-ampere-reactive
09	ins kVa	Instantaneous kilovolt-ampere
10	a ins kV	Instantaneous kV of phase a (incoming)
11	c ins kV	Instantaneous kV of phase c (incoming)
12	ins pf	Instantaneous power factor
13	max kW d	Maximum (Peak) kilowatt delivered
14	max kW d TIME	Date & Time of max kW
15	max kvard	Maximum kilovolt-ampere-reactive delivered
16	max kvard TIME	Date & Time of max kVard
17	max kvarr	Maximum kilovolt-ampere-reactive received
18	max kvarr TIME	Date & Time of kVarr
19	max kVa	Maximum kilovolt-ampere
20	max kVa TIME	Date & Time of max kVa
21	MWh d FZ	Megawatt-hour frozen (reading up to last day of last month)
22	Mvarh d FZ	Megavar-hour delivered, frozen (reading up to last day of last month)
23	Mvarh r FZ	Megavar-hour received, frozen (reading up to last day of last month)
24	MVsqh FZ	Megavolt-square-hour frozen (reading up to last day of last month)
25	max kW d FZ	Maximum kilowatt, frozen (maximum kilowatt of the last month)
26	max kW d TIFZ	Date & Time of max kW d Fz
27	pwd	No. of power interrupted (PDB interruption)
28	btm	Time for which the battery was used

ANNEX Q

LIST OF INTERVIEWS

DHAKA

Rural Electrification Board

1. Brigadier Muhammad Enamul Huq, Chairman
2. Syed Tanveer Hussain, Member (Finance)
3. M.A. Wadud, Member PBS & Training
4. Md. Abdus Samad, Member (Engineering)
5. Tauhidul Islam, Chief Engineer Projects
6. Md. Abdul Halim Mollah, Chief Engineer (Planning & Operation)
7. Mozaffar Hossain, Controller, Accounts and Finance
8. Kamruzzaman Khan, Executive Director, PBS Dev. & Management
9. Mahfuzur Rahman, Director, Programme Planning
10. Mozammel Haque, Director, System Operation
11. Md. Anwarul Kabir Chowdhury, Director (MPSS)
12. Khalilur Rahman, Director, Procurement
13. Mr. Abu Nayeem, Director Training
14. Sk. Ahmed Ali, Director Accounts
15. A.S.Q.M. Billah, Deputy Director, Evaluation Programme Planning
16. Kaiser Ahmed, Deputy Director (Planning)
17. Belayet Hossain Chowdhury, Deputy Director, Programme
18. Suria Kamal, Deputy Director, Personnel Directorate
19. Sajedul Huq, Rate Cell, Finance Directorate
20. Sawkat Ali, Deputy Director, Engineering (South)
21 Parvin Sultana, Asst. Director, Programme Planning
22. Ziauddin Mahmood, Asst. Engineer
23. Zafar Sadeque, Asst Engineer

USAID

1. Dick Brown, Mission Director
2. Frank Young, Deputy Mission Director
3. Rosalie Fanale, Director, Office of Project Development & Engineering
4. G.I. Haycock, Chief Engineer, Office Project Development & Engineering
5. Jan Rockliffe-King, Evaluation Specialist
6. Nasir Ahmed, General Engineer, Office of Project Development & Engineering
7. Raka Rashid, WID Officer

NRECA

1. Charles Overman, Team Leader
2. Bob Schiller, Power Use Advisor

3. Dr. John E. Andrews, Institutional Training Advisor
4. Ben M. Schafer, PBS Finance Advisor
5. Willard E. Garrett, REB Finance Advisor
6. John E. (Jack) French, Engineering Advisor
7. Ed Wheeler, Technical Training Advisor
8. Vern Rauscher, System Operations Advisor
9. Ken Breunig, Construction Advisor
10. Virgil L. Schafer, Distribution Design Engineer

Bangladesh Power Development Board

1. Engr. Mohammad Suja-at Ali, General Manager, Commercial Operation
2. Mahmud Ali Khan, Member Finance
3. Md. Abdul Jalil, Director, System Planning
4. M.A. Jalil, Director, System Planning
5. Delwar Hossain, Deputy Director, System Planning

Other Donors

1. Arun Banerjee, Chief, Operations Unit, World Bank
2. Nurul Alam, Senior Program Officer, World Bank
3. Chrisantha Ratnayake, Power Engineer, World Bank
4. Shamsuddin Ahmed, Project Officer, Asian Development Bank
5. Esther Lonstrup, Technical Advisor, DANIDA
6. Inger Bjorklund, DANIDA Consultant
7. Rene P. Maillet, DANIDA Consultant
8. Skylark Chandhs, DANIDA Consultant
9. Sven Nilsson, DANIDA Consultant

Local Consulting Engineering Firms

1. Kaiser Rashid Chowdhury, Kaiser Corporation Ltd.
2. Sultan Ahmed, Managing Director, PEU Consortium Office
3. Md. Mahmuduzzaman Khan, Managing Director, Prakaushal Upadeshta Ltd.
4. Hossain Shaheen Meer Akram, Team Leader & Senior Engineer, Prakaushal Upadeshta Ltd

Other Agencies and Organizations

1. Dr. Saleemul Huq, Executive Director, Bangladesh Centre for Advanced Studies
2. A. Atiq Rahman, Director, Bangladesh Centre For Advanced Studies
3. Zillur Rahman, Research Fellow, Bangladesh Institute of Development Studies
4. Debapriya Bhattacherya Ph.D, Research Fellow, Bangladesh Institute of Developemnt Studies
5. Steven Haggblade, Chief of Party, Bangladesh Food Policy Project

6. Mahfoozur Rahman, Consultant, Bangladesh Food Policy Project
7. Hassanat Miah, ILO-Assistant to Director

PBS VISITS

Jessore-2

Governing Board

1. Shafiqul Islam, President, Governing Board
2. Abdul Wadud, Secretary, Governing Board
3. Khoda Baksh Gazi, Member, Governing Board
4. Abdul Gafur, Member, Governing Board
5. Abul Qasem, Member, Governing Board
6. Dr. Abul Hossain, Member, Governing Board
7. Ranjit Kumar Sarkar, Member, Governing Board
8. Nishat Sultana, Lady Advisor

Management

1. F.M. Faridul Hoque, General Manager
2. Kamrul Ahsan Habid, Assistant General Manager (COS)
3. Kamrul Hasan, Assistant General Manager (MS)
4. Liaquat Ali Khan, Assistant General Manager (GS)
5. Monohar Kumar Biswas, Assistant General Manager (Engineering)
6. Rajit Kumar Debnath, Assistant General Manager (Finance)
7 Mr. S.M. Abdur Rahim, Retainer Engineer, Local Consultant

Consumer-Members: Agriculture

1. Group meeting with farmers using irrigation technology from the villages of Mobarakpur, Rampur, Maswimnagar, Hanuar, Monohorpur, Hayedpur and Chandipur held at Rajgonj. No. of participants: 33.
2. Group meeting with landless and marginal farmers (BRAC beneficiaries) at Rajgong

Consumer-Members: Light Industry

1. Monirul Alam, Owner, Kapataka Pressed-Rice Mill, Saw Mill and Rice Mill, Keshebpur
2. S.M. Waheduzzaman, Owner, Ureka Oil Mill, Jamen Rice Mill

Consumer-Members: Heavy Industry

1. Mr. Golam, General Manager, Raj Textile Mill, Abhoynagar
2. K.N. Huda, Manager, Bangladesh Leaf Tobacco Co. Ltd.

Consumer-Members: Domestic

1. Group meeting with villagers of electrified and non-electrified villages. No. of participants: 55, held at Bhagoti, Norendrapur

Social Sectors

1. Mr. Rahamatullah, Head Master, Rajgonj High School

Village Advisors

Meeting with 5 village advisors at Jessore-2

Kushtia

Governing Board

1. Rezaul Karim
2. Lutfur Rahman
3. Naquibul Hassan
4. Nazrul Karim
5. Nazrul Islam
6. Ismail Hossain
7. Shamsul Alam
8. Sydur Rahman
9. Abdul Malaq
10. Golam Sowrawer
11. Nowab Ali

Management

1. Samiul Haque Khan, General Manager
1. Abul Kalam, Asst. General Manager, Finance
2. Md. Solaiman, Asst. General Manager, Commercial
3. Shakhawat Hossain, Asst. General Manager, General Service
4. Mr. Giasuddin, Asst. General Manager, Member Service
5. Wahidul Islam, District Manager

Natore-1

Governing Board

1. Md. Nuruzzaman Sarkar
2. Md. Liakat Ali
3. Md. Golam Kibria
4. Md. Momtazuddin
5. Ms. Selina Akhtar Banu

Management

1. Monjur Rahman, General Manager
2. Md. Khalequzzaman, Asst. General Manager (GS)
3. Md. Inser Ali, Asst. General Manager (MS)
4. Proloy Kumar Shah, Asst. General Manager (Finance)
5. Abdullaha-Al-Amun, Asst. General Manager (C)&M)
6. Sala-uddin Al-Biller, District Manager
7. Nazmul Haque, REB, Asst. Engineer

Consumer-Members: Agriculture

1. Group meeting with 18 farmers using shallow tubewells from the villages of Koirabari, Saherbari, and Sorabari
2. Group meeting with 15 farmers using deep tubewells belonging to Chandpur Deep Tubewell Cooperative Society
3. Group meeting with 12 farmers using shallow tubewells from the villages of Nazarpur, Mirzapur, Pundori, Kalam and Jogolpur

Consumer-Members: Industry

1. Rezaul Karim, General Manager, Natore Sugar Mill
2. Md. Noor Baksh, General Manager, Jamuna Distillery
3. A.K.M. Kamal, Service Engineer, Jamuna Distillery

Consumer-Members: Domestic

1. Group meeting with 14 women (including destitute ones) from the villages of Sherkoil and Ramnagar
2. Group meeting with 9 men from Sherkoil village including disconnected consumers

Rangpur-2

Governing Board

1 Md. Tobarak Hossain
2 Md. Motahar Hossain
3 Md. Atikur Rahman
4 Md. Hasinuzzaman Choudhury
5 Md. Emdadul Haque
6 Kesab Chandra Sarker
7 Md. Mokhlesur Rahman
7 Md. Abdul Kader Shah

Management

1. D.A.J. Shamsuddin, General Manager
2. Ratan Kanti Basak, Asst. General Manager, General Service

3. Md. Jahangir Alam, Asst. General Manager, (Member Service)
4. Md. Feroz Al Mujahid, Asst. General Manager, (Finance)
5. Md. Salim Bhuiyan, Asst. General Manager, (CO&M)
6. Md. Shahabuddowla, Executive Engineer, REB
7. Md. Mizanur Rahman, Retainer Engineer
3. Ms. Raquibul Hoque, Asst. Engineer, REB

Consumer-Members: Industry

1. Al-Haj Md. Nurul Islam, Administrative Officer, Abul Biri Factory and Abul Tobacco Co. Ltd.
2. Md. Abdul Halim, Accountant, Abul Biri Factory and Abul Tobacco Co. Ltd.
3. Md. Jamaluddin, Manager, M.H. Tobacco Mill
4. Mr. Zahar Mian, Asst. Manager, Aziz Biri Factory
5. Md. Nurul Islam, Manager, Maulana Bashir Cold Storage, Monthowa

Consumer-Members: Commercial

1. Ruhul Islam, owner of Chand Pharmacy, Uttam Hajirhat
2. A group of 10 small shop-owners in Uttam Ganjipur Bazar

Consumer-Members: Domestic

1. Group meeting with 9 domestic consumers from Daodoba village
2. Group meeting with 8 women from Daodoba village

Social Sectors

1. Md. Rafiqul Islam, Medical Asst., Family Welfare Center, Uttam
2. Mr. Abdul Hannan, Teacher, Jafarganj High School, Uttam

NGOs

1. Mr. Khaled Hossain, Regional Field Officer, ADAB, Rangpur
2. Anup Kumar Shah, Asst. Regional Field Officer, NGO Forum for Water Supply and Sanitation, Rangpur
3. Abdul Malek, Coordinator, RDRS, Rangpur

<u>Madaripur</u>

Governing Board

1. Mujibur Rahman
2. Mosharraf Hossain
3. Abdul Hamid Khan
4. Ataur Rahman
5. Mrs. Jogomaya Shaha Roy
6. Panua Lal Chowdhury

Management

1. Tushar Kanti Debnath, General Manager
2. Mr. Mohammad Eunus, Asst. General Manager (GS)
3. Mr. Motahar Hossain, Asst. General Manager (MS)
4. Khan Mohammad Borhan, Asst. General Manager, CO&M)
5. Mr. Kamaluddin, Asst. General Manager, (Finance)

Consumer-Members: Agriculture

1. Group meeting with a group of 33 farmers using shallow tubewells from Dadkhali Union

Consumer-Members: Industry

1. Abdul Motwar, Production Officer, Takerhat Milk-Vita Processing Plant
2. Yehedul Islam, Asst. Manager,Takerhat Milk-Vita Processing Plant
3. Alı Asgar Miyan, Azad Saw Mill, Akbar Rice and Oil Mill
4. Owner, Al-Amin Fish and Ice Plant

Consumer-Members: Domestic

1. A group meeting of 15 consumers from electrified village of Rajoir
2. A group meeting of 15 consumers from non-electrified villages of Rajoir

NGOs

1. Program Management Officials of Gono Unnayan Proceshta (GUP), Rajoir, Madaripur

Tangail-1

Management

1. Syed Nurul Islam, General Manager, Tangail PBS

Consumer-Members: Agriculture

1. Group meeting with farmers using DTWs and STWs in Chaktail

Consumer-Members: Industry

1. Mr. Anwar, owner, Anwar Textile Mills, Tangail
2. Sams Prodo Das, owner of Sama Prodo Das Handloom Industry, Tangail
3. Loxmi Kanti Basak, owner of Rasak Handloom Industry
4. Akil Basak, owner of Handloom Industry

Chittagong-1

Management

1. Mr. Shah Zulfiqar Haider, General Manager
2. Mr. Rabiul Hossain, District Manager
3. Mr. Shahjahan Kabir, Asst. General Manager Construction and Maintenance
4. Mr. Abu Bakar Siddiqui, Asst. General Manager, Finance
5. Mr. Abul Mansur Chowdhury, Board Secretary
6. Mr. Renjit Kumar Rudra, Director
7. Mr. Abu Bakar Siddiqui, Director
8. Mr. Abu Zafar Fazlul Karim, Executive Engineer, REB

Retaining Engineers

1. Mr. Mohammed Hashudur Rahman, Director, Technological Services Limited (Consultant)
2. Mr. Abdul Quddus, Technological Services Limited (Consultant)

Moulavibazar

Governing Board

1. Abdul Hannan
2. Mosaddeq Ahmed Manik
3. Gopal Deb Chowdhury
4. Abdur Razzak
5. Abdul Hashem
6. Rashendra Kumar Dutta

Management

1. Abdur Rashid, General Manager
2. Sheik Md. Idris Ali, District Manager
3. Md. Nurul Amin, Asst. General Manager (GS)
4. Md. Afadul Amin, Asst. General Manager (MS)
5. P. Kumar Mondol, Asst. General Manager (Engineering)
6. R. Jubaraj Chandra Pal, Asst. General Manager, (O&M)

Central Warehouse, Shiromoni, Khulna

1. Engr. Ramesh Chandra Kapuria, Deputy Director

ANNEX R

RESUMES OF TEAM MEMBERS

MARK J. CHERNIACK

Energy Sector Experience

1989-1992. **Director**. International Institute for Energy Conservation, Asia Regional Office. Bangkok, Thailand
Responsible for working throughout Asia with government agencies to promote institutional development for power sector energy efficiency programs.

1983-1989. **Conservation Analyst**. Northwest Power Planning Council, Portland, OR.
Responsible for monitoring and analyzing the institutional effectiveness of the electrical energy efficiency programs of the Bonneville Power Administration, a federal power marketing agency.

1979-1983. **Project Co-Director**. Franklin County (MA) Energy Project
Responsible for developing concept of community-based energy planning and management of small-scale wind, solar and hydroelectric projects.

1982. **Energy Management Consultant**, Portland, OR.
Produced institutional review and comprehensive energy management report for the city of Portland.

1981-1982. **Manufacturing/Marketing Staff**. Solar Alternatives, Inc. VT.
Assisted with general business development, marketing, prepared training course for solar installer certification, assembled collectors and pump transport modules.

1977-1981. **New England Representative**. Center for Renewable Resources (Washington, DC)
Represented regional energy and environmental public interest groups to advocate for increased support for energy conservation and renewable energy technology from the U.S. Department of Energy and the U.S. Congress.

International Energy Consultancy

1993. USAID. Bangladesh Rural Electrification Evaluation.
1993. World Bank. Vietnam Power Sector Mission, Demand Side Management.
1992. Asian Development Bank. Terms of Reference for Technical Assistance for Thailand Energy Conservation Promotion Fund.
1991. Asian Development Bank. Terms of Reference for Demand Side Management Assessments in Asia Power Sector Lending.
1991. The World Bank. Thailand GEF Inception Report.
1991. The World Bank. FINESSE Project (ASEAN Sustainable Energy Market Studies). Thailand County Market Study
1990. UN Development Programme. Training Faculty. National Energy Training Workshop for Vietnam.
1990. U.S. Agency for International Development. Comprehensive Power Sector Assessment for Costa Rica.

Education

1976	M.Ed. Future Studies/Environmental Education. University of Massachusetts-Amherst, MA
1973	B.A. Political Science. University of Massachusetts-Amherst, MA

ANN SCHWARTZ

Evaluation Experience

1991-1993. **Economist/Evaluation Consultant**

Conducted a Monitoring and Evaluation Workshop for the Organization of Eastern Caribbean States.

Developed a monitoring system for the USAID-funded West Indies Tropical Produce Support Project, which supports increases in non-traditional agricultural exports.

Provided assistance to the International Centre for Ocean Development, a Canada-based Crown Corporation, for development of program performance indicators.

Evaluation team member: CIDA evaluation of CARE Rural Maintenance Program.

Developed a detailed monitoring and evaluation system for the USAID-funded Technology Initiative for the Private Sector project in Sri Lanka.

1989-1991. **Evaluation Specialist**. USAID Mission to Bangladesh
Responsible for organizing and coordinating evaluation activity for all Mission projects. Main areas of evaluation responsibility included: agricultural development, agricultural research and food policy, economic policy and financial sector reform, industrial development, infrastructure development including RE, women's micro-enterprise development, NGO's, etc.

Developed Program Performance Indicators; prepared Annual Evaluation Plan and Budget.

Developed Terms of Reference for evaluations and carried out "quality control" oversight of evaluations; detailed M&E plans for new projects.

1988-1989. **Economist/Consultant**
Study of Cooperatives in Bangladesh. Revised and edited a major donor review of the cooperative system, with particular emphasis on sustainability to support rural development.

1972- 1980. **Economist**
Prince Edward Island, Canada: Economist for the Comprehensive Development Plan.

Education

B.A. (Hons), McGill University, Montreal, Canada
Courses/Comp. exams for MSc - Ag Econ, University of Minnesota., USA

DEAN D. MOODY, P.E.

Power Sector Projects

1990. **Project Officer**. USAID. Egypt. Shoubra El Kheima Power Plant (4x315 MW), Ismaelia Power Plant (4x150 MW), Mehalla Textile Mills (3x25 MW) 1990.

1990. **Project Officer**. USAID. Electric utility training program in the West Indies.

1980-1990. **General Engineer**. USAID. Egypt, Sudan, Yemen, Barbados.

1970-80. **Consulting Engineer**. Developed 2-year work plans and 10-year long range plans for Mohave Electric Cooperative, Kingman AZ; TRICO Electric Cooperative, Tucson AZ; and Papago Tribal Utility Authority, Sells AZ. Plans conformed to REA requirements for REA borrowers. Work plans and long range plans included extensive distribution system analyses.

1972. **Consulting Engineer**. Design of 30/40/50 MVA (OA,FA,FOA) 230 kV/69 kV substation at the U.S. Bureau of Reclamation Davis Power Plant (hydro-electric), 69 kV transmission, and 69/24.9 kV substations to serve loads of Mohave Electric Cooperative in Arizona.

1977. **Consulting Engineer**. Design of 69 kV transmission and 69/24.9 kV substations for Papago Tribal Utility Authority.

1978. **Consulting Engineer**. Design of 161/69 kV switching station (main and transfer bus arrangement) for Wellton Mohawk Irrigation and Drainage District, Yuma County, AZ.

Affiliations

Institute of Electrical and Electronic Engineers, Senior and Life Member
American Society of Heating, Refrigeration and Air Conditioning Engineers, Life Member
National Society of Professional Engineers

Registration

Registered Professional Engineer (Mechanical and Electrical): Arizona, California, Nevada

Education

B.S. Electrical Engineering. University of Arizona. 1950.

PETER H. FRIEDLANDER

Economic/Financial Analysis Experience

1987-1993. **Management and Financial Consultant** - electric utilities

1974-1987. **Manager**. Management Consulting Services, Gibbs & Hill Inc., Architects & Engineers for International Power Projects, New York, N.Y.

1970-1974. **Consulting Systems Engineer**, Gibbs & Hill Inc., New York, N.Y.

1967-1968. **Corporate Staff-Financial Services**, W.R. Grace & Co., New York, N.Y.

International Power Sector Consultancy

Performed financial evaluations in 13 developing countries for World Bank, UNDP, USAID, African Development Bank and agencies of foreign governments. These countries included: Sudan, Pakistan, Jamaica, Honduras, Mexico, Colombia, Brazil, Venezuela, Nigeria.

Consulting services performed for 16 U.S. electric utilities involving economic/financial subjects, clients included:

- Otter Tail Power Company, Minnesota
- Niagara Mohawk Power Company, New York
- Hawaii Electric Company, Hawaii
- Puerto Rico Water and Power Company, Puerto Rico
- Rural Electrification Administration, Washington D.C.
- City of Austin Electric Department, Texas
- City of Oswego Electric Department, New York
- Dayton Power & Light, Ohio

Provided expert witness testimony in electric utilities financial subjects before various State Public Utility Commissions in New York, Texas, Maryland and Mississippi.

Education

- B.Sc, University of Glasgow, Scotland
- Ph.D., University of Glasgow, Scotland
- Post-Doctoral Fellow Research and Teaching, University of Pennsylvania, Philadelphia
- MBA Refresher Course, Harvard Business School Extension
- Financial Analysis Course on U.S. Stock and Bonds, Princeton University Extension

JAMALUDDIN AHMED

Power System Experience

1993. **Power System Consultant**. K&M Engineering and Consulting Inc. Washington D.C., USA. Consultation to USAID to evaluate the condition of Armenian power distribution system, its design and operating policy. Recommend necessary steps to rehabilitate and upgrade power distribution system. Consultation to World Bank to study feasibility of a energy sub-sector loan in two phases as per World Bank specification.

1992-1993. **Power Distribution Engineer**. International Bechtel Inc., Kuwait
Investigation and analysis of Ahmadi Township and all of Kuwaits oil field's, as regards voltage profile, switchgear capacity, system protection and operation using computer programs. Recommend system upgrade for existing system and system modification needed for future load demand.

1991-1992. **Engineer Specialist**. Bechtel Power Corporation, Gaithersburg, Maryland, USA.
Analysis and design of power generating plant and auxiliary distribution system. Selection of equipment and coordination of plant relay protection system.

1987-1991. **Senior Electrical Engineer**. Fluor Daniel, Chicago, Illinois, USA
Analysis and design of power generating plant and auxiliary distribution system. Selection of equipment and coordination of plant relay protection system. Analysis and relay protection of high voltage system. Relay protection of steam, combustion turbine and nuclear power generating plants of 30 to 1500 MVA size. Specification for generating plant equipments. Power system design for cogeneration, combined cycle, chemical and industrial plants.

1982-1987. **Consultant**. Bangladesh Power Development Board East-West Interconnector project and its upgrading for operation at 230 KV.

1978-1981. **Assistant Engineer**, Ontario Hydro, Canada
Power system monitoring and operation for the bulk power system.

Education

1974	Ph.D in Electrical Engineering, University of Windsor, Windsor, Ontario, Canada
1970	M.S. in Electrical Engineering, University of Windsor, Windsor, Ontario, Canada
1967	B.S. in Electrical Engineering, University of Engg. & Tech., Dhaka, Bangladesh

KHAWJA SHAMSUL HUDA

Administration, Management, Institutional Planning & Program

1980-1992. **Director**. Association of Development Agencies in Bangladesh (ADAB).

1984-1986. **Visiting Lecturer**. Department of Sociology, Dhaka University.

1975-1979. **Assistant Professor**. Department of Sociology, Chittagong University.

1970-1975. **Lecturer**. Department of Sociology, Chittagong University.

Research & Evaluation

1992. NGO Sector Review in Pakistan, EZE, Germany.

1992. Community Based Natural Resource Management, Asian NGO Coalition (ANGOC), Philippines.

1992. Evaluation of the Programs of Sind Agricultural Development Association (SAD), Pakistan, EZE, Germany.

1992. Evaluation of the Programs of Idara-E-Amn-O-Insaf, Pakistan, EZE, Germany.

1992. Evaluation of the Programs of IDE, Swiss Development Cooperation (SDC), Switzerland.

1990. NGO Sector Review in Bangladesh, Asian and Pacific Development Center (APDC), Kuala Lampur.

1989. NGO Contributions in Environment and Forestry, the Asian Development Bank, Philippines.

1987. Evaluation of the Programs of CODEC, Danis International Development Agency (DANIDA), Denmark.

1983. Institutional Development - Involvement of the Landless and Marginal Farmers, the Asian NGO Coalition (ANGOC), Philippines.

1983. Evaluation of the Programs of BRAC, NOVIB, The Netherlands.

Education

1979	Ph.D, Cornell University, (Sociology, Economic Development and Social Organization and Social Change)
1970	M.A., Dhaka University, (Sociology)

MOHAMMED ALAM BUKSH

1989-1992. **Senior Engineer**. Project Engineering, Green Road, Dhaka.
Consumer survey at Uttara and Tongi under Dhaka Electric Supply Authority (DESA). Turnkey contract for 500 KVA substation in Tejgaon, Dhaka

1988-1989. **Senior Engineer**. Udayog Consulting Engineers, Elephant Road, Dhaka.
Construction supervision of 3 nos. 132/33 KV grid station.

1985-1988. **Director**. Planning and Implementation, SHACO International Ltd., Dhaka
Supervised the construction of i) 3 nos. of 132/33 KV substation, ii) Extension work at Ishuri 132/33 KV substation, iii) 230 KV transmission line from Ashuganj to Ghorashal, and iv) 230 KV substation at Ashuganj under BPDB power projects.

1984-1984. **Project Director**. Atlanta Enterprise Ltd., Elephant Road, Dhaka
Consultancy services to Jute Mills Association for improvement of power and metering system.
Preparation of technical and financial proposal for electrification of Chittagong Hill Tracts area.

1979-1983. **Director, Design and Planning; Director, Business Operation; Director, Equipment and Materials; Superintending Engineer**, Jessore Division, Rural Electriciation Board, Bangladesh.

1975-1979. **Deputy Director**, Program, Bangladesh Power Development Board, Dhaka

1969-1975. **Assistant Engineer**, Program, Bangladesh Power Development Board.

1968-1969. **Assistant Engineer**, Operation Division, Dhaka Electric Supply, EPWAPDA.

Affiliations

Fellow, Institute of Engineers Bangladesh.
Fellow, British Institute of Management, UK.
International Member American Management Association, USA.

Education

1967	B.Sc Engineering (Elect.), Bangladesh University of Engineering & Technology, Dhaka.
1974	M.Sc Engineering (Elect.), Bangladesh University of Engineering & Technology, Dhaka.
1979	MBA, Institute of Business Administration, Dhaka.

ANNEX S

BIBLIOGRAPHY

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