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RURAL ELECTRIFICATION IN BANGLADESH

FINAL REPORT

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PART ONE: ASSESSMENT OF POST-1996 TECHNICAL ASSISTANCE NEEDS

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Accessing information from diverse sources to complete an assessment of a large, complex organizational entity in a relatively short period of time requires a great deal of cooperation from a great many people. Circumstances were complicated somewhat by public political events which restricted movement and activities at times, but the effect on the final assessment product is considered minimal, thanks to those who helped us work around them.

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We also pay tribute to all who have contributed to the remarkable effort to electrify the rural areas of Bangladesh and the achievement thus far.

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ACRONYMS

ACOS	Allocated cost of service
ACRE	Area Coverage Rural Electrification
ACSR	Aluminum conductor steel reinforced
ADB	Asian Development Bank
AGM	Assistant General Manager (PBS)
BDG	Bangladesh Government
BOL	Build-Own-Lease
BOLT	Build-Own-Lease-Transfer
BOO	Build-Own-Operate
BOOT	Build-Own-Operate-Transfer
BPDB	Bangladesh Power Development Board
CC	Construction Contractor
DESA	Dhaka Electricity Supply Authority
DD	Deputy Director (REB)
EC	Engineering Consultant
FY	Fiscal Year
GM	General Manager (PBS)
GOB	Government of Bangladesh
GWh	Gigawatt-hour
HFO	Heavy fuel oil
km	Kilometer
KV	Kilovolt
KW	Kilowatt
KWh	Kilowatt-hour
MCF	Thousand cubic feet
MIS	Management Information System
MW	Megawatt
NGO	Non-governmental organization
NRECA	National Rural Electric Cooperative Association
O&M	Operations and maintenance
PBS	Palli Bidyut Samity (rural electric cooperative)
PSMP	Power System Master Plan
PSRP	Power Sector Reform Proposal
PTA	Performance Target Agreement
RE	Rural Electrification
REB	Rural Electrification Board
ROI	Return on investment
RPC	Rural Power Company
TAKA	Taka (Bangladesh currency: Taka 40=US$ 1)
TD	Training Directorate (REB)
USAID	United States Agency for International Development

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PART ONE

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RURAL ELECTRIFICATION IN BANGLADESH

PART ONE

ASSESSMENT OF POST-1996 TECHNICAL ASSISTANCE NEEDS (DISTRIBUTION)

EXECUTIVE SUMMARY

1.0 OBJECTIVE:

The objective of this assessment is to examine the post-1996 technical assistance needs of the Rural Electrification Board (REB) and rural electric cooperatives (known by the acronym PBS for Palli Bidyut Samity) in maintaining and expanding electricity distribution in Bangladesh.

The assessment identifies specific areas of institutional management and technical functions in need of strengthening for a five-year period beginning in 1996. It also outlines technical assistance requirements for the period and provides illustrative anticipated results and measures of success for such technical assistance.

2.0 BACKGROUND

The Rural Electrification Board (REB) was created in 1977 with statutory authority "(a) to establish electricity generation, transmission, transformation and distribution systems in the rural areas of Bangladesh; (b) to take measures for effective use of electricity to foster rural development with special emphasis on increase in use of electric power for economic pursuits...(c) to determine, with the approval of the government, the criteria for rural electrification and associate works...(g) to organize the prospective customers of electricity into formal and informal groups, such as Palli Bidyut Samities, electric and other cooperatives, societies, associations and companies for the purpose of execution and management of schemes and providing related services..."

Under a plan designed by the National Rural Electric Cooperative Association (United States) to electrify all rural areas by 2005, USAID funded the development of the first PBSs which now number 45 with eight more in formation.

REB, a semi-autonomous government agency, receives funds from donor countries through the Government of Bangladesh (GOB) and makes loans to PBSs to construct lines to unserved areas. REB employs contractors to construct the lines and, once energized, the lines are turned over to the PBSs for operation of the distribution system. The PBSs repay the loans from REB with interest from their revenue from energy sales. All power is purchased from the Bangladesh Power Develpment Board. All materials and commodities for line construction and operation are purchased with donor funding by REB, received at a central warehouse and shipped as needed to the construction sites.

PBSs are autonomous, consumer-owned cooperatives which operate under policies and procedures set forth by REB. Each PBS has its own board of directors originally recruited and approved by REB and, after their first three-year terms, subsequently elected by the PBS membership at an annual meeting. All actions by the PBS board of directors are subject to REB approval. PBS general managers and department heads are appointed by REB and may be moved or removed without approval of the PBS board.

While 30 of the 45 PBSs are not yet producing operating margins individually, 15 are economically viable, although several achieve margins only when interest earned on reserves is considered. In the aggregate, the rural electrification program is viable.

A growing threat to the viability of the PBSs is the effect of frequent load-shedding, almost daily, by the Bangladesh Power Development Board due to insufficient generating capacity to meet peak demand. The PBSs are shed first and most frequently during the 5:00 pm - 9:00 pm period when

most of the domestic consumers' meager power consumption occurs. The potential for very serious economic impact on the PBSs lies in the losses to their largest consumers caused by power outages which motivates them to consider self-generation. Loss of these large consumers from the PBS load would shift operating costs to the remaining small consumers and cause significant rate increases. Part Two of this assessment examines the feasibility of installing small generating plants to serve PBS loads independent of the BPDB grid. (See separate report: Part Two: Assessment of Power Generation by the Rural Cooperatives)

3.0 FINDINGS:

In general, the assessment team concurs fully with the broad national and international consensus which affirms the laudable success of the rural electrification program in providing access to electricity to more than 15 million persons in rural Bangladesh through the construction of some 68,000 kilometers of line and more than one million connections. Such an accomplishment in 17 years of dedication can only be acclaimed as revolutionary in the life of the nation.

Efforts now should be directed toward :

- entrenchment of the territorial gains to date;
- retention and enhancement of PBS viability where the most potential exists;
- systematic, planned maintenance of the older PBS distribution systems;
- implementation of new management tools at REB and PBSs to aid decision-making;
- installation of small generation plants at selected PBSs, independent of the national grid.

3.1 Technical Assistance Needs:

REB's noteworthy success in administering the rural electrification program can be attributed, first, to the national commitment in 1977 to undertake the formidable challenge to electrify the rural areas and the creation/empowerment of REB to implement the plan. Secondly, achievement to date is directly due to the sustained level of technical assistance made available by USAID and other donors since the program's inception. The sourcing of the technical assistance may have been as important as the level of assistance in that it has been provided from the experience of a highly successful rural electrification program in the United States and has been delivered by people who "wrote the book" on duplicating the model in other countries.

While the technical assistance and training provided have established a substantial capability within REB and the PBSs, this assessment concludes that continued specialized technical assistance will be needed in several key institutional and operational areas for the foreseeable future. These areas include overall institutional management requirements such as strategic planning and performance monitoring, financial management and accounting systems to support it, and the refinement and institutionalizing of skills and procedures to enhance the basis for decision - making and implementation. Many things are being done well and many are ripe for improvement through targeted assistance.

3.2 REB Operations:

REB of necessity has focused throughout most of its existence on construction of lines to unserved areas with, at the same time, control of and responsibility for the distribution of electric power through the PBSs. While it is referred to as a utility, REB itself does not provide service, send and collect bills, connect or disconnect consumers or relate to the end-users of the product as their only reason for being. The delivery of service to the consumers is accomplished by the 45 PBSs which operate under policies and procedures set forth by REB with limited flexibility for local initiative except to suggest any modifications in order to respond to local circumstances. The PBS Operating Instructions (Series 300) recently have been reviewed and updated.

There are many strengths within REB; there also are many circumstances that impede overall institutional functionality, although not at all unlike most government agencies in any country and certainly not unlike others in Bangladesh. Such impediments would be troublesome in any organization when judged by generally accepted standards of efficiency, but in a highly centralized public service agency, they can take on critical proportions at times.

The strengths are found in many well-prepared people who have the basic training, ability and motivation to do their jobs well. Generally, what is lacking is coordination, monitoring and refinement of the process. Monitoring and refinement of processes are areas for improvement and are candidates for targeted technical assistance in management information systems (MIS), financial forecasting and allocated cost of service (ACOS) for the PBSs.

Many of the impeding circumstances seem to be attributable to the fact of being a government agency and, therefore, the bureaucracy inherent in the organization. The manifestations of this government culture (and the fact that it is not likely to change) suggest that REB may harbor the seed for evolving over time into the likeness of the Bangladesh Power Development Board, widely regarded as the epitome of an ingrained bureaucracy in charge of an essential public service with proven unacceptable result. One analogy in REB is considerable anecdotal evidence of a cumbersome decision-making process which requires multi-level approvals of often routine matters. This builds in undue delay in actions, adding to the unavoidable difficulty of responding in timely fashion from Dhaka to both routine and critical operational matters at the PBS distribution level because of the logistics of movement around the country. In a service utility, this often creates situations that affect the basic service to consumers. The principles of efficiency of the management of a very large enterprise such as rural electrification suggest the prudence and logic of enabling the PBSs to take more initiative at their discretion, given the resources to do so.

3.3 PBS Operations:

Individual economic viability of the PBSs aside for the moment, PBS operations are very similar in all 45 systems since they operate under the same rules and procedures set forth by REB. Mature PBSs follow virtually the same operational guidelines as the less-developed systems regardless of their greater resources in accumulated margins and experience. This much-criticized fact conflicts with the original design stated in the Rural Electrification Master Plan of 1982 which states:

> "*PBS Autonomy and Authority :* 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 carefully weighted against the REB's needs to sufficiently guide, monitor and control <u>new PBSs</u> (emphasis added) under the terms of the development loans. As the PBSs develop with experience and achieve financial viability, the monitoring and assistance from the REB will be reduced accordingly."

In spite of many adverse circumstances, the PBSs visited demonstrate a basic ability to get the job done to connect consumers, respond to problems (every one has a "one stop" complaint desk), deliver and collect the bills. The collection efficiency in the aggregate of the 45 operating PBSs averaged 83 percent for the 1994-95 fiscal year. Receivables from energy sales totaled US$13 million, 34.5 percent of which were current and 65.5 percent over 30 days. Domestic consumers represented 26.8 percent of receivables while irrigation accounted for 23.3 percent and general power 22.7 percent.

Their technical capability (i.e., line design, staking, etc.) is functionally enhanced by the on-site consulting engineering service which is contracted for that specific purpose. Often lacking is readily available, responsive support for major technical problems such as a substation malfunction which, if not given attention, could take the entire system out for an indefinite period. (After reporting a problem to REB, one PBS had been operating with the substation regulator disconnected for six months resulting in chronic low voltage and vulnerability to damage from

an undependable power supply.)

Systematic, planned maintenance is a definite need as many of the PBSs age and should be an area for consideration for assistance from donors to augment their investment in building the rural systems. Maintenance also should be adequately weighed in the Performance Target Agreements (PTAs) by which PBSs are evaluated (as REB contends they are).

PBS boards of directors meet monthly to review operations and hear the general manager's report after reading the minutes of the previous meeting. Most proposed actions must be submitted to REB for approval which reportedly may be slow in coming. While only two board meetings were actually attended by assessment team members, responses to several inquiries indicated the board functions basically are perfunctory by design.

A real need exists for a "mechanism" (the term used in several discussions) whereby PBSs can use their own or borrowed funds to purchase materials for operations and maintenance. REB policy allows this to be done (and the viable PBSs do so), but operations would be enhanced by a mechanism to pool purchases since individual PBSs need quantities too small to be practical or economical. All commodities are purchased by REB under donor agreements for new line construction; therefore, when a transformer fails on existing lines, often a replacement must be "borrowed" from REB development stores. A proposal has been put forth by NRECA advisors that an autonomous Cooperative Services Organization (CSO) be formed by the PBSs to independently acquire maintenance materials and also to provide a variety of other cooperative services.

PBSs know their consumers statistically by category of service quite well in spite of manual billing records. They relate more directly and more frequently with large consumers, including irrigators, and are very responsive to their needs because of their importance to the PBS's viability. They learn from many consumers through their "one stop" complaint desk where problems and solutions are recorded and prompt action taken by a member services representative. Services to members beyond the very basic electric service are virtually non-existent nor is there any organizational priority for doing more. It should be said, however, that by any standard, the Bangladesh context poses special challenges for increased member involvement.

3.4 Training :

The challenge for providing training involves the sourcing of needed expertise (the content), the "packaging" (the curriculum and other tools of implementation) and the delivery system (the logistics of access by the targeted group). In Bangladesh, all these elements pose special considerations.

Training has been supported by technical assistance for many years, provided by two long-term NRECA advisors, one for institutional training and another for technical training. A complete curriculum plan for REB, PBS and associated personnel was revised in June, 1995. Computerized records show 863 persons attended courses during the July-September quarter for a total of 8,428 trainee days. While a variety of courses was offered, a large percentage of the training days were invested in two-week courses for village electricians.

Problem areas were identified as shortage of personnel, inadequate facilities at the Dhaka Training Center (i.e., hostel space) and sometimes the cancellation by an REB instructor with no notice. The REB/NRECA Strategic Plan contains important training objectives including a computer training facility, a Central Training Academy, regional training centers and projection of training needs by region. Most of the Dhaka-based training utilized REB staff as instructors.

Within REB, a chronic problem is created by the government policy of transferring personnel from one department to another. To advance, an employee usually must be assigned to another position. As a result, training invested in a person may not remain resident where it was

introduced and, therefore, is not cumulative in its application. Employee rotation, of course, can be a problem in any enterprise in any country.

At the PBS level, some credence is given to the observation that "the right people" often do not receive training. The reference is to cases where an REB functionary receives training in an area he may supervise from Dhaka, but the PBS personnel who actually perform the function does not receive training. While some PBS managers and assistant managers do receive training, statistics show a distinct tilt toward REB personnel in the ratio of people trainied.

The assessment team has reservations about the true value of out-of-country training because of its cost, the limited number of people who can be sent and the debatable efficiency of the technology transfer that occurs, especially in "visiting other cooperatives." There is no recommendation in this assessment for out-of-country training, although there always are special circumstances that should be considered for very specific skill training. In such cases, it would seem prudent to require some assurance of the application of skills so acquired upon the return of personnel trained for some reasonable period of time and for the transfer of the skill to replacement personnel if reassignment moves the initial training from where it should be implemented.

3.5 Local Sources of Technical Assistance:

There are numerous sources of local technical assistance available, although definitive assessment of the quality of companies or individuals is difficult. REB and the PBSs have many years of good experience with contracted engineering services which indicates a strong source of local expertise with utility orientation. In the field of finance/accounting, there is no shortage of chartered accounting firms with good credentials. The Bangladesh Management Development Centre, operated under the Ministry of Industries, offers a wide range of courses which suggests a source for people with specialized training in several areas for which locally-sourced technical assistance is recommended.

Often the adequacy of local consultants may be determined by their lack of experience in the utility field. For example, a person skilled in spreadsheets would have limited value in developing a financial forecast model. On the other hand, expertise in materials management may not require specific experience with utility materials.

This assessment recommends local sourcing wherever possible.

4.0 CONCLUSIONS:

4.1 Technical Assistance Scope:

Planning, coordination and monitoring are the principle areas in which REB and the PBSs continue to need technical assistance. The recommendations made in this assessment are very specifically targeted at helping develop and/or refine the tools and the skills to use them to improve financial/accounting records, provide long-term methodologies and systems to undergird decision-making, and to put in place procedures to better manage the normal, essential functions involved in carrying out REB/PBS responsibilities. A summary of specific technical assistance recommended to strengthen the overall management function and achieve institutional objectives is on the next page. Then, tables on the following three pages present a more detailed description and prioritization of the assistance.

4.1.1 Long-term advisors in these areas:

• Management/strategic planning	60 manmonths
• Financial analysis/MIS/financial forecasting	60 manmonths
• Utility operations/system coordination/ materials control	60 manmonths
• Training management/curriculum development	60 manmonths
Total long term:	240 manmonths

4.1.2 Medium and short-term consultancies in these areas:

• Workshops on management monitoring system	15 manmonths
• MIS/records automation	4 manmonths
• Allocated cost of Service/rate design methodology	10 manmonths
• Financial forecast methodology	10 manmonths
• General accounts manual development/training	10 manmonths
• Automated PBS loan records/monitoring	3 manmonths
• Computerized billing system for PBSs	20 manmonths
• Computer billing training	18 manmonths
• Revise accounting procedures manual	12 manmonths
• Revise PBS budget system	6 manmonths
• Materials inspection RFP	2 manmonths
• Materials control/inventory	12 manmonths
• PBS system preventive maintenance plan	12 manmonths
• Materials "acceptable quality" list	12 manmonths
• Utility system protection design	1 manmonths
• System automation/SCADA	6-12 manmonths
Total medium and short term:	163 manmonths

Total long, medium and short term..... 409 manmonths

The above total recommended technical assistance is detailed and prioritized in Table 1 (next page).

Table 2 summarizes only the high priority recommendations which total 270 manmonths.

A third option is to scale-back the total recommendations by reducing long-term advisors to 36 manmonths each and reducing most medium and short term by half, plus deletion of four low priority items. This scaled-back option would total 220 manmonths.

TABLE 1: TOTAL TECHNICAL ASSISTANCE SUMMARY AND PRIORITIZATION

Priority	OBJECTIVE	TECHNICAL ASSISTANCE/SKILL MIX	Man-months	DELIVERABLES [DEL] EXPECTED RESULTS [ER]
HIGH	To provide counsel on planning and institutional matters, and to coordinate work of other advisors.	Long-term advisor (expatriate) to advise REB on cooperative utility management and strategic long-range planning; extensive utility management background with special skills in strategic planning and cooperative utility operation.	60	**DEL:** Ongoing analyses of strategic concerns of RE program for REB and donor community. **ER**: Present source of technical and management counsel to enhance direction of RE program; documentation and evaluation of TA provided.
HIGH	To provide oversight and guidance to the development of operational plans to protect the PBS systems and facilitate flow of materials.	Long-term advisor (expatriate) to coordinate new technical applications at PBSs; background in utility system operations, system design and technical planning.	60	**DEL:** Properly installed systems for PBS system coordination and protection, including uni-grounded wye system to replace stolen neutral wires; optimized productivity of short-term specialists, plus follow-up oversight. **ER**: Safer PBS systems by replacement of stolen neutrals with alternate grounding method; effective use of short-term consultancies; better timely flow of materials for PBS operations.
HIGH	To develop a monitoring system at REB which will lessen need for high-level supervision of more developed PBSs and to institutionalize capability to apply the system; to develop financial forecast methodology as a routine management tool; to develop process of allocated cost of service and rate design methodologies.	Long-term consultant (expatriate) with experience in developing the management process of monitoring organizations; preferred background in financial and tariff matters. Advisor will divide time thusly: 50% to monitoring system 25% to financial forecast system 25% to allocated cost-of-service system	60	**DEL:** Monitoring standards for different groups of PBSs; routine production of financial forecasts for REB and PBSs; production of ACOS studies and rate design proposals. **ER:** Established monitoring system at REB with differentiated requirements for groups of PBSs; reduction in level of REB's supervision efforts over PBSs; increased responsibilities at the PBSs.
MED	To provide management/planning advice to REB Training Directorate on curriculum development and delivery systems for all training programs.	Long-term advisor (expatriate, unless a qualified, credentialed local source is available) to assist in professionalizing the REB training function and advise on optimum utilization of resources; also oversee local counterpart's curriculum development. Degreed educator or trainer with adult education specialty and experience; background in curriculum development.	60	**DEL:** Developed curricula for the most critical training programs and assistance/support to short-term specialized training consultancies. **ER:** An enhanced, better-planned training program through professional overview; effective planning for new training facilities and training in their operation.
HIGH	To develop a monitoring system at REB to reduce need for high level of supervision over more developed PBSs.	Short-term consultant (local, if possible) to conduct ongoing workshops for REB and PBS personnel on the monitoring process; management consulting experience and capable of stature and respect at REB. Would work closely with long-term advisor.	15 3 each of 5 years.	**DEL:** Ongoing training and institutionalized monitoring standards for PBSs. **ER:** Established monitoring system and reduced level of supervision efforts over PBSs; increased responsibilities at PBSs.
HIGH	To provide REB a refined management information system (MIS) to produce reliable, timely and informative reports to assist in planning and decision-making.	Short-term consultant (expatriate) to work closely with REB/PBS counterpart staff to build in-house capability; wide experience in design and development of computerized MIS.	4	**DEL:** An MIS design. **ER:** REB and PBSs will have timely, reliable information for monitoring PBS performance.

Priority	OBJECTIVE	TECHNICAL ASSISTANCE/SKILL MIX	Man-months	DELIVERABLES [DEL] EXPECTED RESULTS [ER]
HIGH	To develop the process of allocated cost of service and rate design methodologies to be integrated in stages as routine management tools by REB and PBSs and to institutionalize the capability to apply the systems.	Short-term consultant (expatriate) to conduct workshops and develop courses for REB and PBS personnel; strong experience in applying ACOS process and training skills and, ideally, training skills; would work closely with long-term advisor.	10 in as many as 5 stages or continuous	**DEL:** Established ACOS and rate design methodologies for PBSs; production of ACOS studies at PBSs with monitoring and review by REB. **ER:** Ability to produce ACOS studies and rate design proposals as routine management tool as part of an REB monitoring system with differential requirements for groups of PBSs; reduced level of REB's supervision efforts over PBSs; increased responsibilities at PBSs.
HIGH	To develop financial forecast methodology as an integrated management tool by REB and PBSs; to provide insights, analysis and monitoring and to institutionalize capability.	Short-term consultant (expatriate) to develop courses and conduct training for REB and PBS personnel; specialist in financial forecasting for utilities.	10 in 4 trips	**DEL:** An established financial forecast methodology for REB and PBSs; training courses in methodology and scenario analysis. **ER:** REB/PBS capability to produce financial forecasts as routine management tool; reduced level of supervision over PBSs; increased responsibilities at PBSs.
LOW because other ideas are under study	To provide for the required pre-shipment inspection of materials purchased by REB and PBSs by contracting an independent firm.	Short-term consultant (locally sourced) to assist REB in development of the RFP and in evaluation of proposals; experience in materials inspection requirements and in developing/evaluating RFPs.	2	**DEL:** Awarded contract to an independent agency; training for REB personnel to perform subsequent contract awards. **ER:** Fulfillment of an essential function by out-sourcing the service, thus freeing the process from current uncertainty as to who will perform the services.
LOW because basics are in place	To allow REB more flexibility in use of donor-funded materials; to expedite flow of materials through the warehouse to PBSs.	Medium-term consultant (locally sourced, if available) to assist REB in improvement of material control process; experience in developing and operating warehousing and procurement systems for electric or related industries.	12	**DEL:** An REB-coordinated materials procurement, disbursement and stocking system that can deliver normally-stocked material to PBSs in timely manner. **ER**: Ability to identify optimum stocking levels, rate of stock turnover and anticipated procurement; PBSs will receive needed materials on a more timely basis.
LOW because GOB may not allow it	To develop a system to approve materials and equipment for use on PBS systems that can be purchased without extensive inspection requirements.	Medium-term specialist (expatriate) to set up quality-assurance criteria for acceptable materials and to develop initial list of approved materials; should have specific knowledge of electric utility materials and applicable international standards and specifications.	12 not all in country	**DEL:** List of materials by manufacturer generally acceptable for use on PBS systems and a system within REB to qualify materials submitted for approval testing. **ER:** A more efficient process for material procurement through a pre-sceening of manufacturers of materials of acceptable quality and a process for benefitting from experience with sources of unacceptable quality.
HIGH	To develop a detailed preventive maintenance program guide for PBSs.	A medium-term specialist (expatriate) to assist REB and PBSs in developing an electric system preventive maintenance program; an electrical engineer or utility operations manager with extensive experience in distribution system operations and maintenance, and system monitoring/detection techniques.	12 not all in country	**DEL:** A written preventive maintenance guide to distribute to PBSs. **ER:** Better planning for preventive maintenance as PBS systems age; more reliable service by forestalling unanticipated failure of equipment; PBS personnel better trained to detect possible problems through monitoring techniques.
HIGH	To develop a system protection scheme for all PBSs to counter the chronic problem of stolen neutral wire.	A short-term specialist (expatriate) to assist REB in developing an appropriate, practical scheme that does not require a neutral wire; special skills in system grounding and uni-grounded wye distribution systems.	1	**DEL:** A system protection scheme to isolate line-to-ground faults on a uni-grounded wye system, including grounding and equipment criteria. **ER:** Mitigation of the chronic and unavoidable theft of neutral lines and reduction of system hazards caused by absence of a system ground.

Priority	OBJECTIVE	TECHNICAL ASSISTANCE/SKILL MIX	Man-months	DELIVERABLES [DEL] EXPECTED RESULTS [ER]
LOW but useful	To develop a guideline for designing and installing a System Control and Data Acquisition (SCADA) system on PBS distribution systems.	A short-term specialist (expatriate) to assist REB in preparing SCADA guidelines; an electrical engineer with experience in specifying, designing, installing, operating and maintaining a SCADA system, and knowledge of the variety of systems available.	6 to 12 not all in country	**DEL:** A document to assist REB and PBSs in determining if a PBS needs a SCADA system and the necessary guidelines to design and specify a SCADA system with appropriate monitoring. **ER:** Ability to determine application and expected benefits of a SCADA system in specific PBSs depending on need.
LOW but useful	To provide a comprehensive, understandable reference guide for accounting/financial personnel and also to train new employees.	Short-term consultant (locally sourced) to work closely with REB/PBS counterpart staff to develop a comprehensive REB general accounts manual and build in-house expertise for future revisions; financial/accounting background with direct experience in the development, review and improvement of finance /accounting systems.	10	**DEL:** An updated, comprehensive General Accounts Manual for REB. **ER:** Improved overall quality of work in day-to-day accounting functions.
MED	To facilitate loan recordkeeping, monitoring, and reporting and provide readily available information on loans to PBSs.	Short-term consultant(s) (locally sourced) to work directly with REB/PBS counterpart staff to build in-house capability in operation of automated loan monitoring; information technology background and wide experience in developing and implementing computerized operating systems.	3 depends on the chosen software	**DEL:** A functional computerized loan monitoring system that meets requirements of both REB and PBSs. **ER:** Reliable loan records and information; timely reports; more time for staff analysis work; reduced duplication of effort; loan amortization schedules to improve cash-flow planning and budgeting for debt service by PBSs.
HIGH	To facilitate billing, consumer accounting and timely reports, especially those which will improve implementation of collections and disconnections.	Short-term consultants for the pilot PBS and long-term consultant (expatriates) for all other PBSs to install a computerized consumer accounting system; direct experience in implementation of computerized billing systems for electric cooperatives.	20 short-term. Unable to estimate long-term for 45 PBSs over time.	**DEL:** An operational computerized billing system encompassing consumer information, billing and collection, and financial/management reporting complete with users' guide and documentation. **ER:** Improved personnel effectiveness; more accurate billing; timely reports; reduced pesonnel requirements as consumer base increases; overall improvement in management information for performance monitoring.
HIGH	To introduce PBS personnel to computers through training and prepare users of the computerized billing system.	Short-term consultants (expatriate and locally sourced) to work closely with REB/PBS counterpart staff to build in-house training capability; direct experience in developing training programs and delivery of computer training.	18 Does not include time to develop computer based training.	**DEL:** Developed foundation computer skills in DOS, word processing and spreadsheets; specialist training for billing personnel; system coordinator training for in-house capability; advanced skills for any specialty groups (i.e., financial forecaster/ACOS). **ER:** PBS personnel basically trained in computer use; basis for on-the-job training to be effective.
LOW but useful	To provide updated, comprehensive reference for accounting procedures for guidance of personnel and training of new ones.	Medium-term consultant (locally sourced) to work closely with REB/PBS counterpart staff to develop in-house capability for future revisions; direct experience in review and development of finance/accounting systems.	12	**DEL:** An updated, comprehensive Accounting Procedures Manual for REB and PBS personnel. **ER:** Better accounting records as result of readily available guide for day-to-day accounting functions.
LOW but useful. Possible GOB limitation.	To improve current budget system and documents; to provide guide for budgets that can quantify financial and operating measures necessary for evaluation of performance.	Short-term consultant (locally sourced) to work directly with REB and PBS personnel on budgeting process and content beyond requirements of GOB; experience in budget development or related area.	6	**DEL:** A budget manual to serve as reference guide for PBSs, including standard forms for monitoring PBS performance. **ER:** A participative budgeting process that produces a budget that can be used to evaluate actual performance of PBSs compared with projections; will enhance materially the value of financial forecasts.

TABLE 2: HIGH PRIORITY TECHNICAL ASSISTANCE ONLY

[Medium and low priorities deleted]

Priority	OBJECTIVE	TECHNICAL ASSISTANCE/SKILL MIX	Man-months	DELIVERABLES [DEL] EXPECTED RESULTS [ER]
HIGH	To provide counsel on planning and institutional matters, and to coordinate work of other advisors.	Long-term advisor (expatriate) to advise REB on cooperative utility management and strategic long-range planning; extensive utility management background with special skills in strategic planning and cooperative utility operation.	60	**DEL:** Ongoing analyses of strategic concerns of RE program for REB and donor community. **ER**: Present source of technical and management counsel to enhance direction of RE program; documentation and evaluation of TA provided.
HIGH	To provide oversight and guidance to the development of operational plans to protect the PBS systems and facilitate flow of materials.	Long-term advisor (expatriate) to coordinate new technical applications at PBSs; background in utility system operations, system design and technical planning.	60	**DEL:** Properly installed systems for PBS system coordination and protection, including uni-grounded wye system to replace stolen neutral wires; optimized productivity of short-term specialists, plus follow-up oversight. **ER**: Safer PBS systems by replacement of stolen neutrals with alternate grounding method; effective use of short-term consultancies; better timely flow of materials for PBS operations.
HIGH	To develop a monitoring system at REB which will lessen need for high-level supervision of more developed PBSs and to institutionalize capability to apply the system; to develop financial forecast methodology as a routine management tool; to develop process of allocated cost of service and rate design methodologies.	Long-term consultant (expatriate) with experience in developing the management process of monitoring organizations; preferred background in financial and tariff matters. Advisor will divide time thusly: 50% to monitoring system 25% to financial forecast system 25% to allocated cost-of-service system	60	**DEL:** Monitoring standards for different groups of PBSs; routine production of financial forecasts for REB and PBSs; production of ACOS studies and rate design proposals. **ER:** Established monitoring system at REB with differentiated requirements for groups of PBSs; reduction in level of REB's supervision efforts over PBSs; increased responsibilities at the PBSs.
HIGH	To develop a monitoring system at REB to reduce need for high level of supervision over more developed PBSs.	Short-term consultant (local, if possible) to conduct ongoing workshops for REB and PBS personnel on the monitoring process; management consulting experience and capable of stature and respect at REB. Would work closely with long-term advisor.	15 3 each of 5 years.	**DEL:** Ongoing training and institutionalized monitoring standards for PBSs. **ER:** Established monitoring system and reduced level of supervision efforts over PBSs; increased responsibilities at PBSs.
HIGH	To provide REB a refined management information system (MIS) to produce reliable, timely and informative reports to assist in planning and decision-making.	Short-term consultant (expatriate) to work closely with REB/PBS counterpart staff to build in-house capability; wide experience in design and development of computerized MIS.	4	**DEL:** An MIS design. **ER:** REB and PBSs will have timely, reliable information for monitoring PBS performance.
HIGH	To develop the process of allocated cost of service and rate design methodologies to be integrated in stages as routine management tools by REB and PBSs and to institutionalize the capability to apply the systems.	Short-term consultant (expatriate) to conduct workshops and develop courses for REB and PBS personnel; strong experience in applying ACOS process and training skills and, ideally, training skills; would work closely with long-term advisor.	10 in as many as 5 stages or continuous	**DEL:** Established ACOS and rate design methodologies for PBSs; production of ACOS studies at PBSs with monitoring and review by REB. **ER:** Ability to produce ACOS studies and rate design proposals as routine management tool as part of an REB monitoring system with differential requirements for groups of PBSs; reduced level of REB's supervision efforts over PBSs; increased responsibilities at PBSs.

Priority	OBJECTIVE	TECHNICAL ASSISTANCE/SKILL MIX	Man-months	DELIVERABLES [DEL] EXPECTED RESULTS [ER]
HIGH	To develop financial forecast methodology as an integrated management tool by REB and PBSs; to provide insights, analysis and monitoring and to institutionalize capability.	Short-term consultant (expatriate) to develop courses and conduct training for REB and PBS personnel; specialist in financial forecasting for utilities.	10 in 4 trips	**DEL:** An established financial forecast methodology for REB and PBSs; training courses in methodology and scenario analysis. **ER:** REB/PBS capability to produce financial forecasts as routine management tool; reduced level of supervision over PBSs; increased responsibilities at PBSs.
HIGH	To develop a detailed preventive maintenance program guide for PBSs.	A medium-term specialist (expatriate) to assist REB and PBSs in developing an electric system preventive maintenance program; an electrical engineer or utility operations manager with extensive experience in distribution system operations and maintenance, and system monitoring/detection techniques.	12 not all in country	**DEL:** A written preventive maintenance guide to distribute to PBSs. **ER:** Better planning for preventive maintenance as PBS systems age; more reliable service by forestalling unanticipated failure of equipment; PBS personnel better trained to detect possible problems through monitoring techniques.
HIGH	To develop a system protection scheme for all PBSs to counter the chronic problem of stolen neutral wire.	A short-term specialist (expatriate) to assist REB in developing an appropriate, practical scheme that does not require a neutral wire; special skills in system grounding and uni-grounded wye distribution systems.	1	**DEL:** A system protection scheme to isolate line-to-ground faults on a uni-grounded wye system, including grounding and equipment criteria. **ER:** Mitigation of the chronic and unavoidable theft of neutral lines and reduction of system hazards caused by absence of a system ground.
HIGH	To facilitate billing, consumer accounting and timely reports, especially those which will improve implementation of collections and disconnections.	Short-term consultants for the pilot PBS and long-term consultant (expatriates) for all other PBSs to install a computerized consumer accounting system; direct experience in implementation of computerized billing systems for electric cooperatives.	20 short-term. Unable to estimate long-term for 45 PBSs over time.	**DEL:** An operational computerized billing system encompassing consumer information, billing and collection, and financial/management reporting complete with users' guide and documentation. **ER:** Improved personnel effectiveness; more accurate billing; timely reports; reduced pesonnel requirements as consumer base increases; overall improvement in management information for performance monitoring.
HIGH	To introduce PBS personnel to computers through training and prepare users of the computerized billing system.	Short-term consultants (expatriate and locally sourced) to work closely with REB/PBS counterpart staff to build in-house training capability; direct experience in developing training programs and delivery of computer training.	18 Does not include time to develop computer based training.	**DEL:** Developed foundation computer skills in DOS, word processing and spreadsheets; specialist training for billing personnel; system coordinator training for in-house capability; advanced skills for any specialty groups (i.e., financial forecaster/ACOS). **ER:** PBS personnel basically trained in computer use; basis for on-the-job training to be effective.

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POLICY/ACTION/COMMITMENT REQUIRED TO IMPLEMENT

RECOMMENDATIONS AND/OR TECHNICAL ASSISTANCE

TA/RECOMMENDATION	POLICY/ACTION/COMMITMENT	APPROVAL	EXPECTED RESULTS
REB is urged to take definitive action on its review of the proposed revolving fund to utilize PBS surplus revenue for loans for approved activities judged to be beneficial to the PBSs.	Change in REB policy and PBS Bye-laws specifying use of PBS surplus.	REB PBS	Constructive use of a portion of accumulated reserves which now have no definitve purpose except to earn interest or to extend new service from existing lines in their service area. Use of members' money for members' benefit.
REB is encouraged to adopt a plan to federate various services for the PBSs and their employees through a mechanism such as the proposed Cooperative Services Organization.	REB policy allowing PBSs to form an autonomous organization.	REB	PBSs will have a mechanism through which their statutory autonomy can be utilized beneficially and independent of government-entity restraint (i.e., use of their own funds to purchase materials for system maintenance).
Development of financial forecast and allocated cost of service as management tools and ultimate transfer of responsibility for these tools to the PBSs.	REB policy/procedure providing initially for substantive participation by PBSs in development of financial forecasts and cost of service studies. A policy change ultimately would be required to allow PBSs to set their own rates, subject to REB approval.	REB	PBSs will have more influential input into developing information which will form basis for management decisions and in time (five years?) set their own rates. In the near term, PBSs would have more flexibility to respond to needs of large at-risk consumers in rate setting. REB's efforts would be reduced in dealing with more mature PBSs.
An additional position at PBSs is recommended (financial analyst). REB staff would train the PBS personnel and provide ongoing technical assistance for financial forecast model problems, analytical problems, computer problems, etc. REB would provide oversight for forecasts submitted by PBSs.	REB would need to authorize the new position to be filled by PBSs and commit to the goal of shifting responsibility for initializing financial forecast data and rate design to PBSs.	REB	PBSs would begin building in-house capability from the beginning of the development of financial forecasts and cost of service studies as key management tools to be ultimately transferred to them for development.

TA/RECOMMENDATION	POLICY/ACTION/COMMITMENT	APPROVAL	EXPECTED RESULTS
It is recommended that REB establish a Financial Planning Directorate to concentrate on the development of financial forecast tool.	REB is encouraged to decide quickly to establish this organizational unit and staff it with qualified people.	REB	A specialized unit will be in place to give the required concentration to the development, implementation and evolution of the financial forecast.
It is recommended that REB review the existing budgeting system and develop improvements, as necessary, to enable PBSs to control and monitor their operations more effectively and on a contemporaneous basis. (Reportedly, the budget year is often half over before budgets are approved by REB and GOB.)	REB has responded that the budgeting system complies with GOB budget discipline. For clarification, the recommendation refers to PBS budgets which, presumably, are not subject (or should not be) to GOB guidlines/format. REB is urged to commit to revising PBS budgets by including variance reporting (actual vs projected) for better performance monitoring. To be useful, PBS budgets must be approved more promptly by REB.	REB GOB ?	PBSs will have a better, timely comparison of actual performance compared with budget projections which will benefit both PBSs and REB's monitoring of them.
It is recommended that REB activate a Consumer Services Office to plan and promote, with specific PBS input, services to PBS members and encourage their participation in PBS affairs. PBSs should be given more flexibility to initiate member services and activities appropriate to their communities.	REB is encouraged to establish the Consumer Services Office and commit to support of PBS services to consumers and the PBS communities in appropriate ways which reflect the member ownership of their utility.	REB	Consumers will be made more aware of their member relationship to the PBS and benefit from that membership beyond the receiving of electric service.

PART ONE

ASSESSMENT OF POST-1996 TECHNICAL ASSISTANCE NEEDS

(DISTRIBUTION)

1.O BACKGROUND:

In 1976, less than three percent of Bangladesh's rural population had access to electricity. Realizing that sustainable economic development and quality of life depend on a reliable supply of electricity, the Government of Bangladesh (GOB) decided to extend the public supply of electricity to its rural communities. Cooperating with the United States Agency for International Development (USAID) and GOB, the National Rural Electric Cooperative Association (NRECA) developed a comprehensive rural electrification plan. NRECA's plan called for the complete electrification of rural Bangladesh in five phases concluding in 2005. To date, 45 PBSs are operating and eight more are in formation. Some one million connections have been made to the systems and more than 65,000 kilometers of line have been constructed and approximately 15 million people have access to electric power.

The basis for the NRECA plan was the development of autonomous, member-owned rural electric cooperatives called Palli Bidyut Samity (PBS). All PBSs come under the aegis of the semi-autonomous Rural Electrification Board (REB) in Dhaka. The REB sets national rural electrification policy and standards, assists with organizational, technical and financial operations, and acts as financier for the PBSs. The REB is authorized to construct generating capacity and transmission and distribution systems using funds supplied by the GOB. The PBSs operate the local distribution system after it is commissioned. The PBS plans and implements expansion of the local distribution system and handles all business functions such as meter reading, billing and collection.

REB employs about 1,100 people (758 authorized in the government manpower budget and 350 "project employees" funded by external funds. They have submitted a proposal to GOB to increase the budgeted work force by 63 percent. The majority of the increased personnel would be added to the engineering departments. (See Annex 3: 1995-2000 Manpower Proposal.)

The governing body of REB is a board comprised of a chairman, three full-time members and two part-time public members. All are government appointees. The office of the chairman is responsible for planning and general administration. The full-time board members head the major departments of Engineering, PBS and Training, and Finance. (See Annex 2: REB Organizational Charts.) The tenure of the chairman averages about two years since the appointee often is from the military.

Donor funding is channeled through GOB to REB and most often is designated for commodities and materials for specific PBS line extension. REB also receives subsidies from GOB for initiating new PBS service areas. All these funds are loaned to PBSs at low interest and the loans are repaid from operating revenues from energy sales. (See operating highlights in the Financial Reporting and Accounting section of this report.) A significant percentage of REB's activities is related to donor-funded purchases of materials to build the distribution system.

The other significant portion of REB work deals with the supervision and support of the PBSs. REB acquires their funds, designs their system, buys their materials, builds their lines, sets forth operating policies/procedures, provides technical support, fixes their rates, names their managers, approves their budgets, buys their power, trains their employees and directors, approves their engineering and auditing firms, sets their compensation, provides their housing and monitors/audits all operations. There is limited flexibility for local initiative by the PBS without prior approval of REB. Operating Instructions (Series 300) must be followed by PBSs, but some deviation is allowed when local circumstances warrant. These instructions recently have been reviewed and updated.

To fulfill all these functions adequately requires the timely, efficient processing of a huge amount of data. In addition to the standard accounting systems, there is a strong requirement for analysis and

projection which can best be accomplished by the use of modern information management tools. One of REB's strengths is a cadre of well-prepared people who understand the basics of information management and appreciate its value. One of their weaknesses is the process required to decide to implement some improved procedure and then to do it. Perhaps their greatest organizational weakness (not unique to REB in Bangladesh) is the top-down hierarchy of initiative, decision-making and mandate. The 1993 evaluation study referred to it as a "tendency to delegate upward," but it is much more culturally endemic than that. Overall, their basic organizational structure is adequate and functional.

Since 1978, an estimated $320 million in GOB and external donor funds have been invested in the rural electrification system. However, the rural population still accounted for only 13 percent of the total electricity consumed in 1994. The objective of this assessment is to examine future technical assistance needs of the Rural Electrification Board (REB) and rural electric cooperatives (PBSs) in maintaining and expanding electricity distribution in Bangladesh, and becoming self-sufficient in the skills and processes involved.

One of the major threats to the PBSs' financial viability is the frequent load-shedding imposed on the PBSs by the sole power generation entity, Bangladesh Power Development Board (BPDB). Currently, during peak demand time, the BPDB generation facilities can be as much as 500 MW short and are forced to shed load to maintain system operability. This scenario will remain for five to ten years until the construction of new power facilities is completed and this is dependent upon BPDB improving its operations. The feasibility of small power generation by the rural cooperatives is addressed in Part Two of this overall assessment.

Part One will:

1) Identify areas of institutional strengthening where technical assistance will be needed during the 1996-2001 period.

2) Indicate specific institutional improvement objectives and ways to achieve them.

It must be emphasized at the outset that the standards by which current capabilities of REB and the PBSs were evaluated are the standards of conventional, accepted and proven utility operation. Such standards were applied as base-line because to do otherwise would compromise the essential goal of maximum efficiency and service. Allowance was made for actual circumstances which to varying degrees limit the optimum level of achievement, but to lower the standard would obscure the goal. The application of the standard allows some assessment of how far short of the goal the reality of circumstances places the actual operations (i.e., how much room for improvement) or, in some cases, the application of the standard raises a red flag to signal predictable, negative consequences of an action or inaction (or a policy or procedure) for which there may be some expedient mitigation. (If the BEST solution is not available, what's the next best ? But the choice should never be to do nothing.) If there is no mitigation ("it's the best we can do under the circumstances with limited resources"), then the predictable, negative results must be accepted and tolerated. The long-term danger here is surrender to the circumstances until the mediocre becomes the standard, the unacceptable becomes acceptable, the goal is deemed unattainable and the motivation to improve is squelched.

This assessment report is presented in seven topical sections which, aggregated, cover institutional management, strategic planning, performance monitoring, systems operation and maintenance, procurement and materials flow, financial management and accounting systems, activities in organizing PBSs, assisting PBSs with engineering and operational problems, and encouraging member participation and cooperative strengthening. Each section is the report of an individual assessment team member in the area of their expertise and their assigned subjects of the project's scope of work. Operations of both REB and the PBSs are addressed in each section.

The seven sections are:

1. Institutional Management/Training
2. Development of a Monitoring System at REB (Management Information System)
3. Financial Forecasting
4. Allocated Cost of Service/Rate Design/Tariff Administration
5. Financial Records and Accounting Systems
6. Engineering, Operations and Material Handling
7. Socio-Economic Impact of Electrification/PBS Member-Consumer services

2.0 GENERAL:

REB can be compared in many ways with a utility holding company with 45 operating units (the PBSs). Its function is to govern the overall mission by planning the structure, providing the resources to carry out the mission (i.e., secure donor funding) and formulating policies and procedures to accomplish the work while establishing processes by which to monitor and measure the results. Given the nature and scope of the mission -- to electrify the rural areas -- the REB has a daunting, complex task which requires a multitude of skills and techniques. With technical assistance from those who have traveled the road before them in another setting, they have accomplished a great deal.

Now the task has evolved into a new phase: operations, maintenance and reliable power supply. For the new phase, new modes and approaches are needed. External financial and technical support will be essential to help them meet the challenge. Future financial support from donor countries should be reoriented toward maintaining and strengthening the sound base now established with the same motivation that justified the original investment to develop the system. Certainly there is much development yet to be done to extend lines to the unserved areas, but the time has come to shift the primary emphasis to entrenchment, intensification and protection of the viability achieved thus far.

REB takes very seriously its 1977 mandate "...to establish electricity generation, transmission, transformation and distribution systems in the rural areas of Bangladesh. ..." The priority of that mandate continues to be to build lines to the unserved areas which, from the beginning , has been a fairly straightforward task: find the money, buy the materials, hire a construction company to build the lines and check the work when it's done. While that is a gross oversimplification of the enormity of the job, it does describe the basic process involved. With pent-up demand for electric service everywhere, it remained only to designate certain geographical areas for the formation of PBSs, map out the backbone system and, with direction from experts in rural electrification from the United States, implement the construction design and connect the consumers who could afford to wire their premises to receive the service.

As the initial construction progressed in the first years, the cream was skimmed from the pent-up demand and planning new PBSs became more problematic. While the rural electrification program is financially viable as a whole, most PBSs are not individually viable. The "skimmed cream" concept is manifested in the statistics reported in the 1993 Mid-Term Evaluation:

> "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 (to 100 per Km)."

Plans continue to extend more lines to more new areas because donor funding has been provided and materials are in the pipeline. New lines to unserved areas are projected to be built at the 1995 pace of 10,000 kms annually.

It is against this scenario that the current assessment is oriented, combined with the chronic, debilitating shortage of power and the nature of REB as a government agency with characteristic inability to adjust to circumstances in a timely manner.

3.0 FINDINGS:

3.1 General management:

It is essential that REB be a government entity in order to channel funds from donor countries. That essential fact is an impediment to efficiency because of the constraints on policies and procedures imposed by the government system. Perhaps the most critical of these constraints is the operational culture of government agencies in Bangladesh which are virtually devoid of any functional authority to make decisions at the level at which the work is done.

There is a dearth of motivational leadership, in large measure attributable to organizational circumstances which provide only for transient occupancy (by appointment, often from the military) of the REB chairmanship and the inherent passive resistance to the office by career bureaucrats who know they will be there when the chairman moves on. This is not unlike most agencies in any government where top leadership positions are occupied by political appointees who generally are relative short-termers in their posts. REB is not unique in this context.

These brief references, gleaned from many inquiries about how the work gets done, point to a very basic deterrent to efficient institutional management when measured by conventional criteria.

3.2 Strategic planning:

The early-1994 REB/NRECA Strategic Plan put in place with the concerted guidance of NRECA advisors is one of the more positive developments in recent times. It is comprehensive, specific, thoughtful and time-targeted at real goals which, if/when attained, will make a real difference in REB's effectiveness. Under the coordination of NRECA advisors, the plan is being implemented to a significant degree.

3.3 Performance monitoring:

Other sections of the report detail the availability and status of various databases by which performance monitoring is being accomplished and improvements that can be made. It is noted here to emphasize the importance of the area to institutional management and priority given to it by the assessment. The basic finding is that a beginning has been made by REB on putting monitoring systems (MIS) in place, but the tools in use are subject to considerable expansion and refinement to make them more valid and valuable.

3.4 Training:

The challenge for providing training always involves the sourcing of needed expertise (the content), the "packaging" (the curriculum and other tools of implementation) and the delivery system (the logistics of access by the targeted group). In Bangladesh, all these elements pose special considerations.

4.0 ANALYSIS:

4.1 General management:

Business procedures and processes can be learned, but behavioral changes do not yield to constructive advice. That's why it is important to put systems in place that provide the basis for

sound decision-making. Provided with technical assistance on what to do and the resources to implement recommendations, the challenge seems to be to make the decision to carry them out.

Independent organizational review of REB has been recommended by previous studies, but that is a conventional suggestion for an unconventional problem. The convention is that deficiencies revealed by such a review would be addressed (or at least would be addressable). Such a review of an organization that has not been initiated by an entity empowered to effect change is a futile exercise. Even if the organizational structure were to be changed, the cultural practice of top-down control without functional authority at the line supervision level would not.

4.2 Strategic planning:

The REB/NRECA Strategic Plan is an extremely important document. It represents written, referable concurrence from the top to the middle of the organizational hierarchy that certain things need to be done to accomplish specific, consensus goals. (This statement presumes, of course, there was more than just tacit concurrence with the components of the Plan.) The extent to which the Plan and the process that produced it are sustainable without long-term assistance present may be questionable because of the historic tendency to accept technical services more readily than technical assistance. This assessment recommends systems in which strategic planning is integral in important processes for decision-making in certain areas (i.e., financial forecasting); it is important, therefore, that further technical support be provided to encourage the institutionalizing of the strategic planning function.

4.3 Performance monitoring:

A key ingredient of the analysis of REB's planning function is the need for foundation analytical tools to improve the validity of financial projections. The deficiency is assessed to be the lack of emphasis given to comparing actual results of performance with the projections. That is done to some degree (i.e., Performance Target Agreements), but the breadth and depth of such verification, comparison and course correction need to be increased so more decisions can be made better and more timely.

4.4 Training:

The REB/NRECA Strategic Plan contains important training objectives, including a computer training facility, a Central Training Academy, regional training centers and projection of training needs by region by collecting personnel demographics. These recommendations are well-founded in that they imply a merited priority to training. While there is an impressive list of courses in the REB Curriculum Plan and a prescribed curriculum for most employees (REB and PBS), it is not completely clear how efficiently they are scheduled for it.

Training has been strongly supported by technical assistance for many years, provided by two long-term NRECA advisors, one for institutional training and another for technical training. A complete curriculum plan for REB, PBS and associated personnel was revised in June, 1995. Computerized records show 863 persons attended courses during the July-September quarter for a total of 8,428 trainee days. A large percentage of these days were invested in courses for PBS wiring inspectors and village electricians. (See Annex No. 4)

Problem areas were identified as shortage of personnel, inadequate facilities at the Dhaka Training Center (i.e., hostel space) and sometimes the cancellation by an REB instructor with no notice. Most of the Dhaka-based training utilizes REB staff as instructors.

Within REB, a major problem is created by the government policy of transferring personnel from one department to another. As a result, training invested in a person may not remain resident where it was introduced and, therefore, is not cumulative in its application.

At the PBS level, some credence is given to the observation that "the right people" often do not receive training. The reference is to cases where an REB functionary receives training in an area he may supervise from Dhaka, but the PBS personnel who actually perform the function does not receive training. While REB seeks to accommodate training for PBS personnel, statistics show the ratio of training opportunities is definitely tilted toward REB.

For all the years of technical assistance in training, which has benefited the program significantly, some basic foundation work still is lacking -- the development of actual curriculum material for all courses which now are taught from outlines.

The REB Training Directorate should be staffed at senior level by professionally-trained people who are career trainers rather than by career civil servants who "get assigned" to the area. REB should aggressively seek to recruit such personnel. (It is a safe assumption they are not on staff currently).

The assessment team has reservations (based on extensive experience) about the true value of out-of-country training because of its cost, the limited number of people who can be sent and the questionable efficiency of the technology transfer that occurs, especially in "visiting other cooperatives." No such training is recommended in this assessment, but there always is justification for considering special skill training for selected personnel. Where such training is found to be feasible, it is suggested that some plan be implemented to assure that training so acquired is applied for a reasonable period of time and that the training is passed on to replacement personnel when staff changes move the trained person to another assignment.

5.0 CONCLUSIONS/RECOMMENDATIONS:

5.1 The institutional objectives of the following recommendations and those in subsequent sections are:

- **to assist in the creation of new entities and activities to enhance the sustainability and operational functionality of PBSs;**
- **to strengthen REB's ability to plan, coordinate and monitor its functions and those of the PBSs through the introduction and institutionalizing of analytical tools and information systems;**
- **to enhance the participation of PBSs in the localizing of data to improve the quality of REB's databases;**
- **to prepare REB for a broader role in utility regulation in representation of the rural electrification sector;**
- **to improve the quality of training available to REB, PBS and associated personal;**
- **to systematize the coordination and protection of the PBS distribution systems.**

5.2 REB is urged to take definitive action on its review of the proposed revolving fund to utilize PBS surplus revenue for loans for approved activities judged to be beneficial to the PBSs.

5.3 REB is encouraged to adopt a plan to federate various services for the PBSs and their employees through a mechanism such as the proposed Cooperative Services Organization.

5.4 Technical assistance requirements:

5.4.1 Objective: To provide timely and constructive counsel to REB on planning and institutional matters, and to coordinate the work of other advisors.

Measures/Deliverables: Ongoing analyses of strategic concerns of rural electrification for the edification of REB and the donor community.

Technical Assistance: Long-term advisor (expatriate) to advise REB on effective management considerations and planning for the future of rural electrification.

Skills/Experience Mix: Extensive utility management background with special skills in strategic planning and cooperative utility operation.

Expected Results: A present source of technical and management counsel to enhance the direction of the rural electrification program; documentation and evaluation of technical assistance provided.

Estimated Manmonths: 60

5.4.2 Objective: To provide oversight and guidance to the development of operational plans to protect the PBS systems and facilitate the control and flow of materials.

Measures/Deliverables: Properly-installed systems for PBS systems coordination and protection and coordination of short-term consultancies to optimize their productivity and provide follow-up oversight.

Technical Assistance: Long-term advisor (expatriate) to coordinate new applications at PBSs.

Skills/Experience Mix: Background in utility system operations, system design and technical planning.

Expected Results: Effective use of short-term consultancies in specialized areas which will require follow-up monitoring after installation (i.e., uni-grounded wye system to replace neutral wires; SCADA systems; materials control program, etc.)

Estimated Manmonths: 60

5.4.3 Objective: To provide management/planning advice to the REB Training Directorate on curriculum and delivery systems for all training programs.

Measures/Deliverables: Developed curricula for the most critical training courses and assistance to short-term consultancies in specialized training; better planning for training functions.

Technical Assistance: Long-term advisor (expatriate, unless a qualified, credentialed local advisor is available) to assist in professionalizing the REB training function and advise on optimum utilization of resources; oversee local counterpart's curricula preparation.

Skills/Experience Mix: Degreed educator or trainer with adult education specialty and experience; background in curriculum development.

Expected Results: An enhanced training program through provision of professional overview and advice; effective planning for new training facilities and training in their operation.

Estimated Manmonths: 60 .

DEVELOPMENT OF MONITORING SYSTEM AT REB

1.0 OBJECTIVE:

To develop a performance monitoring system which relieves REB of the necessity of continued high levels of direct supervision over those PBSs which have developed strong management and economic viability and to institutionalize the capability to apply the system..

2.0 FINDINGS:

2.1 Management Information System (MIS):

The Rate Cell is responsible for the MIS. Computers are available and being utilized for data-gathering and reporting. Rate Cell personnel have received training in allocated cost of service. Rates offered by the PBSs have been summarized in a very useful fashion.

One of the databases developed for the MIS contains the PBS financial and statistical data which are being summarized monthly using a Lotus spreadsheet. The data encoding is cumbersome as posting of year-to-date and monthly data is done monthly. From this database, an MIS report is generated which contains PBS statistical information on villages electrified, system loss, collection efficiency, connections and disconnections, KWh consumption, government subsidies and accounts receivable. Other databases are available in Lotus spreadsheets, such as yearly actual Performance Target Agreement (PTA) achievement summary, approved energy rates for all PBSs and comparative PTA (actual and target) by PBS and PBS groupings (Groups I, II and III which denote degrees of maturity.)

3.0 ANALYSIS:

3.1 Threats to the continued success of rural electrification:

There is a recognized dichotomy between the REB as a governmental entity and the PBSs with their cooperative structure. Both REB and PBS personnel recognize and articulate this difference. Nonetheless, it falls to REB to take the initiative to address it prudently and expeditiously. REB should set standards that the PBSs must meet to ensure the integrity of the rural electrification program. At the same time, REB faces the great challenge of ensuring that its bureaucratic nature does not interfere with the very efficiency of PBS operation that it wishes to ensure. The REB must undertake the delicate task of determining when PBSs can take more responsibility without compromising the service provided by a PBS or harming the rural electrification sector. To ensure that this occurs, risk-taking and initiative by accountable personnel must not be penalized.

The PBSs, at the same time, face a very great challenge to provide quality electric service to their member-owners. PBSs must provide the distribution and consumer service function to members. With the acquisition of BPDB and DESA lines, the sometimes tenuous economics of line extensions and the great expectations on the part of the community, this is challenge enough. However, the PBSs face another problem, almost totally outside their control. The BPDB generation system currently has inadequate capacity to meet peak demands. Load-shedding is a routine occurrence. For large commercial and industrial customers, the production losses can be unacceptably large.

The PBSs must be able to respond to the large commercial/industrial consumers. If not, there is a very real threat that simple economics will cause them to leave the PBS. Loss of these large loads, with high rates which explicitly subsidize the domestic consumers, can cause a very economically viable PBS to face the possibility of incurring operating losses. An illustration of this problem can be found in Background Paper No. 4, Industrial Perspectives of Power Supply in Part Two of this report. Moulvibazar PBS loses nearly all its operating margins were the tea

garden loads to be met by self-generation. With the revenues from the tea gardens, it is a very viable PBS.

One way PBSs could address these issues is with capital credits, whereby a budgeted percentage of margins (profits) is returned to consumers in proportion to their purchases from the PBS. That tool is not currently available to PBSs and is not likely to be in the near future. Another way PBSs can address these issues is to seek input from these consumers and take those considerations into account in the development of cooperative policies, strategies and decisions. Those PBSs can establish rate levels for their consumer classes, with monitoring and oversight by regulatory bodies and the REB. This option is available to the rural electrification sector. The operating surplus made by the financially-solvent PBSs can be used under present policy for the intensification of the existing distribution system in their own service area.

3.2 Roles which REB must fulfill:

REB should consider itself to fulfill two roles:

1. construction of new PBSs and new lines at existing PBSs; and,

2. technical assistance to PBSs to progressively assume greater management functions as they evolve and mature.

From a management perspective, the REB needs to develop appropriate monitoring and oversight for three distinct groups of PBSs:

1. newly formed PBSs which are in the process of establishing basic operations;
2. Group II and III PBSs which, either because of age or economic situation, still need considerable oversight; and
3. Group I PBSs, which have sufficient experience and economic vitality to be reasonably expected to successfully address greater utility responsibilities.

In addition, REB will need to continue to expand its leadership role in the rural electrification sector. Participation in power sector reform, successful replacement of outside advisors with in-house capabilities and development of self-sustained financing will be challenging and necessary tasks.

REB has achieved successes with existing PBSs. Continuing development of new PBSs will tax the existing staff. The new PBSs which will be initiated are expected to be more difficult situations, as they will be developed in areas with fewer economic resources and therefore will require additional support from REB. However, simply adding more REB staff will make REB even more unwieldy. Of necessity, then, REB must find a way to reduce the effort it devotes to the existing PBSs. The challenge is to transfer additional responsibilities to the PBSs in a reasonable period of time. Existing personnel levels should remain, but the roles played by many of those employees should change and evolve into other positions. This should not be a difficult organizational problem since employees are routinely transferred from area to area.

REB already has experience with establishing different requirements for various groups of PBSs. Performance Target Agreements (PTAs) have some modest differentiation among Groups I, II and III. In addition, the monthly MIS subtotals information by group.

Two useful tools which should be added are financial forecast and allocated cost of service (ACOS). These two processes are logical extensions of electric utility management information systems and are routine and well-known management tools in electric utilities. Development of the management tools and transfer to the PBSs will be aided considerably by computerization which will occur in the coming years. The trick will be using the tools and their implementation to both achieve basic monitoring functions at REB as well as promote the capability of the PBS.

To complete this work at the local PBS level will require the careful identification of additional positions. One logical position to be added at the PBS would be that of Financial Analyst. REB staff would become the trainers for the PBS personnel and provide ongoing technical assistance for model problems, analytical approaches, computer problems, etc. REB staff would provide the oversight and monitoring of the submitted financial forecasts. Finally, REB staff would combine the individual financial forecasts to provide a combined rural electrification financial forecast. This approach recognizes that the rural electric sector is maturing, both at REB and PBS. It recognizes that the REB and PBSs have built a solid foundation and are prepared to advance into the next phase of development.

An alternative approach would be to have consultants perform these roles, at least initially. This approach seems to work well with the consulting engineers currently at the PBSs. However, production of ACOS and financial forecasts and the analyses which would emanate from them are routine business functions at electric utilities. They are vital parts of a business planning process which should be integrated into daily operations of a PBS so that it can function well under limited oversight of REB. Nonetheless, if the consultant alternative is utilized, it would have the benefit of improving the training function by eliminating the problem of experienced REB personnel being routinely transferred to other areas. Further, it would build local expertise in these areas which is essential for sustainability of the usefulness of the analytical tool.

3.3 Preparation for additional responsibility at REB:

It can be anticipated that the rural electrification sector will have to perform additional functions and REB will be the likely agency to carry out those responsibilities.

3.3.1 Regulation: As a regulatory agency is established, REB will be the logical agency to take the lead in working with the regulators to establish appropriate regulatory requirements for PBSs.

3.3.2 Determination of wholesale tariffs: REB is the logical agency to develop the skills to intervene in the establishment of appropriate wholesale tariffs. As private power is developed in Bangladesh, REB and the PBSs will need to determine the most economic source of supply and ensure that those supplies are priced appropriately.

3.3.3 Research and development: Consistent with the National Energy Policy (NEP), REB can be the agency which carries out research and development activities on behalf of the PBSs. Maintenance of a rural electric database is also identified in the NEP. This would be a logical evolution for REB, as it already maintains a considerable amount of information on the rural electrification program. The NEP wants the linkage to industrial activities identified and implemented.

3.4 Management Information System (MIS):

The process of accumulating or creating and generating necessary reports on an "as needed basis" in addition to regular reports can be made simple and less time-consuming if a computerized database program is available. Staff will have more time to do analysis and provide more meaningful MIS reports on the overall objectives and programs of both REB and PBS for planning and decision-making purposes.

The expansion of the MIS function will be a necessary component of an efficient monitoring process.

4.0 CONCLUSIONS/RECOMMENDATIONS:

4.1 Develop monitoring standards for PBSs by setting monitoring requirements for each group:

- Reduce the number of approvals and time for approval for all PBS initiatives.
- Differentially reduce the numbers of approvals and time for approval (i.e., less for Group I, relatively more for the other groups).

4.2 Identify studies which should be completed at the PBS level:

- Allocated cost of service studies
- Financial forecasts

4.3 Prepare for additional roles in rural electrification:

- Development of the appropriate regulatory scheme for rural electrification
- Development of wholesale power tariffs
- Research and development for rural electrification
- Strategic planning and policy development

4.4 Develop a general approach for information transfer from REB to PBSs:

- Initiate and develop required activities at REB
- Train REB and PBS personnel
- As soon as practicable, transfer the activity with sufficient resources to the PBSs

4.5 Develop a management information system that will adequately provide information to management for planning and decision-making.

5.0 TECHNICAL ASSISTANCE:

5.1 Objective: To develop a monitoring system at REB which relieves it of the necessity of continued high levels of direct supervision over those PBSs which have developed strong management and economic viability and to institutionalize the capability to apply the system.

Measures/Deliverables: Monitoring standards for PBSs, differentiated by groups.

Technical Assistance: Long-term consultant (expatriate), 50 percent of time. Short-term consulting (local, if possible) to conduct on-going workshops for REB and PBS personnel on the monitoring process.

Skills/Experience Mix: The long-term advisor should have experience in developing the management process of monitoring organizations. It would be preferable to have a background in financial and tariff matters. The short-term advisor should have management consulting experience and have stature/respect at REB.

Expected Results: Establishment of a monitoring system at REB with differential requirements by groups of PBSs; reduction in level of REB's supervision efforts over PBSs; increased responsibilities at the PBSs.

Estimated manmonths: 30 manmonths by long-term consultant (50 percent of time over a five-year period). 15 manmonths by short-term consultant (three manmonths during each of the five years).

5.2 Objective: To provide REB a refined management information system to produce reliable, timely and informative reports that will assist them in planning and decision-making functions and to institutionalize the capability to apply the system.

Measures/Deliverables: An MIS design.

Technical Assistance: Short-term consultant (expatriate). REB/PBS counterpart staff to work closely with the short-term consultant to build in-house capability.

Skills/Experience Mix: Wide experience in the design and development of computerized MIS.

Expected Results: REB and PBSs use the generated reports for monitoring.

Estimated manmonths: 4 (If software development is required, the manmonths requirement should be determined by the developer.)

FINANCIAL FORECASTING

1.0 OBJECTIVE:

Develop a financial forecast methodology which can be integrated as a routine management tool by both REB and PBS to provide insights, analysis and monitoring in the rural electrification sector and to institutionalize the capability to apply the system..

2.0 FINDINGS:

Though it was recommended in the 1993 Mid-term Evaluation, the Financial Planning Directorate has not been established; neither has the Rates and Contracts Cell (Rate Cell) had its number of personnel expanded. Additional work responsibilities are assigned to personnel in other areas of REB with time to perform the function.

The Power Sector Reform effort in Bangladesh has identified financial forecasting as a necessary requirement. The financial forecast has previously been identified as a responsibility of the PBS, with REB monitoring its results. In December, 1993, REB and NRECA advisors met to identify the functional division of authority and responsibility for REB and the PBSs. The financial forecast was explicitly addressed. The PBS is responsible for submitting a financial forecast to REB after approval by its Board of Directors. The REB would approve the financial forecast.

The financial forecasting effort is underway within REB. However, this effort is taking place in the PBS Loans and Budget Directorate, not the Rate Cell, by an REB staff member formerly in the Rate Cell. Development of a financial forecast was identified as an important item by the World Bank and REB is responding. REB and the World Bank have agreed on a set of assumptions and have developed a spreadsheet model. Coordination to acquire data required is occurring within REB. System Engineering has provided a projection of loads for each PBS. System Operations has provided a projection of losses through the planning horizon for each PBS. An initial effort at the financial forecast, using Dhaka PBS-1 data, is available. The target is to complete a financial forecast for each PBS by the end of 1996. Part of the effort will be to derive a combined financial forecast for all PBSs.

2.1 Development of the financial forecast model:

REB has initiated the development of the financial forecast with the model being prepared with the World Bank. It is a spreadsheet model, with a straightforward and transparent approach. It uses the data which are available on load forecasts, expansion plans, loan repayments and expenses. Assumptions have been identified to be used in the forecasts. They are very simplified and, at the present time, are the same for all PBSs. For example, in the load forecast, all classes for all PBSs are assumed to increase at the same rate through time. The financial forecast assumptions for all PBSs are currently the same also. While these constant assumptions will obviously not yield accurate data and results for each PBS, it may be a reasonable average for the rural electrification sector as a whole and provide some useful preliminary results.

Rate Cell personnel have attended training on a more complex financial forecast model in the US. NRECA is attempting to bring the consultant who conducted that training to Bangladesh to provide a modified financial forecast model which reflects local conditions. The consultant would then provide additional training in the use of the model.

3.0 ANALYSIS:

3.1 Using the process of development of financial forecast capability for institution- building:

Initiation and development of the financial forecast tool can provide a process to increase REB's oversight/monitoring role, reduce REB's ongoing burden by transferring this responsibility to the PBSs and develop the ability of the PBSs to analyze future projects. This can establish the process by which other management tools are developed and transferred to the PBSs and the appropriate oversight by REB determined.

Furthermore, it could also establish the model of limited technical assistance by outside experts. As REB matures, it will be able to more clearly identify and limit the roles which these outside experts are required to play. REB personnel will have the training, expertise and experience to "know what they don't know."

As rural electrification develops in Bangladesh, the financial forecast itself and the process which develops the forecast will provide key management guidance. For PBSs which have gone through the initial development stage, the financial forecast will provide the means to quantify and evaluate the impacts of expected business. The financial forecast effort will allow the PBSs, with REB oversight, to analyze alternative PBS intensification and expansion scenarios. Estimates of additional revenues and costs can be incorporated into the base financial forecast to see the impact on financial indicators.

Beginning with a simple model is an appropriate step. Initially, the input data will necessarily be preliminary and limited. The data development process will then be implemented. Experience with the simple steps will allow experience to be gained by the users which will naturally lead them to more complex analyses and a desire for additional analyses. With experience, users can reliably produce these analyses.

At some point, a determination must be made which financial forecast model should be used. The model should be as straightforward and obvious as possible. Spreadsheet models, whose relationships can be easily determined and modified for individual PBS situations, offer greater hope for their successful introduction and continued use. However, a more complicated model, which makes use of more sophisticated computer capabilities, can facilitate data entry, ensure that all required information has been provided, provide internal diagnostic evaluation and aid in the monitoring process.

3.2 Development of data and assumptions:

REB/PBS have the data and capability to generate the financial forecasts now. In developing the World Bank forecast model, REB has been able to use these data. The Form 550 provides the basic data set upon which a financial forecast would be based. Capital requirements, load forecasts and estimates of losses are available from other departments in REB and the PBSs. Required assumptions can likewise be identified and reasonable estimates made. As financial forecasts are generated for the existing PBSs and the process repeated in the future, appropriate modifications to the assumptions can be incorporated.

Development of assumptions to be used in the financial forecast is a necessary part of the process. While developing the assumptions can be a difficult task, it nonetheless provides the opportunity for management and the Board of Directors to better understand the environment in which they operate. With a computerized model, key assumptions can be changed and the results on financial performance observed. This can provide critical guidance to the PBS in determining which alternative course of action should be undertaken and what the associated risks are.

3.3 Role of computerization:

Computerization will facilitate the initial production of the financial forecasts. Once the REB has produced a financial forecast for a PBS, it can be provided in electronic form to the PBS personnel. PBS personnel, with training and assistance by REB representatives, can produce succeeding financial forecasts starting with a standard set of assumptions. The assumptions can then be tailored to the individual PBS by the PBS personnel who know the local situation.

If, however, introduction of computers at the PBSs were to lag, the REB could function as a service bureau during the interim. Data and assumptions would be provided by the PBS, incorporated into the model by REB and then sent to the PBS for review and comment. Revisions would be incorporated by REB for the final product.

4.0 CONCLUSIONS/RECOMMENDATIONS:

4.1 Establish the process to develop a financial forecast for the rural electrification sector:

- Produce the initial financial forecast for each PBS.
- Identify standard data and assumption sets for baseline financial forecasts.
- Develop procedures to monitor PBSs as they produce succeeding financial forecasts.

4.2 Establish the Financial Planning Directorate to guide the development of the financial forecast.

4.3 Define and establish the required monitoring functions for the production of financial forecasts at the PBSs.

4.4 Implement the financial forecast as a management tool in the PBS.

- Add the position of Financial Analyst at each PBS.

4.5 Develop the process through which actual results are compared with projected results

4.6 Establish training courses for PBS personnel:

- Preparation of financial forecast: Financial Analyst
- Preparation of financial forecast: Assistant General Manager - Finance
- Utilization of financial forecast in decision-making: General Manager
- Utilization of financial forecast in decision-making: Board of Directors
- Use of financial forecast in the analysis of new projects

4.7 Complete combined financial forecast for all PBSs, by REB staff, including existing and proposed PBSs.

5.0 TECHNICAL ASSISTANCE:

5.1 Objective: To develop a financial forecast methodology which can be integrated as a routine management tool by both REB and PBSs to provide insights, analysis and monitoring in the rural electrification sector and to institutionalize the capability to apply the system.

Measures/Deliverables: Establishment of a financial forecast methodology for REB and the PBSs; production of financial forecasts at PBSs, with monitoring/review by REB.

Technical Assistance: Long-term consultant (expatriate), 25 percent of time. Short-term consultant (expatriate) to conduct training workshops and develop training courses for REB and PBS personnel.

Skills/Experience Mix: Wide experience and expertise in financial forecasting for electric cooperatives.

Expected Results: REB/PBS capability to produce financial forecasts as a routine management tool; establishment of a monitoring system at REB with differential requirements by groups of PBSs; reduction in level of REB's supervision efforts over PBSs; increased responsibilities at the PBSs.

Estimated manmonths: 15 manmonths by long-term consultant (25 percent of time over a five-year period); 10 manmonths by short-term consultant(s) (see tasks below).

Short-term Assistance: As the financial forecast process for electric cooperatives is a technical and specialized area, it is anticipated that the short-term consultants would be expatriates.

2 manmonths	Introduction of computerized financial forecast model. (Note: This is tentatively expected to occur in the first quarter of 1996.)
3 manmonths	Model review/verification/modification. Develop training courses for financial forecast.
3 manmonths	PBS training course/develop PBS-generated financial forecasts.
2 manmonths	Using the financial forecast for scenario analysis.

ALLOCATED COST OF SERVICE/RATE DESIGN/TARIFF ADMINISTRATION

1.0 OBJECTIVE:

To develop the process of allocated cost of service (ACOS) and rate design which can be integrated, in stages, as a routine management tool by both REB and the PBSs. The outputs of these analyses should be used as vehicles for the PBS to better understand the results and impacts of its operation, and take actions which will benefit all its member-owners. For the REB, completion of these analyses by the PBSs will facilitate its appropriate monitoring role. Higher level REB personnel have visited US cooperatives to learn how the process works there.

2.0 FINDINGS:

Some preliminary activities in this area can be identified. A number of personnel in the Rate Cell have received training in the ACOS process outside Bangladesh. At least one of the persons trained has left the Rate Cell. However, the Finance Directorate reaches out to available and experienced personnel to assist personnel in the Rate Cell when additional analyses are required.

Cost-of-service studies have not been performed by REB. Additional training in cost-of-service and financial forecasting in Bangladesh by a consultant from the US training firm is being pursued. At the time of this report, such training had not been finalized. It would be very helpful if this training could occur to solidify knowledge of the cost-of-service process as well as develop the PBS-specific data required to ensure that the cost-of-service analysis delivers reasonable and useful outputs.

2.1 Ratesetting philosophy:

REB personnel articulate that rates should be based on cost of service, with appropriate modifications for ability to pay. Current tariff levels reflect a subsidy to domestic consumers. In fiscal year 1994-95, based on reported sales and revenues in the REB Form 550s submitted by the PBSs, domestic consumers paid an average of 2.3 Taka, the lowest of any consumer class. By contrast, the Commercial, General Power and Large Power classes paid 4.2, 3.2 and 2.7 Taka, respectively. Peak/Off-Peak tariffs are offered on an optional basis, but the existing MIS does not present data on number of consumers or sales under this option.

The National Energy Plan also specifies that rates be based on cost of service with ability to pay taken into account. At the same time, there is a recognition that the capacity shortage and load-shedding result should be addressed. The Power System Master Plan notes that BPDB and DESA tariffs contain an overall subsidy which does not permit electric revenues to recover the full cost of providing electric service. It notes that those tariffs also have a cross-subsidization between consumer classes.

REB establishes and revises tariffs for the PBSs. The current rate designs for all PBSs are very similar. As explained by REB, considerable care is taken to ensure that the tariffs established for a new PBS adjacent to existing PBSs do not differ significantly. As a result, tariffs for the PBS have the same form, with seven consumer classes. Two of the classes, Charitable Institutions and Street Lighting, have the same rates nationwide.

The 1993 Mid-term Evaluation noted that revisions to tariffs were ongoing and a large burden to the REB Rate Cell. In recent years, that burden has been reduced as tariffs have not been revised. However, REB is anticipating that there may well be an adjustment to the BPDB wholesale tariff. If that occurs, REB would likely adjust the tariffs of the PBSs by at least an equal percentage.

2.2 The case of Moulvibazar PBS:

There is evidence that Group I PBSs have the capacity, desire and need to establish tariffs to reflect local conditions. In February, 1995, the Board of Directors of Moulvibazar PBS approved a resolution to reduce tariff levels. This was forwarded to REB. As of the time of this report, no response had been received. At the same time, the tea growers in the area are voicing considerable concern about the level of the tariff they are paying, as well as the problems caused by the load-shedding experienced in Moulvibazar. The concern is enhanced by the fact that the PBS's accumulated margins are substantial and the tea gardens know much of it is "their money."

Moulvibazar PBS and its Board of Directors are justified in being concerned and attempting to address the issues raised by the tea growers. Nearly one-third of their energy sales are made to tea growers. These KWh are sold at a higher than average rate. Loss of these sales would cause Moulvibazar PBS to change from a very financially-viable cooperative to one which incurs operating losses. Projections show that, to generate the same level of operating margins, they would have to increase tariff levels by 30 percent or increase sales by 66 percent (while incurring no additional operating costs).

Of even greater concern is the fact that the tea growers have alternatives to buying electricity from the local PBS. They can install their own generation and, if they can achieve a reasonable load factor, can produce electricity for their own use cheaper and more reliably than they can obtain it from the PBS.

3.0 ANALYSIS:

3.1 Using the process of development of ACOS/rate design/tariff administration for institution-building:

While REB rate personnel have attended training in the United States, there has been no follow-up on developing allocated cost of service in Bangladesh. Currently, there are delays in bringing short-term consultants in country to work with REB personnel to develop ACOS based on actual data. It is critical that these efforts be ongoing and continuous. ACOS is a very specialized, technical field. It is possible to get an understanding of the ACOS process in a course setting with example data. However, to ensure that ACOS is introduced to rural electrification and becomes a valuable analytical tool, the requirement to provide this must be supported by REB with adequate personnel. Finally, for ACOS to be relied upon by the PBS to make good decisions, the data, assumptions and approaches must be based on local PBS data, philosophy and strategic direction.

The Power Sector Reform effort, as it is implemented, will likely place additional requirements for analysis and development of ratesetting methodologies on the electric power sector, including rural electrification. Envisioned tariff reforms include the development of long-run marginal cost calculations at various voltage levels, calculations of demand and energy components, determination of a transfer pricing mechanism and the establishment of a national regulatory authority. These are well-established measures in more mature electric power sectors in other countries. Bangladesh faces the challenge of implementing these measures in a very short period of time and ensuring that the adopted measures are appropriate to meet specific local conditions.

Production of revised tariffs, even on a percentage change basis, has been found previously to be a significant burden to the REB Rate Cell. During the last few years, there have been no rate adjustments. With the introduction of computer capability at the REB, making these types of rate adjustments will be facilitated considerably. Nonetheless, this is a process which can and should be taken over by the PBSs as they reach a certain level of maturity, with REB taking on the role of monitoring the process and result.

The process, developed by REB, can be replicated at the local PBS level through the use of the same computer spreadsheets utilized by REB. All tariff structures are the same. As the process evolves, the local PBS will be able to suggest changes in tariff levels and structures which will better serve its member-owners. REB can develop appropriate guidelines within which these changes should occur. REB would also provide an appropriate monitoring process. Part of REB's oversight would include a review of the process used by the local PBS which led to the recommendation. The PBS will be required to provide the policy and strategic direction within which the proposed changes are made.

Rate design should generate tariffs which will reflect the diurnal nature of demand in Bangladesh. Time-of-day, interruptible and demand/energy rates should be developed for large consumers to provide correct price signals. ACOS can provide the basis for this rate development.

As the case of Moulvibazar PBS clearly demonstrates, there are local conditions which cannot be adequately addressed by a nationwide establishment of rate levels. REB cannot reasonably be expected to know and be able to address local conditions for 45 PBSs. Even with additional personnel in REB, the quality of the end result cannot be as high as when there are skilled personnel at the PBS level. REB can, however, play a key role by identifying critical elements to be considered in analyses, establishing analytical processes, training PBS personnel in the use of those analyses, transferring the models to the PBS and establishing flexible, responsive monitoring processes.

3.2 Development of data and assumptions:

The ACOS, like the financial forecast, is a standard tool used by electric utilities. Similarly, a process whereby the REB establishes the model and baseline assumptions for the "average" or "typical" PBS will establish the ACOS process. Standard data for the ACOS are available from the Form 550 and the PBS accounting system. Development of allocators used in the ACOS will likely be the most difficult task.

3.3 Role of Computerization:

Introduction of computers will allow the baseline model to be transferred from REB to the PBSs. The PBS personnel can then update the model with current data from the PBS. Modification of the allocators which would better reflect the individual PBS would then begin.

4.0 CONCLUSIONS/RECOMMENDATIONS:

4.1 Develop the process to transfer responsibility for maintenance of the tariff schedules to the PBSs:

- Develop standards for the tariff schedules which will ensure that they contain the appropriate components, but grant PBSs latitude to make adjustments for local conditions, subject to approval.
- Identify and develop the procedures by which changes in the wholesale power cost will be incorporated into the tariffs.

4.2 Establish the process to develop an ACOS for the rural electrification sector:

- Produce the initial ACOS for each PBS.
- Provide oversight and monitoring to PBSs to produce succeeding ACOS studies.

4.3 Establish the Financial Planning Directorate to complete this work at REB.

4.4 Define and establish the required monitoring functions for the production of ACOS at the PBSs.

4.5 Implement the ACOS as a management tool in the PBS.

4.6 Establish Financial Analyst position for PBSs to provide ACOS analysis, as well as the financial forecast.

4.7 Establish training courses for PBS personnel:

- Preparation of ACOS: Financial Analyst.
- Preparation of ACOS: Assistant General Manager - Finance.
- Utilization of ACOS in decision-making: General Manager.
- Utilization of ACOS in decision-making: Board of Directors.

5.0 TECHNICAL ASSISTANCE:

5.1 Objective: To develop the process of allocated cost of service and rate design which can be integrated, in stages, as routine management tools by the REB and the PBSs and to institutionalize the capability to apply the system.

Measures/Deliverables: Establishment of allocated cost of service and rate design methodologies for the PBSs; production of ACOS studies and rate design proposals at the PBSs, with monitoring/review by REB.

Technical Assistance: Long-term consultant (expatriate), 25 percent of time. Short-term consulting (expatriate) to conduct training workshops and develop training courses for REB and PBS personnel.

Skills/experience Mix: The long-term advisor should have experience in developing the management process of monitoring organizations. It would be preferable to have a background in financial and tariff matters. The short-term advisor should have strong experience in applying the ACOS process and, ideally, training skills.

Expected Results: Production of allocation cost of service studies and rate design as a routine management tool; establishment of a monitoring system at REB with differential requirements by groups of PBSs; reduction in level of REB's supervision efforts over PBSs; increased responsibilities at the PBSs.

Estimated manmonths: 15 manmonths by long-term consultant (25 percent of time over a five-year period. 10 manmonths by short-term consultant (see tasks below).

Short-term Assistance:

1 manmonth	**ACOS training (Note: Expected to occur in the first quarter of 1996.)**
3 manmonths	**ACOS model review/verification/modification; develop training courses for ACOS.**
2 manmonths	**Marginal cost concepts**
2 manmonths	**Rate design - Basic (Standard rate options)**
2 manmonths	**Rate design - Advanced (Innovative rate options)**

ENGINEERING, OPERATIONS AND MATERIAL HANDLING

1.0 OBJECTIVE:

To assess the overall effectiveness of the REB in the following areas and recommend where further technical assistance would be beneficial:

- PBS system planning and expansion
- Construction progra
- Construction inspection and quality assurance
- System monitoring and performance standards m implementation
- Material quality assurance
- Material handling and control
- System intensification, (i.e., increasing consumer density on existing lines)
- System operation and maintenance

2.0 FINDINGS:

2.1 General:

The rural electrification program is a success by nearly every measure. The rural areas are benefiting from the installation of new electrical distribution lines at the rate of 10,000 km in 1995. The PBSs are increasing their connections by nearly 20 percent per year. The international community has continued to support the program with greater amounts of assistance each year.

REB support from many donors has allowed the program to accelerate. At the same time, however, it has created new challenges for REB to perform to the expectations of the donors.

The power supply by BPBD has not had the same success in attracting assistance and the generation capacity has not been increasing as fast as the load growth. Presently, BPDB, with approximately 2,200 MW available generating capacity, is more than 300 MW short of the peak load requirements and the nation is experiencing selective load-shedding. Based on the recent Power System Master Plan, the load will exceed the generating capacity for at least the next five years. The PSMP study did not address the present electrical energy shortage or the related problems the shortage causes in the economy.

The total PBS requirement is estimated to be 15 percent of the total electrical energy requirement of Bangladesh. However, the PBS systems have been experiencing more than 15 percent of the load-shedding.

2.2 PBS system planning and expansion:

REB has developed an organization which constructs electric distribution lines into non-electrified territory in an effective manner. System planning has been prepared using generally accepted methods. The timing of the actual new line construction is based on several independent criteria including financial feasibility, available donor sponsorship to provide the materials and political considerations.

2.3 Construction program implementation:

REB has allowed the establishment and utilization of two private service sectors, the Engineering Consultant (EC) and the Electrical Construction Contractor (CC). These private sector activities have been a major factor in the successful construction program. REB, being a government agency, has a policy that frequently rotates employees between positions and departments. One of the results of this policy is the loss of expertise at REB on a periodic basis. The service

organizations, being non-governmental, do not have the same rotation policy, so their staffs have become very proficient in their respective areas. The EC has trained his staff to prepare the necessary construction documents and inspect the construction to be certain that all standards are maintained. The CC has trained his line crews to construct the lines in an efficient and responsive manner. Had REB not allowed private sector development in these areas, the program likely would have been much less successful in its development to date.

In the visit to Dhaka PBS-1, the general manager indicated that his PBS has a one-man engineering department and that its primary function is to work on system operating problems such as loss reduction. The system design is prepared by the EC's Retainer Engineer located at the PBS office. In discussions with that EC, he indicated that all staking sheets and designs are reviewed by the REB Supervising Engineer before the work is assigned to the CC. The PBS manager must also approve the work order before it is submitted to the REB engineer. The work can be assigned to the CC only if the materials are in the budget and are available for that PBS from a donor.

Construction program implementation has become more cumbersome than it normally would be as a result of REB and donors requiring that each PBS construction project and donation be kept separate and identifiable. This requirement has created substantial extra record-keeping and constrictions in the expansion of the PBSs. We were told that some PBSs may have a more viable area to be served than another PBS, but if the donor funding is not available for the former PBS, the latter project is funded first as a result of donor designation. The entire material handling and disbursements process is encumbered by an elaborate tracking system that is not normally required in traditional utility operations.

A possible conflict of interest could occur in budgeting work for the EC and CC at the various PBSs. The expansion criteria are applied by the EC and could be modified to create an "economics" expansion to satisfy donor, EC or CC expectations even though it may not be to the benefit of the PBS.

2.4 Construction inspection and quality assurance:

The responsibility for construction inspection has been placed on the EC with final acceptance by the PBS. Periodically, NRECA has been invited to make spot inspections and generally has found that the line construction is accomplished satisfactorily. However, in some cases it was evident that the inspector may not have been to every job as some of the line construction was not up to the normal standard (i.e., improper installation of ground rods, anchors, etc.). The REB and the CC inventory the final project prior to transfer to the PBS. While the material is shipped on an estimated-requirement basis, it is charged to the PBS on an as-inventoried basis. The surplus materials are supposed to be delivered to the PBS, but it is not evident that the tracking of this material is adequate.

It was noticed during field trips, to the Jessore area, that substantial line construction is in various phases of completion and the construction had been stalled. We were informed that this construction was for a new PBS that was to be operational by April, 1996.

2.5 System monitoring and performance standards:

REB and the PBSs have an excellent record in reducing losses and improving energy sales. REB and the donors have developed Performance Target Agreements (PTAs) to assess the "success" of the program and areas where future improvement should be achieved. Many of these PTAs are used to determine the incentives given to the PBS managers. The PTAs should be reviewed on a systematic basis to be certain the desired objectives are being achieved.

Several PBS General Managers expressed concern that some of the PTAs as not true measures of efficiency of system operations. For example, when new areas are added to an existing PBS from a BPDB system, it may take two to three years to reduce the "non-technical losses" of the

added system to the level of the PBS. The PTA, by continuing to target lower losses, penalize the PBS in the short term, even though in the longer term, its viability has been enhanced by improving the load and revenue density. Also, by taking on the BPDB facilities, the PBS will incur additional renovation and maintenance costs which have a short-term, negative impact on the PTA ratios unless such operating expenses are adequately considered. REB says this is being done.

In interviews with REB, we were told that better system monitoring is needed to determine the location of system weaknesses. In that discussion, it was suggested that assistance in implementing a Geographical Information System (GIS) or Automated Mapping Facilities Management (AM-FM) system be included in the next technical assistance assignment. In further discussions, it was determined that the request was for assistance in developing AutoCadd or other computer-aided maps and drawings. System monitoring on a real time basis (i.e., SCADA) was not requested or discussed. We did discuss system records and mapping and learned that computer-aided drafting is available from local sources. In the area of system monitoring, most of the voltage and current readings on the lines are taken by portable clamp-on units.

2.6 Materials quality assurance:

Material quality assurance is accomplished by inspection by REB and its agents both at the country of origin and upon receipt. NRECA has been providing inspection for the past many years. The material suppliers are paid 90 percent of the contract price upon shipment of the material with the remaining portion payable upon acceptance by REB. Based on experience of projects in other countries, once an inferior product enters the country, even though rejected, it may end up on a PBS's system from a secondary market. Therefore, it is more effective to make certain that the inferior product does not enter the country. Even with the existing materials testing and acceptance program, some inferior products do enter the system. At Jessore PBS-2, the GM reported the receipt of malfunctioning meters. NRECA and USAID have stressed that inspection services will not be provided after January 1, 1996.

2.7 Material handling and control:

Both REB and NRECA expressed concern about the existing material-handling system. The new computer program for material inventory records can track material by item, by donor, by warehouse and staging area, and by contractor. REB should be able to maintain much better control of the materials once this system is fully in place. REB emphasized that, while there are more than 400 items of materials in stock, 20 percent of the items account for 80 percent of the value and it may not be necessary to control all items to the same extent.

The REB Khulna warehouse facility is marginally adequate to receive and disperse the quantity and variety of materials currently being handled. Recently an annex area was added to accommodate the volumes of material being received and shipped from the warehouse. The REB Khulna staff has an excellent system for inventory control, but is not provided with a schedule of the materials and equipment deliveries. As a result, all similar materials are not stored in the same area due to inadequate time for space planning. Also, materials are not placed into inventory until the items are acceptance-tested, a process that requires off-site testing and up to two weeks delay. Even with the testing, however, the PBSs have been receiving some inferior meters, hardware, transformers and other materials, creating system construction and operating problems.

An ancillary problem was discovered in interviews with REB, PBS General Managers and NRECA staff concerning materials needed for ordinary replacements. This problem has negative impacts on both operations and maintenance as well as construction activities. Currently, the PBS does not have access to materials other than those provided by the donors for new construction or REB for maintenance. When a PBS needs a replacement transformer or other material, the PBS prepares a requisition for material and it will normally take two months or

longer for the materials to be received. In the interim the PBS will "borrow" the material from stock designated for a construction project and then restocks the construction project inventory when the materials arrive. This action creates a deficiency in the construction materials and delays construction until all of the materials are available at the construction site. Another problem is the practice of the transport companies to deliver the heavier and larger items to the job first because they are paid by weight and they can earn more from the larger, heavy materials; consequently, some smaller items may not be delivered in a timely manner and the construction is then delayed until it is delivered.

2.8 System intensification:

This program is in two parts: the BPDB property transfers and short system extensions from the existing distribution feeders. Approximately 20 percent of the budgeted line additions are allocated to this program. The PBS has some latitude in short line extensions (up to 0.5 km). The PBS can have the EC apply the feasibility criteria and, if the extension is feasible, it is submitted to the REB Supervising Engineer for approval. Once approval is obtained, the project can be designed and constructed. For short, one or two pole projects, PBS linemen may be used rather than the REB CC.

Comments were received about the need to recondition the transferred BPDB facilities and the lack of material available to do so. Typically, where PBS takes over a BPDB facility, the transferred system is substandard and the PBS must conform the transferred facilities to its standards.

2.9 System operation and maintenance:

Throughout the interview process with REB, PBS General Managers and NRECA staff there was a consensus that the maintenance required to sustain the systems has not been addressed. One area of concern expressed by NRECA and the PBS General Managers involved ordinary maintenance. We were told, for example, of a lack of adequate fuse supplies and the use of "naked" fuses (a piece of galvanized wire) in place of a normal fuse. This practice is necessary, according to the General Managers, in order to keep the power in service. The result of this practice has been to increase the risk of transformer failure and increase the safety hazard of the electrical system. Throughout the country, the overhead neutral conductor has been removed by thieves. This results in an uni-grounded wye system where the ground is established at each transformer installation. In our discussions about system coordination and protection, it was determined that little if any breaker and fuse coordination is achieved.

In discussing the availability of materials and equipment for ordinary maintenance, the PBS General Managers, REB and NRECA all agreed that, under the existing procurement system, there is no mechanism for the PBS to purchase the necessary materials. DESA purchases from various local vendors, so there appears to be a local supply for this material for PBS purposes. REB indicated there are local manufacturers of many of the items needed for distribution systems, including poles, crossarms, conductor, meters, hardware, insulators, connectors and transformers. There appears to be no exchange of maintenance materials or supplies between the PBSs, PDB or DESA.

PBS General Managers have a high level of restrictions placed on them by the REB. When asked if they could call the adjoining PBS for assistance, the response was negative, except in rare instances. Also, the constraints about the number of employees and the ratio of consumers per employee was seen to be too rigid by the managers. They indicated their staff cannot accomplish the necessary work in the time allocated and they personally sign more than 100 documents per day. Every communication, request, and report currently requires the General Manager's signature. Another concern expressed was the number of approvals required from USAID and REB to authorize a project to begin and the associated loss of staff time in meeting the approval process. It may take more than ten signatures to gain approval of a single task order.

Programmed preventive maintenance concentrates on testing and monitoring and program the repairs before the facility fails. Ordinary maintenance concentrates on fixing the failed facility. Since the distribution systems have been constructed, little programmed preventive maintenance has been performed. The primary reasons for this condition are as follows:

- A new system does not require much programmed maintenance during the first ten to 15 years;
- the PBS systems have not had the materials available for maintenance programs; and,
- the present PTAs do not establish measurable goals for determining an adequate programmed system maintenance. The PTA that focuses on net revenue per km of line encourages the PBS to keep its maintenance expense at a minimum to enhance the net margin.

3.0 ANALYSIS:

3.1 PBS system expansion and construction program implementation:

The past success of the REB program has opened sources for additional expansion. This past success, however, will not be attainable in the future if the system expansion continues without a coordinated increase in generating capability. The extension of the system, without adequate power supply, will cause increased power interruptions, lower revenue per unit investment and even more consumer dissatisfaction. REB, by its achievements, will have difficulty meeting the high expectations of its donors.

3.2 Construction inspection and quality assurance:

While the present method of material and equipment distribution has allowed the construction program to be successful, it is likely to result in the loss of substantial material before and during the construction phase. The magnitude of the lost or misappropriated materials will not be known until the supply is restricted. The existing system of EC and CC has worked well for major projects, but care must be taken to verify the basic feasibility of the new construction. Under the current system, the EC prepares the feasibility study and then prepares the system design. The extension is then approved by PBS GM and REB engineer. The materials are requisitioned and the construction is started when the materials are available at the site.

3.3 System monitoring and performance standards:

While the present PTAs are useful in setting goals, they should not be used as the only measure of the success of the PBS and its general manager. The annual goal-setting session between REB and the PBS is a good method to stimulate improved system performance, but if achieving a goal has a long-term negative impact on the PBS (improving net margins by deferring needed maintenance), the short-term goal may inhibit long-term program success.

Both the ECs' and CCs' work load is dependent on the PBS's expansion mode prepared by the EC. It is extremely important to verify the basic information used in the feasibility analysis upon which a decision is made to extend new lines.

Performance standards are helpful in improving results. The number and kinds of standards can and should change to reflect the maturing of the PBS systems. Early in the program, guidelines were developed for employee requirements. These guidelines should not be used as a standard for each PBS because of special local conditions. A PBS with irrigation consumers has a much different requirement for billing clerks and linemen than a PBS with large industrial consumers and should not be expected to have the same employee mix or number. Also, when BPDB lines

are transferred, an allowance should be made in the PTA to reflect the higher line loss and collection problems.

3.4 Material quality assurance:

In order to maintain the high standard of materials which are accepted for use by the PBSs after the NRECA assistance is withdrawn, it will be necessary to reinforce the efforts of the existing REB staff for this function. The material supplier requirement to pay 90 percent of the contract price before shipment places the REB and PBS at an extreme disadvantage with the supplier. After that payment, the supplier will not have a real monetary interest in satisfying REB's requirement unless he has a long-term commitment to serve future orders. The in-country inspection is necessary under the existing system to assure that REB is taking delivery of materials and equipment of the required quality.

3.5 System intensification:

Generally, electric systems with greater load, consumer and revenue density per km of line have greater net margins after expenses. The system intensification program can substantially improve the PBSs' financial position over a shorter time frame than extending into new service area. The transfer of accounts and distribution system from BPDB to the PBS should also improve the load and revenue density of the PBS and improve overall margins and does not add to the existing BPDB generating requirements. However, the immediate need to both improve metering and collections from the former BPDB customers and improve the distribution lines can have a short-term, negative impact on the net margin of the PBS, but the longer-term gain should far outweigh the short-term reductions.

3.6 System operations and maintenance:

While system preventive maintenance has not been a high priority since the beginning of the Rural Electrification Program, some of the original PBSs are now nearly 20 years old and portions of the systems will need maintenance attention either on an unplanned or a planned basis. In order for the PBSs to begin any preventive maintenance program, they must be provided with adequate resources, both material and labor. In order to protect the substantial investment and assure continued service quality and reliability, a systematic preventive maintenance program is essential and adequate materials and equipment must be available.

4.0 CONCLUSIONS/RECOMMENDATIONS:

4.1 REB should curtail the present PBS system expansion program until the generation resources are expanded to match the load growth of the PBSs. The present level of system expansion is not sustainable, given the limited availability of generation resources.

4.2 REB should focus its available resources on system intensification rather than expanded areas. Until an improvement is assured in the power supply situation, the intensification will allow the existing PBSs to improve their economic condition through increased load density. While the energy sales will be constrained by power supply, the investment requirements for system intensification are substantially less than expanding into new areas. Furthermore, impacts on the generation resource will be limited since BPDB customers are already being served.

4.3 REB should conduct periodic, unscheduled, construction inspection audits of sample segments of new PBS facilities to assure satisfactory construction inspection is being done by the EC and that the construction is in accordance with the REB specifications. If an EC is negligent in design and construction inspection, REB and the PBS must be able to have the EC and CC correct the deficiency at no additional cost to the PBS. In addition, if the EC or CC is found to be continually out of compliance, they should not be allowed to provide services to REB or the PBS.

4.4 REB should require PBSs to monitor all system expansion into new areas to verify the planning assumption used to justify the expansions. Both estimated investments and revenues should be compared to actual investment and records.

4.5 REB should revise its Performance Target Agreement process to allow for the unique characteristics of each PBS. As the PBS systems are expanded, the less economic areas will become served. It is not proper to establish performance criteria which are outside of the control of the PBS General Manager and staff. The efficiency of a billing clerk is measured not only by the number of bills calculated, but also by the complexity of the bill and the number of other functions that are required. Impacts of acquisition of BPDB lines should be explicitly factored into the PTA calculation.

4.6 REB should evaluate the contract services of an independent materials and equipment inspection company or companies to replace the inspection services now being provided by NRECA. This function is vital to the interest of the donors to assure the quality of the materials used on the PBS systems. An outside agent might avoid problems associated with periodic staff rotation within REB.

4.7 REB should implement a new materials control system as soon as possible which expands the computerized inventory control system now being implemented. In addition, REB should require that all future donor materials not be PBS-specific. The prioritization for future electrification must be based on the overall needs of REB and Bangladesh and should not be subject to the individual donor preference. The present constraints on the use of materials from donor to selected PBSs creates an unnecessary burden on REB. Also, if the donor is given a choice of which PBS to sponsor, it may not be the PBS that has the greatest need for materials.

4.8 It could be very useful if REB could establish a list of approved "Acceptable Materials and Equipment" to reduce the burden of acceptance testing. Once a material is on the list, the supplier could be allowed to ship without "at-site" inspection as long as the material quality remains satisfactory. However, REB contends GOB procurement procedure would preclude this method which has been followed since the early years of rural electrification in the United States.

4.9 REB should provide a way for the PBSs to acquire REB-approved material to supplement the donor material supply. This material source will allow the PBS to supplement the construction contractor's material shortages and provide the necessary maintenance and replacement equipment for use on the existing system. Individual PBS purchases directly from vendors may be impractical due to small quantities. REB suggests the need may be met by establishing O&M materials stock in the central and zonal warehouses.

4.10 REB should require the EC to report monthly to the PBS the status of all major construction projects, the percent complete and the estimated completion date.

4.11 REB should set up guidelines for a preventive maintenance program for the PBSs. This program should include pole-testing, hardware-tightening, connector and jumper inspection and system ground investigations. The loss of neutral conductor requires that an alternate solution to a continuous grounded wye system be developed and implemented. REB should commission a study to determine the ground resistance of various soils within the PBS service territories and develop guidelines for adequate equipment grounding for the various soil conditions. In addition, REB should train the ECs and the PBS engineers in proper equipment and system grounding for an ungrounded-wye system.

5.0 TECHNICAL ASSISTANCE REQUIREMENTS:

5.1 Monitor system expansion:

Objective: To provide a system to determine if the basic assumptions used to justify extending service to new areas are valid. The information would be used to modify the basic assumptions used in subsequent analyses.

Measures/Deliverables: A worksheet formatted to include the basic assumptions used and the actual amounts realized after the construction, including the following: consumer density, revenue per KM, and construction costs.

Technical Assistance: Short-term engineering or economics consultant (preferably sourced locally) to work with REB/PBS counterpart staff. The consultant would also prepare an analysis of past expansion programs and validate the assumptions used.

Skills/Experience Mix: Direct electrical utility experience in construction costs, load projections, revenue calculations and line extension analysis.

Expected Results: A tool to determine if the planning assumptions being used to justify the expansion into new areas are valid. Used properly, this tool will provide the PBSs information to make valid economic choices for system expansions and REB the information needed to assure a sustainable RE program.

Estimated Manmonths: 3

Note: This function is similar to that recommended for financial forecasting in another section of this report; therefore, it is not repeated in the summary of total technical assistance.

5.2 Independent materials and equipment inspection service company:

Objective: To provide for the required inspection of material and supplies purchased by REB and the PBSs by contracting an independent firm.

Measures/Deliverables: Award of a contract to an independent agency based on a detailed request for proposal and the selection based on the qualifications of the contractor.

Technical Assistance: Short-term consultant (preferably locally sourced) to assist REB in the development of the RFP and in the evaluation of the proposals.

Skills/Experience Mix: Experience in materials inspection requirements to assure quality assurance, in developing RFPs, and in evaluating proposals.

Expected Results: In addition to REB gaining an independent inspection agent to assist in the local and international inspection requirements, the consultant would be expected to train REB staff in the development of proposal requests and awarding.

Estimated Manmonths: 2

5.3 New materials control system:

Objective: To allow REB to have more flexibility in the use of materials provided by the donors, to expedite the flow of materials through the warehouse and to respond to PBS material requests more efficiently.

Measures/Deliverables: An REB-coordinated materials procurement, disbursements and stocking system that is able to deliver normally-stocked material to the PBSs in a more timely manner.

Technical Assistance: Medium-term specialist (locally sourced, if available) to work with REB in improving the material control process.

Skills/Experience Mix: Experience in developing and operating warehouse and procurement systems for electric or related systems.

Expected Results: Materials will be procured, stocked and issued on a basis of the needs of the PBSs using a system that identifies optimum stocking levels, rate of stock turnover, and advance order times for long delivery items. PBSs will be able to get needed materials on a more timely basis.

Estimated Manmonths: 12

5.4 Acceptable materials and equipment list for use on REB/PBS systems:

Objective: To develop a system to approve materials and equipment for use on PBS systems that can be purchased without extensive inspection requirements (i.e., a preferred source of materials).

Measures/Deliverables: A document with a list of materials by manufacturer which are acceptable for use on PBS systems and a system within REB to qualify materials that are submitted for approval testing.

Technical Assistance: A medium-term specialist (expatriate) to set up the quality assurance test criteria for acceptance of materials and to develop the initial list of materials.

Skills/Experience Mix: A materials quality assurance specialist with electric utility materials experience; Special knowledge in applicable international standards and specifications and in developing acceptance standards.

Expected Results: A document and a system for material acceptance to establish standards of acceptable quality and to benefit from experience with unacceptable quality.

Estimated Manmonths: 12

5.5 PBS preventive maintenance program:

Objective: To develop a detailed preventive maintenance program guide for the PBSs.

Measurable Deliverables: A preventive maintenance guide in sufficient quantity to distribute to the PBSs and REB.

Technical Assistance: A specialist to assist REB in developing an electric system preventive maintenance program.

Skills/Experience Mix: An electrical engineer or electrical utility operations manager with extensive experience in distribution systems operations and maintenance. He should have additional experience in detection techniques for monitoring distribution systems.

Expected Results: A preventive maintenance program guide for the PBSs and training in maintenance monitoring techniques.

Expected Manmonths: 12

5.6 System protection and coordination:

Objective: To develop a protection scheme for a uni-grounded wye electric distribution system.

Measures/Deliverables: A system protection scheme to isolate line-to-ground faults on a uni-grounded wye system including grounding and equipment criteria.

Technical Assistance: A specialist to assist REB in developing an appropriate and practical system protection scheme which does not require a continuous neutral wire.

Skills/Experience Mix: A system protection specialist with special skills in grounding and uni-grounded wye distribution systems.

Expected Results: A functioning scheme for isolating system faults in a uni-grounded system which will mitigate the unavoidable theft of neutral lines and reduce system hazards caused by the absence of a system ground.

Expected Manmonths: 1

5.7 Guideline for selecting and installing system control and data acquisition systems (SCADA):

Objective: To develop a guideline for designing and installing a SCADA system on PBS distribution systems.

Measures/Deliverables: A document detailing the application and expected benefits of a SCADA system and a guideline for the design and specification for a system on PBSs.

Technical Assistance: A short-term specialist (expatriate) to assist REB in preparing the SCADA guidelines.

Skills/Experience Mix: An electrical engineer with experience in designing, specifying, installing, operating and/or maintaining a SCADA system on a electrical distribution system and knowledge of the variety of systems available.

Expected Results: A document that will assist the PBSs in determining if the PBS has a need for developing a SCADA system and the necessary guidelines to design and specify a SCADA system and provide appropriate monitoring guidelines for REB.

Expected Manmonths: 6 to 12 (not all in-country)

FINANCIAL REPORTING AND ACCOUNTING

1.0 OBJECTIVE, SCOPE AND METHODOLOGY:

To identify specific areas of financial functions needing strengthening and recommend actions to correct deficiencies noted.

It must be noted that the work performed in on this area did not constitute an audit of Rural Electrification Board (REB) or any Palli Bidyut Samity's (PBS) financial statements for any period. Accordingly, we do not express an opinion as to any of the financial information which appears in the report. Such financial information was made available by REB or PBS management who must assume all responsibility for its accuracy.

2.0 FINDINGS:

2.1 Rural Electrification Board:

2.1.1 Financial performance:

Operating highlights (Annex 6): The audited financial statements of REB for the years ended June 30, 1992 to 1994, and the interim financial statements prepared by REB as of June 30, 1995, indicate that REB has operated profitably. Operating income represents the interest accrued on loans extended to the PBSs with REB acting as creditor to the PBSs. REB operates as a government agency which derives revenue in the form of interest income and incurs interest expenses out of its lending activity.

Operating expenses ranged from 48% to 75% of operating revenues. For the fiscal year ended 1995, it was 54% of revenues. Operating expenses consist of interest expense, depreciation and other expenses which are 23%, 18% and 13% of operating expenses, respectively.

Other income is composed of GOB revenue grants, equipment rental, sale of tender documents, interest on loans to employees and other miscellaneous income. GOB revenue grant ranged from 20%-31% of operating revenue.

Financial condition (Annex 6): REB has minimal investment in fixed assets which account for .9 percent of total assets (or US $5.5 million). It includes properties such as land and land rights, transportation equipment, training equipment, etc. and property under construction.

Construction work in progress (CWIP) for PBSs amounts to US $16 million as of June 30, 1995. This account represents on-going or completed construction not yet turned over to PBSs. In 1993 it increased by 73% in 1993 and went down by 47% in 1994. The reduction may be attributed to close-out and turnover of assets to the PBSs. In 1995, it went up by 378%.

Long-term loans to PBSs increased by 6% in 1993, 21% in 1994 and 17% in 1995. As of June 30, 1995, it amounted to US $338.5 or 54.5% of total assets. Long-term loans to PBSs represent receivables arising from various loans extended to the PBSs which are payable over a period of 30 years.

Other property and investment consists of guarantee deposits and special funds which represents 5.9% (or US $36.4 million) of total assets.

Current assets posted a positive growth of 78% in 1993, 5% in 1994 and 70% in 1995. The large increase in 1995 was due to increases in cash, advances to employees and

inventories. Current assets are made up of cash, short and medium term loans to PBSs, prepayments, plant materials and operating supplies. It represents 30% of total assets of June 30, 1995.

Equities and margins represent 43.7% of total liabilities and equities as of June 30, 1995. It includes: (a) Tk 9.2 billion (US$230 million) GOB capital grant; (b) Tk 854 million (US$21 million) capital gains which represent interest on bank deposits, penalty fees from PBSs and others; and, (c) Tk 813 million (US$20 million) retained earnings.

Long term loan obligations went up by 21% in 1993, 16% in 1994 and 14% in 1995. It represents 50.9% total liabilities and equities as of June 30, 1995. Current liabilities increased by 262% in 1993, 48% in 1994 and 20% in 1995. Current liabilities consist of accounts payable, security advances and deposits from contractors and supplies.

Deferred liabilities consisting of advance amortization payments from PBSs, insurance claims, insured amount of PBS substation and retention fees went up by 153% in 1993, but decreased by 40% in 1994. In 1995, it increased by 41%.

Conformance with Generally Accepted Accounting Principles (GAAP): REB's financial statements for the fiscal year ended June 30, 1995, generally conform with the requirements of GAAP. However, we have observed the following:

- Some accounts such as interest on bank deposits, penalty interest, contributions in aid of construction and penalties on suppliers are reported as capital gains.
- Advances received from PBSs for merchandise are classified under Deferred Debits.
- Advance loan amortization (Debt Service Liability) payments from PBSs are reported as Deferred Credits.
- Interest charged to PBSs on the value of materials issued to PBSs is reported as "Interest Between Disbursement of Credit" under the Deferred Liability account.

2.1.2 Accounting and financial reporting:

Recordkeeping: Accounting records such as the general ledger and subsidiary ledgers (SLs) for various loans to PBSs and materials inventory are properly maintained. Entries to the SLs are properly supported by necessary documents. SLs are being reconciled regularly with the general ledger balances. Currently, a computerized accounting system is being developed by a local programmer based on the accounting system designed by REB. The computerized accounting system covers payroll, general accounts, inventory monitoring, disbursements, external and internal bills. The payroll module is already operational while the inventory system will be ready very soon.

Accounting policies and procedures: Accounting policies and procedures are available and can be found in various "Instructions Under 600 Series." These instructions cover the uniform system of accounts (or chart of accounts), imprest funds, depreciation, disbursements, materials accounting, etc. A list of these "Instructions Under 600 Series" is shown in Annex 6. Based on interviews, these instructions are currently being updated by a local accounting firm.

Inventory recording system: The inventory materials movements at the Khulna Central Warehouse (KCW) are properly documented in terms of receipts, issues and available balances. However, we observed that numerous copies of receiving reports and issue vouchers are prepared. In terms of incoming shipments, we were told that KCW is informed of incoming materials only when shipping documents are received.
Two types of detailed inventory records are being maintained at the KCW: master ledger and subsidiary ledger (SL). The master ledger is being kept by type of inventory (e.g. poles by size, meters by type, etc.) while the SLs are maintained by donor, phase and type of materials. Both records are maintained manually and by computer. Posting to

the master ledger, SLs and the automated inventory system is up-to-date and balances are reconciled based on the inventory items sampled. Inventory balances are reported to REB headquarters in Dhaka monthly. Physical counts are conducted annually by REB.

At the REB Accounts Directorate, SLs for materials inventory are also being maintained by warehouse, donor, phase and inventory item. Similarly, posting to the SLs is current. However, information on the total available balance for a particular inventory item is not readily available. To improve the inventory recordkeeping and provide readily available information on inventories, a computerized system is being developed. As mentioned earlier, the computerized inventory system is estimated by the developer to be ready in 15 days (from October 25, 1995). Based on interviews, a monthly report of material balances is being prepared and reconciled with the balances from the warehouse. Warehouse personnel are asked to explain any difference.

The KCW will be able to plan ahead for the storage of incoming shipments if regularly informed and provided copies of orders. Computerization of the inventory system would minimize errors and provide readily available information on the inventory balances on hand. Recordkeeping will be simplified and staff will have more time for analysis work.

2.1.3 Loans:

Foreign loan obligation: As of June 30, 1995, REB has a reported loan obligation totaling US$310.7 million. Matured portion of the loans cannot be segregated as this information is not available. GOB sends a statement of account to REB for the amount due for payments.

GOB extends loans to REB under the "uniform on lending terms (UOLT)". Under UOLT, REB pays 0.75% interest during the grace period, which is eight years from date of first disbursement, and 2% over 25 years.

Loans to PBSs (Annex 6): The total loan exposure of REB to PBSs as of June 30, 1995, amounted to US$369 million. These loans consist of cash and commodity loans classified in the books into four types: operating fund, construction fund, in kind and capitalized interest (interest due during grace period). Any new loan and maturing portion of loans are communicated to the PBSs through a Debit Memo from REB. No loan amortization schedules are provided to the PBSs. A "Balance Confirmation of REB" is provided to each PBS which contains information on loan balances by classification.

Loan terms: PBSs are granted liberal loan terms. Interest that accrues during the grace period is considered additional loan in the form of capitalized interest. The rates on loans granted also follow the UOLT. PBSs were charged almost the same rate that the GOB charges to REB which is .75% during grace period of five years and 3% during the life of the loans which is 25 years.

Loan repayments: Collection of loans from PBSs appears to be very good. For the fiscal year ended June 30, 1995, total DSL amounted to US $18.7 million. Of this amount, 65% (or US $12 million was collected of which 52% (or US $5.5 million) was applied to interest and penalty payments.

Loan control and monitoring: Four sets of subsidiary ledgers (SLs) for borrowers' loans are maintained at REB. Two sets are maintained at Accounts Directorate, one for principal and another for interest. The other two sets are maintained by PBS Loans and Audit Directorate, also one for principal and one for interest. The loans SLs at Accounts Directorate provide information on the total loan balance and interest receivable for each type of loan to PBSs while the loans SLs at PBS Loans and Audit Directorate contain

information on matured principal and interest. All SLs are maintained manually by donor, project phase and loan type.

A review of loan balances shown in REB's unaudited Balance Sheet as of June 30, 1995, indicated a total amount of US$ 369.4 million (or Taka 14.776 billion). Aggregate balance of PBSs' loans per PBSs' records amounted to US $376.6 million (or Taka 15.067 billion). Annex 6 shows a comparison of loan balances between REB's and PBSs' records. As shown by the comparative figures, loans balances are not reconciled. Based on interviews, PBS personnel come to REB headquarters yearly to reconcile their loan records with REB's. As claimed, PBS accountants reconcile their loan balances with REB annually.

Annex 6 also shows advance payments of DSL are not being deducted from the outstanding loans. This advance payment, as alleged by the PBS, continues to be charged with interest. As indicated in the annex, loan receivables from PBSs are recorded and reported by REB in various accounts. In PBS books of accounts, loans are classified into (i) Cash Loans - Operation and Construction; (ii) Loans in Kind, subclassified into equipment/materials, construction close-out, new construction, PDB take-over, provisional, and deferred interest (capitalized interest).

2.1.4 Management Information System:

Based on information gathered, one of the databases developed for the MIS contain the PBS financial and statistical data which is being summarized monthly using a Lotus spreadsheet. The data encoding is cumbersome as posting of year-to-date and monthly data is done monthly. From this database, an MIS report is generated which contains PBS statistical information on villages electrified, system loss, collection efficiency, connections and disconnections, KWh consumption, government subsidies, accounts receivables, etc. Other databases are available in Lotus spreadsheets, such as yearly actual PTA achievement summary, approved energy rates for all PBSs and comparative PTA (actual and target) by PBS and PBS groupings (Groups I, II and III).

2.1.5 PBS audit:

Two directorates at REB conduct reviews of the PBSs financial operations and transactions. Office Systems performs routine review of the financial and related activities to ensure that the monthly financial and statistical report agrees with the general and subsidiary ledgers, PBS Instructions under 200 series are followed and required reports are being prepared, etc. PBS Loans and Audit conducts an audit of the financial statements.

2.2 Palli Bidyut Samities:

2.2.1 Financial highlights (Annex 7)

As of June 30, 1995, the PBSs recorded aggregate net margin of 11% of gross operating revenue. This good performance is due to interest earned on bank deposits. However, on an individual basis, 16 of the 45 PBSs show losses ranging from .9 percent to 18.8%. Without interest earnings from bank deposits, 30 PBSs are operating at a loss. An analysis of the financial statements for individual PBSs indicates that a minority of the PBSs with outstanding financial performance are responsible for most of the combined financial success.

Overall, sales to domestic or residential consumers (29.6%), irrigation (26%) and general power (25.4%) constitute the bulk of the operating revenue. Operating costs represents 98% of operating revenues. Power cost, the major component of operating cost, is 59.5% of operating revenues.

Investment in Utility Plant in Service, including construction in progress, averages 72.2%. of total assets. Net accounts receivable from energy sales amounting to US $13 million represent 2.7 percent of total assets and 17.5% of total sales.

Long-term loans from REB totaled US $354.7 million as of June 30, 1995. It represents 75% of total liabilities and equities.

2.2.2 Systems and procedures:

Discussed below is a summary of our findings at the PBSs visited which include Dhaka PBS-1, Jessore PBS-1 and Jessore PBS-2. The systems and procedures examined are representative of all 45 PBSs.

Consumer Accounting

Meter reading: Meter reading records appear adequate and properly filed in booklets for easy retrieval and tracing. Meter readings are being performed by individuals contracted by PBSs. The contract covers a three-year period renewable every year. Each meter reader is assigned to read 2,000 meters each month covering several routes. Any observations made during meter readings (such as stuck meters, broken covers, wrong serial numbers, etc.) are noted and reported. For internal control, meter readers' route assignments are rotated every three months. In addition, as claimed during the interviews, messengers are required to check on the readings by comparing the readings in the bill against the meters when electric bills are delivered to the consumers. Meter reading for industrial and irrigation customers is done by officers of the PBS as assigned by the general manager. Computation of the Kwh usage is done manually based on the reading sheets.

Billing: Billing is done manually by billing assistants. Each billing assistant is assigned to prepare 1,500 bills each month. In addition to bill preparation, billing assistants are responsible for updating the consumer subsidiary ledgers which contain details of meter readings, KWh usage, bills issued, collections and account balances. In spite of the manual process of bill preparation and other billing tasks, bills are prepared promptly. Due to the volume of billing transactions, all the PBSs visited are clamoring for a computerized billing system for which plans are underway.

Collections: Bills are delivered to the consumers by PBS messengers. Bills are due twenty days from date of the bill. Consumers are instructed to pay their electric bills direct to PBS's Head Office, district offices and authorized collection banks. Each PBS has a number of collection banks (Jessore PBS-1 has 33, while Jessore PBS-2 has 21). Collection banks are required to report collections on a weekly basis. Collections made by the banks are deposited to the PBS's general fund account maintained in the bank.

As of June 30, 1995, total receivables from energy sales amount to US$13 million of which 34.5% are current while 65.5 % are over 30 days. Accounts receivable increased by 33% compared to last year. Receivables from domestic consumers represent 26.8% of total receivables, irrigation 23.3% and general power 22.7%. Receivables from street lights represent the lowest (.7 percent). (Refer to Annex 7).

Based on the PBS financial and statistical reports for the fiscal year ending June 30, 1995, collection efficiency ranged from 66% to 88%. Average collection efficiency for all the PBSs is 83%. The bulk of collection came from general power, domestic and irrigation customers as indicated by the collection efficiency which are 25.4%, 21.1% and 18.5%, respectively. Collection efficiency from street lights (.2 percent) and charitable institutions (.5 percent) registered the lowest. (See Annexes 7).

Disconnections and reconnections: Electric service is disconnected if the electric bill is not paid by the consumer within 30 days. After three months, coinciding with the guarantee deposit required from the consumers upon connection which equals three months' estimated average consumption. Final disconnection takes effect if the delinquent bill is not paid.

Disconnected consumers can be reconnected upon payment of disconnection and reconnection fees which vary per consumer type. Presented in Annex 7 is a sample Schedule of Charges for connections and reconnections at Jessore PBS-2.

Computerization plan for consumer accounting: There is a plan to computerize the billing function at selected PBSs. Only a few personnel from the PBSs visited are computer literate, but not including any of the finance/accounting staff. At Jessore PBS-2, two computers have been purchased. These units are intended to be utilized for training and engineering purposes. Based on interviews, a study on computerization was made in the recent past, but it was very limited.

We were told that more than 150 REB/PBS employees have been trained on DOS, word processing and spreadsheet. Trainers have also been trained to continue the training program, but failed to do so. The training is supposed to resume in November, 1995.

Accounting and financial reporting: The PBSs adhere to the policies and procedures prescribed by REB. Appropriate books of accounts are being maintained. Books of accounts maintained at Jessore PBS-1 and Jessore PBS-2 are properly and neatly maintained. Postings were current for both the general ledger and subsidiary ledgers reviewed.

Depreciation charges are booked monthly based on depreciation rates established by REB. In addition, a replacement fund has been set aside to cover the cost of replacements, repairs and maintenance of plant property and equipment. This fund represents five percent of the gross utility plant amount and is funded from available net margins of the PBS. However, the PBSs cannot use the fund for the specified budgeted purpose unless authorized by REB.

An allowance for doubtful accounts of 0.5 percent of monthly sales is being provided.

An Accounting Procedures Manual consisting of two volumes was available at each PBS visited. The manual which was developed in 1987 is referred to as "Instruction 200-6 Series." It contains general instructions/procedures and proforma forms compiled in a three-ring binder for easy insertion of revised portions.

Budgeting system: It appears that budgets are prepared by PBSs to satisfy the requirements of REB and, according to REB, to comply with the financial discipline of GOB; also to disburse funds to finance the day-to-day operation. Existing budgets are not objectives-oriented. Performance cannot be measured against formally established work objectives and/or work programs. Variance reporting is not practiced, limiting program planning and control.

Inventory monitoring: Subsidiary ledgers for stores materials are maintained by accounting. At the warehouse, a materials journal is also maintained. Physical counts are conducted yearly for Construction Stores and General Plant.

3.0 ANALYSIS:

3.1 Rural Electrification Board:

3.1.1 Financial review:

Conformance with Generally Accepted Accounting Principles (GAAP): The practiceof reporting interest income and penalty interest as capital gains will result in the understatement of income while recording payments as deferred liability overstates both the assets and liabilities. Additionally, affected PBSs will be charged interest for the loan portions that have been paid in advance.

Interests and penalty charges from PBSs should be recorded as "other income" while the contributions in aid of construction may be reported separately as an equity account under "Contributions in Aid of Construction" or "Donated Capital." Advances received from PBS for merchandise should be reclassified to "Cash" if money was received. Interest charged to PBSs on value of materials issued to PBSs reported as "Interest Between Disbursement of Credit" under the Deferred Liability account should also be classified as other income. Receivables from PBSs should be classified in one main account for easy review and monitoring.

3.1.2 Accounting and financial reporting:

The General Accounts Manual available at REB contains "Instruction 600-16 Series" which describes the accounting terms, some general instructions, detailed charts of accounts, account descriptions and account coding scheme. There are other REB Instructions under the 600 Series. These instructions should be reviewed and improved, as necessary, and consolidated or compiled into a comprehensive Accounting Manual for easy reference by personnel under Member Finance.

A comprehensive accounting manual would provide a complete reference. It would serve as training tool for both new hires and old employees not only in accounting and finance, but also those with accounting-related responsibilities. The updated Accounting Manual should contain the chart of accounts, accounting records, finance/accounting policies, systems and procedures, and proforma forms and reports.

3.1.3 Inventory recording system:

There are a few areas that need improvement at Khulna Central Warehouse (KCW) such as reduction of number of copies of forms prepared as well as coordination between procurement, warehousing and accounts directorates to ensure proper planning of procurement and storage, and reporting of inventory balances.

The inventory records at KCW have been computerized and are being run in parallel to the manual system. At the Accounts Directorate in REB, an automated inventory system is underway. Efforts are duplicated and computerization efforts seem uncoordinated.

We were informed that an NRECA advisor has outlind the functional and manning requirements for a Computer Cell at REB to coordinate the computerization efforts at REB. The outline was prepared more than a year ago but the Computer Cell is not yet in place. We were told that REB will have the Computer Cell by January, 1996.

3.1.4 Loans:

Separate SLs are maintained for principal and interest at Accounts and PBS Loans and Audit directorates. Review of the loan accounts would be much easier if SLs from the two directorates are consolidated into one. Recording and classifying of loans receivable

in two directorates, coupled with classifying them in different accounts, may create future problems. Personnel performing the reconciliation may not be aware of such practice and might provide erroneous figures.

Manually maintaining the Loan SLs by donor, project phase, and loan type and PBS requires significant manpower and time. A computerized loan monitoring and recordkeeping system would facilitate recording, preparation of loan reports or generation of statement of balances for the PBS, calculation of interest and other loan information that may be required by management. Generation of an amortization schedule for loans granted to the PBSs would also provide reliable information to the PBS for cash flow planning and budgeting for debt service liabilities to REB.

3.1.5 Management information system:

Information requested from MIS personnel is readily available. The process of accumulating or creating and generating necessary reports on "as needed basis" in addition to regular reports can be made simple and less time consuming if a computerized database program is available. MIS staff will have more time to do analysis and provide more informative and meaningful MIS reports which can be related or compared to the overall work objectives or program of both REB and PBS such as service connections, service expansions, etc. for planning and decision-making purposes.

3.1.6 PBS audit:

Audit functions, both operations and financial review, will be more effective and efficient if carried out by the financial auditors. It will allow them to see the process of collecting, classifying and summarizing transactions and internal controls, and will be able to relate the same in the financial transactions being audited. It appears that, audit functions of the PBSs are duplicated in some ways. Since these two functions are interrelated, one directorate should perform both functions.

3.2 Palli Bidyut Samities:

3.2.1 Consumer accounting:

REB provide all PBSs with operational manuals outlining the policies, guidelines and procedures that are to be followed. These include specific guidelines for meter reading, billing, collection, disconnection, penalties for disconnection, reconnection, etc. These procedures are done manually. With the increasing number of consumers, which currently range from 4,000 to 58,000, the manual billing process is cumbersome. The manual processing of large numbers of consumers may lead to erroneous computation of bills as well as delayed posting to consumer records and preparation of reports. Billing transactions are voluminous and preparing bills, summaries, and reports require much time, manpower and attention. Disconnections which should be undertaken on time might be delayed due to absence of timely detailed information on unpaid or overdue accounts. Adding another billing assistant for each additional 1,500 consumers eventually could reach critical mass as PBSs grow over time (i.e., a 50,000 member PBS would require 33 billing assistants).

Automating the billing system will improve the effectiveness of the PBSs in preparing accurate bills and consumer records. It also will facilitate the timely preparation of reports on sales, disconnections, aging of receivables, etc. More importantly, it will allow PBSs to collect the correct amount due from each consumer. The billing system should not only perform bill generation, but also integrate the member services activities, meter reading, collection and preparation of necessary reports.

3.2.2 Accounting and financial reporting:

Similarly, an Accounting Procedures Manual was developed and provided to the PBSs. The manual was developed in 1987 and many changes have occurred. The existing manual needs updating to incorporate these changes.

3.2.3 Budgeting system:

A good budgeting system would provide objectives that are quantifiable for both the financial and operating measures necessary for evaluating actual performance. To use the budget to measure performance, PBS personnel need to participate in the budgeting process. The budget is not just a compilation of numbers, but a tool to evaluate the performance of the various units, management and the organization as a whole. Involving the staff in the process makes them committed to make the objectives happen.

4.0 RECOMMENDATIONS:

4.1 For the Rural Electrification Board:

4.1.1 Reclassify certain accounts for proper financial statement presentation:

Objective: To present financial statements in accordance with international accounting standards.

Measures/Deliverables: A revised chart of accounts incorporating the required changes in order to properly classify financial transactions in the accounting records and reports.

Expected Results: Financial statements showing the true financial status of REB prepared in accordance with international standards..

Estimated Manmonths: Included in the estimate for updating the accounting manual.

4.1.2 Update the REB General Accounts Manual and orient users to the changes:

Objective: To provide a comprehensive, readily available reference guide that is easy to read and understand by accounting and financial personnel and which can be used as training material for newly hired personnel.

Measures/Deliverables: An updated, comprehensive General Accounts Manual for REB.

Expected Results: REB accounting and finance personnel being able to use the Accounting Manual as a helpful guide in performing their day-to-day accounting functions, thereby improving the overall quality of work.

Technical Assistance: Short-term consultant (sourced locally, if available) to work closely with REB/PBS Counterpart Staff to build in-house expertise for any future revisions/amendments.

Skills/Experience Mix: Financial/accounting background, with direct experience in the development, review and improvement of finance/accounting systems.

Estimated Manmonths: 10

4.1.3 Coordinate the computerization efforts for inventory monitoring system:

Technical Assistance: None.

4.1.4 Review the existing system on inventory control and monitoring and develop improvements:

Objectives: To improve the inventory control and monitoring system at Khulna central Warehouse.

Measures/Deliverables: An improved inventory control and monitoring system for the REB.

Expected Results: Warehouse personnel being able to plan ahead for the incoming shipments, respond promptly to the needs of the PBSs, savings in office supplies cost and improvements in the inventory system incorporated in the computerized system.

Technical Assistance: Short-term consultant (expatriate).

Estimated Manmonths: Refer to the Engineering, Operations and Materials Handling section of the report; not repeated in the summary of total technical assistance.

Skills/Experience Mix: Direct experience in inventory management.

4.1.5 Consolidate loan records in one directorate (or section) only:

Technical Assistance Needed: None.

4.1.6 Automate loan monitoring and recordkeeping and train the users:

Objectives: To facilitate loan recordkeeping, monitoring and reporting and provide readily available information on loans.

Measures/Deliverables: A working computerized loan system that meets the requirements of both REB and PBSs.

Technical Assistance: Short-term consultants (preferably sourced locally, if available). REB/PBS Counterpart Staff to work directly with the consultants in order to build in-house capability.

Skills/Experience Mix: Information technology background and wide experience in developing and implementing computerized operating systems.

Expected Results: Reliable loan records and information; timely reports for REB and PBSs; more time for staff for analysis work; reduced duplicated effort; amortization schedules to improve cash flow planning and budgeting for debt service by PBSs.

Estimated Manmonths: Unable to estimate. It will depend on the type of software, customized or packaged, to be used.

4.1.7 REB should consolidate the review and/or audit functions of Office Systems and PBS Loans and Audit directorates.

Technical Assistance Needed: None

4.2 For the Palli Bidyut Samities

4.2.1 Computerize the consumer accounting and recordkeeping:

Objective: To facilitate bill preparation, consumer accounts recordkeeping andtimely preparation of necessary reports, especially those that would improve the implementation of collections and disconnections.

Measures/Deliverables: An operational computerized billing system that will encompass customer information, billing and collection, and financial and management reporting complete with necessary documentation such as a user's guide.

Expected Results: Improved billing personnel effectiveness; accurate bills andupdated consumer records; timely preparation of billing-rated reports; reduced PBS personnel requirements as number of consumers increases; overall improvement in timely information available to management for performance monitoring.

Technical Assistance: Short-term consultants for the pilot PBS and long-term consultant for all the PBSs.

Skills/Experience Mix: Short-term expatriate consultants with direct experience in the development and implementation of computerized billing systems for electric cooperatives. The consultants will work closely with REB and PBS personnel directly involved in billing and/or local experts for the purpose of building in-house or local capability to develop and incorporate future enhancements.

Estimated Manmonths: This will depend on the tasks to be performed which may include among others; (i) gathering of data required for the billing software; (ii) hardware acquisition; (iii) software tailoring if needed; (iv) installation; (iv) staff training; (v) parallel running; etc.

A pilot PBS could be selected for initial installation. The methodology and experience in the pilot PBS should be reviewed and revised, if necessary. The revised installation methodology would be implemented in all the PBSs. Implementation at all PBSs to start at a later date.

4.2.2 Design a computer training plan responsive to the needs of the PBSs:

Objective: To introduce PBS personnel to computers through training and prepare the users of the computerized billing system.

Measures/Deliverables: (i) develop foundation computer skills and knowledge by conducting introductory level training courses in DOS, word processing and spreadsheets; (ii) specialist training for billing assistants; (iii) system administrator training to provide in-house capability; (iv) develop advanced skills for special groups, if any.

Expected Results: PBS personnel awareness of what computers can do; actual on-the-job application of the skills learned.

Technical Assistance: Short-term consultants, both international and locally-sourced, to work closely with REB/PBS Counterpart Staff to build in-house training capability.

Skills/Experience Mix: Direct experience in developing training programs and delivery of computer courses. The locally-sourced consultants should be appropriately qualified training companies/consultants subject to a rigorous quality review of ability to develop and conduct training programs.

Estimated Manmonths: 18 Estimate does not include an estimate for the number of manmonths if a computer-based training program will be developed for use on a continuing basis.

4.2.3 Update the Accounting Procedures Manual:

Objective: To provide an updated, comprehensive, easy to read, understand and follow reference quide for accounting and financial personnel and which can be used as training material for newly-hired personnel in accounting and finance.

Measures/Deliverables: An updated, comprehensive Accounting Manual for PBSs.

Technical Assistance: Short-term consultant (sourced locally, if available) to work closely with REB/PBS Counterpart Staff to develop in-house capability for future revisions.

Skills/Experience Mix: Direct experience in the review and development of finance/accounting systems.

Expected Results: PBS accounting and finance personnel being able to use the Accounting Manual as helpful guide in performing their day-to-day accounting functions.

Estimated Manmonths: 12

4.2.4 Review the existing budgeting system and develop improvements, as necessary, to enable PBSs to control and monitor their operations effectively:

Objective: To improve the current budgeting system and documents to provide a guide in the preparation of budgets that contain quantifiable financial and operating measures necessary for evaluating performance.

Measures/Deliverables: A Budget Manual to serve as a reference guide for the PBSs including standard forms which can be used for monitoring PBS performance.

Expected Results: A participative budgeting process providing a budget that can be used to measure and evaluate actual performance of PBSs compared with projections. It will materially enhance the value of financial forecasting recommended elsewhere.

Technical Assistance: Short-term consultant (sourced locally, if available) to work closely with REB/PBS Counterpart Staff.

Skills/Experience Mix: Experience in developing budgeting systems or related areas.

Estimated Manmonths: 6

SOCIO-ECONOMIC IMPACT OF ELECTRIFICATION AND PBS MEMBER-CONSUMER SERVICES

1.0 OBJECTIVES:

1.1 To identify the future technical assistance needs of REB and PBSs that will enable them to provide better consumer services and increase membership participation, particularly in the older, more established PBSs, for the overall benefit of REB-PBS operations.

1.2 To identify possibilities and constraints to provision of consumer services in the future to very low income rural consumers. (This is a recent USAID addition to the scope of work.)

2.0 FINDINGS:

2.1 Consumer survey:

The local private, non-profit research organization, Unnayan Samannay, tasked through NRECA to evaluate the socio-economic impact of the rural electrification program, provide a formal monitoring system, and train REB/PBS personnel on the methods of evaluating impact, has completed the field research and presented three interim reports to NRECA. Interim Report III: Instruments, Survey Design, and Some Preliminary Field Findings arrived in draft at NRECA on October 31.

This Interim Report is primarily about field methods, and there are as yet few findings to report. Briefly, the 'instruments' used in the field research included long and short questionnaires, and topics for focused group discussions. REB briefed the researchers before they went to communities served by ten PBSs during October, 1995. Some questions were intended to elicit opinions regarding the services provided by the PBSs. A checklist to guide fieldworkers to observe local characteristics and facilities includes the fieldworker's observation of the local people's perception of the PBS.

Preliminary findings confirm what we know, that electricity "is very dear to their hearts and they do not want to live without it." Commercial activities have increased many times since electrification, creating new jobs and income for the people in the area, whether or not they have electricity in their own homes. The present and potential favorable impact of electricity on rural areas is uncontestable.

However, while demand for electrification was unanimous, the respondents complained about fluctuations and outages. PBS members "shied away" from answering questions about the cooperatives and mentioned dissatisfaction with irregularities. The consultant's project staff is reluctant to speculate on the reasons before the data are tallied. For the sole purpose of this report, and upon request, a researcher shared these perceptions informally: a) the cultural hierarchy in rural areas prevents many members from believing that they, not the General Manager, own the PBS; b) consumer-members will not come in from their villages to attend PBS meetings because by interrupting work, they will suffer economic costs for which they see no return in terms of PBS benefit; c) PBS membership offers nothing beyond what it already provides (unreliable electric service), thus the PBS cannot motivate consumers to be active members.

2.2 Scope of PBS member services:

The present scope of work for an Assistant General Manager of Member Services is limited to expansion, not enhancement. The AGM:

- plans and directs the PBS's housewiring program;
- makes arrangements for the annual meeting of the members;
- develops training programs for the PBS employees, electricians and wiring inspectors;
- handles the PBS's area extension and line entension function;
- arranges programs for consumer growth and members' motivation. (This appears to mean energizing new villages.)

The PBSs visited appeared to fulfill the scope within the limits of their mandate. If rural development were as established a process here as it is elsewhere, this scope of work would be enough. The Bangladeshi director of a development office said consumer service has not been understood or valued here. But when most new members have never had electric power, energizing the line without teaching how to use it is like giving someone a computer without showing him how to use the software.

There is nothing wrong with the PBSs as they are, but aside from their main mission of providing electric service, they are mute institutions that have not been allowed to develop their leadership role in the community. Despite the conscientious, by-the-book commitment observed, there is little evidence that the PBSs have outreach capacity or the ability to respond to the catalytic issues of this revolutionary phenomenon of electrification. When asked about special projects, there were none.

Daily events go smoothly and small accomplishments take on a timeless importance. Members stopped at a one-stop-shop desk in the entrance. There is a checklist of the most common problems to direct the inquiry and seating for those who wait; small amenities. Elsewhere, staff kept a tidy log of complaints and resolutions. Another PBS provides a bulletin board on which one item addresses load-shedding. General managers sign stacks of forms daily (REB requires the GM's signature on documents), then receive members personally throughout the day. At one PBS, the position of AGM/Member Services had been vacant for a year and it did not seem to make a difference.

2.3 Community Outreach Activities:

Apparently REB once had an office of Member Services to identify PBS members with raw materials and idle funds, and then to identify projects to help the member develop the industrial potential, providing technical assistance in design, credit, production, marketing and financial management–a version of the modern "incubator" approach to economic development which fosters start-up enterprises in a supportive environment and helps them succeed.

A PBS general manager recently considered a proposal to train 50 local Scouts (aged 18-25) to earn their electrification merit badges in exchange for their commitment to provide free, safe wiring to poor households and present small programs on the safe use of electricity. Since the PBS is already equipped to train village electricians, he suggested his staff could also train unemployed young men to repair small appliances and open their own businesses. While he has a clear idea of what he and the PBS could do, he probably will not propose it to REB because he does not expect it will be received favorably and there is no REB office which focuses on such activities. The GM of another PBS noticed the mechanical inclinations of a beggar, set him up as a partner in a tubewell venture where he has done well enough to be self-supporting.

3.0 ANALYSIS:

3.1 Consumer survey:

The one thousand heads of household who sat through the comprehensive questionnaires and the 26 women who participated in the focused group discussions and diagrams will never forget their own role, and may become a constituency for rural electrification. However, if early indications hold, few rural members know they have a vested interest as owners of the PBS, nor do they have any opportunity to participate in this local, democratic institution except to attend the PBS's annual meeting where directors are elected by members. (One PBS General Manager reports that only 4.9 percent of the male members and .55 percent of the females, have attended the annual membership meeting.) Yet, since electrification, 50 percent more land has bee irrigated in the area served by the PBS; more rice, wheat, sugarcane, potatoes and vegetables have been harvested; 142,000 jobs have been created in agriculture and 35,000 jobs in small industries. Commercial areas have tripled, and health centers have increased tenfold. Electrification is already taken for granted.

Whether the survey will lead to a useful monitoring system is unclear. (Useful to whom and for what purpose?) The function of monitoring is to feed information to project managers to help them make better decisions. If this study is only to be used by REB to plan where to use more poles and line, the existing consumers will be subverted by the utility sector's mentality of construction-expansion that already distributes electricity unreliably. If this report is just used as a marketing tool by donors to win home support to provide more materials, under the present constraints of inadequate power supply the service problem may get worse before it gets better.

If, on the other hand, better market data leads REB to activate a Consumer Services Initiative, the information can be used to help the PBSs promote electric power as a tool for production of food and rural enterprises for jobs. REB could target future project ideas for implementation by PBSs to make them community service centers and implementing agencies for the productive, rather than consumptive, use of electricity.

3.2 Scope of PBS member services:

The general managers and assistant general managers/member services of the older, stronger PBSs are as effective in providing member services as their limited authority permits. More initiative can be exercised only if REB grants the flexibility and supports it with commitment.

3.3 Community outreach activities:

The REB-PBS system has a dormant capacity to be a catalyst for rural development because of its omnipresence in the areas served and its inherent self-interest in economic development. Being the provider of a basic public service of benefit to every single inhabitant, electric cooperatives are unique contributors to the overall quality of life.

The ongoing program, and the objective of consumer services for members, is to develop a rural utility cooperative culture. The co-op mentality that really results in rural development is bottom-up, where the members collectively own the facility and use it to access the skills, funds and fresh ideas they need. However, when the members scarcely participate except to pay their bill, and some staff say they would take jobs in other power facilities, we are in a static crisis in which both the members and the workers would leave if they could.

To keep the utility co-op concept alive as an agent for rural development, PBSs must expand their scope beyond more lines and meters, and put in place, together, community service projects. The goal of rural electrification through co-ops is sustainable rural development, enlarging the economic pie.

4.0 Conclusions/Recommendations:

4.1 Consumer survey:

Those who will read the final report of the consumer survey should give close attention to the respondents' views of the REB-PBS system. As the clients, REB and the PBSs alone will determine if they can become a customer service organization. If the decision and the institutional commitment to consumer services is affirmative, then there is ample reason to continue the impact assessment for five more years. If the agencies elect not to develop their potential to expand services to member-consumers, it is hard to see how useful follow-on studies will be except to confirm the obvious: the demand for electricity is increasing.

Recommendation:

REB should determine to become a member/consumer-oriented agency.

Technical Assistance Requirements:

Objective: To devise an easily and usefully-updatable monitoring system to monitor the socio-economic impact of the rural electrification program and to regularly measure members' attitudes and needs through collection of quantifiable data.

Measures/Deliverables: An annual updated report on the most important indicators, for each of five years; a consistent, intermittent (annual) contract capability to refine indicators and revise research instruments as needed.

Technical Assistance and Skills/Experience Mix: Project management and field staff must be experienced in rural data collection in Bangladesh. The local contractor completing the current survey has certifiable specific skills and a network of respondents in the field which suggests an extension of the present contract would expedite delivery of services.

Expected Results: At minimum, the annually-updated data will provide REB, GOB and donors an assessment of their investment as a tool for rural development programs. At best, the update will guide the PBSs to a full-service capability to serve the rural population.

Estimated manmonths: For five years, two months x 20 researchers for fieldwork and delivery of results, preceded by one month for organization/planning by senior management and followed by one month for analysis/reporting. Total: 220 over 5 years.

4.2 Scope of PBS member services:

General managers and AGM/Member Services of the PBSs provide basic member services within the limits of their scope of work and the present constraints on PBS initiative. Expanding the initiative with committed support from REB is a needed, logical, evolutionary extension of the service cooperative concept on which the rural electrification program is founded.

Future consumer service support and activities could include activating an REB Member Services office to support the PBSs by identifying opportunities for enterprise development, delegating to the PBSs authority for small project design and implementation, and increasing member participation through public service programs, disaster recovery and sustainable renewable energy projects to benefit the very poor in areas inaccessible to the electric distribution grid.

Recommendation:

REB should activate a dynamic Member Services Office for project development capability and delegate appropriate authority to the PBSs to implement small projects and activities within established guidelines.

4.3 Community outreach activities:

Some micro-projects are easy to achieve. Use the PBS campus for public meetings and classes. For the captive audience in the foyer, prepare, display, and distribute brochures, the PBS bye-laws in Bangla, and newsletters or show videos about basic lessons in health. Entertaining but educational themes for short video spots could include turning off the light when leaving the room to conserve power during peak demand; the safe, effective, and productive uses of appliances and electric tools. Emphasize the mutual benefit of PBS membership, and the opportunities for democratization and leadership, and if or when appropriate, the future return of capital credits.

Recommendations:

Offer incentives and rewards to PBS personnel for developing and implementing creative, locally-responsive projects and activities that will motivate the members to look to the PBSs for leadership and benefit in rural development.

Technical assistance requirements: (NOT NECESSARILY FOR DONOR FUNDING)

Objective: To educate PBS members on effective uses of electricity and to encourage their interest as member-owners of the cooperative.

Measures/Deliverables: A kit of public outreach and member information tools (i.e., inexpensive, locally printed, illustrated, step-by-step pamphlets in Bangla).

Technical Assistance: Short-term local consultant to prepare educational materials.

Skills/Experience Mix: Experience in advertising, public relations, communications; fluent written Bangla.

Expected results: more knowledge of effective uses of elecricity and greater member interest in the PBSs.

Estimated manmonths: 2 - one month to research, design, write; one month to produce and distribute to selected PBSs.

SUMMARY OF RECOMMENDATIONS
TO INCREASE CONSUMER/MEMBER PARTICIPATION IN PBSs

1.0 OBJECTIVE:

To lend perspective to the realities and practicalities of activities designed to encourage, enhance and entice greater knowledge of, interest and participation in the affairs of Palli Bidyut Samities (PBSs - rural electric cooperatives) in Bangladesh.

2.0 BACKGROUND:

The PBSs in Bangladesh were authorized as the distribution system for electric power to serve the rural areas by the ordinance adopted in 1978 creating the Rural Electrification Board. The REB was empowered to create PBSs and, under a comprehensive plan developed by the National Rural Electric Cooperative Association funded by USAID, adopted the concept and model of non-profit, consumer-owned cooperatives from the United States where they are a proven, successful system. The non-profit structure was essential in the US because of the sparsely-populated areas to be served which were not attractive to investor-owned power companies. In Bangladesh, all electric service was state-owned until the PBSs were formed, but economics also were the reason the rural areas remained unserved: the density of the rural population, while much greater in Bangladesh than in the US, was not sufficient to amortize the large amounts of capital required to install any electric system if the capital had to come from conventional commercial sources at conventional rates of interest. Therefore, in both the US and Bangladesh, the same solution was applied to the problem: loans were made available to the cooperatives and PBSs in the respective countries from their governments at low interest rates. The principal difference is where the governments get the money to lend; in the US, loan funds came from the US Treasury (either from tax revenue or from the sale of government securities) and in Bangladesh, loan funds come from grants from donor countries.

The non-profit structure of PBSs is necessary due to the circumstances in which they serve. The consumer ownership is an option with the only alternatives being government ownership or ownership by the autonomous entity itself. In the case of cooperatives, the entity holds and manages the assets on behalf of the consumers who, in fact, are the owners of the assets. Their actual ownership is illustrated by the allocation to individual equity accounts (called capital credits) of any margins (revenue in excess of expenses) realized from operations. These margins, if any, are retained by the cooperative to be used for purposes for the common benefit of the members: to finance the construction of new facilities (rather than borrowing more money), to use in case of emergencies such as storm damage to the system and to provide working capital to operate the cooperative.

Rates charged the members for electric service are set so as to collect enough revenue to (1) operate and maintain the system; (2) service debt; and (3) create prudent business reserves. Under this legal structure, the ultimate manifestation of consumer ownership would be that, if the cooperative systems were ever sold or if the cooperative were disbanded for any reason, all remaining assets would be divided among the member-owners according to the capital credits allocated on the books in their name after all claims against the aggregate assets were satisfied.

In addition to the financial implications of consumer ownership, the other basic concept involved is the manner in which that ownership is expressed in the operation of the cooperative. The primary expression of the rights of ownership is election of directors whose responsibility is to set policies and generally manage the business on behalf of and in the best interests of the members. The election of directors by whatever process provided in cooperative bye-laws is the ONLY direct involvement members have in their cooperative. Once elected, decision-making is delegated to the directors, although some of those decisions are subject to approval by the membership.

In Bangladesh, decisions of the PBS board of directors are subject to another level of approval, that of REB. Since REB is a government agency, GOB in effect manages the autonomous PBSs on behalf of the members.

3.0 ANALYSIS:

One of the precepts of cooperative philosophy is member education. That is the members' right -- to have information about how their utility is doing. If that information leads enough members to believe things are not going well or not to their liking, their means of expression of that dissatisfaction is by electing new directors who, in their opinion, might improve the situation. That precept is operative in Bangladesh only to the extent that members can elect their directors; the modification of the precept is that elected directors do not have the power to act independently on behalf of the members.

This does not suggest that REB makes decisions in exercising close control over the PBSs that are not in the best interests of the members. It does suggest, however, that a very basic ingredient of cooperative reality is not present in Bangladesh: the reality that cooperative management (including boards of directors) must take care to "keep members happy" or the members can and will do something about it. In Bangladesh, that member action is precluded. Stated in the terms used above, REB (the ultimate controller of the PBSs) does not have to "keep the members happy" because the members have no access to REB in Dhaka and the election of new directors has no substantive effect on how the PBS is run. That fact implies that whatever services are provided to members beyond basic electric service must be motivated by a sense of commitment to service and in recognition of a cooperative's responsibility to its member-owners.

Succinctly stated, a cooperative's only reason for being is service.

4.0 CONCLUSIONS/RECOMMENDATIONS:

To promote and encourage greater member participation and interest in PBS affairs, there must be a basic recognition and commitment by REB and the PBSs that such enhanced participation is a desirable goal to strive to achieve. To strive toward the goal, there must be a commitment of adequate and appropriate resources (personnel and funds) to that purpose.

The logical beginning for new or renewed efforts is to do the obvious: build on what already is in place, namely, the annual meeting which is the one mass event open to all members at the same time. Beyond the annual meeting, almost any other activity will be selective and limited to particular groups of members (by locale, subject, member circumstance).

The scope of member services embraces three principal areas: (1) information to which members have a right (i.e., what's going on at the PBS in the members' general interest); and (2) information or activities in which particular groups of members have a specific interest (i.e., irrigators, small businesses, industries); and (3) activities related to overall community interests which may have nothing to do with electric service. An expanded member services program will include some of each, but it should not be expected that all can be done at once. As a rule, information should be disseminated without critical consideration as to whether one thinks it will be read massively or whether one thinks the members really want to know it. Disseminate information members have a right to know or should want to know, and do it whether they want to know it, need to know it, have a right to know, and do it without regard to whether they know that they need to know it or have right to know it.

Most member service activities, even those designed to communicate cognitive information (i.e., effective irrigation practices, safe use of electricity in the home, etc.) should implicitly communicate that the PBS cares and is a "good neighbor."

Motivation for community/economic development activities is found in the PBSs' inherent self-interest: if the members do well, the PBS does well.

Some policies/actions/activities to consider:

- **Make information brochures available wherever members regularly appear -- the PBS office, wherever they pay their bills, delivered by bill messengers or meter readers, local businesses.**
- **Free up time for the general manager and/or an assistant general manager to participate in community activities. Visibility demonstrates interest.**
- **Form a member advisory committee composed of members from a cross-section of the membership and named by the board of directors. Feed them a meal when they meet. Such a committee can serve as a sounding board and listening post to learn what members are thinking. They also can become good, better-informed candidates for the board of directors.**
- **Consider ways to broaden participation in the election of directors, such as making it possible for members to vote even if they are unable to attend the annual meeting. If mail ballots are not practical in rural areas, consider polling places in villages in the service area or at banks where PBS bills are paid.**
- **Prior to the annual meeting (or mid-year between annual meetings), hold meetings out in the service area to provide opportunity for members to be in contact with someone other than a bill collector.**
- **Project the PBSs as leaders in the communities served and catalysts for bringing resources to bear on matters of community interest and need (housing, health care, fire protection, ambulance service, waste disposal, etc.)**

USE OF RENEWABLE ENERGY TO SERVE THE VERY POOR IN REMOTE AREAS

1.0 OBJECTIVE:

To briefly consider the circumstances of very poor people, especially those who live in inaccessible areas which are not likely to be reached by the distribution grid, and examine the possibility and social merit of investigating the use of renewable energy to provide basic electric service to them.

2.0 FINDINGS:

We know from the preliminary findings of the socio-economic assessment that in electrified villages,even the non-electrified households enjoy the benefits of increased economic activity in the village. However, how could REB, PBSs and the donors address the needs of the landless rural poor who live in unelectrified, isolated settlements, ("paras") located at such distance from the grid that no utility engineer will extend the line ? In view of present technologies, we are not looking for the solution to productive uses, but light to extend the useful day, particularly for women and young children. The men walk into the lighted strip of bazar stalls in the early evening, while wives stay in the paras, where the only light is a kerosene or oil lamp. Darkness blindfolds these women and children. Daylight allows the delivery of education (the government goal is universal literacy), health, hygiene and family planning programs at the community center. A schoolteacher in a para near Chuadanga said that if there were enough light, she would continue the reading lessons past nightfall. Her students included two widows, aged 61 and 63, who were learning to read from Bangla primers with useful stories about washing hands and raising chickens. With their old eyes, they could not read by lamplight after dark. Let the electrified villages, with jobs and social programs, continue to be the only place for education and better health, and they will draw permanent settlement away from the isolated areas and toward the bazar lights.

One informant offered his rural electrification strategy : if you cannot bring the light to the people, tell the people to go to the light! But with an estimated 86,000 villages in 1995 (an increase from the 68,000 counted in 1991) each of which is comprised of some number of paras, rural-rural in-migration to electrified villages is potentially a worst case scenario that would cause cultural/familial dislocations and shortages of shelter and services in newly congested rural-commercial magnets. Large numbers of people in Bangladesh can hike all of their belongings from the para to the nearest electrified village. The spread effects of a mass movement of dislocated people is a potential socio-economic cost of not electrifying the remote paras. Meanwhile, we know the grid will not extend that far for decades and even if it did, there is no power supply to feed it at peak hours when they need it.

The National Energy Policy supports renewable energy in remote and isolated areas which are not likely to be brought under the network in the foreseeable future, in spite of high capital costs. The momentum for solar solutions has been building with successes in other countries. REB, with technical assistance from the Bangladesh Center for Advanced Studies, will soon pilot-test a donor-supported solar program. Narsingdi PBS-1 will be trained to operate and manage the solar program and collect fees. (The details of collection are still being determined.) The BCAS will assess the technical feasibility of installing, running and maintaining solar modules to determine economic viability, social acceptability and the user's ability to pay. The solar equipment may be installed in the next few months.

The project area is an island bounded by the Meghna River chosen for the pilot because it is near Dhaka, but has much the same conditions as coastal and rural areas throughout the country that may never be served by the grid. The twenty villages comprise 8600 households, of which 1370 will be offered lanterns of varying capacity and cost. The smallest is 3,238 taka (US$81) the largest is 42,878 taka (US$1,072) including installation. Had the procurement included local suppliers, the costs would have been 30,000 taka (US$750 - retail, including installation and two years maintenance) for a minimum package of 42W panel, 3x8W tube lights (equal to 30W incandescent bulbs) and a black and white solar-powered television. This kit runs four hours at full load, sufficient for an evening's use.

How feasible is solar? The assessment team thought large solar units are not yet cost effective for the larger issues of commercial and industrial productivity, and even for street lights (the solar unit costs $30,000/pole). However, the team also decided that if the objective is the social economy - education, health, family planning - and if light is a necessary component of these projects, then the installation of solar equipment to light a school or community center is likely to be technically and financially feasible. In rural Bangladesh, with 85 percent of the people presently off the grid in tens of thousands of villages and paras, the applications are significant.

REB would benefit the country to not sit back and let this pilot project fail, but assure that it is successful by identifying all technical needs, providing them, anticipating the next sites and train the next PBS site management team now. In order to provide consumer service for projects such as this, the PBSs must know the intended market, their capacity and willingness to pay for electric (or solar) lights vs kerosene, and what will motivate the potential consumer to switch from present equipment to electrified equipment.

2.0 ANALYSIS:

What are our objectives in supporting the Rural Electrification Program? First, the viability of the PBSs, which will depend on commercial and industrial users, whose needs are addressed in earlier parts of this assessment, and ultimately, the social goal to reach more consumers, including the poorest, with power.

How poor do you have to be to not afford electric power? Let's start with the ideal PBS domestic consumer-member, the billing supervisor in the PBS. As one earner of a two-income family, she described a budget that required 10,000 taka/month for a family of four, and paid 600 taka/month for electricity to run lights, ceiling fan, table fans, tv and fridge.

We constructed an income pyramid, with the poorest families at 1000-2000 taka/month at the bottom and not presently considered potential members. The PBS had just that week energized a commercial center in a small settlement, and estimated the local income per household for that para to be 2,000-3,000/ household, all farmers and small vendors. Within that level of the pyramid were the peons and sweepers in town at 2,500/month, and just above, the linemen and billing assistants at 4,500/month. The GM said most of the domestic customers in that para were probably at these lower levels, but probably none of their customers were at the poorest level, which they had no ability to reach.

The AGM Member Services estimated that, at the level of the landless rural poor, the average family of 4-5 spends at minimum 1,000 taka/month. Obviously most goes to food, health, and necessities, particularly rent, and 20-40 taka/month for lamp oil or kerosene. But even at this lowest income level, the PBS staff estimated that a man spends 2-4 taka/day on smokes (bidis), which is more than the basic minimum charge for electricity, (45 taka/month) once it is installed. The impediment to electrification among the lowest income group is the 1,000 taka installation charge and the cost of a light fixture and 15 taka/40 watt bulb. This anecdotal picture of the rural poor suggests that, if they were within reach of a line, and if the cost of hookup and deposit were free or overcome, the family theoretically could have the basic domestic electric account if the father of the house gave up smoking, which he probably won't. This crude analysis based on anecdotal data leads to a hypothesis: Does the low rate of rural hookups among the poor reflect not only the lack of taka, but the choices they have made on how to spend them?

3.0 CONCLUSIONS/RECOMMENDATIONS:

If unreliable electric power means that families (of all income levels) must use kerosene in addition to electricity during load-shedding, does the unreliability of electric power lead the poorest families to make a sensible economic choice to buy kerosene instead of electricity? If the strategy is to assist all families, even the poorest, to be reached with minimum power for light, the unrealiability of supply from the grid may make that objective particularly hard to reach. With real income and expenditure data in hand, one could monitor the effect of electrification by a house-by-house survey at the beginning of electrification, with the minimum two 50-watt bulb capacity, and the number of minimum billings. Then in five years, revisit the village to find if income, use of more lights and therefore the electric bill paid to the PBS have risen. It would be an easy questionnaire survey. An AGM suggested that absent inflation, one might expect the monthly bill of those accounts to double, to almost 100 taka/month. Unfortunately, since the domestic rate is heavily subsidized by the commercial and industrial users, the more power domestic households use, the worse the effect on the PBS books. Therein is a policy clash between our two objectives, unless we look ahead to renewable sources as well.

Recommendations:

REB can support the projects of the REB Renewable Energy Unit as part of a renewed commitment to consumer services.

Technical Assistance requirements:

Objective: To assist the REB and PBSs to assess technical feasibility of installing, running and maintaining solar modules in remote areas, to determine economic viability, cultural acceptability and capacity of potential users to pay, and to motivate willing users for most effective use.

Measures/Deliverables: a model format or protocol to be used to assess solar projects as they are proposed.

Technical Assistance: Short-term consultant (locally sourced, if qualified) to devise criteria for evaluation of solar projects on case-by-case basis.

Experience/Skills Mix: international expert in small scale, cost-effective use of solar technology in rural areas; independent of vendor of solar equipment.

Expected Results: a more proactive approach to innovative technology to solve larger social and economic needs, resulting optimally in a means to provide the basic benefits of electrification to inaccessible areas where extension of the grid may never be feasible.

Estimated manmonths: 1

DEVELOP A DISASTER RECOVERY CAPABILITY TO BE IMPLEMENTED BY THE PBSs

1.0 OBJECTIVE:

To develop a disaster recovery capability, specifically designed for electric utilities, to be implemented by the PBSs.

2.0 FINDINGS:

Five coastal PBSs suffered substantial losses in the cyclone of 1991. The GM of another PBS temporarily shut down as the result of flooding in 1988. After the water receded, they cleaned up, removed and replaced meters, and rebuilt facilities. The known uninsured costs for wages, construction materials, meters and meter sockets totaled 1,744,536 taka (about US$44,000). In addition to unplanned expenses, the PBS lost revenue during the two months that it took more than 60 percent of the members to restore their own facilities and come back on line. The last major account came back on line six months after the disaster after considerable difficulty. The GM estimates it took three years of normal operation to recover from the financial effects of the disaster. The social effects of the flood have not been forgotten, and the flood line is marked on posts at the PBS. Apparently donor funds to REB for disaster mitigation, such as remounting meters above the flood level, were not used.

3.0 ANALYSIS:

Ask many in REB and the PBSs about the capacity of the PBSs and their major members to respond and recover from natural disasters, and touch a nerve. Those who have seen the damage caused by tropical flooding know the challenge of organizing the cleanup, disposal of debris, public security, and the unexpected delays in getting new supplies and equipment, including immediate five-fold cost inflation. While floods and cyclones are not preventable, many immediate and lingering aspects of disaster are. Preparedness, including warning member-consumers and the public through organized interpersonal contact, is already well known in Bangladesh. Warning systems are not enough. Recovery and rebuilding during the immediate market dislocations after a disaster demands extraordinary, but teachable, organizational and project management skills. Effective mitigation measures, including simple changes in design, can be undertaken during the non-disaster season by the PBSs and their members. Absent a program to share specific disaster skills for electric utilities, recovery takes longer, is more costly than necessary, and jeopardizes the financial health of the PBS.

The government, REB and the PVOs are effective implementers of disaster preparedness, but the recovery challenges of specialized installations like electric utilities apparently have not been widely addressed.

4.0 CONCLUSIONS/ RECOMMENDATIONS:

As the major users of electric power demand increased reliability, the PBSs cannot afford preventable disruptions. The potential costs of interruptions will compound if REB continues to expand its physical system, and disaster mitigation should be wisely considered as part of the program. If the REB and PBSs choose to undertake a new initiative in member-consumer services, disaster recovery and mitigation will be a popular offering. As electrification becomes increasingly crucial to long-term economic development, REB could become an international model in utility disaster recovery and mitigation. The effectiveness of the proposed program will depend on transfer of skills to the most vulnerable PBSs, and from the PBSs to their members.

Recommendations:

REB should give high priority to professionalizing a disaster recovery capability to be implemented

Technical assistance requiremnts:

Objective: to transfer known skills in post-flood and cyclone utility recovery and mitigate future effects to REB, PBSs and major PBS members.

Measures/Deliverables: a short training program in Dhaka for REB and PBS managers, and on-site consultations at the most disaster-prone PBSs. An emergency checklist for referral.

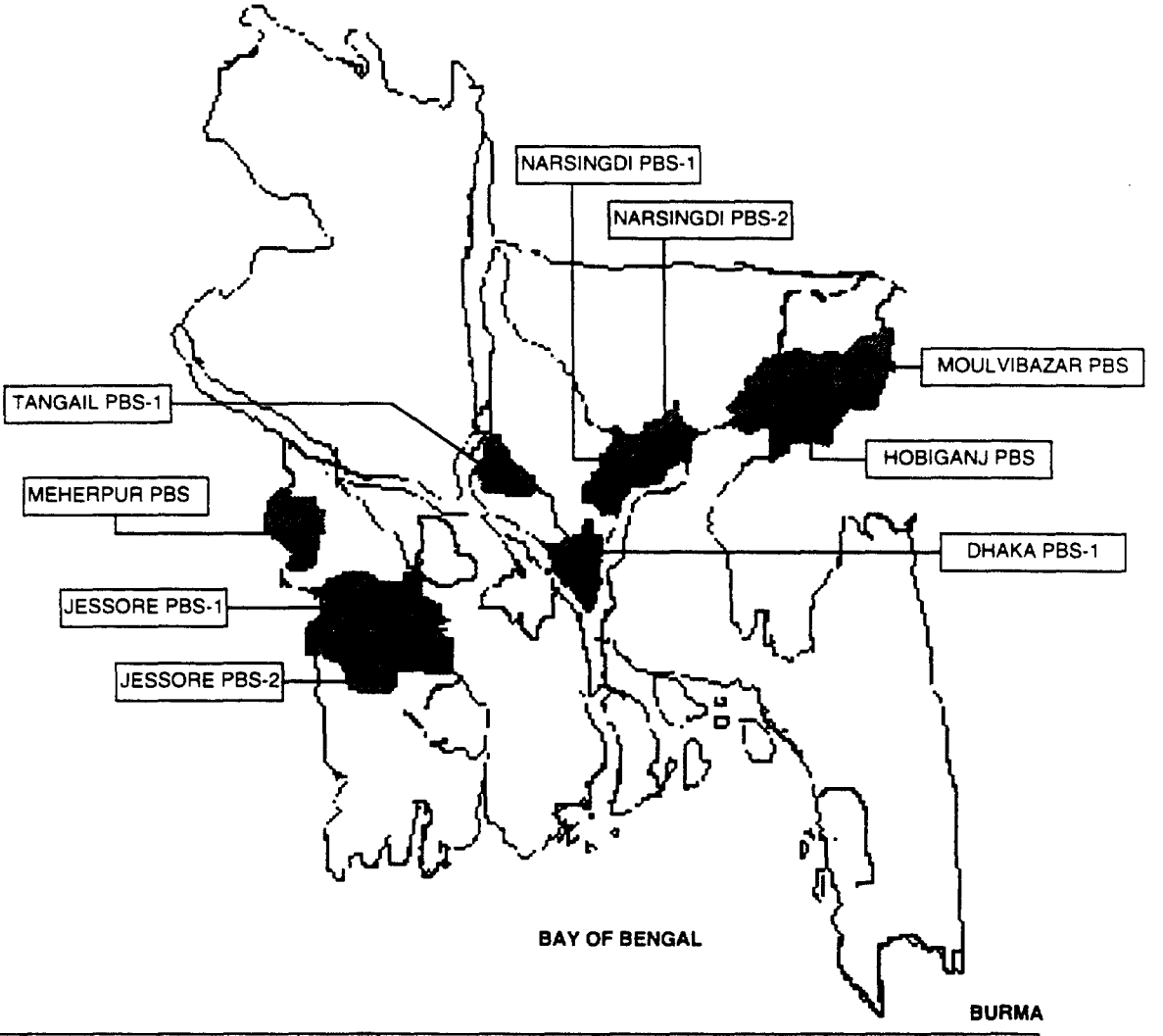
Technical Assistance: Bicentennial Volunteers International, an association of Tennessee Valley Authority (TVA) electrical engineers, for many years has provided the major technical assistance to electric co-ops through the U.S. Federal Emergency Management Agency. If tasked, BVI could provide in Bangladesh a program to develop pre-disaster planning for electric utilities, and in the case of an actual disaster, help REB and the PBSs identify damage, assess costs, organize the rebuilding program, and design mitigation.

Expected Results: an enhanced capacity to recover from natural disasters without unnecessary interruption of service to members.

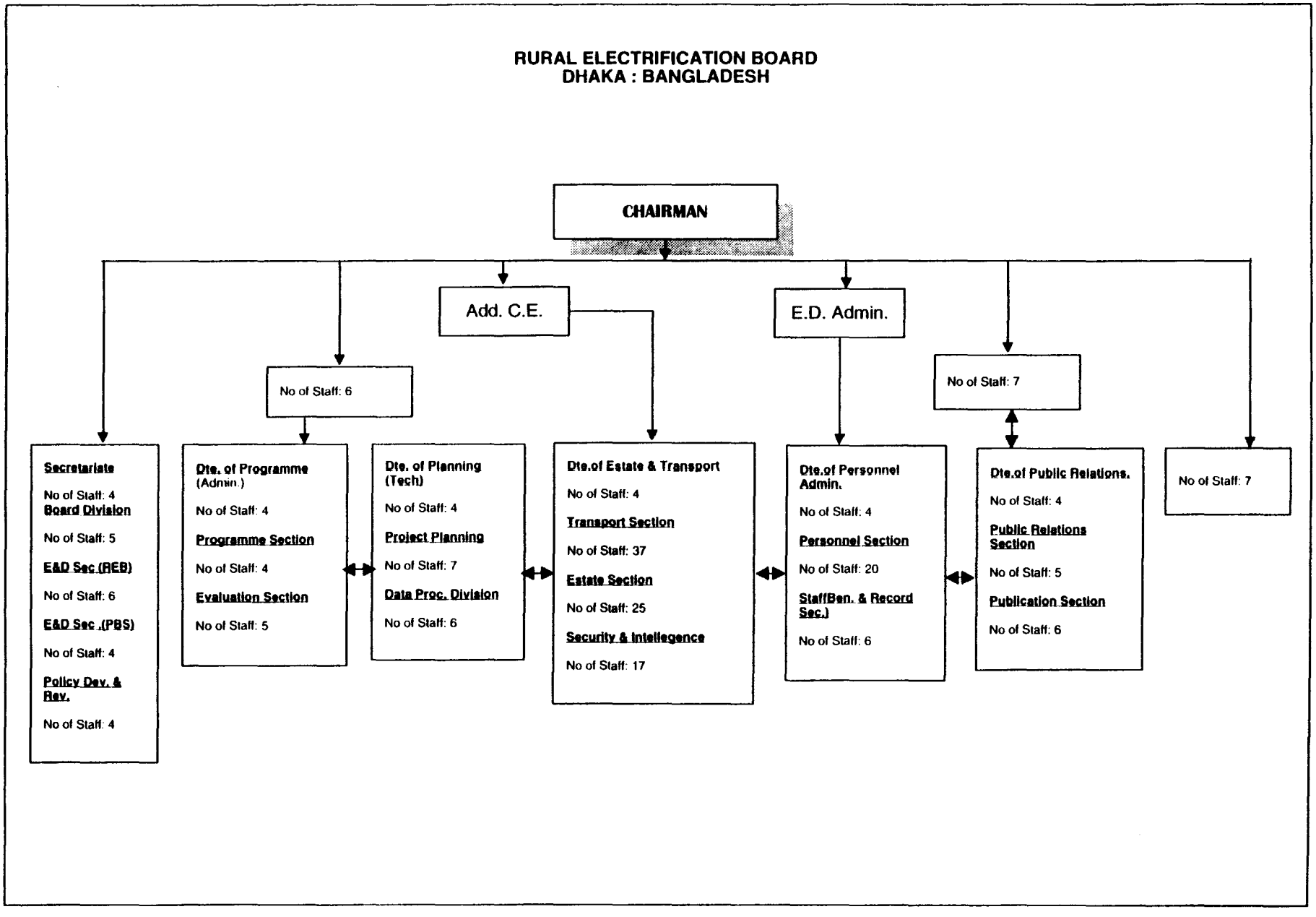
Estimated manmonths: 3 Pre-disaster program in Bangladesh - three engineers for one month, including orientation. On-site recovery assistance as needed.

Annex 1: Map of Bangladesh : PBSs Visited

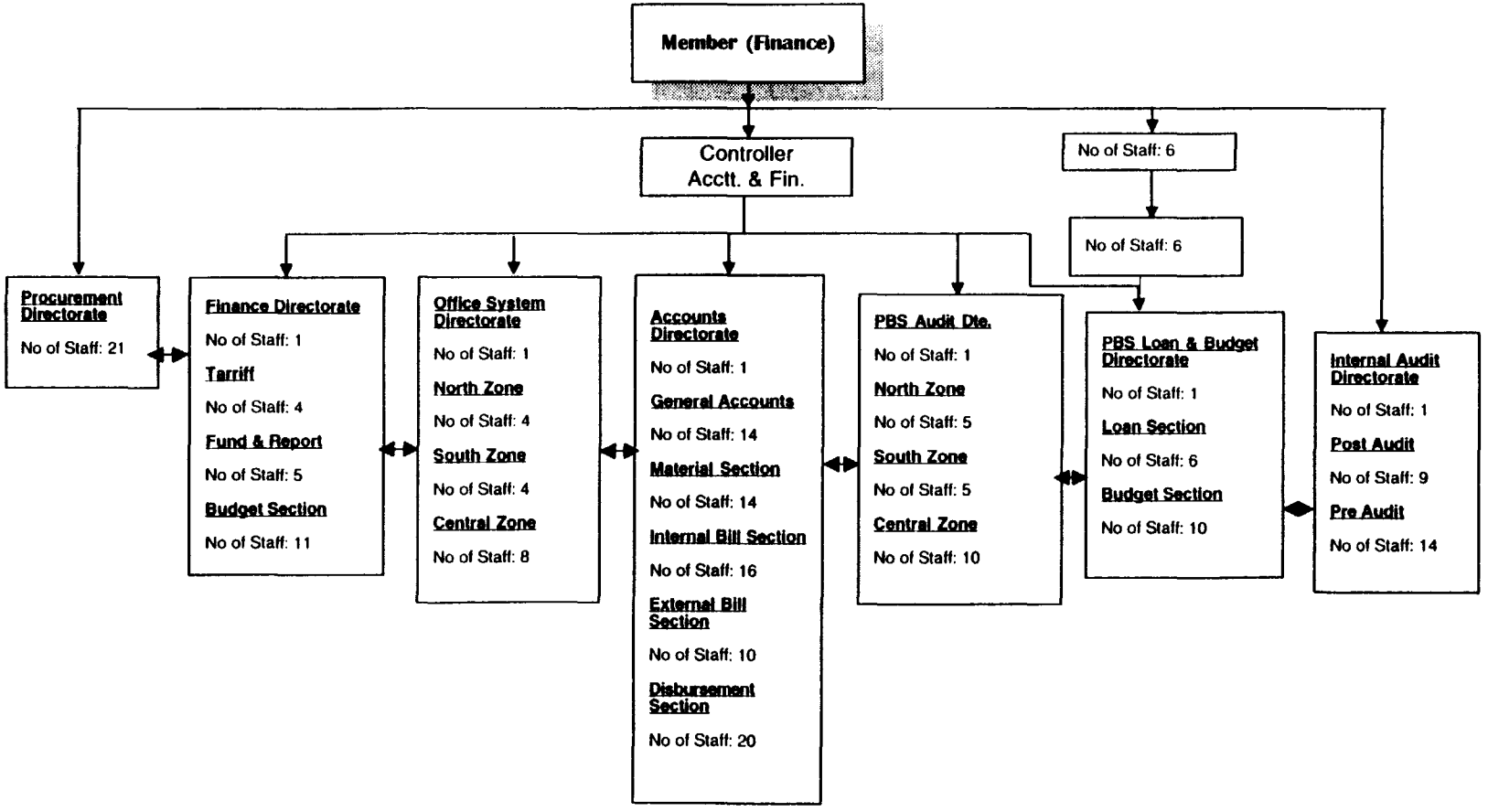
LIST OF PBSs VISITED BY THE MEMBERS OF MANAGEMENT ASSESSMENT TEAM OF USAID

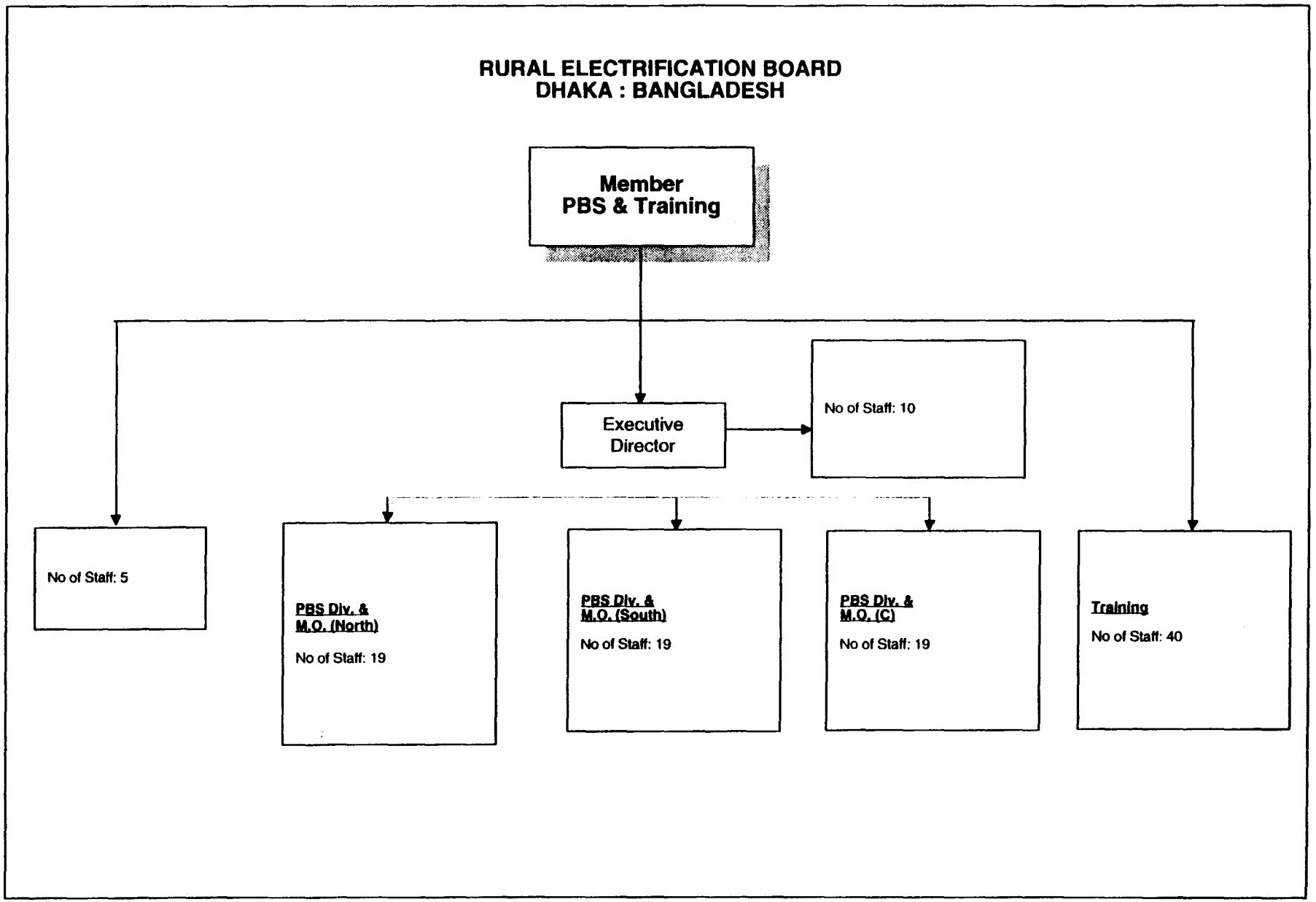


SR#	PBS	SR#	PBS	SR#	PBS
1	Bagerhat PBS	19	**Jessore PBS-1**	37	Natore PBS-1
2	Barisal PBS-1	20	**Jessore PBS-2**	38	Natore PBS-2
3	Barisal PBS-2	21	Jhenaidah PBS	39	Nawabganj PBS
4	Bogra PBS	22	Joypurhat PBS	40	Netrokona PBS
5	Brahmmanbaria PBS	23	Kishorganj PBS	41	Nilphamari PBS
6	Chandpur PBS	24	Kurigram-Lalmonirhat PBS	42	Noakhali PBS
7	Chittagong PBS-1	25	Kushtia PBS	43	Pabna PBS-1
8	Chittagong PBS-2	26	Laxmipur PBS	44	Pabna PBS-2
9	Comilla PBS-1	27	Madaripur PBS	45	Patuakhali PBS
10	Comilla PBS-2	28	Magura PBS	46	Pirojpur PBS
11	Cox's Bazar PBS	29	Manikganj PBS	47	Rajshahi PBS
12	**Dhaka PBS-1**	30	**Meherpur PBS**	48	Rangpur PBS-1
13	Dinajpur PBS-1	31	**Moulvibazar PBS**	49	Rangpur PBS-2
14	Dinajpur PBS-2	32	Mymensingh PBS-1	50	Satkhira PBS
15	Faridpur PBS-1	33	Mymensingh PBS-2	51	Sirajgonj PBS
16	Feni PBS	34	Naogaon PBS	52	Sylhet PBS
17	**Hobiganj PBS**	35	**Narsingdi PBS-1**	53	**Tangail PBS-1**
18	Jamalpur PBS-1	36	**Narsingdi PBS-2**	54	Thakurgaon PBS
				55	Not Assigned

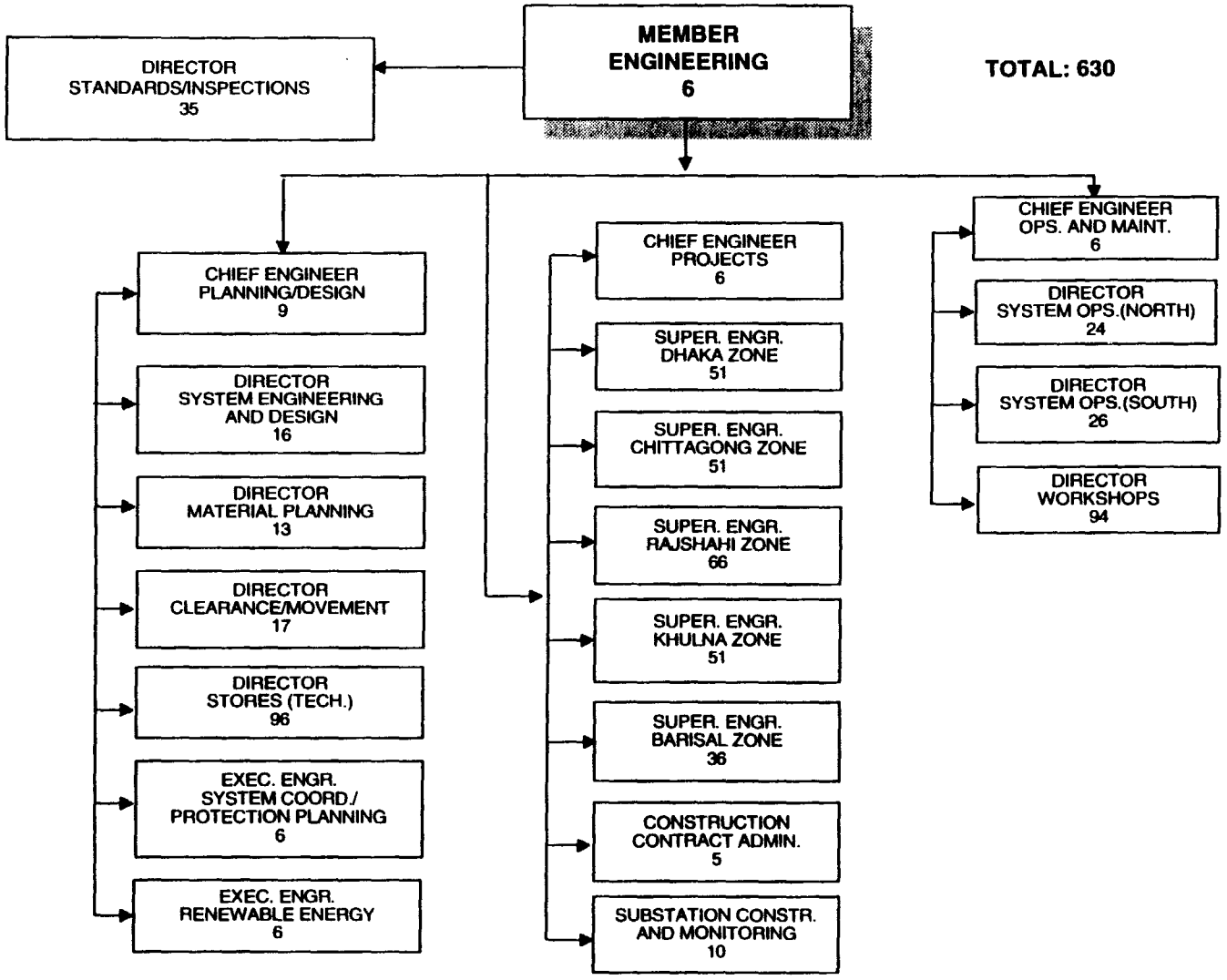

RURAL ELECTRIFICATION BOARD
DHAKA : BANGLADESH
CHAIRMAN
Add. C.E.
E.D. Admin.
No of Staff: 6
No of Staff: 7
Secretariate
No of Staff: 4
Board Division
No of Staff: 5
E&D Sec (REB)
No of Staff: 6
E&D Sec .(PBS)
No of Staff: 4
Policy Dev. & Rev.
No of Staff: 4
Dte. of Programme (Admin.)
No of Staff: 4
Programme Section
No of Staff: 4
Evaluation Section
No of Staff: 5
Dte. of Planning (Tech)
No of Staff: 4
Project Planning
No of Staff: 7
Data Proc. Division
No of Staff: 6
Dte.of Estate & Transport
No of Staff: 4
Transport Section
No of Staff: 37
Estate Section
No of Staff: 25
Security & Intellegence
No of Staff: 17
Dte.of Personnel Admin.
No of Staff: 4
Personnel Section
No of Staff: 20
Staff(Ben. & Record Sec.)
No of Staff: 6
Dte.of Public Relations.
No of Staff: 4
Public Relations Section
No of Staff: 5
Publication Section
No of Staff: 6
No of Staff: 7

RURAL ELECTRIFICATION BOARD
DHAKA : BANGLADESH




RURAL ELECTRIFICATION BOARD
DHAKA : BANGLADESH
Member
PBS & Training
Executive
Director
No of Staff: 10
No of Staff: 5
PBS Div. &
M.O. (North)
No of Staff: 19
PBS Div. &
M.O. (South)
No of Staff: 19
PBS Div. &
M.O. (C)
No of Staff: 19
Training
No of Staff: 40

RURAL ELECTRIFICATION BOARD
DHAKA : BANGLADESH



RURAL ELECTRIFICATION BOARD

NUMBER OF EMPLOYEES

SL.	Directorate/Offices	Number of Employees			Remarks
		1985-90	1991-95	Proposed to add after 1995	
1	2	3	4	5	6
01.	**Chairman's Office**	7	7	--	
02.	Executive Director (Admin)	--	--	7	
03.	Additional Chief Engineer	--	--	6	
04.	Secretariat	17	17	7	
05.	Director, Personnel Administration	35	35	7	
06.	Director, Estate & Transport	44	44	40	
07.	Director, Public Relations	7	7	8	
08.	Director, Programme	13	13	2	
09.	Director, Planning	6	6	11	
	Sub-Total :	129	129	88	
10.	**Member PBS & Training**	6	6	--	
11.	Executive Director	5	5	6	
12.	Director, PBS Development & Operation (North)	18	18	1	
13.	Director, PBS Development & Operation (South)	18	18	1	
14.	Director, PBS Development & Operation (West)	--	--	19	
15.	Director, Training	29	29	16	
	Sub-Total :	76	76	43	
16.	**Member Finance**	6	6	--	
17.	Controller (Accounts & Finance)	5	5	2	
18.	Director, Finance	24	24	(-4)	
19.	Director of Accounts	59	59	16	
20.	Director of Office System	--	--	19	
21.	Director of PBS Audit	20	20	1	
22.	Director of Loans & Budgets	--	--	17	
23.	Director, Internal Audit	12	12	12	
24.	Director, Procurement	17	17	5	
	Sub-Total :	**143**	**143**	**68**	

1	2	3	4	5	6
25.	**Member Engineering**	6	6	--	
26.	Chief Engineer (Projects)	6	6	--	
27.	Chief Engineer (Operation & Maint).	--	--	7	
28.	Chief Engineer (Planning & Design)	6	6	4	
29.	Superintending Engineer (Projects) & (6) & Project Divisions	218	218	57	
30.	Director Standard & Inspection	15	15	21	
31.	Director, SE & D	15	15	2	
32.	Director, Material Planning Specification	13	13	1	
33.	Director, Clearance Storage & Movement	16	16	4	
34.	Director, Stores	68	68	34	
35.	Director, System Operation (North)	21	21	6	
36.	Director, System Operation (South)	--	--	27	
37.	Director, Workshop	26	26	74	
38.	Executive Engineer (System Coordinator & Protection Planning)	--	--	6	
39.	Executive Engineer (Renewable Energy)	--	--	6	
40.	Executive Engineer (Construction Contract Admn.)	--	--	5	
41.	Executive Engineer (Sub-station Construction Cell)	--	--	10	
	Sub-Total :	410	410	265	

* In addition, there are some 350 "project employees" funded outside the government manpower budget.

TRAINING REPORT FOR THE JULY'95 TO SEPTEMBER'95
FY-1995 to 1996

Annex 4: REB Quarterly Training Summary.

Sl No	COURSE CODE	COURSE NAME	TRAINEE CODE	TRAINEE DESIGNATION	TRAINING DURATION From	To	PROGRAM VENUE	NUMBER OF TRAINEES REB	PBS	Other	Fee	Total	HOURS Trg Dir	Other	Total	TRAINEE DAYS
1	TW110	Advanced consumer Wiring	P15	PBS Wiring Inspector	15/07/95	25/07/95	Central	0	12	0	0	12	50	16	66	113
2	TW015	Basic consumer wiring	P15	PBS Wiring Inspector	21/06/95	13/07/95	Central	0	17	0	0	17	115	23	138	235
3	TW015F	Basic consumer wiring(field)	P15	PBS Wiring Inspector	01/07/95	01/07/95	Rangpur PBS-1	0	6	0	0	6	7	0	7	6
4	IM100	Basic supervision	P23	PBS Storekeeper	08/07/95	13/07/95	Central	0	16	0	0	16	27	12	39	89
5	IM100	Basic supervision	P10	PBS Billing Supervisor	15/07/95	20/07/95	Rangpur PBS-1	0	14	0	2	14	27	12	39	78
6	TE200	Distribution Line Staking	P05	AGM(CON)	18/07/95	23/07/95	Central	0	12	0	0	12	8	24	30	51
7	IF516	Electricity Sales & Customer Accounting	P11	Billing Assistant	22/07/95	25/07/95	Feni PBS	0	17	0	17	17	19	17	36	87
8	TL010	Lineman Part-I	P07	PBS Lineman	17/06/95	16/07/95	Savar	0	18	0	0	18	139	41	180	463
9	TL010	Lineman Part-I	P07	PBS Lineman	27/05/95	01/07/95	Rangpur PBS-1	0	22	0	0	22	12	168	180	566
10	TL035	Lineman Part-III (Field)	P07	PBS Lineman	03/07/95	04/07/95	DinajpurPBS-1	0	4	0	0	4	7	7	14	8
11	TL035	Lineman Part-III (Field)	P07	PBS Lineman	08/07/95	09/07/95	Barisal PBS-2	0	3	0	0	3	7	7	14	6
12	TL035	Lineman Part-III (Field)	P07	PBS Lineman	11/07/95	12/07/95	Jessore PBS-2	0	4	0	0	4	7	7	14	8
13	TL035	Lineman Part-III (Field)	P07	PBS Lineman	22/07/95	23/07/95	Cox.Bazar PBS	0	5	0	0	5	7	7	14	10
14	TE010	PBS System Design	P05	AGM(CON)	04/07/95	17/07/95	Central	0	12	0	0	12	3	60	63	108
15	IO100	REB/PBS General Orientation (Officer)	P04	AGM(GS)	29/07/95	31/07/95	Central	0	15	0	0	15	13	8	21	45
16	IO100	REB/PBS General Orientation (Staff)	P10,P11	Billing Sup.,Billing Asst	09/07/95	11/07/95	Rangpur PBS-1	0	15	0	7	15	18	3	21	45
17	IO100	REB/PBS General Orientation (Staff)	P10,P11	Billing Sup.,Billing Asst	11/07/95	12/07/95	Rangpur PBS-1	0	19	0	12	19	18	3	21	57
18	IO100	REB/PBS General Orientation (Staff)	P10,R18	PBS Billing Sup.,REB Ast.	22/07/95	25/07/95	Central	4	9	0	2	13	14	7	21	39
19	IM100	Basic supervision	R12,R17,R23	Sub-Asstt. Engineer,Accou	19/06/95	23/08/95	Central	14	0	0	2	14	24	12	36	72
20	TE200	Distribution Line Staking	O02	Consultant Inspector	28/08/95	31/08/95	Central	0	0	26	0	26	7	23	30	111
21	TC017	Distribution Line Cons.& Inspection	O02	Consultant Inspector	06/08/95	26/08/95	Central	0	0	25	0	25	75	33	108	388
22	TC015	Distribution Line Cons.& Inspection	P05	AGM(CON)	23/07/95	09/08/95	Central	0	0	12	0	12	95	13	108	185
23	IF518	Electricity Sales & Customer Accounting	P11	Billing Asstt.	12/08/95	15/08/95	Bogra PBS	0	24	0	24	24	20	16	36	123
24	TL050	Hot stick Lineman Part I	P07	Lineman	18/06/95	09/08/95	Savar	0	8	0	0	8	280	0	280	320
25	TO010	Introduction to PBS distribution Syste	P13	AGM(GS)	09/06/95	15/08/95	Central	0	14	0	0	14	13	6	19	38
26	TL030	Lineman Part-III	P07	Lineman	29/07/95	20/08/95	Central	0	23	0	0	23	79	47	126	414
27	TL040	Lineman Part-IV	P07	Lineman	26/06/95	31/08/95	Central	0	16	0	0	16	1	41	42	96
28	TL010	Lineman Part-I	P07	Lineman	19/07/95	20/08/95	Savar	0	15	0	0	15	137	43	180	388
29	IM105	Management- its nature & scope	P04	AGM(GS)	05/08/95	08/08/95	Central	0	15	0	0	15	23	8	31	66
30	IO150	REB/PBS General Orientation (Officer)	P04	AGM(GS)	29/07/95	03/08/95	Central	0	15	0	0	15	19	23	42	90
31	IO150	REB/PBS General Orientation (Officer)	P05	AGM(CON)	09/08/95	16/08/95	Central	0	13	0	0	13	19	23	42	78
32	TW015	Basic consumer wiring	P15	AGM(MS)	12/09/95	30/09/95	Central	0	13	0	0	13	69	33	102	189
33	TW110	Advanced consumer Wiring	O07	Village Electrician	20/09/95	21/09/95	Kusatia PBS	0	0	24	0	24	14	0	14	48
34	TW110	Advanced consumer Wiring	O07	Village Electrician	24/09/95	25/09/95	Chittagong-1	0	0	24	0	24	14	0	14	48
35	TW015	Basic consumer wiring	O07	Village Electrician	27/09/95	28/09/95	Comilla-2	0	0	24	0	24	3	0	3	10
36	TW015	Basic consumer wiring	O07	Village Electrician	23/09/95	24/09/95	Satkhira PBS	0	0	24	0	24	3	0	3	10
37	TW015	Basic consumer wiring	O07	Village Electrician	23/09/95	24/09/95	Meherpur PBS	0	0	24	0	24	3	0	3	10
38	TW015	Basic consumer wiring	O07	Village Electrician	27/09/95	27/09/95	Cox's Bazar	0	0	24	0	24	3	0	3	10
39	IR—	Departmental Exam REB staff	P15	REB Line Inspector	23/09/95	30/09/95	Central	30	0	0	0	30	23	13	36	154
40	TL010	Lineman Part-I	P07	Lineman	21/08/95	19/09/95	Savar	0	18	0	0	18	141	39	180	463
41	TL010	Lineman Part-I	P07	Lineman	19/06/95	24/09/95	Satkhira PBS	0	24	0	0	24	12	168	180	617
42	TL010	Lineman Part-I	P07	Lineman	02/09/95	30/09/95	Barisal-1	0	24	0	0	24	12	168	180	617
43	TL010	Lineman Part-I	P07	Lineman	25/07/95	05/09/95	Sylhet	0	24	0	0	24	12	168	180	617
44	TL010	Lineman Part-I	P07	Lineman	28/08/95	25/09/95	Joypurhat	0	24	0	0	24	12	168	180	617
45	IO150	REB/PBS General Orientation (Officer)	P13,P19	AGM(MS),AGM,ENG.)	05/09/95	11/09/95	Central	0	17	0	0	17	18	24	42	102
46	IO100	REB/PBS General Orientation (Staff)	P06,P10,P11,P15,etc.	JE,BS,Bill Ast.,WI,etc.	18/09/95	18/09/95	Sylhet PBS	0	35	0	14	35	13	8	21	105
47	TC100	Sub-station construction	O02	Consultant Inspector	02/09/95	06/09/95	Central	0	0	25	0	25	6	27	33	118
48	TL040	Transformer Maintenance & Repair(Pt.48)	P07	Line Technician	02/09/95	07/09/95	Central	0	16	0	0	16	7	35	42	96
49	TL044	Voltage Regulator MaintenanceRepair(Pt.	P07	Line Technician	09/09/95	14/09/95	Central	0	16	0	0	16	3	33	36	82
50	IF570	Work Order Procedure	R16	AD(Fin)	04/09/95	07/09/95	Central	9	0	0	0	9	6	19	25	32
							TOTAL	57	574	232	80	863	1862	1813	3275	8428

Annex 5: Summary of Discussion and Plans for Additional Autonomy at Local PBS.

9 December 1993

TO: Brigadier Mohammad Enamul Huq, Chairman
Syed Tanveer Hussain, Member Finance
M.A. Wadud, Member PBS Development and Training
M.A. Samad, Member Engineering
Kamruzzaman Khan, Executive Director
Md. Mazaffer Hossain, Controller
Charles L. Overman, NRECA Team Leader

FR: Robert Schiller

SUBJECT: Summary of Discussion and Plans for Implementing Additional Autonomy at Local PBSs

The Chairman of REB, three permanent Members, Controller, Executive Director, NRECA Team Leader and Management Advisor met on 5 December 1993 to discuss the transfer of additional autonomy to the local PBSs. The following is a summary of the discussion and suggested plans for implementing greater autonomy to the PBSs.

Definition of Autonomy - Autonomy is the independence of the Rural Electric program in the energy sector of Bangladesh with REB and PBSs having distinct responsibilities in order to achieve the program objectives. The Rural Electrification Board (REB) is responsible for the "RE Program" and the Palli Bidyut Samities (PBSs) are responsible for specific independent operating organizations formed under The Rural Electrification Board Ordinance, 1977 and registered with the Board. REB is responsible for the strategic direction of the program and the PBSs are responsible for operational function of the distribution system.

REB - PBS Responsibilities

The following identify the functional division of authority and responsibilities for the Rural Electrification Board and the Palli Bidyut Samities (PBSs).

1. REB - Provides financing for construction and intensification of PBSs and, if needed, short term operational loans.

   PBS - Responsible to make scheduled interest and principle payments to REB based on loans used for initial and subsequent construction and intensification, as well as any short term operational loans.

2. REB - Establishes engineering designs and standards for the construction and operation of all distribution, transmission and substations utility plant in order to ensure highest quality and long term dependability.

   PBS - Responsible to comply with all engineering designs and standards. Any deviation must have prior approval of REB.

3. REB - Approves all material specifications in order to secure the highest quality material for the program.

   PBS - Must use only approved REB material.

4. REB - Purchases all utility material and tools for construction, maintenance and operations according to REB specifications, compliance with donor requirements, assures the highest quality of material, best price and delivery schedule.

   PBS - Determines and request purchase of material and tools needed for construction, operations and maintenance of established PBS using internal funds or aid to construction funds.

5. REB - Develop Uniform Accounting Procedures for the PBSs.

   PBS - Must comply with the Uniform Accounting Procedures.

6. REB - Develops in concert with the PBSs annual performance targets for the PBSs.

   PBS - System performance is judged on accomplishing annual performance targets.

7. REB - Provides for delivery, continuity of electric service and favorable wholesale power cost to the PBS's at their point of delivery.

   PBS - Is required to purchase all wholesale power based on arrangements negotiated by REB.

8. REB - Maintains official relations with Government of Bangladesh and donors on behalf of the Rural Electric Program.

   PBS - As in the best interest of the PBS to support the efforts of REB with Government Officials and donors.

9. REB - Develops in coordination with local PBSs tariffs that will allow them to accomplish their financial, social and contractual agreements.

   PBS - Implement the tariffs as designed.

10. REB - Provides training for employees, directors, and support for internal training for the PBS.

    PBS - Ensure that employees and directors participate in the training programs and make recommendations concerning additional training that is required by the PBS.

11. REB - Assist the PBS in planning and conducting the Annual Meeting of the Membership and Organization Meeting in compliance with Bye-Laws.

    PBS - Plans and conducts Annual Meeting of the Membership and Organization Meeting in compliance with Bye-Laws.

12. REB - Selects the General Manager of each PBS. REB can transfer or remove any General Manager or Departmental Manager without the concurrence of the PBS Board. Departmental Managers of the PBS are appointed by the General Manager with the approval of the PBS Board and REB.

    PBS - General Manager reports directly to Board of Directors with frequent communications with REB concerning the operations of the PBS. The General Manager is the Chief Executive of the PBS.

13. REB - Establishes standards for the financial audits performed by auditing firm. REB has final approval in hiring a Financial Auditing Firm by the PBS.

    PBS - Has the responsibility to appoint a Financial Auditing Firm.

14. REB - Has final approval in hiring a Retaining Engineering Firm.

    PBS - Has the responsibility to appoint a Retaining Engineering Firm on a permanent or modified retainer schedule depending on need and experience of PBS staff engineer.

15. REB - Approves the System Long Range Plan.

    PBS - Has the responsibility to submit to REB after recommendation of the Retaining Engineering Firm and acceptance of the Board of Directors a System Long Range Plan.

16. REB - Approves the Financial Forecast.

    PBS - Has the responsibility to submit a Financial Forecast to REB after approval of the Board of Directors.

17. REB - Approves Annual Allocation Work Plan (REB Form 500) to include; new line, tie lines, conversion and line changes, new substations, switching stations, metering points, transformers, meters, capacitors, regulators, sectionalizing equipment, service wire to increase capacity, security lights, transmission line, headquarter facilities. Funding of the Work Plan may come from PBS's internally generated funds or REB.

    PBS - Has the responsibility to submit to REB after recommendation of the Retaining Engineering Firm and acceptance of the Board of Directors an Annual Allocation Work Plan.

18. REB - Approves the Power Requirement Study.

    PBS - Has the responsibility to submit to REB after recommendation of Retaining Engineering Firm and acceptance of the Board of Directors a Power Requirement Study.

19. REB - Approves all new facilities or buildings prior to construction.

    PBS - Has the responsibility to submit to REB after acceptance of the Board of Directors all designs, cost estimates and reason for the new facility.

20. REB - Performs on a scheduled basis management, operational & maintenance, and financial audits of the PBSs to ensure compliance with operating instructions.

    PBS - Is responsible to ensure all instructions are in compliance with REB.

21. REB - Has the responsibility to define service territory to the PBS.

    PBS - Is responsible to provide service in all area assigned within REB financial feasibility standards.

Process of Transferring Greater Autonomy to PBSs

1. Acceptance or modification of Autonomy Definition.

2. Acceptance or modification of REB - PBS Responsibilities.

3. Develop a one year "pilot" project consisting of two PBSs in transferring of additional autonomy. Required action:

    a. Explain the intent of the "pilot" project to REB and PBS personnel.

b. Select two "pilot" PBSs - Suggest Mymensingh (KFAED) and Comilla-1 (U.S. Aid)

c. Conduct initial meetings with General Manager, Staff and employees of the PBS to discuss the project. Conduct meetings with the Board of Directors and General Manager concerning the long term strategic importance of the project.

c. Perform Organization Review of selected PBSs. Review findings with REB and PBSs. Implement approved recommendations during autonomy project.

d. Submit for REB approval suggested changes to the PBS Bye-Laws and REB instructions in order to implement specific areas of additional autonomy.

Suggested plans to implement specific areas of additional autonomy are; additional items will be defined as the Organization Review is discussed and suggested changes in the Bye-Laws are approved by REB.

1. The PBS will be responsible to prepare a comprehensive annual Work Plan and Budget by functional area (power cost, operations, maintenance, consumer accounting, consumer services expense, etc.) using general ledger account numbers as prescribed in the Uniform System of Accounts. The PBS will summarize the general ledger account budget into line items as established on the REB Form 550, Statement of Operations.

The work plan and budget should be developed by the General Manager and his staff, presented to the Board of Directors for approval, modification or changes. Once the work plan and budget has been approved by the Board of Directors the General Manager should accomplish the work plan within the budget constraints.

If the cost of accomplishing any activity is above the budget amount or an additional item is needed during the budget period the Board of Directors must take separate action and record their actions within the minutes of a regularly held board meeting.

Monthly reports concerning the work plan accomplishments and actual compared to budget will be presented the Board of Directors. REB should get a copy of the Operations Budget, however, authority for approval of the operating budget should remain with the local Board of Directors.

Rural Electrification Board
COMPARATIVE BALANCE SHEET
(In Thousands)

	Amount in Taka				Amount in US Dollars			
June 30	1992	1993	1994	1995	1992	1993	1994	1995
ASSETS								
Plant, Proper								
Net General Plant	118,829	129,558	130,141	127,759	2,971	3,239	3,254	3,194
Construction Work in Progress – REB	2,873	15,772	61,717	93,482	72	394	1,543	2,337
Construction Work in Progress – PBS	146,303	253,707	133,817	640,503	3,658	6,343	3,345	16,013
Subtotal	268,005	399,037	325,675	861,745	6,700	9,976	8,142	21,544
Long Term Loans (PBS)								
Long Term Loans – Operating Fund	114,653	121,053	129,053	144,973	2,866	3,026	3,226	3,624
Long Term Loans – Construction Fund	35,525	50,475	65,488	77,261	888	1,262	1,637	1,932
Long Term Loans – Other Loans in Kind	8,718,251	9,256,992	11,210,135	13,188,892	217,956	231,425	280,253	329,722
Long Term Loans – Capitalized Interest	116,116	131,212	131,212	131,212	2,903	3,280	3,280	3,280
Subtotal	8,984,545	9,559,732	11,535,888	13,542,338	224,614	238,993	288,397	338,558
Other Property and Investment								
Guarantee Deposits	3,020	3,041	3,041	110,041	76	76	76	2,751
Special Fund	961,410	947,718	1,380,682	1,347,735	24,035	23,693	34,517	33,693
Subtotal	964,430	950,759	1,383,723	1,457,776	24,111	23,769	34,593	36,444
Current Assets								
Cash in Bank	157,030	778,027	376,363	2,826,368	3,926	19,451	9,409	70,659
Working Fund	3,534	3,694	3,828	3,938	88	92	96	98
Medium/Short term Loan to PBS	6,875	6,588	6,398	7,031	172	165	160	176
Advance to Employees	5,492	3,833	1,302	1,602	137	96	33	40
Plant Materials and Operating Supplies	1,500,249	2,083,464	2,692,239	3,150,820	37,506	52,087	67,306	78,771
Prepayment and other Receivables								
Prepayments & Other Receivables	208,729	399,917	254,147	243,671	5,218	9,998	6,354	6,092
Receivables from PBS	492,200	955,313	1,102,878	1,333,389	12,305	23,883	27,572	33,335
Subtotal	700,929	1,355,230	1,357,024	1,577,060	17,523	33,881	33,926	39,426
Misc. Current Assets	1,768	1,734	1,664	1,399	44	43	42	35
Total Current Assets	2,375,877	4,232,570	4,438,819	7,568,219	59,397	105,814	110,970	189,205
Deferred Debits								
Deferred Assets	34,391	627,945	980,254	413,055	860	15,699	24,506	10,326
Store-in-Transit	23,804	568,513	879,085	1,005,268	595	14,213	21,977	25,132
Loan to REB Employees	13,441	15,358	16,028	18,356	336	384	401	459
Subtotal	71,636	1,211,816	1,875,367	1,436,679	1,791	30,295	46,884	35,917
TOTAL ASSETS	**12,664,493**	**16,353,914**	**19,559,472**	**24,866,757**	**316,612**	**408,848**	**488,987**	**621,669**
LIABILITIES AND OTHER CREDITS								
Equities and Margins								
Government Capital Grant	3,704,325	4,563,925	6,198,372	9,196,647	92,608	114,098	154,959	229,916
Capital Gain								
Interest on bank deposit	202,880	278,185	398,865	493,850	5,072	6,955	9,972	12,346
Penal Interest (PBSs)	7,121	7,121	7,121	7,121	178	178	178	178
Others	184,295	205,981	242,219	353,785	4,607	5,150	6,055	8,845
Subtotal	394,296	491,287	648,205	854,756	9,857	12,282	16,205	21,369
Retained Earnings	170,896	428,540	598,902	813,750	4,272	10,713	14,973	20,344
Subtotal	4,269,516	5,483,751	7,445,480	10,865,153	106,738	137,094	186,137	271,629
Long Term Loan								
Government Loan	0		237,230	237,230	0	0	5,931	5,931
Foreign Loan	7,792,902	9,448,552	10,874,120	12,431,298	194,823	236,214	271,853	310,782
Other Long term Liability	116,279	116,279	0		2,907	2,907	0	0
Subtotal	7,909,181	9,564,831	11,111,351	12,668,528	197,730	239,121	277,784	316,713
Current Liabilities	69,287	251,107	372,941	446,700	1,732	6,278	9,324	11,168
Deferred Credits								
Deferred Liability								
Government Subsidy for PBSs		26,055	12,300		0	651	308	0
Fund receivable from PBS (DSL advance)	62,394	109,077	121,020	118,059	1,560	2,727	3,026	2,951
Others	115,097	644,558	165,892	359,872	2,877	16,114	4,147	8,997
Subtotal	177,491	779,690	299,212	477,931	4,437	19,492	7,480	11,948
Interest Between Disbursement of Credit	239,018	274,535	330,489	408,445	5,975	6,863	8,262	10,211
Subtotal	416,508	1,054,225	629,701	886,376	10,413	26,356	15,743	22,159
TOTAL LIABILITIES AND EQUITIES	**12,664,493**	**16,353,914**	**19,559,472**	**24,866,757**	**316,612**	**408,848**	**488,987**	**621,669**

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Rural Electrification Board

COMPARATIVE BALANCE SHEET

(In Thousands)

	Increase(Decrease)			% to Total			
June 30	1993	1994	1995	1992	1993	1994	1995
A S S E T S							
Plant, Proper							
Net General Plant	9.0%	0.5%	-1.8%	0.9%	0.8%	0.7%	0.5%
Construction Work in Progress - REB	449.1%	291.3%	51.5%	0.0%	0.1%	0.3%	0.4%
Construction Work in Progress - PBS	73.4%	-47.3%	378.6%	1.2%	1.6%	0.7%	2.6%
Subtotal	48.9%	-18.4%	164.6%	2.1%	2.4%	1.7%	3.5%
Long Term Loans (PBS)							
Long Term Loans - Operating Fund	5.6%	6.6%	12.3%	0.9%	0.7%	0.7%	0.6%
Long Term Loans - Construction Fund	42.1%	29.7%	18.0%	0.3%	0.3%	0.3%	0.3%
Long Term Loans - Other Loans in Kind	6.2%	21.1%	17.7%	68.8%	56.6%	57.3%	53.0%
Long Term Loans - Capitalized Interest	13.0%	0.0%	0.0%	0.9%	0.8%	0.7%	0.5%
Subtotal	6.4%	20.7%	17.4%	70.9%	58.5%	59.0%	54.5%
Other Property and Investment							
Guarantee Deposits	0.7%	0.0%	3519.2%	0.0%	0.0%	0.0%	0.4%
Special Fund	-1.4%	45.7%	-2.4%	7.6%	5.8%	7.1%	5.4%
Subtotal	-1.4%	45.5%	5.4%	7.6%	5.8%	7.1%	5.9%
Current Assets							
Cash in Bank	395.5%	-51.6%	651.0%	1.2%	4.8%	1.9%	11.4%
Working Fund	4.5%	3.6%	2.9%	0.0%	0.0%	0.0%	0.0%
Medium/Short term Loan to PBS	-4.2%	-2.9%	9.9%	0.1%	0.0%	0.0%	0.0%
Advance to Employees	-30.2%	-66.0%	23.0%	0.0%	0.0%	0.0%	0.0%
Plant Materials and Operating Supplies	38.9%	29.2%	17.0%	11.8%	12.7%	13.8%	12.7%
Prepayment and other Receivables							
Prepayments & Other Receivables	91.6%	-36.5%	-4.1%	1.6%	2.4%	1.3%	1.0%
Receivables from PBS	94.1%	15.4%	20.9%	3.9%	5.8%	5.6%	5.4%
Subtotal	93.3%	0.1%	16.2%	5.5%	8.3%	6.9%	6.3%
Misc. Current Assets	-1.9%	-4.1%	-15.9%	0.0%	0.0%	0.0%	0.0%
Total Current Assets	78.1%	4.9%	70.5%	18.8%	25.9%	22.7%	30.4%
Deferred Debits							
Deferred Assets	1725.9%	56.1%	-57.9%	0.3%	3.8%	5.0%	1.7%
Store-in-Transit	2288.3%	54.6%	14.4%	0.2%	3.5%	4.5%	4.0%
Loan to REB Employees	14.3%	4.4%	14.5%	0.1%	0.1%	0.1%	0.1%
Subtotal	1591.6%	54.8%	-23.4%	0.6%	7.4%	9.6%	5.8%
TOTAL ASSETS	29.1%	19.6%	27.1%	100.0%	100.0%	100.0%	100.0%
LIABILITIES AND OTHER CREDITS							
Equities and Margins							
Government Capital Grant	23.2%	35.8%	48.4%	29.2%	27.9%	31.7%	37.0%
Capital Gain							
Interest on bank deposit	37.1%	43.4%	23.8%	1.6%	1.7%	2.0%	2.0%
Penal Interest (PBSs)	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
Others	11.8%	17.6%	46.1%	1.5%	1.3%	1.2%	1.4%
Subtotal	24.6%	31.9%	31.9%	3.1%	3.0%	3.3%	3.4%
Retained Earnings	150.8%	39.8%	35.9%	1.3%	2.6%	3.1%	3.3%
Subtotal	28.4%	35.8%	45.9%	33.7%	33.5%	38.1%	43.7%
Long Term Loan							
Government Loan							
Foreign Loan	21.2%	15.1%	14.3%	61.5%	57.8%	55.6%	50.0%
Other Long term Liability	0.0%	-100.0%		0.9%	0.7%	0.0%	0.0%
Subtotal	20.9%	16.2%	14.0%	62.5%	58.5%	56.8%	50.9%
Current Liabilities	262.4%	48.5%	19.8%	0.5%	1.5%	1.9%	1.8%
Deferred Credits							
Deferred Liability							
Government Subsidy for PBSs		-52.8%	-100.0%	0.0%	0.2%	0.1%	0.0%
Fund receivable from PBS (DSL advance)	74.8%	10.9%	-2.4%	0.5%	0.7%	0.6%	0.5%
Others	460.0%	-74.3%	116.9%	0.9%	3.9%	0.8%	1.4%
Subtotal	339.3%	-61.6%	59.7%	1.4%	4.8%	1.5%	1.9%
Interest Between Disbursement of Credit	14.9%	20.4%	23.6%	1.9%	1.7%	1.7%	1.6%
Subtotal	153.1%	-40.3%	40.8%	3.3%	6.4%	3.2%	3.6%
TOTAL LIABILITIES AND EQUITIES	29.1%	19.6%	27.1%	100.0%	100.0%	100.0%	100.0%

COMPARATIVE LOAN BALANCE BETWEEN REB AND PBSs Books
As of June 30, 1995
(In Thousands)

	TAKA	US DOLLAR
Loan Balance per PBSs		
Long Term Debt		
LTD – Cash	240,577	6,014
LTD – Provisional Plant	1,032,570	25,814
LTD – Construction Close Out	7,016,835	175,421
LTD – Others	5,517,249	137,931
Subtotal	14,188,937	354,723
Matured Portion of LTD		
Matured Interest	59,540	1,489
Matured LTD	818,554	20,464
Subtotal	878,095	21,952
Total Loan Balance per PBss Books	**15,067,032**	**376,676**
Loan Balance per REB		
Long Term Loans (PBS)		
Long Term Loans – Operating Fund	144,973	3,624
Long Term Loans – Construction Fund	77,261	1,932
Long Term Loans – Other Loans in Kind	13,188,892	329,722
Long Term Loans – Capitalized Interest	131,212	3,280
Subtotal	13,542,338	338,558
Medium/Short term Loan to PBS (for housewiring materials, electric motors, etc.)	7,031	176
Other Receivables		
Receivables from PBS	1,333,389	33,335
Deferred Debits		
Receivables from PBSs for materials purchased by REB from its own sources	11,845	296
Deferred Liability		
Fund receivable from PBS (DSL advance)	(118,059)	(2,951)
Total Loan Balance per REB's Books	14,776,544	369,414
Difference	**290,488**	**7,262**

RURAL ELECTRIFICATION BOARD
DHAKA, BANGLADESH

INSTRUCTION TITLE: FINANCE & ACCOUNTS.
(Subject of REB Instructions Under 600 Series.

Instruction No.	Subject	Remarks
600-01	Uniform system of accounts accounting manual.	
600-02	Imprest Fund.	
600-03	signing and countersigning checks.	
600-04	Fidelity guarantee requirements for REB employees.	
600-05	REB annual budgets.	
600-06	Purchase orders.	
600-07	Vouchers approval of time of payment.	
600-08	Internal control for REB operations.	
600-09	Accounting procedures manual.	
600-10	Procurement manual.	
600-11	Establishment of operating fund for Palli Bidyut Samities working	
600-12	capital requirement.	
600-13	Cash disbursement fund.	
600-14	Wiring material credit sales to PBS procedures.	
600-15	Depreciation rates & procedures.	
600-16	Utility uniform system of accounts.	
600-17	release of contractor retention.	
600-18	Material accounting policies.	
600-19	Substation transformer insurance (PBS Instruction 300-48).	
600-20	Monitoring financial activities of the PBS (PBS Instruction 200-27).	
600-21	Guideline for establishing CPRs.	
600-22	Audit manual (PBS Instruction 200-25).	
600-23	Audit of REB borrower accounting records - A guide for external auditors.	
600-24	Determination of PBS Long Term Loan-Moratorium period (PBS	
600-25	Instruction 200-31).	
600-26	Monitoring foreign currency utilization.	
600-27	Audit procedures manual, Internal audit.	
600-28	Import procedures of materials and equipment necessary for	
600-29	operations and maintenance of PBS (PBS Instruction 100-46).	
600-30	Auditing of contractor's bill before 90% payment.	

Palli Bidyut Samities
STATEMENT OF REVENUE AND EXPENSES
For the Fiscal Year Ended June 30, 1995
(In thousands)

	PBS Name	Energization Date	Funding Agency	Gross Operating Revenue	Cost of Power	Operating Expenses	Operating Margin	Other Operating Expenses			Net Operating Margin	Non-Operating Revenue & Expenses			NET MARGIN
								Depreciation	Interest on LTD	Others		Interest Income	Govt Subsidy	Others	
1	Dhaka 1	80 Jun	USAID	364,269	221,049	20,537	122,683	14,633	9,915	374	97,761	37,632	0	644	136,037
2	Narsingdi 1	86 Oct	IDA	156,535	94,041	11,082	51,412	10,939	7,401	195	32,878	6,014	0	1,014	39,906
3	Comilla 1	81 Jan	USAID	141,422	81,637	17,835	41,950	13,889	9,619	246	18,195	6,942	0	405	25,543
4	Hobigonj	82 May	USAID	91,266	48,635	12,874	29,757	8,120	5,564	118	15,956	6,781	0	207	22,944
5	Moulvibazar	81 Jun	USAID	90,243	49,511	11,954	28,779	7,531	5,992	145	15,110	10,999	0	155	26,264
6	Tangail 1	81 Aug	USAID	124,534	74,533	14,726	35,275	12,076	9,398	292	13,508	4,807	0	420	18,736
7	Jessore 2	81 Feb	USAID	85,396	47,032	12,478	25,886	7,888	5,133	263	12,602	6,658	0	332	19,592
8	Serajgonj	81 Apr	USAID	95,274	57,105	12,041	26,127	7,874	5,777	239	12,236	4,263	0	434	16,933
9	Jessore 1	81 Jun	USAID	105,501	59,363	12,760	33,378	11,902	9,244	224	12,008	3,930	0	237	16,175
10	Naogaon	90 Apr	IDA	74,398	42,510	9,215	22,674	12,900	0	88	9,685	4,495	0	417	14,597
11	Natore 2	81 Dec	USAID	67,454	37,861	12,105	17,487	7,235	5,317	120	4,815	3,971	0	219	9,005
12	Natore 1	81 Feb	USAID	69,495	39,784	11,514	18,197	8,437	6,389	112	3,259	2,847	0	102	6,208
13	Dinajpur 1	84 Nov	KFAED	92,376	52,153	11,458	28,766	14,142	11,769	217	2,637	4,553	0	319	7,510
14	Bogra	86 Sep	USAID	112,638	69,585	15,776	27,277	14,414	12,067	195	600	3,513	0	982	5,096
15	Chandpur	81 Dec	USAID	66,649	35,721	12,426	18,503	9,096	9,127	229	50	3,038	0	304	3,392
16	Netrokona	93 Jul	JDRG	9,013	5,359	3,115	539	859	0	58	(379)	122	610	175	529
17	Kishoreganj	90 Mar	IDA	42,925	24,630	7,414	10,881	11,339	0	114	(572)	2,435	778	324	2,965
18	Pabna 2	82 Jan	USAID	40,904	22,421	8,665	9,818	5,396	5,746	153	(1,477)	3,821	0	161	2,505
19	Thakurgaon	86 Sep	FINLAND	87,553	55,470	9,357	22,726	12,212	12,038	34	(1,558)	3,302	0	281	2,025
20	Mymensingh 1	84 Mar	KFAED	91,193	52,088	11,076	28,029	14,721	15,000	221	(1,914)	3,557	0	1,265	2,908
21	Feni	84 Feb	KFAED	81,483	47,325	13,257	20,901	10,328	12,653	165	(2,245)	3,488	0	369	1,612
22	Satkhira	84 Feb	KFAED	47,030	25,667	8,919	12,443	6,974	7,598	156	(2,284)	2,412	0	345	473
23	Manikganj	92 Nov	IDA	19,343	13,276	4,866	1,200	3,426	0	62	(2,288)	193	3,907	177	1,990
24	Pabna 1	82 Dec	USAID	44,030	25,586	7,806	10,638	7,095	6,427	107	(2,991)	1,973	0	255	(762)
25	Laxmipur	90 Aug	IDA	20,486	11,169	5,166	4,151	7,446	0	31	(3,327)	1,569	1,400	173	(185)
26	Dinajpur 2	94 Apr	IDA	13,346	9,410	3,922	13	3,509	0	40	(3,536)	153	4,215	187	1,019
27	Rangpur 2	86 Mar	USAID	47,710	26,633	7,956	13,121	8,898	8,303	95	(4,175)	2,637	0	167	(1,371)
28	Patuakhali	92 Sep	IDA	9,956	5,600	4,418	(62)	4,253	0	13	(4,328)	331	3,454	140	(403)
29	Narsingdi 2	90 Apr	IDA	34,507	21,875	7,056	5,576	10,620	0	107	(5,151)	1,636	8,768	303	5,556
30	Comilla 2	94 Apr	IDA	18,308	17,627	3,716	(3,035)	2,542	0	33	(5,610)	111	7,609	36	2,146
31	Noakhali	86 Dec	IDA	41,184	23,051	8,974	9,158	7,496	7,530	178	(6,046)	3,256	0	210	(2,580)
32	Joypurhat	86 Feb	KFAED	46,467	26,461	8,085	11,920	8,917	9,222	46	(6,265)	2,785	0	204	(3,276)
33	Jamalpur 1	86 Jun	USAID	49,367	28,433	8,404	12,530	8,991	9,800	103	(6,364)	3,185	0	337	(2,842)
34	Barisal 1	90 Sep	IDA	15,806	9,097	6,140	569	7,220	0	70	(6,722)	966	9,980	92	4,316
35	Meherpur	87 Feb	IDA	41,117	22,845	8,410	9,861	8,681	8,111	77	(7,007)	3,290	0	770	(2,948)
36	Cox's Bazar	93 Dec	IDA	34,078	26,679	6,192	1,207	8,414	0	38	(7,245)	288	3,648	329	(2,980)
37	Madaripur	85 Oct	IDA	35,869	21,247	7,847	6,775	7,233	7,007	104	(7,569)	1,898	0	228	(5,443)
38	Bagerhat	86 Apr	IDA	24,640	13,493	7,865	3,282	6,318	6,144	70	(9,250)	2,420	0	102	(6,728)
39	Sylhet	90 Jun	IDA	27,295	16,958	8,455	1,882	12,729	0	154	(11,000)	1,290	12,823	346	3,458
40	Rangpur 1	84 Mar	KFAED	69,337	39,438	9,906	19,994	14,037	17,129	213	(11,386)	4,455	0	779	(6,151)
41	Kushtia	85 Oct	KFAED	46,016	25,880	10,138	9,998	11,076	10,991	76	(12,145)	2,905	0	217	(9,023)
42	Barisal 2	85 Sep	IDA	38,878	27,481	8,411	2,986	7,447	7,899	23	(12,383)	1,723	0	154	(10,507)
43	Pirojpur	86 May	KFAED	19,370	10,691	6,972	1,707	6,666	7,581	78	(12,618)	1,566	0	191	(10,862)
44	Chittagong 1	88 Mar	USAID	42,945	26,701	10,352	5,892	8,681	12,816	113	(15,718)	3,268	18,018	669	6,237
45	Chittagong 2	85 Sep	IDA	87,426	72,608	14,806	13	11,053	9,845	205	(21,090)	1,266	2,929	492	(16,403)
	TOTAL (Taka)			2,965,031	1,765,720	436,448	762,863	405,655	294,552	5,997	56,659	172,743	78,139	15,671	323,212
	(US $)			74,126	44,143	10,911	19,072	10,141	7,364	150	1,416	4,319	1,953	392	8,080
	% to Total Sales			100.0%	59.6%	14.7%	25.7%	13.7%	9.9%	0.2%	1.9%	5.8%	2.6%	0.5%	10.9%

Palli Bidyut Samities
SUMMARY OF SALES BY CONSUMER TYPE
As of June 30, 1995
(In Thousands)

PBS NAME	KWH SOLD								Operating Margin
	Domestic	Commercial	Irrigation	Charitable Institutions	General Power	Large Power	Street Lights	Total	
1 Chittagong 2	23,730	2,061	1,759	887	2,585	440	36	31,498	(21,090)
2 Chittagong 1	10,922	835	1,787	505	1,313	0	16	15,379	(15,718)
3 Pirojpur	3,025	678	2	117	2,007	327	22	6,178	(12,618)
4 Barisal 2	3,974	697	254	141	2,924	8,990	70	17,049	(12,383)
5 Kushtia	7,075	867	2,765	209	4,174	403	45	15,538	(12,145)
6 Rangpur 1	4,727	1,917	9,115	232	7,317	71	5	23,384	(11,386)
7 Sylhet	7,638	801	1	263	892	0	27	9,622	(11,000)
8 Bagerhat	4,133	761	52	183	2,735	0	32	7,896	(9,250)
9 Madaripur	5,132	728	3,957	193	2,827	0	74	12,911	(7,569)
10 Cox's Bazar	3,605	2,254	1,186	336	2,932	1,327	26	11,666	(7,245)
11 Meherpur	5,842	419	3,767	234	3,691	0	78	14,051	(7,007)
12 Barisal 1	3,480	414	28	139	841	590	14	5,506	(6,722)
13 Jamalpur 1	2,870	436	11,659	128	2,472	0	21	17,586	(6,364)
14 Joypurhat	4,229	309	7,733	129	3,736	0	27	16,163	(6,265)
15 Noakhali	9,373	1,181	964	367	2,163	0	8	14,075	(6,046)
16 Comilla 2	2,611	632	2,149	73	1,244	0	0	6,709	(5,610)
17 Narsingdi 2	4,308	986	3,441	126	2,694	0	36	11,591	(5,151)
18 Patuakhali	1,464	335	3	51	866	310	9	3,039	(4,328)
19 Rangpur 2	4,018	811	4,883	189	5,958	0	0	15,859	(4,175)
20 Dinajpur 2	693	248	1,447	37	1,665	517	2	4,610	(3,536)
21 Laxmipur	3,487	1,066	778	155	1,167	0	9	6,661	(3,327)
22 Pabna 1	3,525	797	8,638	161	2,319	77	67	15,583	(2,991)
23 Manikganj	2,834	866	1,549	95	1,750	0	9	7,125	(2,268)
24 Satkhira	5,066	1,185	4,214	242	4,842	0	90	15,659	(2,264)
25 Feni	13,777	2,784	1,695	532	3,129	6,501	71	28,490	(2,245)
26 Mymensingh 1	6,111	1,662	18,075	276	5,506	0	75	31,706	(1,914)
27 Thakurgaon	2,662	249	26,090	103	3,279	86	11	34,699	(1,556)
28 Pabna 2	6,859	1,437	1,531	184	3,742	1	46	13,801	(1,477)
29 Kishoreganj	3,892	1,587	3,068	292	4,031	1,575	30	14,495	(572)
30 Netrokona	935	267	1,194	37	596	0	5	3,054	(379)
31 Chandpur	8,511	2,713	6,650	466	3,479	249	68	22,139	50
32 Bogra	10,220	1,317	17,556	295	9,807	254	4	39,453	600
33 Dinajpur 1	5,063	962	14,142	215	10,294	1,169	27	31,871	2,637
34 Natore 1	6,966	1,147	8,403	363	6,478	668	37	24,063	3,259
35 Natore 2	8,603	1,673	2,985	354	6,295	3,001	72	22,983	4,815
36 Naogaon	7,765	951	9,736	193	7,301	0	23	25,968	9,665
37 Jessore 1	10,421	2,471	14,936	315	7,372	1,270	100	36,884	12,008
38 Serajganj	9,974	2,740	13,312	313	8,644	514	99	35,596	12,236
39 Jessore 2	7,199	2,106	5,857	274	5,227	8,543	108	29,313	12,602
40 Tangail 1	9,428	1,312	22,586	217	5,597	6,405	62	45,609	13,508
41 Moulvibazar	11,063	1,627	17	248	15,167	3,255	238	31,814	15,110
42 Habiganj	8,050	2,232	1,755	285	11,369	7,240	161	31,093	15,956
43 Comilla 1	16,085	3,715	11,037	676	13,459	5,915	99	50,987	18,195
44 Narsingdi 1	7,984	699	6,421	219	27,100	10,468	18	52,908	32,878
45 Dhaka 1	21,717	2,345	12,067	492	44,027	57,156	58	137,862	97,761
TOTAL SALES in kWh	**311,267**	**57,522**	**273,307**	**11,585**	**267,010**	**127,322**	**2,135**	**1,050,148**	**56,659**
TOTAL SALES in Taka	**724,055**	**242,107**	**656,774**	**32,117**	**853,363**	**340,029**	**6,242**	**2,854,687**	
US $	**18,101**	**6,053**	**16,419**	**803**	**21,334**	**8,501**	**156**	**71,367**	
% to TOTAL (kWh)	**25.36%**	**5.48%**	**23.01%**	**1.13%**	**29.89%**	**11.91%**	**0.22%**	**100.00%**	
(Taka)	**29.64%**	**5.48%**	**26.03%**	**1.10%**	**25.43%**	**12.12%**	**0.20%**	**100.00%**	
Ave. Rate in Taka	**2.33**	**4.21**	**2.40**	**2.78**	**3.20**	**2.67**	**2.92**	**2.72**	

Palli Bidyut Samities
CONSOLIDATED BALANCE SHEET
As of June 30, 1995
(In Thousands)

	Taka	US Dollar	% to Total
A S S E T S			
Plant Property and Equipment			
Gross Utility Plant in Service	14,522,433	363,061	76.88%
Accumulated Provision for Depreciation	2,283,337	57,083	12.09%
Net Utility Plant in Service	12,239,096	305,977	64.80%
Construction Work in Progress	1,410,681	35,267	7.47%
Total Utility Plant	13,649,777	341,244	72.26%
Other Property and Investment			
Replacement Reserve Fund	658,261	16,457	3.48%
Other Special Fund	523,228	13,081	2.77%
Total Investment	1,181,489	29,537	6.26%
Current Assets			
Cash			
General	429,625	10,741	2.27%
Special Deposits	4,023	101	0.02%
Working Funds	550	14	0.00%
Temporary Investments	882,930	22,073	4.67%
Total Cash	1,317,128	32,928	6.97%
Accounts Receivable			
Net Receivable – Electric	520,913	13,023	2.76%
Other Receivable	277,852	6,946	1.47%
Total Receivable	798,765	19,969	4.23%
Materials and Supplies	1,131,421	28,286	5.99%
Prepayments	126,848	3,171	0.67%
Other Current and Accrued Assets	238,601	5,965	1.26%
Total Current and Accrued Assets	3,612,763	90,319	19.13%
Deferred Debits			
Miscellaneous Deferred Charges	221,108	5,528	1.17%
PDB Customer Dues Outstanding	223,543	5,589	1.18%
Total Deferred Debits	444,652	11,116	2.35%
TOTAL ASSETS	**18,888,681**	**472,217**	**100.00%**
LIABITIES AND EQUITIES			
Equities and Margins			
Membership Issued	9,397	235	0.05%
Membership Subscribed	21,894	547	0.12%
Retained Earnings	1,668,410	41,710	8.83%
Donated Capital and Capital Gains	801,876	20,047	4.25%
Total Margins and Equities	2,501,576	62,539	13.24%
Long Term Debt			
LTD–REB, Cash	240,577	6,014	1.27%
LTD–REB, Provisional Plant	1,032,570	25,814	5.47%
LTD–REB, Construction Close Out	7,016,835	175,421	37.15%
LTD–REB, Others	5,517,249	137,931	29.21%
Total	14,188,937	354,723	75.12%
Current Liabilities and Accrued Liabilites			
Current and Other Liabilities	823,357	20,584	4.36%
Matured Interest	59,540	1,489	0.32%
Matured LTD	818,554	20,464	4.33%
Total	1,701,452	42,536	9.01%
Deferred Credits			
Deferred Credits	264,661	6,617	1.40%
PDB Dues Outstanding	232,054	5,801	1.23%
Total	496,715	12,418	2.63%
TOTAL LIABILITIES AND EQUITIES	**18,888,681**	**472,217**	**100.00%**

Palli Bidyut Samities
ACCOUNTS RECEIVABLE
June 30, 1995
(In Thousands)

	PBS NAME	TOTAL RECEIVABLE								CURRENT	30 DAYS
		Domestic	Commercial	Irrigation	Charitable Institutions	General Power	Large Power	Street Lights	TOTAL	Total	Total
1	Bagerhat	1,170	485	23	1,173	1,316	0	20	4,185	1,935	2,250
2	Barisal 1	1,173	336	72	249	668	0	4	2,501	1,355	1,147
3	Barisal 2	1,184	465	142	1,091	1,150	950	34	5,016	2,931	2,086
4	Bogra	5,332	1,423	5,589	1,564	3,470	61	3	17,443	6,972	10,471
5	Chandpur	2,242	1,709	1,684	1,742	1,461	0	184	9,023	3,089	5,934
6	Chittagong 1	4,154	999	598	2,930	1,127	0	20	9,828	2,863	6,965
7	Chittagong 2	18,259	3,999	1,244	3,848	1,975	1,055	73	30,453	6,380	24,073
8	Comilla 1	5,046	3,080	4,787	2,895	4,584	1,461	188	22,040	8,851	13,189
9	Comilla 2	1,254	798	1,997	116	618	0	0	4,783	1,422	3,362
10	Cox's Bazar	2,818	2,765	1,416	385	2,258	1,261	35	10,957	3,945	7,012
11	Dhaka 1	14,338	3,789	5,601	2,499	18,351	12,942	167	57,687	28,157	29,530
12	Dinajpur 1	2,668	1,172	7,092	1,464	3,892	418	17	16,724	5,946	10,777
13	Dinajpur 2	252	159	500	9	801	0	2	1,722	1,027	695
14	Feni	4,555	2,479	797	2,402	2,029	1,645	82	13,990	5,992	7,998
15	Hobigonj	4,876	2,533	1,245	1,527	4,912	0	142	15,236	4,460	10,775
16	Jamalpur 1	2,560	801	4,676	1,333	1,630	0	38	11,039	1,771	9,268
17	Jessore 1	4,107	1,944	5,002	1,085	3,621	610	83	16,452	7,191	9,262
18	Jessore 2	3,828	1,869	3,716	1,520	2,519	723	116	14,292	4,579	9,712
19	Joypurhat	2,091	454	1,615	797	1,512	0	16	6,485	2,793	3,692
20	Kishoreganj	2,770	1,759	1,349	1,107	1,139	7	35	8,167	1,978	6,189
21	Kushtia	2,500	689	1,371	1,439	2,065	83	42	8,190	3,530	4,660
22	Laxmipur	1,549	1,042	180	524	699	0	5	3,999	1,745	2,254
23	Madaripur	1,530	503	1,791	1,471	891	0	44	6,230	1,791	4,438
24	Manikganj	898	777	841	108	1,317	0	4	3,945	1,735	2,210
25	Meherpur	2,307	472	726	1,662	1,539	0	38	6,744	2,926	3,818
26	Moulvibazar	3,942	2,027	17	1,803	5,186	334	262	13,569	5,674	7,895
27	Mymensingh 1	3,447	2,387	10,919	1,638	3,357	0	790	22,538	3,982	18,556
28	Naogaon	3,446	1,036	2,302	767	3,367	0	24	10,943	5,715	5,228
29	Narsingdi 1	5,728	1,246	8,277	1,010	15,126	4,148	36	35,571	14,932	20,639
30	Narsingdi 2	2,782	1,545	1,961	455	2,236	0	54	9,033	2,413	6,620
31	Natore 1	2,393	950	4,487	2,293	3,937	0	107	14,168	4,492	9,676
32	Natore 2	4,961	1,770	2,032	1,788	4,023	103	169	14,845	4,523	10,322
33	Netrokona	702	390	1,419	105	677	0	5	3,298	606	2,692
34	Noakhali	3,431	1,094	402	2,083	966	0	12	7,988	2,850	5,137
35	Pabna 1	1,235	485	4,715	1,009	941	145	56	8,585	2,153	6,432
36	Pabna 2	3,105	1,650	893	1,249	1,596	34	212	8,740	2,870	5,870
37	Patuakhali	645	295	7	47	438	0	8	1,440	730	710
38	Pirojpur	1,506	726	12	757	1,387	51	115	4,554	1,519	3,035
39	Rangpur 1	3,976	3,479	6,381	1,214	5,606	70	77	20,803	5,108	15,695
40	Rangpur 2	3,712	1,656	3,220	1,449	2,325	0	32	12,394	3,038	9,355
41	Satkhira	2,051	1,138	1,246	1,676	2,038	0	64	8,214	3,500	4,914
42	Serajgonj	3,592	1,907	3,587	1,712	4,324	492	252	15,865	5,365	10,500
43	Sylhet	2,470	654	9	191	528	0	24	3,875	2,518	1,357
44	Tangail 1	3,778	1,587	11,112	1,088	3,984	2,173	203	23,925	5,198	18,727
45	Thakurgaon	2,202	527	15,569	1,027	1,754	23	18	21,119	3,536	17,583
TOTAL	**Taka**	**152,562**	**63,051**	**132,621**	**58,301**	**129,340**	**28,808**	**3,911**	**568,594**	**196,082**	**372,712**
	US $	**3,814**	**1,576**	**3,316**	**1,458**	**3,233**	**720**	**98**	**14,215**	**4,902**	**9,318**
% to Overall Total		**26.8%**	**11.1%**	**23.3%**	**10.3%**	**22.7%**	**5.1%**	**0.7%**	**100.0%**	**34.5%**	**65.5%**

Palli Bidyut Samitiee
COLLECTION EFFICIENCY
June 30, 1995
(In Thousands)

PBS NAME	Account Receivable (June 30, 1994)	Account Receivable (June 30, 1995)	Increase (Decrease)	COLLECTION EFFICIENCY – JUNE 30, 1995							
				Average	Domestic	Commercial	Irrigation	Charitable Institutions	General Power	Large Power	Street Lights
1 Barisal 2	4,061	5,016	24%	88%	24.4%	7.8%	1.5%	0.4%	22.9%	30.5%	0.5%
2 Chandpur	7,042	9,023	28%	87%	30.2%	16.5%	21.1%	1.0%	16.9%	1.3%	0.3%
3 Joypurhat	5,710	6,485	14%	87%	21.2%	2.9%	37.5%	0.3%	24.9%		0.1%
4 Dinajpur 2	16	1,722	10869%	87%	11.2%	6.9%	23.7%	0.7%	33.9%	10.3%	0.0%
5 Moulvibazar	14,431	13,569	−6%	87%	22.0%	7.0%	0.1%	0.2%	48.5%	8.0%	1.0%
6 Sylhet	2,197	3,875	76%	86%	60.2%	12.8%	0.0%	2.9%	10.0%		0.3%
7 Naogaon	7,655	10,943	43%	86%	23.4%	5.1%	28.1%	0.6%	29.0%		0.1%
8 Comilla 1	21,278	22,040	4%	86%	21.8%	9.3%	16.4%	0.8%	27.2%	10.4%	0.2%
9 Dhaka 1	45,499	57,687	27%	86%	10.0%	2.1%	6.5%	0.1%	30.3%	36.6%	0.0%
10 Jessore 1	11,974	16,452	37%	86%	21.2%	9.1%	30.2%	0.6%	21.0%	3.3%	0.2%
11 Patuakhali	342	1,440	321%	85%	35.3%	13.4%	0.0%	1.2%	28.5%	6.8%	0.2%
12 Bogra	12,465	17,443	40%	85%	19.4%	4.3%	34.2%	0.6%	26.2%	0.7%	0.0%
13 Jessore 2	13,886	14,292	3%	85%	17.4%	8.8%	13.7%	0.4%	18.0%	26.7%	0.3%
14 Serajgonj	14,301	15,865	11%	85%	20.1%	9.8%	28.3%	0.3%	25.3%	1.1%	0.3%
15 Hobigonj	12,668	15,236	20%	85%	15.6%	8.3%	4.0%	0.6%	36.3%	19.7%	0.6%
16 Meherpur	5,500	6,744	23%	85%	33.5%	3.9%	20.1%	0.4%	26.5%		0.4%
17 Barisal 1	1,265	2,501	98%	85%	50.9%	11.0%	−0.0%	1.9%	15.7%	5.1%	0.2%
18 Feni	11,417	13,990	23%	84%	34.8%	12.4%	4.5%	0.9%	11.8%	19.9%	0.2%
19 Satkhira	7,153	8,214	15%	84%	24.2%	9.6%	19.9%	0.6%	29.6%		0.4%
20 Bagerhat	3,030	4,185	38%	84%	37.6%	12.1%	0.6%	0.8%	32.8%		
21 Madaripur	4,579	6,230	36%	84%	30.0%	7.7%	21.5%	0.4%	23.9%		0.5%
22 Kushtia	6,873	8,190	19%	84%	33.4%	7.4%	12.4%	0.4%	27.6%	2.4%	0.2%
23 Dinajpur 1	12,102	16,724	38%	83%	12.1%	4.1%	30.0%	0.3%	33.5%	3.4%	0.1%
24 Tangail 1	20,886	23,925	15%	83%	17.6%	3.8%	34.7%	0.2%	12.3%	14.3%	0.1%
25 Pabna 1	8,562	8,585	0%	83%	17.2%	7.2%	41.4%	0.3%	15.8%	0.6%	0.4%
26 Natore 1	13,098	14,168	8%	82%	20.8%	6.3%	25.1%	0.5%	26.5%	3.0%	0.1%
27 Noakhali	5,713	7,988	40%	82%	49.5%	10.6%	5.1%	0.8%	16.3%		0.1%
28 Pabna 2	10,537	8,740	−17%	82%	33.1%	12.4%	9.1%	0.5%	26.1%	0.8%	0.3%
29 Kishoreganj	4,616	8,167	77%	82%	18.7%	13.4%	14.6%	0.7%	29.5%	5.1%	0.2%
30 Laxmipur	1,995	3,999	100%	82%	35.8%	18.8%	9.0%	1.2%	16.7%		0.1%
31 Natore 2	14,965	14,845	−1%	81%	25.2%	8.7%	9.1%	0.8%	25.9%	11.5%	0.2%
32 Manikganj	1,874	3,945	111%	81%	24.2%	15.6%	18.7%	0.8%	21.3%		0.1%
33 Chittagong 1	9,693	9,828	1%	80%	53.6%	7.3%	9.0%	1.0%	9.3%		0.1%
34 Jamalpur 1	8,957	11,039	23%	80%	12.3%	3.2%	50.2%	0.2%	14.4%		0.1%
35 Pirojpur	3,773	4,554	21%	80%	32.9%	12.7%	0.1%	0.7%	30.8%	2.0%	0.4%
36 Narsingdi 1	16,489	35,571	116%	79%	7.9%	1.4%	6.4%	0.1%	46.3%	16.8%	0.0%
37 Mymensingh 1	15,367	22,536	47%	78%	13.7%	6.3%	39.7%	0.4%	17.9%		0.1%
38 Rangpur 2	10,888	12,394	14%	78%	16.4%	5.7%	20.6%	0.4%	35.0%		0.0%
39 Thakurgaon	7,627	21,119	177%	77%	7.8%	1.1%	56.9%	0.1%	11.1%	0.4%	0.0%
40 Narsingdi 2	5,914	9,033	53%	77%	22.7%	9.8%	20.8%	0.5%	22.8%		0.1%
41 Rangpur 1	16,858	20,803	23%	75%	12.3%	8.9%	24.9%	0.4%	28.3%	0.2%	0.0%
42 Comilla 2	8	4,783	62306%	73%	24.2%	9.9%	18.3%	0.4%	20.3%		
43 Chittagong 2	21,262	30,453	43%	69%	47.9%	7.5%	3.7%	0.9%	8.2%	1.2%	0.1%
44 Cox's Bazar	662	10,957	1554%	68%	13.8%	18.4%	2.5%	1.2%	19.7%	12.0%	0.1%
45 Netrokona	1,160	3,298	184%	66%	19.5%	11.0%	17.8%	0.5%	17.4%		0.1%
Total	**Taka 426,349**	**Taka 568,594**	**33%**	**83%**	**21.1%**	**6.9%**	**18.5%**	**0.5%**	**25.4%**	**10.1%**	**0.2%**
	US $ 10,659	**US $ 14,215**									

SCHEDULE OF CHARGES FOR CONNECTIONS AND RECONNECTIONS
(Jessore PBS 2)

Charge Type	Amount in Taka
Membership Fee	20
Application Fee	
Domestic	25
Commercial	25
Irrigation	250
General Power	1,000
Meter Testing Fee	
Domestic	50
Commercial	50
Charitable Institutions	50
Irrigation & Industrial	200
Guarantee Deposit (3 months)	
Domestic	105
Commercial	135
Charitable Institutions	165
Clubs (Society Organizations)	300
All types of industrial	
Connected load for all types of industrial and commercial consumers	600/KW
Connected load for LLP (Low Lift Pump) & STW (Shallow Tube Well)	625/hp
DTW (Deep Tube Well)	1,000
Disconnection Fee	
Domestic	30
Commercial	30
Charitable Institutions	30
Street Lights	30
Irrigation & Industrial (Single Phase)	100
Irrigation & Industrial (3 Phase)	200
Reconnection Fee	
Domestic	20
Commercial	20
Charitable Institutions	20
Irrigation & Industrial (Single Phase)	100
All types of 3 phase	200

RURAL ELECTRIFICATION BOARD
DHAKA, BANGLADESH

INSTRUCTION TITLE: FINANCE
(Subject of REB Instructions Under 200 Series.

Instruction No.	Subject	Remarks
200-02	Audit of REB borrowers accounting records.	
200-03	Minimum insurance and fidelity coverage for REB borrowers.	
200-04	Designation of banks, check-signing and countersigning authority and bank procedures.	
200-05	Internal control of REB borrowers operations.	
200-06	Accounting procedures manual.	
200-07	Electrical distribution borrower's financial and statistical report.	
200-08	Advance of funds for PBS requirements prior to availability of loan funds.	
200-09	Wiring materials, Cash sales procedures.	
200-10	Payments to Architects, Engineers & Contractors.	
200-11	Use of approval of general funds for additions to plant.	
200-12	General funs.	
200-13	Imprest (Petty cash) fund for PBS.	
200-14	Continuing property records.	
200-15	Identification and numbering of PBS equipment and property.	
200-16	Establishment of Rural Electrification revolving fund.	
200-17	Electrification loan policies and application procedures.	
200-18	Electric loan policy for consumer and contractors equipment.	
200-19	Budgetary control and advance of electrification loan funds.	
200-20	PBS Initial accounting requirements.	
200-21	Depreciation rates and procedures.	
200-22	Equipment rental to contractors.	
200-23	REB/PBS General accounts manual (REB Instruction 600-16).	
200-24	Authorizing operations of bank accounts (PBS Instruction 300-43).	
200-25	House wiring loan (PBS Instruction 300-44).	
200-26	PBS audit manual (REB Instruction 600-24).	
200-27	Monitoring financial activities of the PBSs (REB Instruction 600-21).	
200-29	Management of PBS fund.	
200-30	Accounting treatment of Bad debts.	
200-31	Determination of PBS long term loan-moratorium period (REB Instruction 600-26).	

SCOPE OF WORK

1.1 BACKGROUND

A. *The Rural Electrification (RE) Program in Bangladesh*

In 1976, Less than 3% of the rural population had access to electricity. At that time the bangladesh Government (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 industries.

Following that decision, the National Rural Electric 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 Electrfication" (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, 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.

All PBSs come under the aegis of the semi-autonomous Rural Electrification Board in Dhaka, which sets national rural electrification policy and standards, represents the interests of the PBSs and rural electrification generally, assists with organizational, financial and technical operations, and acts as financier for the PBSs. The REB employs about 1100 people.

Funds required for construction, intensification and expansion of the distribution network are channeled (as loans or grants) from the BGD to the REB, which provides loans to the PBSs. An estimated $ 320 million in BDG and donor funds have been invested in the rural electrification system since 1978. Fourteen donors have provided commodity support.

Each PBS has a board of directors composed of members elected to review policy, management, and financial operations. PBSs are headed by general managers responsible for overall coordination of PBS business, liaison with REB, personnel management, strategic planning and performance monitoring. PBSs oversee construction of system expansion. They also run programs to motivate member participation in PBS affairs, educate members regarding their rights and responsibilities, and promote electrical safety. There are about 4000 employees of the PBSs.

B. USAID Support to Date

Since 1978, USAID has provided commodities to construct and engergize 17 PBSs and technical assistance for the construction and startup implementation of all 45 current PBSs. NRECA has providedthe technical assistance under USAID's rural electrification projects, RE I, Re II and RE III. Under RE I and II, NRECA experts focused almost exclusively on construction needs. Technical assistance under RE III, which has as its purpose to develop the capability of the REB to establish self sustaining, viable and well-managed rural electric cooperatives, has evolved from a greater emphasis on electrical engineering to concentrate on management.

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A 1993 formal mid-term project evaluation found that USAID's long term commitment to technical assistance has been the single key external factor in the success of the REB/PBS program thus far. The evaluators found the REB to be a mature and efficient utility with a working system of rural electricity distribution based on rural electrification experience in the U.S. However, they noted that management, training, finance and technical functions still need strengthening before the REB will be able to operate completely independently of long term technical assistance. They cautioned that, after the current period of assistance ends in mid-1996, USAID (or another donor) will need to provide this support.

The evaluation noted that technical and engineering functions of REB and the PBSs are performed with a high level of competence, but increasing orientation to operations and maintenance will be needed as the system ages. It emphasized that the areas most requiring continued assistance are institutional, stating that the devlopment of management and planning skills necessary to sustain the capacity of REB and the PBSs to evolve and innovate over time in response to changing demands is an area of need. Another area where further technical assistance is needed is information management and computerization of the cooperative network.

Technical assistance provided by NRECA currently includes a team of 8 people, with the number scheduled to be scaled back to a total of 4 when the current project ends in mid-1996. The areas of emphasis of this assistance during the remainder of RE III are :

General Management, including advice on strategic planning, performance monitoring and information systems.

Financial Management, including such areas as Computerization of records; accounting manuals and instructions; financial analysis and financial forecasting; and assisting REB establish linkages with private CPAs to conduct audits.

Technical Advice and Support, including such areas as system engineering and design advice; engineering manuals preparation; monitoring line and substation construction; materials planning, specification, tender documents and bid evaluation; materials testing; procurement services (inspections); and advice on warehouses, workshop and repair facilities.

PBS Systems Operation, including assistance with technical problem solving; establishing a PBS maintenance program (including line inspection, equipment maintenance, substation preventive maintenance and inspection); and helping PBSs with customer service approaches.

Institutional and Technical Training, in support of the REB's program to train its staff and PBS board, employee and member training. This includes helping the REB organize training of trainers and training materials production; curriculum planning; training planning and training information system; and advice on computer training facilities. NRECA also coordinates a U.S. based participant trainee program.

Since the evaluation, technical assistance has become more focused on strategic needs, consistent with an early 1994 NRECA - REB strategic plan laying out objectives for the remainder of the project with the overall intention to maximize the transfer of capacity from the technical assistance team to the REB. The plan covers general organization issues, accounting, financial reporting and internal control systems, financial planning, computerization needs, materials flow and procurement integration, and development of technical (material, construction and engineering) standards and specifications. Short term consultancies have been planned and many are underway to

assist long term experts in these areas. Additionally, with NRECA assistance, a socio-economic impact monitoring system is being established at REB using a locally-contracted firm, with a baseline scheduled to be completed within the next six months.

C. Analytical Background for New Distribution Technical Assistance

Although the REB's strong performance as a utility (e.g. low systems loss) continues to make it attractive to donors, major multilateral and bilateral donors have indicated their reluctance to provide significant commodity financing to the REB over the next several years without an assurance that necessary technical assistance will be in place. USAID's comparative advantage in providing technical assistance to the rural electrification program is widely recognized and appreciated by the other donors, who view USAID as a "catalyst".

Overall, USAID support since 1978 totalling #180 million in commodities and technical assistance has "leveraged" another $460 million in commitments for commodities from other donors.

The REB distribution system now serves about 15 million people through about one million hookups. This represents about 39 percent of current electricity consumers in Bangladesh, but is only 15 percent of the rural population. At the same time, access to electricity is a proven critical factor in increasing productivity of agriculture and agriultural employment and in facilitating growth of new and expansion of existing small and microenterprises in Bangladesh. Expanding access to rural power is thus a high priority for the BDG and a central part of USAID's strategy to increase food security of the poor and encourage broad based economic growth. New technical assistance, as a result, will need to focus on enabling the REB to meet the management challenges of increasing the numbers of consumers to be reached with power while sustaining its good performance.

During the 1996 - 2001 period, distribution expansion is planned from the current 45 operating PBSs to a target of 60. Intensification, or reaching more consumers in an established PBS, is equally important as energizing new PBSs, since, even in long-established cooperatives, the percentage of the rural population covered remains low (20-30 percent). There will be a need for between $500 million and $ 1 billion to finance the commodities and construction necessary to expand the system over th next 7-10 years.

In order to effectively implement an expanding program, the REB will need to improve its capacity to assess technical requirements, balance plant development and operations, undertake necessary procurement for system growth, and train its staff. With much of the distribution system aging, a new and comprehensive approach to maintenance is needed.

The REB must also rehabilitate thousands of kilometers of line turned over the Power Development Board as distribution lines are rationalized between urban and rural areas. Addressing maintenance and rehabilitation requirements while constructing new lines, and at the same time maintaining the high quality of its performance as a utility poses particular management challenges.

Other factors bear consideration in review of technical assistance needs for REB/PBS distribution :

PBS Operations:

Member Participation. The PBSs, member-owned and based on democratic principles, have already applied many of these principles in member participation programs and training. Especially in the older PBSs, there may be ways to increase member participation for the overall benefit of PBS operations.

"Customer Service". Information on member-consumers preferences regarding service standards-- ways that their electric cooperatives might improve service provisions--and member assessment of the quality of service should be available and used by PBSs.

Delegations of Authority. Specific delegations of authority (as well as accountability) to cooperatives could relieve some of the enormous management burden on the REB as the system as a whole expands, while maintaining REB's role as coordinator, overall policy maker and financier. Delegations of additional authorities to the PBSs are already under consideration by the REB.

REB Operations

Strategic Planning. The importance of rural electrification to economic growth and the attention given to the program by the government and donors alike will pose special demands on the REB's monitoring and planning functions. Ideally, a consumer impact monitoring system should be operational, with a regularly updated information on such impacts as income, employment, enterprise development and social factors such as school attendance. Cunsumer information should feed into program decisions to improve program efficiency and impact. The REB should be able to undertake financial and technical studies to support policy recommendations on tariffs and ways to reduce costs of service. Network extension plans should be based on clear economic, financial and social criteria. Technical assistance may be required to strengthen the REB's planning and monitoring capacity.

In summary, future technical assistance will focus on strengthening management and technical competencies of REB and the cooperatives to enable them to meet performance targets while effectively implementing a large expansion of the program. At the same time, the objective will be to transfer these competencies so that the RE program no longer requires outside, long term technical assistance after this assistance is provided.

While some contracted outside expertise may continue to be needed indefinitely, these needs should eventually be served through short term assistance, much of it locally-sourced. It may eventually be necessary for REB to operationalize linkages with a variety of local and international firms for technical assistance.

D. The Need for Power Generation

Massive expansion of the rural electrification consumer base will also require generation of additional power in Bangladesh. During periods of peak demand the national grid is unable to supply the country's needs and load-shedding is common. Significant rural expansion is not feasible if it is at the expense of existing consumers. Even under the best scenario, major new generation plants to augment the national grid supply will not be in operation for many years. Private power is moving forward, but slowly, and to construct large power plants to meet the increased demand will take 8-10 years at a minimum.

The PBSs presently have a power demand of about 250 MW and by the year 2000 will require about 300 MW. To circumvent the load shedding, it is the concept of REB that

the PBSs should design and construct, under a BOO (Build Own and Operate) or BOOT (Build Own Operate and Transfer), a series of small generation plants that could provide power to the PBSs and during off-demand periods, sell excess power to the PDB. This would be similar to Independent Power Production in most countries of the world. The REB has a mandate to generate power for rural areas, and an initial project to do so is underway with assistance from the Asian Development Bank. A number of cooperative based small plants could effectively ameliorate the medium-term power shortage facing the RE system.

1.2 Title

Project Number : 388 - 0070 :

Title : Rural Electrification in Bangladesh; An Assessment of Post - 1996 Technical Assistance Needs and of the Power Generation of the Rural Cooperatives.

1.3 OBJECTIVE.

General Objective :

(1) Examine future technical assistance needs of the Rural Electrification Board (REB) and rural electric cooperatives in maintaining and expanding electricity distribution in Bangladesh. The assessment will identify specific areas of institutional management and technical functions needing strengthening for a five-year period beginning in 1996. It will also outline technical assistance requirements for the period, and provide illustrative anticipated results and measures of success for such technical assistance.

(2) Examine the potential and implications of power generation by the rural electric cooperatives (PBSs), in particular by those cooperatives in which the cost of interrupted unreliable power is prohibitive and has severe adverse economic effects. One of the major problems with the PBSs becoming financially viable is the frequent load shedding imposed on the PBSs by the sole power generation entity, Bangladesh Power Development Board (PDB) Currenty, during peak demand time, the PDB generation facilities can be as much as 500 MW short and are forced to load-shed to maintain service to priority customers. This scenario will remain for an indeterminate time as the construction of new power facilities are dependent upon PDB improving its operations.

This assessment will provide analytical input into the consideration of new technical assistance support for rural electrification in Bangladesh.

1.4 Statement of Work

A. General Considerations :

There are two parts to the Statement of Work for this assessment, corresponding to the two objectives stated in Section I. Each part will be conducted by a subteam and the subteams will produce separate reports.

The team leader will be responsible for coordination and management of the subteams, and will lead the production of each report.

The primary responsibility for accomplishment of the tasks resides with the contractor. For each subteam, the contractor will develop a schedule and a workplan

for completing all tasks including the use of short term personnel within the first 3 days of the team's arrival in Bangladesh. This workplan must be approved by USAID/B. The contractor will periodically coordinate its work with USAID/B, per Section VI, below.

The contractor shall handle administrative actions including scheduling and planning, logistics, communications and computer/secretarial services.

Tasks, methodology, and team member qualifications are detailed below for each of the two parts of the assessment.

B. Part One - Assessment of Post-1996 Technical Assistance Needs (Distribution)

1. Purpose of the Distribution Assessment.

The assessment will (1) identify areas of institutional strengthening where technical assistance will be needed during the 1996-2001 period; (2) indicate specific institutional improvement objectives, measures and targets which could serve as indicators of effectiveness of technical assistance and identify concrete results and illustrative "deliverables" anticipated from needed technical assistance; (3) identify skills, experience mix and timing for technical assistance inputs.

The team should assume that future technical assistance will be performance - based and linked to clearly identified objectives, with proposers asked to identify approaches and detail the deliverables required to reach results. The team should also assume that, in future assistance, international long-term advisors may be joined by both local and international short term advisors. Ideally, long term personnel will be reduced over time and all long term personnel will depart in advance of project and to enable a period of REB operations with support limited to short term advisors.

2. Tasks

a. Identification of Technical Assistance Needs

In identifying areas of institutional strengthening requiring technical assistance, the contractor will need to examine the following :

REB Operations : Review overall institutional management, strategic planning, performance monitoring, systems operation and maintenance, procurement and materials flow, financial management, and accounting systems. Also review REB activities in organizing PBSs, assisting PBSs with engineering and operational problems, encouraging member participation, and cooperative strengthening.

PBS Operations : Review regular responsibilities of board members and staff. Review "business functions" such as meter reading and billing, member services programs, maintenance programs and expansion activiites. Review use of private consulting engineering expertise and other functions which are contracted out. Review ways in which PBSs collect and use information from consumer-members.

Training : Review all aspects of technical and institutional training to meet both REB and PBS needs, including management, financial, and technical training and address needs regarding training planning, training management, curriculum development and training of trainers. In addition, review the needs for international training.

Using the information from these reviews, summarize areas of institutional strengthening in which technical assistance will be required. In addition, the contractor may include the need for "support" (as opposed to distribution expansion) commodities needed to help meet these institutional needs. (Note: exclude computer hardware and software needs, which will be detailed under a separate assessment.)

b. ***Results Analysis***

For each of the areas of institutional strengthening presented above, the contractor should identify specific, appropriate :

(1) institutional objectives, or what objectives will be met in REB operations, PBS operations, and training should be met as a result of the future technical assistance;

(2) possible measures and targets which would indicate that these institutional objectives have been met;

(3) specific "results" which technical assistance provider(s) would need to achieve in order to enable the above institutional objectives.

c. Local Sourcing

The team should review, for all areas of technical assistance need outlined above, the availability of appropriately skilled and experienced experts in Bangladesh, including both local firms and individuals. Wherever assistance can be locally sourced, this should be planned.

d. Input Options

Using the information from 1,2, and 3, above, present illustrative composition, skills mix and timing of technical assistance inputs. Options should be considered given funding limitations presented by USAID/Bangladesh. Illustrative additional training costs should also be presented.

3. Methodology and Data Sources

The assessment subteam, in colsultation with USAID, shall be responsible for determining an appropriate methodology. USAID suggests the following approach:

- review of key secondary sources such as official USAID project documents including inter alia: past evaluations, project paper supplement, NRECA contract and subcontracts, quarterly and annual reports, and pertinent REB reports;
- review of REB/PBS management information system;
- interviews with USAID, REB, and NRECA staff;
- interviews with key BDG officials and with officials of other donor organizations involved in rural electrification in Bangladesh;
- field visits to selected PBSs and collection of field data. This should include interviews with PBS staff, board members and consumer members. Interviews with consumer members should address customer service preferences and concerns.

C. Part Two: Assessment of Power Generation by the Rural Cooperatives.

1. Purpose of the Power Generation Assessment

The power generation assessment will (1) examine the economic cost of power interruption/shedding in areas of high productivity/export oriented (such as in selective tea growing areas); (2) analyze the feasibility of small power generation, the hook-up to the user, the tariffs, fuel availability and the potential of selling excess power to the PBD; (3) examine technical assistance requirements for small power generation.

2. Tasks

The scope of work for conduct of the power generation assessment consists of the following tasks :

Task 1,

Power Requirements at Selected PBSs

In collaboration with the Government of Bangladesh (GOB), the REB and the PBS's, prepare a short-list of rural electrification cooperatives suitable for consideration as power generators. The basic criteria for preparing the list must be the cost-impact that interrupted power has on the local (and national) economy.

Determine the current and future power requirements of these PBSs and estimate the cost of not having this power. Examine needs/demand at PBSs in the vicinity. Examine the potential of emergency power supply from the PDB. Examine distribution issues i.e. from the power generating PBS to other PBSs (rather than selling excess to PDB) in view of the low voltage line that exists.

Task 2.

Analyze Feasibility of Private Power.

For the selected PBSs, evaluate the existing framework that allows for the construction and operation of cooperative type power facilities. Describe and/or discuss conditions and circumstances by which the PBSs and local private firms can be organized for an efficient allocation of electricity supply. With selected industrial customers: discuss premiums they are willing to pay for uninterrupted high quality power, performance contracts, etc.

Task 3.

Explore Opportunities for Private Investment in Power Facilities in Each PBS.

Discuss approaches for the participation of private sector investors in the power facility and recommend strategy options for REB and PBSs. The objective of this task is, among others, to shed light on the pros and cons of various private development schemes suitable for small power facilities and currently being adopted by other countries. schemes such as BOO, BOT, BOL and BOOT should be examined. Each option must be accompanied by examples to demonstrate the suitability and viability of project financing.

Task 4.

Examine the Introduction of a Second Power Generation Agency in Bangladesh.

Under this task the contractor will examine the implications of creating an additional (to PDB) power generation organization. Regulatory aspects, Power and Fuel Purchasing Agreement aspects and electricity tariffs need to be carefully examined. Issues related to fuel availability, excess power sell-off and emergency power supply from PDB (at time of break-down or

maintenance) will also be examined - e.g. examine fuel availability at selected PBSs, in particular - gas.

Task 5.

Institutional Reform/Strengthening

Consistent with the analyses above, this task will examine the need for institutional strengthening, inside and outside the REB, to better support the introduction of private power into the rural cooperatives. Management issues, training issues and other institutional issues that could present barriers to private power in the REB will be examined.

Task 6.

Private Sector Business, Fiscal and Investment Issues.

This task will include additional aspects associated with the development of private power in the PBS's as identified by the expertise of the contractor's team and consistent with the unique Bangladesh situation.

Task 7.

Technical Assistance Requirements

Under this task, the contractor will identify and outline the technical assistance the REB and PBSs will require, should (private investment) power generation be feasible.

Task 8.

Environmental Considerations.

Examine the environmental implications of small power generation by the PBSs. This task should be undertaken only if the team finds the generation option feasible.

3. Methodology and Data Sources

The assessment subteam, in consultation with USAID, shall be responsible for determining the appropriate methodology to perform this work. USAID suggests the following approach:

- interviews with key BDG officials and with officials at PDB, DESA, REB and PBSs;
- interviews with USAID and NRECA staff in country;
- review of REB/PBS management information systems;
- review REB/PBS power demand projections as well as BPDB's projections of demand and supply and the recently completed Power System Master Plan, if available;
- field visit to selected PBSs and collection of field data. This should include interviews with PBS staff, board members and consumers;
- interview with Government, and possibly private, fuel supply entities.

E. Performance Period and Level of Effort

The contractor's work shall begin in Bangladesh o/a September, 21, 1995 and is expected to end o/a January 12, 1996. The team leader Mr. James Morriss shall travel to Bangladesh in advance of the rest of the subteam to assemble written sources, conduct an initial review of documentation and arrange for adminsitrative support. This will give the subteams a headstart in developing their workplans and generaly improve the efficiency of the assessment.

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Two weeks after USAID/B and the Rural Electrification Board have received the final reports of the assessment and analysis, the Team Leader and the Sub-Team Leader will travel to Bangladesh and lead discussion of the final reports with the REB, USAID/B and other donors and interested entities. The effort will take one week each of both the Team Leader and the Sub-Team Leader.

F. Team Meetings and Debriefings

Each subteam shall meet upon arrival with the Director of the Office of Project Development and Engineering (PD&E), the RE III Project Officer and other Mission staff identified by the Project Officer. Each subteam will hold an initial work planning meeting with the Rural Electrification Baord Chiarman and REB staff delegated by him.

Each subteam shall present a workplan, outline of their final report, and their assessment methodology to USAID/B for approval by the Director of PDE and the Project Officer within three work days of arrival. The team leader and other subteam members, as appropriate, shall meet weekly thereafter with the Project Officer to provide oral reporting on the progress of the assessment.

The team leader, and other members of the subteams as appropriate, shall conduct formal debriefing (s) for USAID/B and selected BDG officials prior to each team's departure from Bangladesh. The subteams shall submit three copies of a draft version of the their assessment reports to USAID/B and to G/EN/EET in USAID/W four days prior to this debriefing.

USAID and REB officials will review the draft reports. USAID will convey its comments on the drafts and those of the REB, in writing, to the contractor no later than 25 working days after receipt of the drafts. As noted above the Contractor shall submit the final version of each report to USAID within four work weeks of receipt of comments.

1.6 Reports

Each of the two report is to be used by USAID and the BDG as a reference for future activity planning including identification of results, measures and targets and preparation of scope(s) of work for needed technical assistance.

The Contractor shall submit the final version of each report to USAID in three copies within four weeks of receiving USAID's and REB's comments on the draft of the report. Each subteam's report shall contain the following :

- Executive Summary: Approximately 5-7 single spaced pages, addressing all areas of investigation and analysis.
- Body of the Report: The report shall provide the evidence and analysis to support the findings and The report shall not exceed 50 single spaced pages, unless otherwise agreed by USAID in advance.
- Annexes: Shall include at least the following: description of review methodology; bibliography of interviewed; and selective presentation of additional and qualitative information.
- Upon completion of the final briefings, the team will brief report of activiities during the discussion of the reports with emphasis on the presentation, discussion and conclusion, recommendations and findings that develop the performance period.

1.7 TECHNICAL DIRECTIONS

Technical Directions during the performance of this delivery order shall be provided by the Project Officer as stated in Block 5 of the cover page pursuant to Section F of the contract.

1.8 TERM OF PERFORMANCE

a. Work shall commence on the date noted in Block 7 of the cover page. The estimated completion date is reflected in Block 8 of the cover page.

b. Subject to the ceiling price of this delivery order and the prior written approval of the Project Officer (see Block No. 5 on the Cover Page), the contractor may extend the estimated completion date, provided that the extension does not cause the elapsed time for completion of the work, including the furnishing of all deliverables, to extend beyond 30 calendar days from the original estimated completion date. Prior to the original estimated completion date, the contractor shall provide a copy of the Project Office's written approval for any extension of the term of this delivery order to the Contracting Officer; in addition, the contractor shall attach a copy of the Project Officer's approval to the final voucher submitted for payment.

c. It is the contractor's responsibility to ensure that the Project Officer-approved adustments to the original estimated completion date do not result in costs incurred that exceed the ceiling price of this delivery order. Under no circumstances shall such adjustments authorize the contractor to be paid any sum in excess of the delivery order.

d. Adjustments that will cause the elapsed time for completion of the work to exceed the original estimated completion date by more than 30 calendar days must be approved in advance by the Contracting Officer.

1.10 DUTY POST

The Duty Post for this delivery order is Bangladesh.

1.11 ACCESS TO CLASIFFIED INFORMATION.

The contractor will not have access to classified information.

1.12 LOGISTIC SUPPORT

The contractor shall be responsible for all logistic support needed to successfully complete the contract.

1.13 WORKWEEK

The contractor is authorized up to a six-day workweek in the field with no premium pay.

1.14 Authorized Geographic Code

The authorized geographic code for procurement of goods and services under this order is 941 and Bangladesh.

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ASSESSMENT METHODOLOGIES

The suggested methodology for the overall project was set forth adequately in the Scope of Work in identifying interviews and document review as principal sources of information. These methods were enhanced through specific efforts to verify from multiple sources the anecdotal information acquired by interviews and by detailed analysis of data supplied in documents.

In preparation for interviews and data-gathering, each team member and/or sub-team specified information needed in their respective areas and submitted advance data requests to REB prior to setting up interviews with the indicated respondent. Files were maintained to track outstanding data requests and, while this organized method did not prove as efficient as hoped, the systematic approach allowed for targeted follow-through to acquire the desired information. Setting interviews was preceded by thorough review of the many pertinent documents provided by USAID/Bangladesh and the advisory staff of the current technical assistance contractor, the National Rural Electric Cooperative Association (NRECA), both of which proved to be an encyclopedic source for past evaluations, analyses and insights gained through their many years of involvement in the concept, design and implementation of the Bangladesh rural electrification program.

The interview methodology utilized usually yielded the desired information and the assertive follow-through provided insight into the status of record-keeping, data bases, the overall management information system and the capability of personnel.

The extensive electric utility experience of team members made it possible to target areas of essential data to allow for a comprehensive assessment of institutional and operational capabilities of REB and PBS personnel.

In the management area, specific team experience facilitated observation and analysis of decision-making, delegation of responsibility/authority from a results-oriented, predictable-consequence viewpoint. Technical experience of team members allowed them to go to the heart of the matter without excessive extraneous distractions which often cloud the real issue and the use of specialized tools (i.e., distribution system analysis software) tested information so acquired. Team expertise in financial analysis, rate-setting and financial forecasting made possible a practical, utility industry-oriented evaluation of the adequacy and accuracy of policies, procedures and capabilities at various organizational levels in REB and the PBSs.

PART 1: ASSESSMENT OF POST-1996 TECHNICAL ASSISTANCE NEEDS (DISTRIBUTION)

ACTION PLAN

ITEM NO.	ITEM DESCRIPTION	RESP.	DUE DATE
1.0	**TECHNICAL ASSISTANCE NEEDS**		
1.1	Review 1993 Mid-Term Evaluation		
2.0	**REB OPERATIONS**		
2.1	Determine degree of implementation of 1993 recommendations; assess current status of operations relative to 1993 assessment	JM all	
2.2	Evaluate any changes in circumstances since 1993 that might affect the validity of the 1993 recommendations and/or justification for reasserting or reprioritizing the recommendation.		
	Interview key REB staff relative to: • institutional management • strategic planning • performance monitoring • systems operation and maintenance • procurement and materials flow • financial management/accounting • organizing PBSs • assisting PBSs with engineering and operational problems • encouraging PBS member participation and cooperative strengthening • tariff setting/financial forecasting	 JM/JC JM/JC All DH DH MV JM DH JM/JC RF	
3.0	**PBS OPERATIONS**		
3.1	Conduct interviews on-site (contingent upon travel restrictions imposed by strikes) to determine current status of the following : • Responsibilities of PBS board members and staff, their inter-relationships and their views of problems for improvement. • Business functions such as meter reading and billing. • Member services programs. • Maintenance programs and system expansion. • Use of private consulting engineering expertise. • Functions contracted out. • Collection and use of information from consumer-members. • Load forecasting	 JM/JC MV JM/JC DH DH All JC DH/MI	
4.0	**TRAINING**		
4.1	Review all aspects of technical and institutional training to meet need of REB and PBSs.		
4.2	Management training (all non-financial, non-technical areas.	JM	
4.3	Financial training	MV/RF	
4.4	Technical training	DH/MI	
4.5	Training management.	JM	
4.6	Curriculum and trainer development.	JM	
4.7	International training.	All	
5.0	**AVAILABLE DOMESTIC SOURCES OF TECHNICAL ASSISTANCE CAPABILITY.**		

ITEM NO.	ITEM DESCRIPTION	RESP.	DUE DATE
6.0	**ANALYSIS**		
6.1	Identify institutional objectives		
6.1.1	REB operations		
6.1.2	PBS operations		
6.1.3	Training		
6.2	Establish targets and metrics for institutional objectives		
6.3	Technical assistance results required to support institutional objectives,		
6.4	Identify possible domestic technical assistance.		
7.0	**CONCLUSIONS**		
7.1	Technical assistance scope		
7.1.1	REB operations		
7.1.2	PBS operations		
7.1.3	Training		
7.2	Technical assistance skills mix		
7.2.1	International technical assistance		
7.2.2	Domestic technical assistance		
7.3	Technical assistance schedule		
8.0	**ANNEXES**		
	ANNEX 1 Scope of Work ANNEX 2 Resumes of team members ANNEX 3 Description of review methodology ANNEX 4 Bibliography of documents reviewed ANNEX 5 List of agency representatives contacted ANNEX 6 Supporting information.		

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Ben Schafer, NRECA

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Ben Schafer, NRECA

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[Department of Environment

Annex 12: Resumes of Assessment Team Members

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Richland, Washington

Lewis Healy
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Frederick M. Freymiller
Energy economist/rate specialist
Chugach Electric Association
Anchorage, Alaska

Myrna B. Villaralbo, CPA
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Price Waterhouse
Manilla, Philippines

Joanne Nagel Connolly
Policy analyst/anthropologist
Miami, Florida

Annex 11: List of Agency Representatives Interviewed.

LIST OF AGENCY REPRESENTATIVES CONTACTED

USAID

Dick Brown, Mission Director
Lisa Chiles, Deputy Mission Director
Rosalie Fanale, Director, Project Development & Engineering (PDE)
Michael Foster, Project Development & Engineering (PDE)
Gilbert Haycock, Chief Engineer, PDE
Md. Kamaruzzaman, General Engineer, PDE
Emilie McPhie, Program Officer
Frank Caropreso, Deputy Controller
Craig Anderson, Environment/agriculture officer
Farouk Choudhury, Economist

Rural Electrification Board (REB)

Brigadier Muhammad Enamul Huq, Chairman
Mahmud Hassan Mansur, Member (Finance)
M.A. Wadud, Member (PBS & Training)
Md. Abdus Samad, Member (Engineering)
Md. Kamruzzaman Khan, Executive Director, PBS
A.K. M. Mofizul Islam, Secretary (Chairman's Office)
Lutful Kabir, Director, Personnel Administration
Shahid Uddin Ahmed, Director, Program Planning
Md Tauhidul Islam, Chief Engineer, Projects
Abdul Halim Mollah, Chief Engineer, Planning/Operations
Md. Khalilur Rahman, Controller, Accounts & Finance
B.D. Rahmatullah, Director, (SE & D)
G.A. Mohiuddin Quadry, Director, PBS Loans & Audit
D.J. Chowdhury, Director, System Operations, (south)
M. Sajedul Karim, Director PBS (south)
Md. Afzal Hossain, Director PBS (central)
Latifur Rahman, Director, Finance
Sk. Ahmed Ali, Director, Accounts
Belayet Hossain Chowdhury, Deputy Director, Program Planning
Kaisar Ahmed, Deputy Director, Planning
Md. Shahidul Alam, Deputy Director, Khulna Central Warehouse
Md. Tariq Haider, Deputy Director, Accounts
Anwar Hossain, Assistant Director, Khulna Central Warehouse
Mohammad Shahjahan, Assistant Director, Finance
Mohammad Morshed, Assistant Director, Finance
Shah Newaz Khan, Assistant Director (Evaluation) Program Planning
Abu Naim Mohammad, Director of Training
Mahbub Alam, Deputy Director, Engineering/design
Shawkat Ali Khan, Deputy Director, Engineering/design
Md. Bajlur Rahman, Deputy Director, PBS Loans & Audit
Akul Chandra Paul, Assistant Director, PBS Loans & Audit
Swapan Kumar Das Gupta, Assistant Director, PBS Loans & Audit
Engr. Sheikh Al-Harun Islam, Assistant Engineer, Renewable Energy Cell
Shahriar Ahmed, Assistant Director, Program Planning

Annex 11: List of Agency Representatives Interviewed.

National Rural Electric Cooperative Association (NRECA)

Robert Schiller, Chief of Party
Dr. John E. Andrews, Institutional Training Advisor
Willard E. Garrett, REB Finance Advisor
Ben M. Schafer, PBS Finance Advisor
Virgil L. Schafer, Engineering Advisor
Jack French, Engineering Advisor
Ken Breunig, Construction Advisor
Ed Wheeler, Technical Training Advisor
Vern Rauscher, Systems Operations Advisor

PBSs

Saleh Ahmed, General Manager, Dhaka PBS-1
Syed Nurul Islam, General Manager, Tangail PBS-1
Md. Bazlur Rashid, General Manager, Narsingdi PBS-1
Md. Serajul Haque, General Manager, Narsingdi PBS-2
Fazlul Halim, General Manager, Moulvibazar PBS
Board of Directors, Moulvibazar PBS
Abdur Rab Miah, General Manager, Habiganj PBS
Md. Abdur Rashid, General Manager, Cox's Bazar PBS
F.M. Faridul Hoque, General Manager, Jessore PBS-2
Md. Abul Kalam, Asst. General Manager-Finance, Jessore PBS-2
Md. Nizamuddin Sarkar, General Manager, Jessore PBS-1
Board of Directors, Jessore PBS-2
Abdul Samad, Asst. General Manager-Finance, Jessore PBS-1
Maya Ranin, Cashier, Jessore PBS-1

Others

Dr. Atiur Rahman, Team Leader, Unnayan Shamannay
Farooq Chowdhury, Project Coordinator, Unnayan Shamannay
Emdad Ul Haq, District Governer, Rotary International, District-3280
Shilu Abed, Advisor Aarong
Afroz Rahim, Rahimafroz Bangladesh Limited
Dr. Akhtaruz Zaman (Surgeon),(Rotary Village Project)
Dr. Md. M.Manzurul Haque, Industrial Engineering Services Limited
Hafiz G.A. Siddiqui, Professor/Academic Dean, North South University
A.M. Shaukat Ali, Chairman, Project Builders Ltd.
Kutubuddin Ahmed, Managing Director, Envoy Group (garment manufacturing)
M. A. Haque, Managing Director, Greenland Engineers & Tractors Co. Ltd.(GETCO) (Caterpillar agent)
Nazmul Haque, General Manager, Greenland Engineers & Tractors Co. Ltd.(GETCO) (Caterpillar agent)
Syed Naved Husain, Executive Director, Beximco Investment Co. Ltd.
Sahabuddin Ahmed, Managing Director, Kader Synthetic Fibres Ltd.
Kazi Kamal Uddin Emran, Director, Engineers & Consultants Bangladesh Ltd, Dhaka
Golam Mustafa, Managing Director, Janata Bank
A.H. Ekbal Hossain, Deputy General Manager, Janata Bank
M.A. Quasem, General Manager (Estates), James Finlay PLC, Srimangal
R.L. Stone-Wigg, Director, James Finlay PLC, Glasgow
Wahidul Haq, General Manager, Deunde Tea Company, Habiganj
Yacoub, General Manager, Satgao Tea Estate
S.Alamgir, Director, Jamuna Group of Companies
M.A. Baset, General Manager, Jamuna Group of Companies
Mahmuduzzaman Khan, Managing Director, Prakaushal Upadeshta Ltd.
Syed Md. Iqbal Ali, senior Fellow, Bangladesh Centre for Advanced Studies
Dr. Saleemul Huq, Executive Director, Bangladesh Centre for Advanced Studies
Dr. Anwar Hossain, Advisor, Bangladesh Centre for Advanced Studies

JAMES A. MORRISS

Energy Sector Experience

1977 - 1995	Executive Vice-President/General Manager, Texas Electric Cooperatives, Inc. Management responsibility for a trade association serving the 80 electric cooperatives in Texas including 175 employees and a $ 25 million annual budget in three divisions. Association Division: traditional trade association services including governmental representation, regulatory and compliance monitoring, employee training, consumer communications and various management services. Treating Division : acquisition, treatment and delivery of power poles; annual production 125,000 poles. Transformer Division: repair of distribution and power transformers, regulators, reclosers, etc.
1973 - 77	Manager of General Services Texas Electric Cooperatives, Inc. Management responsibility for activities in economic development, communications, publications, training and management services.
1981	Initial in-country survey for electric cooperative feasibility; community meetings; selection of two possible sites for cooperative development; under auspices of Ministry of Agriculture of Paraguay.
1985	Instructor for cooperative management course for directors and employees of electric cooperatives in Costa Rica.
1989	Organizational audit of DISCEL, national agency for distribution of electricity in El Salvador.
1989	Training needs analysis for the national power agency in Honduras.
1991 - 95	Performance capability audit for Servicio Nacional de Electricidad (utility regulatory agency) in Costa Rica; in-depth analysis of organizational structure, personnel training needs, performance capability and proposed reform legislation to update the agency's mandate. Follow-up projects over four years.

Education and Affiliations

B.A. (Business/Communications) University of Texas, Austin 1951
Director, NRECA International Foundation
Recipient, NRECA International Award 1994
Past President, Rural Electric Statewide Managers Association.

Annex 12: Resumes of Assessment Team Members.

MUTHURAMAN S. IYER

Energy Sector Experience

1990 - Present	Chief Electrical Engineer, Bechtel San Francisco Regional Office. Management responsibility for the functional department of up to 400 electrical engineers and designers assigned to all business line projects including thermal, hydro and renewable energy projects. In this capacity provided functional oversight (technical, budget and staffing) for several privatized power plants e.g. Crockett, Scrubgrass, March Point. Between 1992 and 1994, managed the coordination and integration of the electrical work processes across all the Bechtel offices world-wide.
1988 -1989	Transition Engineering Manager, responsible for establishing design activities in the Pottstown office.
1984 - 1988	Senior Project Engineer, responsible for all engineering activities on a large power project. Directed a multi-discipline engineering team of up to 600 engineers and designers, with engineering budget of 3 million manhours and $ 225 million for the $ 2.8 billion facility. Managed interfaces between engineering and construction, procurement, sub-contracts and startup organizations. Interfaced with senior client and Bechtel management.
1981 - 1984	Assistant Project Engineer (Planning and Control) for a large power project.
1979 - 1981	Resident Project Engineer, directing the on-site engineering team of multi-discipline personnel and providing timely resolution to construction and startup problems, on a large power project.
1978 - 1979	Engineering Group supervisor, responsible for all the electrical engineering activities for the Waste Isolation Pilot Project (DOE).
1971 - 1978	Varying positions from Design Engineer, System Design Group Leader, Assistant Group supervisor and Engineering Group Supervisor. Supervised up to 60 electrical engineers and designers.
1962 - 1971	Worked for ASEA Electric (India) Pvt. Ltd as : Senior Engineer, responsible for bid preparation, contract finalization and design, testing and commissioning of power and distribution equipment. Trained in ASEA (Sweden) in relays and protective systems, switchgear, instrument transformers etc.
1961	Commercial Engineer, Madras state Electricity Board, India, responsible for load forecasting and substation sizing for rural electrification.

Education and Affiliations

B.S. (Electrical Engineering), University of Madras, India
M.S. (High Voltage-Power Engg.), Institute of Science, Bangalore, India
M.B.A. (Management), Golden Gate University, San Francisco, USA
Registered Professional Engineer, California, USA
Member, Diversity Advisory Council, Bechtel, San Francisco.

LEWIS HEALY

Energy Sector Experience

Thirty five years experience in the power industry at senior levels; 12 years delivery of consultancy service to utilities in many countries.

1992 - 1995	Group Managing Director, Electricity Supply Board, International (ESBI), Dublin, Ireland. Responsible for consultancy business of ESBI, 600 employees, $ 80 M. turnover p.a.
1991 - 1992	Managing Director, ESBI - UK. Responsible for all ESBI operations in the UK, including mobilisation for operation and maintenance of Corby Power Station, in which ESB has equity. $ 25 M turnover p.a., 120 employees.
1989 - 1991	Director, Middle East for ESBI Group; management of joint venture Engineering Services Company (SCH/ESB) in Riyadh and project implementation in adjoining countries.
1987 - 1989	Self Employed Business Consultant, Specialising in Market Research and New Product Launch.
1983 - 1987	Marketing Manager ESB. Responsible for maximising profitable sales growth, for electricity pricing, metering, demand-side management
1978 - 1983	Resident Manager, Bahrain for ESB International. Providing a range of services to the Ministry of Works Power and Water in Generation, Transmission, DIstribution, and associated business functions.
1972 - 1878	Supplies Engineer ESB. Responsible for procurement and physical distribution of all materials used in ESB.
1966 - 1969	Engineer, Dublin District. Responsible for construction of new electricity substations in the Dublin region; provision of an advisory service to industry and the commercial sector on the cost effective use of electricity.
1965 - 1966	Engineer, Distribution Department, ESB. Design of urban and rural networks;Least cost studies on provision of power to isolated rural areas.
1970 - 1972	Industrial Relations Officer ESB Negotiation of wage agreements with employee categories.
1960 - 1965	Engineer, System Operation Department, ESB, Analytical Studies; System Control; Load Despatch.

Education, Registration and Affiliations

Bachelor of Engineering (Electrical)University College, Dublin
Chartered Engineer, Fellow of Institute of Engineers
Member of Institute of Management Consultants
Member of Institute of Directors

FREDERICK M. (RICK) FREYMILLER

Energy Sector Experience

1988-Present	**Manager, Rates & Economics,** Chugach Electric Association, Anchorage, Alaska. Revenue requirements, allocated cost of service and rate design for wholesale and retail cooperative customers. Rate forecasting. Capital credit allocation. Financial analysis. Refinancing of REA debt. Equity management plan. Cost of capital. Strategic planning. Merger/acquisition analysis. Budget. Integrated Resource Planning. Economic analysis. Load research.
1982-1987	**Director, Allocated Cost Studies,** Montana Power Company, Butte, Montana Marginal and accounting cost studies for electric and natural gas utilities. FERC-based revenue requirements for cooperatives. Contract rates for Yellowstone National Park. Rate forecasts. Rate impact analysis. Strategic planning. Economic analysis. Phase-in plan to smooth rate impacts of large generation plant addition
1980-1982	**Senior Analyst, Special Studies,** Montana Power Company, Butte, Montana. Rate forecasts for electric and natural gas. Load research. Testimony on rate design issues in response to Public Utilities Regulatory Policies Act (PURPA). Economic analysis.
1978-1980	**Load Analyst,** Montana Power Company, Butte, Montana. Load research. Statistical sampling. Questionnaire design and analysis.
1976-1978	**Rate Analyst,** Madison Gas & Electric, Madison, Wisconsin. Load research. Statistical sampling. Questionnaire design and analysis. Time-of-Day rates.
1974-1976	**Graduate Research and Teaching Assistant,** Kansas State University, Manhattan, Kansas. Utilization of computerized statistical techniques to investigate relationships among types of cooperatives and financial ratio values.
1970-1973	**Peace Corps Volunteer/Volunteer Coordinator,** Paraguay, South America. Agricultural Extension.

International Power Sector Consultancy

Short-term consulting assignments for NRECA-IPD in Belize, Bolivia, Costa Rica and El Salvador. Regulation, financial analysis, cooperative financing alternatives, economics of power supply alternatives, utility sector restructuring.

Education

1976 M.S., Agricultural Economics, Kansas State University, Manhattan, Kansas.
1970 B.B.A., Accounting, University of Wisconsin, Madison, Wisconsin.

DAVID R. HITTLE

Energy Sector Experience

1967 - Present. **President.** D. Hittle & Associates, Engineers and Consultants, Richland, Washington (USA)

Senior Principal Electrical Engineer responsible for the entire electric utility engineering activities of a small engineering firm of 15 people. Services include system planning reports, construction work plans, load forecasts, financial forecasts, construction budgets, operating budgets and retail rate studies, including cost of service and revenue requirement analyses for electric cooperatives and public utility systems throughout the Pacific Northwest of the United States. Prepared the engineering and feasibility studies for the formation of two new electric utilities and assisted in the negotiations for power supply and financing. Designed and inspected substations and distribution and transmission lines. Represented small electric utilities in negotiations for long term power supply and in wholesale electric rate issues. Prepared integrated resource plans, including conservation and renewable resources, for selecting future electrical energy resources.

1992 - 1995. American Samoa. Assist the American Samoa Power Authority to secure its first and subsequent private financing for expanding the generating capacity of the electric system; prepared a comprehensive electric load forecast, revenue requirements and retail rate analysis; developed a comprehensive electrical system plan and five year construction program including system protection; assisted in negotiations with the major industries and American Samoa Government in special contracts and arrangements for electrical service.

1984. National Rural Electric Cooperative Association, International Programs, Member of the Rural Electric Seminar Team in Kumming, China. The team was sponsored by the China Institute of Science to gain knowledge of the rural electric program of the U.S.

1992-1994 NRECA USAID, Philippines. Revised engineering guidelines for the National Electrification Administration, updating existing documents and developing new guidelines changed requirements, needs and technology. The project included three NEA counterparts and was expanded require four in-country visits totaling more than six man-months.

Education, Registration and Affiliations

B.A. Business Administration, Accounting. Univ. of Wash. Seattle. 1959
Electrical Engineering Courses, Univ. of Wash. Seattle, 1960-1965
Registered Professional Engineer. Washington, 1965. Oregon, 1978. Idaho, 1990.
Member of IEEE, Nat. Society of Prof. Eng. and Am. Society of Consulting Eng.

Annex 12: Resumes of Assessment Team Members

JOANNE NAGEL CONNOLLY

1986 - Present	Consultant (social anthropologist with engineering background); specialist in infrastructure and basic needs project design with extensive experience assessing disaster damage and helping public institutions recover and rebuild.
1992 - Present	Disaster Assistance Reservist, Federal Emergency Management Agency.
1981 - 1986	U. S. Agency for International Development; posts: AID/Washington with TDY assignments in Jamaica, Belize, Guatemala, Costa Rica; field assignment to Eastern Caribbean region; project development officer, housing project manager, infrastructure portfolio and social soundness analyst.
1991	Consultancy; National Rural Electric Cooperative Association; isolated rural electrification project in Nicaragua for USAID funding.
1994	Consultancy; Consortium for International Development; health project proposal in Hungary for World Bank funding.
1994	Consultancy; disaster assessments for FEMA in Georgia floods, winter storms in Tennessee, flash floods in Appalachia; Hurricane Andrew in Florida (1992).

Education and Affiliations

Smith College, 1962-64
Architectural Association School of Architecture, London, 1964-65
B.F.A., University of Illinois, 1967
M.A., anthropology, Northwestern University, 1972
Ph.D. candidacy, anthropology/architecture history, Northwestern University, 1973
Florida International University; College of Engineering and Design, 1987-89
USAID project development training, 1981 and 1985
American Anthropological Association (Fellow)
Society for Applied Anthropology
Society of American Military Engineers
Rotary International

Annex 12: Resumes of Assessment Team Members

MYRNA B. VILLARALBO

1982 - Present — Senior Manager, Management Consulting Services Department, Price Waterhouse, Manila, Philippines; responsibilities include marketing, planning, administration and execution of consulting projects involving financial analysis, financial/accounting systems, institutional strengthening, viability assessment, federal compliance reviews, operational assessment, training.

Energy Sector Experience

Project Manager of a USAID-funded project to enhance billing system for electric cooperatives in the Philippines.

Sub-Team Leader for USAID Rural Electrification Project in the Philippines to improve accounting policies and procedures, budget methodology, development of manuals.

Financial analyst for World Bank study of rural electrification in the Philippines including operational efficiency, investment strategy, pricing policy, financial and organizational issues.

Financial specialist for USAID for review of financial, management and technical issues at National Electrification Administration and electric cooperatives in the Philippines covering monitoring of foreign loans, loans to cooperatives, customer accounting, financial/accounting and internal control systems of cooperatives.

Team member on subsequent projects to assist USAID in building consensus for rural electrification rehabilitation project and defining project goals in the Philippines.

Education and Affiliations

M.B.A., Ateneo de Manila Graduate School of Business (academic requirements), 1986
Certified Public Accountant (Philippines), 1978
B.S.B.A., Accounting, University of the East, Manila, 1977
Associate in Secretarial Administration, University of the East, Manila, 1972
Continuing education courses in technical and managerial areas

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Center for Environment
Office of Energy, Environment, and Technology

RURAL ELECTRIFICATION IN BANGLADESH

FINAL REPORT

FEBRUARY, 1996

PART TWO: ASSESSMENT OF POWER GENERATION BY THE RURAL COOPERATIVES

Prepared for and funded by

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The assessment team gratefully acknowledges the cooperation, assistance and support by the personnel of USAID/Bangladesh, the Rural Electrification Board, the rural electric cooperatives (PBSs), the advisors of the National Rural Electric Cooperative Association, donor organizations and the many government agencies and private entities who responded willingly to our requests for interviews and information.

We also pay tribute to all who have contributed to the remarkable effort to electrify the rural areas of Bangladesh and the achievement thus far.

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ACRONYMS

ACOS	Allocated cost of service
ACRE	Area Coverage Rural Electrification
ACSR	Aluminum conductor steel reinforced
ADB	Asian Development Bank
AGM	Assistant General Manager (PBS)
BDG	Bangladesh Government
BOL	Build-Own-Lease
BOLT	Build-Own-Lease-Transfer
BOO	Build-Own-Operate
BOOT	Build-Own-Operate-Transfer
BPDB	Bangladesh Power Development Board
CC	Construction Contractor
DESA	Dhaka Electricity Supply Authority
DD	Deputy Director (REB)
EC	Engineering Consultant
FY	Fiscal Year
GM	General Manager (PBS)
GOB	Government of Bangladesh
GWh	Gigawatt-hour
HFO	Heavy fuel oil
km	Kilometer
KV	Kilovolt
KW	Kilowatt
KWh	Kilowatt-hour
MCF	Thousand cubic feet
MIS	Management Information System
MW	Megawatt
NGO	Non-governmental organization
NRECA	National Rural Electric Cooperative Association
O&M	Operations and maintenance
PBS	Palli Bidyut Samity (rural electric cooperative)
PSMP	Power System Master Plan
PSRP	Power Sector Reform Proposal
PTA	Performance Target Agreement
RE	Rural Electrification
REB	Rural Electrification Board
ROI	Return on investment
RPC	Rural Power Company
TAKA	Taka (Bangladesh currency: Taka 40 = US$ 1)
TD	Training Directorate (REB)
USAID	United States Agency for International Development

RURAL ELECTRIFICATION IN BANGLADESH

PART TWO

ASSESSMENT OF POWER GENERATION BY THE RURAL COOPERATIVES

I N D E X

RURAL ELECTRIFICATION IN BANGLADESH

PART TWO

ASSESSMENT OF POWER GENERATION BY THE RURAL COOPERATIVES

EXECUTIVE SUMMARY

1.0 OBJECTIVE:

The objective of the assessment in Part Two is to examine the potential and implications of power generation by the rural electric cooperatives (PBSs), in particular by those cooperatives in which the cost of interrupted, unreliable power is prohibitive and has severe adverse economic effects.

2.0 BACKGROUND:

One of the major threats to the PBSs' financial viability is the frequent load-shedding imposed on the PBSs by the sole power generation entity, Bangladesh Power Development Board (BPDB). Currently, during peak demand time, the BPDB generation facilities can be as much as 500 MW short and are forced to shed load to maintain system operability. This scenario will remain for an indeterminate time as the construction of new power facilities is dependent upon BPDB's improving its operations, flow of donor funds and the implementation of power sector reforms to facilitate private sector entry into the power sector.

The matter of power supply for the PBSs is viewed as an urgent, critical concern which must be addressed in the most assertive and creative manner possible to stem the growing inclination for industries to install their own generators. Extensive interviews with numerous industrialists reveal a readiness, born of necessity, to assure their operations a reliable source of power by solving the problem themselves rather than continuing to suffer intolerable losses from load-shedding. The very future viability of PBSs demands immediate action to augment their power supply. Small power generation is economically feasible, but conventional thinking will have to be expanded and characteristic inaction will have to be overcome. A priority project should be undertaken to underpin one or two PBSs which are most at risk to loss of industrial consumers, and to demonstrate REB's determination and ability to solve the power supply problem at local level, since BPDB plans for large generation will take several years. Other parts of this summary provide more detail, but this subject is mentioned at this point to put forth the premise that to continue to build new lines to the unserved without an adequate power supply to serve existing load is imprudent and inadvisable. Serious consideration must be given to the impact of new line construction (and the attendant new debt) without the prospect of sufficient revenues due to lack of power supply. Donors who favor new expansion should reassess how they can best contribute to the success of rural electrification, such as commodity support for operations and maintenance, or for small power generation.

The following is a summary of findings, and conclusions/recommendations on various topics:

3.0 POWER REQUIREMENTS AT SELECTED PBSs:

3.1 Findings:

BPDB has inadequate capacity to serve the existing and planned power requirements of the country and the PBSs' loads are shed the most frequently and for the longest periods. PBSs' industrial consumers are installing their own generating units and the loss of this more concentrated higher load-factor load reduces the viability of the PBSs. There is a net loss of existing consumers during the disconnection and reconnection process.

3.2 Conclusions/Recommendations:

The planned BPDB and Rural Power Company (RPC) generation resources will not solve the capacity and energy shortage until after the year 2000.

A dependable, long-term power supply is critical for PBSs to retain the existing consumer base and to serve load growth and new service areas.

Providing access to adjacent PBSs from small generation plants in the select PBSs can improve the potential of marginal PBSs to attract new industries.

REB should expedite immediate implementation of small power generation projects at Dhaka PBS-1 and Narsingdi PBS-1.

Power generating facilities should be added at the other identified PBSs immediately after the initial installations are successfully constructed and operating.

4.0 FEASIBILITY OF PRIVATE POWER:

4.1 Findings:

The existing commercial structure of the PBSs, and the perception of them by industrial consumers, is not conducive to collaboration with these consumers to construct and operate cooperative-type power generating facilities. Industrial customers who are seriously affected by the frequency of power failures are inclined toward only one solution: provide their own power plant to serve their own needs and protect their own business profitability. They indicate a reluctance to become involved in any business venture with a government-owned entity. Many industries in locations where gas supply is available have installed their own generating plants and are producing highly-reliable electricity at a cost well below that they previously paid to their PBS.

While some of the many industries which are very dissatisfied with the quality of power supply they receive would be prepared to pay a small premium for secure, uninterrupted supply, they consider they already are paying a high price for electricity. There is a growing awareness that self-generation is a viable option, particularly where a high load factor and a use for waste heat exists.

REB has authority under its founding ordinance to generate electricity. It has recently exercised this right by participating in the 60 MW Mymensingh project of RPC.

4.2 Conclusions/Recommendations:

Small power base-load plants in the range 1 to 10 MW are economic in areas Bangladesh where natural gas is available. . Analysis shows the cost of electricity produced from such plants is 1.01 to 1.82 Taka per kilowatt-hour, depending on load factor and assuming that the gas input cost is 47.68 Taka/MCF, which is the gas price to BPDB. In areas where gas is not yet available, small plants fueled by heavy fuel oil or diesel should be used only in limited periods, when normal power supply is restricted, due to the higher fuel cost. In these cases, the PBS must consider the economic impact of losing industries to self-generation versus the temporary higher cost of providing power to them when load is shed by BPDB.

The easiest way to solve the power problem in the PBSs, and to retain valuable industrial consumers, is for REB to implement a program for installing small power generation plants in those PBSs identified as most in need. This action can be taken quickly and need not await the development of a new regulatory framework which will be necessary for major privately-funded independent power projects.

REB should act immediately to arrange installation of small power generating plants in selected PBSs.

5.0 OPPORTUNITIES FOR PRIVATE INVESTMENT IN POWER FACILITIES:

5.1 Findings:

Industry cooperation in building small power generation by PBSs could come in different forms. The tea estates and garment manufacturers, because of the losses they suffer due to poor power supply, said they would be interested in investing or providing loan capital. The general investor would be interested in investment if the repayment period is short and return on investment (ROI) is reasonable. One project developer expressed interest in building and operating the small facilities.

The power sector reforms being undertaken by the GOB may take up to two years before privatized project approaches would be practical.

The following approaches are available for the small power facilities:

- The PBSs build and operate the facility with their own cash reserves, with additional bank loans if needed.
- The PBSs build and operate with their own reserves, equity participation by local investors, and bank loan.
- The PBSs build and operate with financing by equipment supplier.
- Use of private project developer.

5.2 Conclusions/Recommendations:

Classical schemes for private sector participation, such as BOO, BOT and BOL are inappropriate for the simple small power facilities. These schemes are too complex and the country is not ready for their introduction.

Construction of small generation facilities by the PBSs with their own cash reserves and local customer and bank loans is the most effective approach.

REB should provide the necessary support and oversight to the PBSs in the technical, procurement, foreign exchange (or donor support for import of equipment), and commercial (fuel supply prices, etc.) areas to facilitate speedy construction.

6.0 INTRODUCTION OF A SECOND POWER GENERATION AGENCY:

6.1 Findings:

The electricity supply industry in Bangladesh is embarking on a program of change intended to transform it and facilitate private investor involvement, particularly in providing new power generating plants to meet forecast demand. A new 'Power Cell' has been established in the Ministry of Energy and Mineral Resources to formulate the optimum new structure of the industry, implementing the necessary regulatory and legislative framework and ensuring that the necessary changes are made in tariff structures, provisions for power purchase and arrangements for competitive bidding, etc.

Until very recently responsibility for generation of electricity has been with BPDB. Under its ordinance, REB has authority to generate power, but did not do so. Within the last few months REB has recently engaged with PBSs and local investors to form a new company, RPC, which will develop and operate a 60 MW generating plant at Mymensingh.

6.2 Conclusions/Recommendations:

The PBSs can solve the problem of unsatisfactory power supply within the existing capability of the REB. There are very reliable small generating plants on the market in Bangladesh, from several international suppliers. They can be purchased, installed and commissioned within six months. Gas supplies are readily available to those PBSs in the eastern part of the country which have been identified as needing urgent support. In the western part where gas is not available, diesel generation plants can be used, burning heavy fuel oil (furnace oil) similar to that used at Khulna Power Station. Such plant, when operated at high load factor, can deliver electricity with high efficiency and at an acceptable cost when operated only as supplemental generation during load-shedding.

These small generating plants should be operated in parallel with the BPDB system, with appropriate payments for electricity delivered into the system. Arrangements should be made to coordinate protection devices and settings between BPDB and PBSs, and for disconnection of the PBS power plant from the BPDB system at times of major system disturbance and power cuts. The installation of small generation plants will not have significant impact on the load and resource forecast for the BPDB as the entire program is less than 100 MW. The size of each small generating project is envisioned to be 5 to 20 MW total, made up of several smaller units in the 1 to 5 MW range. If for some reason one or more of the units are out of service and BPBD is unable to provide the necessary backup generation, the PBS would likely have a load-shedding situation; however, the amount of load-shedding would be substantially less than the PBS is currently experiencing by being completely dependent of BPDB. In cases where an industry has already installed its own generating plant, arrangements should be made for purchase of any electricity which is surplus to that industry's own requirements, at an appropriate rate of payment.

A second power generation agency should not be established in Bangladesh, pending determination by the Power Cell of the optimal structure of the electricity supply industry.

7.0 INSTITUTIONAL REFORM/STRENGTHENING:

7.1 Findings:

REB at present has the authority to establish electricity generation, transmission, transformation and distribution systems in rural areas of Bangladesh under the Rural Electrification Board Ordinance (1977).

This authority is affirmed in the "Review of Electricity Legislation and Regulations in Bangladesh" prepared for the ADB in the fall of 1995.

7.2 Conclusions/Recommendations:

REB should expeditiously identify all government requirements and approvals.

REB should establish a power generation unit to facilitate the PBS small power generation program.

REB should reaffirm the definition of PBSs as commercial entities competent to enter into agreements.

PBSs should be the owner of the individual small power generation projects.

8.0 PRIVATE SECTOR BUSINESS, FISCAL AND INVESTMENT ISSUES:

8.1 Findings:

Several items of potential PBS involvement with business interests exist:

In the fishing industry areas there is a tremendous shortage of ice. New technologies using waste heat to produce ice are available.

The national natural gas transmission and distribution system contains several pressure-reducing stations which could be tapped for small power generation without consuming fuel.

Major industries which generate their own power would be willing to sell excess power and/or increase their plant capacity to help the PBSs.

8.2 Conclusions/Recommendations:

REB/PBSs should explore potential cogeneration prospects to increase the utilization of the thermal energy of the fuel supply.

The possibility of setting up small generating facilities in conjunction with the pressure-reducing facilities of the gas transmission system should be examined further.

9.0 ENVIRONMENTAL CONSIDERATIONS:

9.1 Findings:

Bangladesh has developed a comprehensive set of guidelines in order to protect its natural heritage and environment. There is an awareness of the need to safeguard the environment as the economy develops and new industries are established.

Natural gas is the most environmentally friendly primary energy for electricity production in thermal plants. Bangladesh has large resources of natural gas and it is the predominant fuel used for power generation.

The proposal to install small power generating plants in a number of PBSs will have minimal environmental impact, for these reasons :

- The physical dispersion of these plants means that their emissions will have far less impact than those which would arise from a single equivalent plant.

- Any accident (e.g. leakage of primary fuel) will have little impact because of the small size of plant.

  The small generating plants envisaged are similar to those widely used in other countries. Such plants often are installed at hotels, hospitals and other civic institutions where environmental impact is a very sensitive issue. Design of these plants has been improved over a number of years and they now incorporate features which take account of the new environmental awareness which exists internationally. It is considered that no additional special features would have to be specified for their use in Bangladesh in the manner now envisaged.

9.2 Conclusions:

There would be minimal environmental impact from the use of the machines proposed; no special environmental measures need be taken.

10.0 TECHNICAL ASSISTANCE REQUIREMENTS:

10.1 Findings:

REB does not have small power generation expertise as it has concentrated on the distribution of electricity to rural areas. Therefore, REB will require technical assistance to implement a small generation project for PBSs.

10.2 Conclusions/Recommendations:

REB will need technical assistance in the following activities and areas of expertise:

10.2.1 Setting up a power generation unit; negotiating arrangements with other government agencies, donors and PBSs; and expediting the financing and implementation of a small generation program. **Power Supply Policy Specialist - 7.5 manmonths**

10.2.2 Develop the selection criteria for sizing and siting the small generation projects at PBSs. **System Planning Engineer - 2.5 manmonths**

10.2.3 Develop technical and construction specifications for each PBS generating project. **Power Engineer - 8.0 manmonths in up to five segments.**

10.2.4 Coordinate and inspect the construction at each selected PBS site. **Project Engineer - 20.0 manmonths total,** with each site requiring one Project Engineer for up to 5.0 man months each.

10.2.5 Develop a training program for the operation and maintenance of the small power projects. **Training Specialist - 24.0 manmonths.**

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SMALL POWER ACTIVITY/TECHNICAL ASSISTANCE IMPLEMENTATION

ACTIVITY	1996				1997				1998				1999				2000				2001			
Quarters	1ST	2ND	3RD	4TH	1ST	2ND	3RD	4TH	1ST	2ND	3RD	4TH	1ST	2ND	3RD	4TH	1ST	2ND	3RD	4TH	1ST	2ND	3RD	4TH
PRIORITY A Identify all government approvals necessary for PBSs to own and operate small power plants within mandate of RE Ordinance.																								
Formulate policy affirming PBSs as commercial entities competent to enter into agreements.																								
Establish and staff a power generation unit within REB.																								
Linked Technical Assistance: **Power supply policy specialist; 7.5 manmonths over two years to advise in power generation unit structure, policy formulation and inter-agency negotiations. (see pp. 29-30) EX-PAT**																								
Develop criteria for sizing and siting small power project in first and subsequent locations.																								
Linked Technical Assistance: **System planning engineer; 2.5 manmonths total from the functioning of power generation unit. (see page 31) EX-PAT**																								
Develop technical specifications for small power units and site-specific construction specs for each installation as planned.																								
Linked Technical Assistance: **Power engineer; 8 manmonths in as many as 5 terms; locally sourced if independent of vendors. (see page 30)**																								
Develop construction specs and tender documents for each small power site: supervise construction.																								
Linked Technical Assistance: **Project engineer; approximately 3 months for each of 8 sites; provide construction inspection services; 24 manmonths total; locally sourced. (see pages 30-31)**																								
Provide for training of small plant operations/maintenance personnel.																								
Linked Technical Assistance: **Contracted O & M services through machine vendors/manufacturers or contracted trainers of PBS personnel in bid packages; manmonths N/A. (See page 31)**																								

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MAIN REPORT

PART TWO

Assessment of Power Generation

by the Rural Cooperatives

PART TWO

ASSESSMENT OF POWER GENERATION BY THE RURAL COOPERATIVES

1.0 BACKGROUND:

In 1976, less than three percent of Bangladesh's rural population had access to electricity. Realizing that sustainable economic development and quality of life depends on a reliable supply of electricity, the Government of Bangladesh (GOB) decided to extend the public supply of electricity to its rural communities. Cooperating with the United States Agency for International Development (USAID) and GOB, the National Rural Electric Cooperative Association (NRECA) developed a comprehensive rural electrification plan. NRECA's plan called for the complete electrification of rural Bangladesh in five phases concluding in 2005.

The basis for the NRECA plan was the development of autonomous member-owned rural electric cooperatives called Palli Bidyut Samity (PBS). All PBSs come under the aegis of the semi-autonomous Rural Electrification Board (REB) in Dhaka. The REB sets national rural electrification policy and standards, assists with organizational, technical, and financial operations, and acts as financier for the PBSs. The REB is authorized to construct generating capacity and transmission and distribution systems using funds supplied by the GOB. The PBSs operate the local distribution system after it is commissioned. The PBS plans and implements expansion of the local distribution system including electricity purchases, meter reading, and billing and collection.

Since 1978, an estimated $320 million in GOB and external donor funds have been invested in the rural electrification system. However, the rural population still account for only 13 percent of the total electricity consumed in 1994. The objective of this assessment is to examine future technical assistance needs of the Rural Electrification Board (REB) and rural electric cooperatives (PBSs) in maintaining and expanding electricity distribution in Bangladesh, and becoming self-sufficient in the skills and processes involved.

One of the major threats to the PBSs' financial viability is the frequent load-shedding imposed on the PBSs by the sole power generation entity, Bangladesh Power Development Board (BPDB). Currently, during peak demand time, the BPDB generation facilities can be as much as 500 MW short and are forced to shed load to maintain system operability. This scenario will remain for five to ten years until the construction of new power facilities is completed and this is dependent upon BPDB improving its operations.

This power generation assessment will:

1) Examine the economic cost of power interruption/shedding in areas of high productivity/export orientation such as selective tea growing areas.

2) Analyze the feasibility of small power generation, connection to the user, tariffs, fuel availability and the potential for selling excess power.

3) Examine technical assistance requirements for small power generation.

2.0 POWER REQUIREMENTS AT SELECTED PBSs:

2.1 Scope:

This section of the report reviews the present and projected power supply and load balance for the PBSs and identifies possible host PBSs for installing the first small power generating stations.

2.2 Findings:

2.2.1 BPDB does not have adequate dependable capacity to deliver power to the entire electric system and has a program to shed load over the peak load periods of most work days. The PBSs, being the most remote and rural portions of the system, are shed first. The present power shortage is estimated to be more than 200 MW during the highest peak load periods and more than 60 MW during average peak load periods. If reserves are included, the BPDB capacity shortfall is 500 MW. It is not possible to determine the amount of load not served during the load-shedding period, but it is greater than the amounts reported due to consumers adapting to the available supply. Based on BPDB information, load-shedding occurred on 220 days and more than 763 hours during FY 1995. REB estimates that the PBSs' energy sales were reduced by more than 53,000 MWH or more than six percent in FY 1995 as a result of the BPDB load-shedding. This resulted in lost revenues of more than 135 million Taka.

2.2.2 The PBSs' load is projected to grow at the rate of 16 percent per year on average and most PBSs have a historical growth rate in excess of 20 percent. BPDB has plans to add generating capacity to meet the nation's load growth, but planned generation will not be adequate to serve the total load until after the year 2000. The formation of the Rural Power Company (RPC) to supplement the BPDB generating capacity is complete and it has solicited statements of interest from potential developers. The RPC 60 MW Mymensingh project has been included in BPDB's resource plan. Private developers of a large generating project will require at least two years before they will be in a position to enter into a contract with BPDB and another two to three years before the project will be producing firm energy.

2.2.3 Many new industries are installing their own generation to meet their needs for reliable electricity. Some industries have left PBS systems and have installed their own generating units as a result of the service interruptions and load-shedding. The most economically-viable PBSs have a consumer mix that is weighted toward general and industrial loads.

2.2.4 There is a net loss of revenue-producing consumers in the disconnection and reconnection process for non-payment of the electric bill. At one PBS the FY 1995 average monthly ratio of disconnections to reconnections was 246 to 304 for a net loss of 58 consumers per month, a loss of nearly 20 percent of the disconnected accounts.

2.3 Analysis:

2.3.1 The existing power shortage problem will continue to deteriorate until adequate generating capacity is added to the system. The PBSs will continue to be the first to be shed as this load has been considered the lower priority load. The industrial and general accounts that require a dependable power supply will

purchase their own generating units and disconnect from the PBS lines. In addition, domestic customers who had expected to receive electricity during the evening hours (the high load hours of the day) will disconnect from the system if power is not available at the time they need it. If the consumer who expected to replace the kerosene lamp or the candle with an electric light still needs to purchase the former, that consumer will not stay connected to the PBS. More importantly, if the PBSs lose all or a portion of their general and industrial consumers, the financial health of the PBS is threatened. Background Paper No. 4, Industrial Perspective of Power Supply, provides more detailed analysis of selected PBSs' sensitivity to the loss of industrial and general consumer load and the potential impact of not having adequate capacity to serve the load growth in demand.

2.3.2 Industries have a need for a reliable power supply and have demonstrated that small generating units are more reliable and produce lower cost energy than the PBSs' retail electric rate. Background Paper No. 11, Small Plant Economics, analyzes the cost of generation at various plant factors. The PBSs must be able to supply the industries with reliable electrical energy or the consumers will opt for their own units.

2.3.3 In selecting the host PBSs for siting the first small generating units, the following criteria were established:

- Industrial consumers who require reliable power supply
- High growth rate of energy sales
- Sufficient load density to distribute generation within 11 or 33 KV system
- Site access (road/river)
- Financially strong PBS

2.3.4 In consultation with REB, PBS General Managers and others, the following list of PBSs has been developed for consideration of small generation installations:

PBS Name	Approx. Plant Size(MW)	Adjacent PBSs
Dhaka-1	10	Tangail, Manikganj
Narsingdi-1	5-10	Narsingdi-2
Chittagong-2	5-10	Chittagong-1, Cox's Bazar
Moulvibazar	10	Sylhet, Hobigonj
Comilla-2	10	Comilla-1, Feni, Chandpur
Jessore-2	5-10	Jessore-1, Satkhira
Bogra	5-10	Natore-1
Dinajpur-1	5	Rangpur-2

All but the Jessore site are located where the gas supply is in the vicinity and natural gas is the fuel of choice.

The strengthening of power supply in each of these PBSs will also result in improved security of supply to adjacent PBSs. This will make them more attractive to new industry. Thus, placement of small generators in selected PBSs will not only underpin their own sustainability, but will also improve the viability of weaker adjacent PBSs.

Those PBSs located where gas supply is not yet available should have similar

opportunity to provide small generating plants to improve reliability of their power supply and to retain industrial consumers. This can be achieved by providing heavy fuel oil for small power generation at a gas equivalent price, until the gas network is extended to the west of the country. This policy action would assist the attraction of industry, the creation of jobs and would help to curtail migration from disadvantaged areas in rural Bangladesh to the cities.

2.3.5 In selecting the PBSs, consideration has been given to the load transfer capability by the PBSs' existing distribution, substation and 33 KV transmission facilities. Background Paper No. 3 includes an analysis of the load transfer capability of the 11 KV and 33 KV feeders. The major constraint in sizing the small generating plants is the size of the existing substations. Properly sited, the small generating plant installation can serve the adjacent PBSs with up to 10 MW of capacity.

2.3.6 The proposed small power generating plants will have a long working life and will deliver the following benefits:

- In the future when the main power supply system becomes more reliable in Bangladesh these generators can be used at times of system peak demand,
- The capital cost per kilowatt is lower than that for large power generating units.
- Fuel conversion efficiency, particularly at good load factors, is comparable with the average efficiency of BPDB thermal plant.
- The system losses will be reduced as the energy is injected into local networks, saving transmission and transformation losses..

2.4 Conclusions/Recommendations:

The above PBSs have sufficient industrial and general load and sufficient financial strength to be candidates for the first small generating projects. The need for a dependable power supply is critical to the long-term sustainablity of the PBSs. If the PBSs lose a major portion of their industrial and general service load, the revenues from the remaining consumers will not cover the remaining operating cost without a substantial rate increase. The annual load growth of BPDB, 150 to 200 MW, is much greater than the maximum small generation capacity of 75 MW suggested for the first eight PBSs. The short-term power supply is inadequate and it will become worse over the next five years. Any new small generating projects that are added to the power supply will not create an energy surplus or reduce sales for BPDB.

2.4.1 **REB should expedite the installation of small power generation projects for Dhaka PBS-1 and Narsingdi-1 PBS so that the process and the arrangements between REB, PBSs BPDB and DESA can be resolved for future small power projects on PBS systems.**

2.4.2 **REB should implement the addition of small power generation projects at the other PBSs on a priority basis.**

2.4.3 **REB and the PBSs should develop a power supply plan for each PBS to determine the economic and technical feasibility of supplementing the BPDB power supply with small power generation.**

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3.0 FEASIBILITY OF PRIVATE POWER:

3.1 Scope:

This section examines the context in which new power facilities can be provided at a local level in the PBSs. It examines the present power shortage situation as it affects PBSs and their major consumers, and it considers how this shortage can be corrected.

3.2 Findings:

3.2.1 PBSs are well managed, and are generally well regarded by their consumers because of the responsive service they provide. They also are perceived to be a part of Government apparatus, very much under the direction of REB, which exercises tight control on most aspects of their operation. This control includes appointment of PBS managers, their remuneration, the setting of tariff levels, the approval of budgets, and the use of any surplus in revenue over expenditure.

PBSs do not have many of the normal freedoms enjoyed by corporate bodies and are not established as cooperatives in the normal meaning of the term. Their boards of directors, who are elected in the usual manner, do not have any real authority to direct the business affairs of these enterprises. While PBSs do not have any control over the supply of power to their networks, they are held responsible by most of their consumers for the frequent power failures.

3.2.2 REB has authority from its founding ordinance "to establish generation, transmission, transformation and distribution systems in the rural areas of Bangladesh ..... and to determine, with the approval of the Government, the criteria for rural electrification and associated works to ensure optimum use of resources and maximum socio-economic benefits." Until very recently REB did not exercise its right to generate power. It has now participated in the establishment of a new company, RPC, which will develop a 60 MW gas turbine plant at Mymensingh with assistance from Asian Development Bank and in joint venture with local investors. REB has directed five PBSs to invest monies in this new plant. It is unclear as to how the participating PBSs will derive direct benefit in the form of improved reliability of power supply, over and above any global improvement in power supply as a result of the commissioning of this new plant.

3.2.3 Many industries have installed their own generating plants because of the production cost impact of frequent power supply interruptions. Many industries cannot accept the costs of power supply interruption and voltage variations. For example, the textile manufacturing industry requires a steady continuous power supply, and many engaged in the industry have already installed their own generators. Background Paper No.4, Industrial Perspective of Power Supply, includes further discussion and analysis of the topic. The preferred power generators are natural gas engines, typically of 1 MW capacity. These are installed in modular configurations. One industrialist has seven of these engines to power his industrial park and is completely independent of public power supply. The price of electricity produced is approximately 1.5 Taka per KWh. In addition, the waste heat produced by the generators is used for industrial processes and for air

conditioning. The cost of 1.5 Taka per KWh incurred by industry-owned plants is based on gas input costs of 2.65 Taka pr m^3, and on the plant being operated at a high load factor (i.e. 85 percent and higher).

3.2.4 There is no arrangement at present whereby those industrial customers who have installed their own generating plant can generate more than their own requirements of electricity and supply it to PBS systems.

3.2.5 There are several suppliers of gas engine generators in Bangladesh offering reputable equipment. These include Caterpillar, Wakasha, Wartsilla and Dresser Machines. It is estimated that installed capacity at industry-owned power plants is already 150 MW and is increasing rapidly.

3.3 Analysis:

3.3.1 The frequency and duration of load-shedding is seriously threatening the sustainability of many PBSs. Failure to retain major industrial customers results in serious loss of revenue. If this continues, and energy intensive industries opt to be self-sufficient in power, the public system will be left with low load factor, higher costs of energy production and lower operating margins.

3.3.2 The conditions in Bangladesh at present are not favorable toward private power project development. However, the GOB is committed in principle to private power development. It has established a Power Cell in the Ministry of Energy and Mineral Resources (MEMR) to formulate plans for implementing necessary changes in organization of the power supply industry and to establish a regulatory and legal framework to facilitate establishment of private power projects.

It is not necessary to await these major structural changes in order to address power supply shortages in the PBSs, which are under the direct control of REB. In its founding ordinance, REB was given the authority to generate electricity. In order to safeguard the sustainability of the PBSs, REB should now exercise that right and provide small generating plants in a number of PBSs. This is the only practicable way to provide additional power to the PBSs in the immediate years ahead. The existing commercial structure of the PBSs does not permit them to enter into joint venture type arrangements with local investors, or allow them to enter into the type of power purchase agreements which any private investor offering to provide power would require.

3.3.3 Small power plants are economic to install and operate in Bangladesh, particularly in those areas where natural gas is available. (see Background Paper No.4)

It is assumed that the input cost of gas to small PBS generators would be the same as that incurred by BPDB (i.e., 47.68 Taka per MCF). Based on this assumption, the following table indicates the cost of power output from small natural gas engines of 1 MW capacity and above at different load factors.

Evaluation of Gas Engine Generating Plant.

Size of generating units	1 MW and 2 MW
Total installed investment cost	24,000 Taka/KW
Fuel cost	47.68 Taka/MCF
Loan amortization period	10 years
Interest rate on loan	10%
Thermal efficiency	25% to 33%, depending on load factor
Operation and maintenance costs	3% of installation cost per year.

Plant Load Factor

	40%	50%	60%	70%	80%	90%
Taka/kWh	1.815	1.534	1.337	1.190	1.075	1.010

In finalizing the location and configuration of these generating plants, a careful appraisal should be made to achieve the following :

- maximum possible load factor for each installation.
- delivery of reliable uninterruptible power to key industrial consumers at all times.
- utilization of waste heat if this is at all possible.
- facility to isolate plant from BPDB/DESA supply system at times of major system disturbance or inadequacy.

3.4 Conclusions/Recommendations:

3.4.1 Small power generation is economically viable.

3.4.2 REB should assist PBSs to install small generating plants in their own locations.

3.4.3 REB should negotiate arrangements with BPDB and with DESA to enable these local PBS generators to operate in parallel with the grid, and to be credited for electricity delivered into the grid.

3.4.4 REB should develop a mechanism whereby industrial consumers who operate their own power generating plants can sell their surplus electricity into the PBS system.

4.0 OPPORTUNITIES FOR PRIVATE INVESTMENT IN POWER FACILITIES IN EACH PBS :

4.1 Scope:

This section covers different approaches for the participation of private sector investors in the power facilities, their pros/cons, their applicability to small generating facilities and recommended strategies.

4.2 Findings :

4.2.1 Because of the limited time available to meet with potential investors and determine feasibility of participation, discussions were held with some industrialists in the Dhaka-1 and Narsingdi-1 PBS area and three tea estate general managers in the Moulvibazar PBS area. It is believed that the following inputs received during the above discussion are typical of any PBS serving industrial consumers:

- Beximco, a major textile and pharmaceutical manufacturer, with their own industrial park, is self-reliant for electricity. They generate and distribute power within their facilities, and use PBS power only on a temporary basis. They are not interested in investing in any private power facilities of the PBS. However, they would consider selling power to the PBS if suitable arrangements could be made.

- Medium industries (e.g. Reliance Spinning, Fakir Cotton Mills) who are installing their own generators would rather use PBS supply if reliable power could be assured, and would be willing to pay some premium for such power. Some may be potential investors.

- Garment industries (who only suffer monetary loss due to overtime, air freight, etc. to meet schedules, but are not sensitive to power quality) are willing to pay a premium for uninterrupted power. Some are willing to invest in private power facilities under reasonable terms. Other private investors expressed an interest in participation in private power projects if the rate of return is attractive.

- The tea industry suffers wasted production volumes due to power interruptions. The general managers interviewed were confident that investment in PBS power facilities could be arranged. If the power reliability issue is not resolved soon, they would be forced to install their own generators, which many of them are not able to afford on their own.

- Some potential investors would invest in private power facilities if the repayment period and interest rate are attractive.

- Discussion with one potential project developer identified interest in small power project development, including potential foreign investor participation. A major concern is ability to repatriate capital.

- One potential equipment supplier expressed interest in providing operating and maintenance services, and perhaps arranging financing for the equipment, if the commercial structure of the PBS is non-governmental.

4.2.2 Potential Approaches to Private Power Facility by PBS:

Background Paper No. 6, Privatized Project Approaches, describes the common schemes BOT, BOO, BOL, etc., their pros/cons and the issues involved in privatized power approaches.

The GOB is undertaking major reforms in the legal, regulatory, administrative, financial and investment areas to facilitate private sector entry into the power arena. This may take another two years.

The REB by its charter is empowered by the GOB to undertake generation and can authorize the PBSs to engage in any activities related to power generation. Therefore the following options are available for the PBSs :

Model 1 : Build and operate the power facility with PBSs' own cash reserves, with additional commercial bank financing, if required. Foreign exchange for equipment is provided by GOB or donors to the RE program.

Model 2 : Build and operate the power facility with PBS cash reserves and equity participation by local investors and bank loan. Investors could be users of output power. Foreign exchange is provided by GOB or donors to the RE program.

Model 3 : Build and operate the facility with PBS cash reserves and financing by equipment supplier.

Model 4 : Invite a domestic private project developer to construct and operate the facility on BOO, BOOT or BOL basis. Foreign exchange provided by GOB or international partner of the developer. PBS may participate in investment.

Model 5 : Invite an international project developer to construct and operate the facility on BOO, BOOT or BOL basis. PBS may participate in investment.

4.2.3 The pros & cons of the above approaches are provided below :

MODEL	PROs	CONs
1	• Completely under PBS control. • Speedy implementation of project	• Requires technical assistance for specification, procurement, construction, and operation and maintenance activities. • Need to obtain foreign exchange for equipment.
2	• Keep major industries tied to PBS. • Industries are interested. • Ability to raise capital (esp. if PBSs do not have adequate reserves)	• Lack of total control. • Requires technical assistance for specification, procurement, construction, and operation and maintenance activities. • Need to come up with attractive terms and conditions for the investors. • May increase unit cost of electricity. • Need to obtain foreign exchange for equipment.
3	• Financing arranged by supplier. • Under PBS control	• May mean uncompetitive prices. • Terms and conditions of financing may be difficult • Need to obtain foreign exchange for equipment. • Requires technical assistance for specification, procurement, construction, and operation and maintenance activities.
4	• Responsibility for project execution moved to developer • Efficiency in operation and maintenance	• Extensive bidding process/time. Availability of experienced developers. • Lose operating control. • Development slow, higher cost. • Need to deal with market cost of producing power. • Need to provide guarantees for power purchase. • Either provide foreign exchange through GOB/ donor, or risk project development/implementation.
5	• Responsibility for project execution moved to developer • Efficiency in operation and maintenance	• Extensive bidding process/time. • Potential for project getting entangled with GOB initiatives for power sector reforms. • Uncertain prospects of successful completion.

4.3 Analysis:

4.3.1 In analyzing the various models presented in section 3.2, and coming up with strategies for private sector participation in power facilities, it is important to consider the following :

a) If the PBS is truly an autonomous unit, with commercial structure, member participation and profit/loss concept, the construction of a small power facility by a PBS by itself would constitute privatization and represents the simplest, classical form of private participation.

b) The ability of the PBSs to become involved in private generation of small power is dependent on the REB providing necessary authority to the PBSs.

c) The success of privatized power in RE program and of the PBSs to engage in related activities will be greatly facilitated by REB leadership and generic assistance in the following areas :

- Issuance of a policy stating that, in order to assure the economic viability of the RE program, adequate and reliable power supply will be provided by the PBSs. The accompanying goals/objectives will include construction of small power facilities at select locations, attracting participation by local user-industries and other investors in the power facility, and use of the generating units for base-load operation to assure economic viability.

- Reaffirmation of the autonomous status of the PBSs and authorization of PBSs to carry out all activities necessary for building small power facilities. These include investing their cash reserves, raising bank loans, entering into agreement with investors, etc.

- Resolving critical issues generic to all the short-listed PBSs. These include (i) obtaining the necessary foreign exchange for the imported equipment; (ii) pursuing the donor community for the supply of the equipment; (iii) standardizing the equipment size, make, etc. and the design of the small power facility; (iv) ensuring that subsidies provided to the power sector projects (duties, taxes, interest rates, etc.) are also extended to the small power facilities; (v) arranging fuel supply at the same rates provided to power generating facilities; and (vi) training workers to operate and maintain the facilities.

d) Private investors' expectations on the recovery period and return on investment would be based on market conditions. A five-year investment recovery and 9 -14% interest rate appear to be normal.

e) Local industry-investor would expect reasonable tariffs, recovery period and ROI, in addition to the reliability of the power supply.

f) Since the commercial structure of the PBSs is unclear, setting up joint ventures with local investors does not appear to be a feasible approach, and it is not necessary.

g) The engineering, construction and startup of the small-sized units are fairly simple.

h) Equipment suppliers are willing to provide operating and maintenance services.

4.3.2 Considering the above factors, the following strategy seems appropriate:

- Where the PBS has adequate cash reserves, the PBS should do it on its own.
- Where additional financing is necessary, local industries who would benefit by the reliable power should be pursued for participation, and any additional capital through bank loans.
- Model 3 could be a preferred approach under the right terms and conditions.
- Model 4 using a local project developer should be considered only if a number of the PBSs are unable to raise the necessary capital. Under this model, BOO or BOL scheme should be used depending on the capability of the developer.
- Model 5 is very complex and is not justified for the small projects under discussion and would not be practicable in the absence of new regulatory and legislative frameworks.

4.4 Conclusions/Recommendations :

4.4.1 Industries who are suffering economic losses due to unreliable power supply are interested in supporting the establishment of small power facilities by PBSs; some are willing to pay a premium for the power.

4.4.2 Classical schemes for private sector participation, using Independent Power Producers (IPPs), such as BOO, BOT, BOL etc. are inappropriate for small projects.

4.4.3 The authorizing laws of the REB recognizes the autonomous status of the PBSs. REB should reemphasize and utilize this autonomy in establishing private sector participation in the RE small power generation program.

4.4.4 Leadership by REB in promoting and emphasizing the necessity of small power generation as the means of ensuring the economic viability of the RE program is essential. Several activities listed under 4.3.1 (c) are generic to all the power-producing PBSs and will be most efficiently handled and facilitated by the REB.

5.0 INTRODUCTION OF A SECOND POWER GENERATION AGENCY:

5.1 Scope:

This section considers the existing framework within which new power generating plants are developed in Bangladesh and whether creation of a second power generation agency is a desirable option.

5.2 Findings:

5.2.1 At present BPDB is the only generator of power delivered into the public supply system. REB has the authority to generate power under the ordinance which established it, but has not undertaken any generation to date. It has, however, recently engaged in joint venture with local investors to form a new company, RPC, which will develop and operate a 60 MW generating plant at Mymensingh.

In former times, it was unusual for a private industry to seek a license to generate its own power. Today many industries seek such licenses and they are readily provided, as government policy supports rapid industrial development, and particularly those industries which are export oriented. There are only two entities generating power to-day: BPDB which generates and distributes on a large scale, and private industrialists who generate for their own purposes. There are no arrangements for delivering power which is surplus to their own requirements into the public system.

5.2.2 The GOB has accepted in principle the need for private investment in power generation in Bangladesh. It recently established a Power Cell in the MEMR which is charged with responsibility for putting in place the necessary regulatory and legislative framework to facilitate private participation in power generation. Terms of reference have been prepared for consulting services to be obtained from an experienced international agency which will include:

- Strategy for attracting outside investors in BOO projects;
- Structured request for proposal (RFP), including drafts of Power Purchase Agreements (PPA), fuel supply agreement (FSA) and land conveyance agreement (LCA);
- Assessment of unsolicited proposals already received;
- Proposals for restructuring BPDB and DESA and for rationalization of the distribution sector;
- Determination of Long Range Marginal Cost (LRMC) of power supply by voltage level and class of customer;
- Recommendations on power purchase rates from IPPs, bulk sales to distribution utilities etc.

There is already a program in place to create an environment within which private power plants can participate fully in supplying the electricity needs of Bangladesh in an open and transparent way.

5.3 Analysis:

5.3.1 Introduction of a second power generation agency in Bangladesh is not considered necessary as a way of improving power supplies to the PBSs; neither is it considered an ideal way to open up the market for private power generation in Bangladesh.

5.3.2 It is not considered appropriate to anticipate the findings of the newly established Power Cell, and their advisors, on how best to structure the electricity supply industry in Bangladesh. Based on experience in many other countries, the formation of a second power generation agency will not be identified as the best solution. More probably, a framework will be recommended within which many private power companies can be established, each competing to deliver power into a wholesale market.

5.3.3 Small power plants can be provided in the PBSs under the existing authority of REB, as recommended in 3.4 above.

5.4 Conclusions/Recommendations:

5.4.1 **Action should not be taken to establish a new second power generation agency in Bangladesh pending determination of an overall structure for the electricity supply industry by the Power Cell and its advisors.**

6.0 INSTITUTIONAL REFORM/STRENGTHENING:

6.1 Scope:

This section examines the need for institutional reform/strengthening, inside and outside the REB, to facilitate the introduction of private power into the PBSs.

6.2 Findings:

Findings regarding the institutional framework for small power generation by REB/PBSs are included in Background Paper No. 10 of this report. Selected quotes of portions of the documents are as follows.

6.2.1 The Rural Electrification Board Ordinance (1977)

Section 3 (2): "The Board shall be a body corporate having perpetual succession and a common seal, with power, subject to the provisions of this Ordinance and the rules made thereunder, to acquire, hold and dispose of property, both movable and immovable, and shall by the said name sue and be sued." (emphasis added)

Section 8. Functions of the Board. "The functions of the Board shall be - (a) to establish electricity generation, transmission, transformation and distribution systems in the rural areas of Bangladesh; (b) to take measures for effective use of electricity to foster rural development with special emphasis on increase in use of electric power for economic pursuits ....(c) to determine, with the approval of the government, the criteria for rural electrification and associate works....(g) to organize the prospective customers of electricity into formal and informal groups, such as Palli Bidyut Samities, electric and other co-operatives, societies, associations and companies for the purpose of execution and management of schemes and providing related services;....(emphasis added)

6.2.2 Another pertinent finding is quoted in the document, Review of Electricity Legislation and Regulations in Bangladesh, sponsored by Asian Development Bank and done by a multi-national project team, August-October, 1995. The review recommends "a comprehensive new Act" to replace the Electricity Act of 1910. It further states:

Page 3: "The power sector is governed by the provisions of the Electricity Act of 1910 as amended from time to time and the provisions of the Ordinances under which the major entities in the power sector were created, namely:

a) Presidential Ordinance No. 59 of 1972 creating the BPDB.
b) Presidential Ordinance of 1977 creating the REB.
c) Presidential Ordinance No. 6 of 1990 and the Dhaka Electricity Supply Authority Act (Act No. 36 of 1990) creating the DESA.

"All the power sector entities have been created as statutory corporations and any change in their structure would need the approval of the Parliament.

The technical and financial performance of BPDB and DESA have been much below the expectation, while that of the REB has been good and their targets for the future are very promising." (emphasis added)

Page 7-9: "The Planning Commission first provides the likely demand for power that would be in line with the other dimensions of the National Plan.

"The MEMR (Ministry of Energy and Mineral Resources) which deals with all fuels draws the supply plan for the Energy sector which could provide the fuel needs of the power sector. Planning Commission and the Ministry of Finance in consultation with the MEMR jointly allocate finances to the various power sector agencies. Normally, any external assistance received is taken into the Government account and lent to the institutions at a much higher interest rate. In the case of REB, the government has permitted the assistance to be directly received by REB and spent on development works to be transferred to the PBSs on condition that the REB functions as a No-Loss-No-Profit organization. (emphasis added) Faced with the shortage of investment funds for the power sector, the government has decided to involve private sector in power generation and has set up an inter-ministerial group which has submitted a very useful report on Power Sector Reforms in Bangladesh (PSRB).

"Summing Up: Bangladesh has well organized institutions in charge of the power sector. Power generation is the monopoly of BPDB; the operations in the area are very unsatisfactory, both in terms of investment for adding new capacity and in operating the existing plants. Unless new agencies are introduced very quickly in power generation activity, the shortage which is already large might become intolerable. Distribution responsibility is shared by BPDB, DESA and REB through PBSs. The distribution functions are discharged with commendable efficiency on the technical side by the REB-PBSs and the consumer satisfaction is also high. (emphasis added) Distribution by the BPDB is far from satisfactory...The distribution work of DESA is very poor.

"The key to power sector reforms in Bangladesh lies in reorganizing BPDB and DESA....

"REB and PBSs appear to have found a good formula for rural electrification and may be retained unchanged." (emphasis added)

Page 11: "The REB felt that the problems of rural electrification are fairly well tackled by it through the PBSs but the supply of power to the PBS is severely constrained because they have to depend on the supplies from BPDB. REB would like to be permitted to set up power stations for supplying power to the PBSs. They pointed out that a beginning has already been made through the Rural Power Company (RPC)". .... (emphasis added)

6.3 Analysis:

There is general consensus in all quarters that REB has the statutory authority, with the approval of the MEMR, to allow the PBSs to invest their own capital reserves in small generation projects to supply their own power or to enter into agreements with other private entities to provide common benefit to consumer-owners of the PBSs.

In brief, the assessment team's analysis of the institutional reform required to implement small power generation is that REB need only seek formal concurrence of the Ministry of Energy and Mining Resources (MEMR). This premise could prove to be oversimplified if we have naively assumed that, if everyone favors the idea, it can be done. It appears that no restructuring of the REB is required to allow them to generate power. Therefore, action by the Parliament is not needed to expand the

present ordinance. The review of electricity legislation quoted in Section 6.2.2 reflects the very positive appraisal of the performance record of the REB/PBSs compared with other government entities in the power sector. The review states flatly that REB/PBSs work well and should not be changed.

With the universal recognition of the power shortage, the time required to respond to it with new capacity from large plants and the incontrovertible evidence of the urgency involved, the proposal for REB/PBSs to be allowed to move quickly to mitigate their own power problems appears to be positioned for easy approval.

The management and training issues involved with small power generation are not considered to be significantly complex. This generating technology requires more skilled operations personnel who could be trained on site by the vendor as part of the purchase agreement. Management matters involve REB's oversight of planning, financing and purchasing, but not of actual operation which would work no better in a centralized mode than does their micromanagement of distribution operations at PBSs.

6.4 Conclusions/Recommendations:

The general conclusion of this assessment is that small power generation by the PBSs is definitely feasible and that there do not appear to be any formidable institutional barriers to its implementation. This is premised on the interpretation of the Rural Electrification Board Ordinance and the notion that the universal appeal of the non-controversial proposal is enough to overcome endemic lethargy in government decision-making. The recommendations are that:

6.4.1 REB should move expeditiously to define the precise requirements for any government approval, present the formal request and use its good offices and reputation to urge immediate implementation in the national interest.

6.4.2 REB should establish a Power Supply Cell to manage the planning, financing and purchase of generation sets and to negotiate agreements with BPDB and DESA to take excess power from PBS generation, to provide emergency supply, to stem loss of loads in PBS areas and generally promote a cooperative relationship.

6.4.3 REB should set forth an expanded definition of PBSs as commercial entities competent to negotiate special rates and agreements with major consumers to clarify the status of PBSs.

6.4.4 Small power generation should be facilitated by REB, but owned by PBSs. REB should amend PBS bylaws to empower PBSs to do the things necessary to implement power generation and to operate and maintain it.

6.4.5 REB should report on generation plans and provide regular status/progress reports, in realistic detail, to PBSs and their at-risk industrial consumers.

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7.0 PRIVATE SECTOR BUSINESS, FISCAL AND INVESTMENT ISSUES :

7.1 Scope:

In this section, various items of interest to the business, fiscal and investment aspects of the PBSs, that were not specifically addressed in the previous sections, are discussed.

7.2 Findings:

As discussed in Background Paper No. 10, Power Sector Reforms, the GOB is undertaking major reforms with the assistance of the World Bank and ADB. These include legislative, regulatory, business, financial and investment areas. A semi-private power project (Mymensingh) is being launched with equity participation by the REB, PBSs and other investors, under the overall direction and assistance from ADB.

During discussions with industry leaders and Petrobangla, several items of potential PBS involvement and business interest were identified, as follows :

7.2.1 In the fishing industry areas, there is shortage of ice resulting in spoilage of fish stock.

7.2.2 Major industries who generate their own power would be willing to sell excess power and/or increase their capacity to help the PBSs.

7.2.3 The production cost of electricity could be somewhat higher than the rate charged by BPDB or DESA to the PBSs.

7.2.4 The national gas transmission system contains several pressure-reducing stations (1500 psi well pressure - 900 psi transmission, 900 psi - 150 psi distribution). The reduction process involves release of energy that may be utilized.

7.3 Analysis:

There is very little expertise available in GOB, REB or PBSs to undertake business in the private power concept. World Bank experts will be assisting the newly created Power Cell of the MEMR to provide technology transfer in all areas vital for private sector entry into the power market. Therefore, discussion of details like implementation agreements and government guarantee are not relevant in the context of small power generation.

7.3.1 New technologies are available that utilize waste heat to produce ice (Heat recovery Absorption Units). Therefore, cogeneration may be utilized in the case of PBSs where feasible. This will increase the efficiency of the gas utilization and reduce the cost of production of power.

7.3.2 In order to buy power from industries, broader issues of tariff-setting are involved.

7.3.3 It is possible that due to various reasons, (e.g., load factor, part-load efficiency) the unit cost of production could be higher than purchases from BPDB. However, since the unit needs to be in operation to support peak load of the system, it is still the right strategy for the PBSs to generate their

power at a reasonable load factor, and use BPDB/DESA supply as a supplementary or standby source.

7.3.4 The amount of electrical energy that could be produced by incorporating appropriate generating sets in the pressure-reduction stations needs to be evaluated. This is perhaps a source of very low cost generation of electricity. Discussions with Petrobangla and manufacturers should be initiated. If may not be a source of a lot of power, but may be worthwhile to tap.

7.4 Conclusions/Recommendations:

7.4.1 PBSs should explore potential cogeneration opportunities (e.g., production of ice in the Chittagong/Cox's Bazar area).

7.4.2 REB should work with BPDB to establish the commercial basis for selling excess power from the small generating facilities.

7.4.3 PBSs should be empowered to enter into power purchase agreements with industries and to develop tariffs for this purpose.

8.0 ENVIRONMENTAL CONSIDERATIONS:

8.1 Scope:

This section examines the environmental implications of small power generation plants which are being proposed for installation in selected PBSs.

8.2 Findings:

There is a well-developed awareness in Bangladesh for the need to ensure that industrial and economic development takes place with due regard for the impact on the natural environment. There is a national Environmental Pollution Control Ordinance which provides for control, prevention and abatement of pollution relating to land, water and air by industrial effluents and emissions.

Bangladesh has large resources of natural gas, which is the most environmentally-friendly fuel for combustion in thermal plants, with minimal associated emission, fuel handling and waste disposal problems. Environmental impacts from existing power plants are quite acceptable. Natural gas is predominant in power generation and the amount of oil used is relatively small.

8.3 Analysis:

The overall environmental impact of operating a natural gas engine plant is low. Emissions are low, with only oxides of nitrogen and carbon being discharged to atmosphere. International guidelines for nitrogen oxide emission (NO_x) are expressed in μg/kJ of heat released. World Bank guidelines for nitrogen oxide emissions (NO_x) are more stringent for gas-fueled power generation plant than for oil or solid fuel-fired plant. The guideline for gaseous fuel is 86 μg/kJ of heat released, which is equivalent to 50 PPM by volume. This is a stringent guideline which is mainly directed at large central gas-fired generating plants. It is not normally considered as a serious compliance matter when small dispersed gas engines are installed to meet particular needs. The total environmental impact of small dispersed power plants will be less than that of an equivalent central power facility. Dispersion of emissions is an intrinsic feature when a number of small plants are installed rather than a single equivalent. The consequences of any accidents are also mitigated in dispersed plants (e.g. oil spillage, if it should occur, will be of smaller impact).

In the case of small power plants which may be installed in the west of Bangladesh, they will be fueled by heavy fuel oil (furnace oil), similar to that which is burnt at Khulna power station. This fuel is relatively high in sulfur content at 3.5% percent mass. Again, the small size of plant involved will mean that emissions will have a minimal effect on the local environment.

With the design improvements in these small generating plants over the last decades, they are generally regarded as environmentally acceptable. They are often installed in hotels, hospitals and civic institutions where sensitivity to negative environmental effects would be higher than normal.

8.4 Conclusions/Recommendations:

Provision of small generation plants at PBSs should proceed without any need for concern on environmental grounds.

9.0 TECHNICAL ASSISTANCE REQUIREMENTS:

9.1 Scope:

This section identifies areas of technical assistance needed to facilitate, engineer, procure, construct and operate small generation facilities by the PBSs.

9.2 Findings:

9.2.1 REB has concentrated its activities on extending electric service to the rural areas and has not focused on alternatives to BPDB power supply. As a result, REB does not have a power supply unit dedicated to the planning and acquisition of electrical generating resources for the PBSs.

9.3 Analysis:

9.3.1 A prerequisite for REB and the PBSs to plan, procure, install and operate small generating projects within the PBSs is for REB to have a power supply unit. In addition to developing the new resources, the unit would be responsible for coordinating its activities with BPDB and other government agencies, making the necessary contractual and system arrangements to facilitate the addition of small generation into the PBS systems. Another important function would be to develop the criteria for evaluating the economic size, location, system interconnections, system and plant protection and metering. This unit would be responsible for developing the procurement specification standards for small generation units. Once the small power projects are a part of the PBS systems, REB will need to provide on-going technical assistance for the operation and maintenance of the units and in the selection and quality assurance of replacement parts. Another major function of this department will be to help the PBSs to obtain the necessary loans and commitments from the donor agencies or other sources.

9.4 Conclusions/Recommendations:

9.4.1 Immediate technical assistance is required to implement the small power generation program in the following areas:

9.4.2 Objective: To assist REB in organizing a Power Supply Cell to gain necessary approvals of and agreements with other government agencies as an urgent priority.

Measures/Deliverables: An adequately structured and staffed, functional REB department focused exclusively on implementing a small power generation program for the PBSs with all authorizations in place.

Expected Results: REB will be positioned to give required priority attention to its essential, expanded role in power supply for the PBSs and thereby able to initiate and pursue actions necessary to authorize and implement the first and subsequent small power projects. Once policy goals have been identified, REB can concentrate on getting them in place without external assistance.

Technical Assistance: Short-term specialist in power supply policy to assist

in organizing the REB Power Supply Cell and developing inter-agency/entity agreements.

Skills/Experience Mix: Substantial successful experience in developing power supply arrangements and agreements; expatriate likely to be required.

Estimated Manmonths: Total of 7.5 manmonths over a two-year period with up to three in-country visits.

9.4.3 Objective: To develop selection criteria for sizing and siting small power generation projects.

Measures/Deliverables: Established criteria for evaluating the needs in any specific PBS circumstance which will serve in the initial and subsequent installations.

Expected Results: REB Power Supply Cell personnel will be able to apply established criteria to size and site any small power generation installation without external assistance. Subsequent installations can be planned while current ones are being implemented, providing lead time for solving any problems encountered without causing undue delay.

Technical Assistance: Short-term system planning engineer to assist the REB personnel, as soon as the Power Supply Cell is organized, to develop criteria for sizing and siting the small generation projects.

Skills/Experience Mix: Specific experience in small power applications and their coordination with existing power supply; expatriate likely to be required.

Estimated Manmonths: 2.5 manmonths total.

9.4.4 Objective: To develop technical specifications for small power generating units and construction specifications for each installation.

Measures/Deliverables: A written specification manual would be available for use in all subsequent small power projects.

Expected Results: REB personnel should be able to independently apply the developed specifications once a standard-size generating unit is determined. With such predetermined guidelines, tenders could be simplified and manufacturers could even be pre-qualified. Advantages in maintenance, training and materials can be gained by standardizing unit size and specifications.

Technical Assistance: Short-term power engineer to assist in developing generation unit specifications; could be locally sourced, if available independent of vendors.

Skills/Experience Mix: Must be thoroughly familiar with small power generation units, the various types and efficiencies.

Estimated Manmonths: 8 manmonths in as many as five separate terms.

9.4.5 **Objective: To coordinate the construction of small power plants at each selected site.**

Measures/Deliverables: Properly installed generation units at diverse sites to optimize operating circumstances.

Expected Results: Small power generation stations would be adequately supervised in actual installation according to construction specifications. Inspection services would assure compliance with contract terms. REB personnel will gain experience in monitoring such services without the need to fully develop in-house capability.

Technical Assistance: Short-term project engineer to be contracted as needed to assist REB and PBSs to develop construction specifications and tender documents for each small power site, and to provide inspection services during actual construction.

Skills/Experience Mix: Civil engineering experience in site preparation and construction; locally sourced.

Estimated Manmonths: Up to 24 manmonths for all eight recommended small power sites on as-needed basis; approximately three months per site.

9.4.6 **Objective: To assure the long-term success of the small power generating program by providing for trained personnel to operate and maintain the units.**

Measures/Deliverables: A source of trained people to operate and maintain small power generating station at each PBS installation.

Expected Results: PBSs will be assured of qualified plant operators without having to train people during the start-up phase of the generating program.

Technical Assistance: It is recommended that, for the first eight recommended sites, operating and maintenance services be contracted from the machine vendors/manufacturers for the first few years. If in-house capability for training seems desirable in the future, trainers should be contracted through the manufacturer as part of the bid package.

Skills/Experience Mix: N/A

Estimated Manmonths: N/A.

PART TWO ANNEXES

ANNEX - 1
SCOPE OF WORK

1.1 BACKGROUND

A. The Rural Electrification (RE) Program in Bangladesh

In 1976, Less than 3% of the rural population had access to electricity. At that time the Bangladesh Government (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 industries.

Following that decision, the National Rural Electric 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, 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.

All PBSs come under the aegis of the semi-autonomous Rural Electrification Board in Dhaka, which sets national rural electrification policy and standards, represents the interests of the PBSs and rural electrification generally, assists with organizational, financial and technical operations, and acts as financier for the PBSs. The REB employs about 1100 people.

Funds required for construction, intensification and expansion of the distribution network are channeled (as loans or grants) from the BGD to the REB, which provides loans to the PBSs. An estimated $ 320 million in BDG and donor funds have been invested in the rural electrification system since 1978. Fourteen donors have provided commodity support.

Each PBS has a board of directors composed of members elected to review policy, management, and financial operations. PBSs are headed by general managers responsible for overall coordination of PBS business, liaison with REB, personnel management, strategic planning and performance monitoring. PBSs oversee construction of system expansion. They also run programs to motivate member participation in PBS affairs, educate members regarding their rights and responsibilities, and promote electrical safety. There are about 4000 employees of the PBSs.

B. USAID Support to Date

Since 1978, USAID has provided commodities to construct and energize 17 PBSs and technical assistance for the construction and startup implementation of all 45 current PBSs. NRECA has provided the technical assistance under USAID's rural electrification projects, RE I, Re II and RE III. Under RE I and II, NRECA experts focused almost exclusively on construction needs. Technical assistance under RE III, which has as its purpose to develop the capability of the REB to establish self sustaining, viable and well-managed rural electric cooperatives, has evolved from a greater emphasis on electrical engineering to concentrate on management.

A 1993 formal mid-term project evaluation found that USAID's long term commitment to technical assistance has been the single key external factor in the success of the REB/PBS program thus far. The evaluators found the REB to be a mature and efficient utility with a working system of rural electricity distribution based on rural electrification experience in the U.S. However, they noted that management, training, finance and technical functions still need strengthening before the REB will be able to operate completely independently of long term technical assistance. They cautioned that, after the current period of assistance ends in mid-1996, USAID (or another donor) will need to provide this support.

The evaluation noted that technical and engineering functions of REB and the PBSs are performed with a high level of competence, but increasing orientation to operations and maintenance will be needed as the system ages. It emphasized that the areas most requiring continued assistance are institutional, stating that the development of management and planning skills necessary to sustain the capacity of REB and the PBSs to evolve and innovate over time in response to changing demands is an area of need. Another area where further technical assistance is needed is information management and computerization of the cooperative network.

Technical assistance provided by NRECA currently includes a team of 8 people, with the number scheduled to be scaled back to a total of 4 when the current project ends in mid-1996. The areas of emphasis of this assistance during the remainder of RE III are :

> General Management, including advice on strategic planning, performance monitoring and information systems.
>
> Financial Management, including such areas as Computerization of records; accounting manuals and instructions; financial analysis and financial forecasting; and assisting REB establish linkages with private CPAs to conduct audits.
>
> Technical Advice and Support, including such areas as system engineering and design advice; engineering manuals preparation; monitoring line and substation construction; materials planning, specification, tender documents and bid evaluation; materials testing; procurement services (inspections); and advice on warehouses, workshop and repair facilities.
>
> PBS Systems Operation, including assistance with technical problem solving; establishing a PBS maintenance program (including line inspection, equipment maintenance, substation preventive maintenance and inspection); and helping PBSs with customer service approaches.
>
> Institutional and Technical Training, in support of the REB's program to train its staff and PBS board, employee and member training. This includes helping the REB organize training of trainers and training materials production; curriculum planning; training planning and training information system; and advice on computer training facilities. NRECA also coordinates a U.S. based participant trainee program.

Since the evaluation, technical assistance has become more focused on strategic needs, consistent with an early 1994 NRECA - REB strategic plan laying out objectives for the remainder of the project with the overall intention to maximize the transfer of capacity from the technical assistance team to the REB. The plan covers general organization issues, accounting, financial reporting and internal control systems, financial planning, computerization needs, materials flow and procurement integration, and development of technical (material, construction and engineering) standards and specifications. Short term consultancies have been planned and many are underway to assist long term experts in

these areas. Additionally, with NRECA assistance, a socio-economic impact monitoring system is being established at REB using a locally-contracted firm, with a baseline scheduled to be completed within the next six months.

C. Analytical Background for New Distribution Technical Assistance

Although the REB's strong performance as a utility (e.g. low systems loss) continues to make it attractive to donors, major multilateral and bilateral donors have indicated their reluctance to provide significant commodity financing to the REB over the next several years without an assurance that necessary technical assistance will be in place. USAID's comparative advantage in providing technical assistance to the rural electrification program is widely recognized and appreciated by the other donors, who view USAID as a "catalyst".

Overall, USAID support since 1978 totalling #180 million in commodities and technical assistance has "leveraged" another $460 million in commitments for commodities from other donors.

The REB distribution system now serves about 15 million people through about one million hookups. This represents about 39 percent of current electricity consumers in Bangladesh, but is only 15 percent of the rural population. At the same time, access to electricity is a proven critical factor in increasing productivity of agriculture and agricultural employment and in facilitating growth of new and expansion of existing small and microenterprises in Bangladesh. Expanding access to rural power is thus a high priority for the BDG and a central part of USAID's strategy to increase food security of the poor and encourage broad based economic growth. New technical assistance, as a result, will need to focus on enabling the REB to meet the management challenges of increasing the numbers of consumers to be reached with power while sustaining its good performance.

During the 1996 - 2001 period, distribution expansion is planned from the current 45 operating PBSs to a target of 60. Intensification, or reaching more consumers in an established PBS, is equally important as energizing new PBSs, since, even in long-established cooperatives, the percentage of the rural population covered remains low (20-30 percent). There will be a need for between $500 million and $ 1 billion to finance the commodities and construction necessary to expand the system over the next 7-10 years.

In order to effectively implement an expanding program, the REB will need to improve its capacity to assess technical requirements, balance plant development and operations, undertake necessary procurement for system growth, and train its staff. With much of the distribution system aging, a new and comprehensive approach to maintenance is needed.

The REB must also rehabilitate thousands of kilometers of line turned over the Power Development Board as distribution lines are rationalized between urban and rural areas. Addressing maintenance and rehabilitation requirements while constructing new lines, and at the same time maintaining the high quality of its performance as a utility poses particular management challenges.

Other factors hear consideration in review of technical assistance needs for REB/PBS distribution :

PBS Operations:

Member Participation. The PBSs, member-owned and based on democratic principles, have already applied many of these principles in member participation programs and training. Especially in the older PBSs, there may be ways to increase member participation for the overall benefit of PBS operations.

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"Customer Service". Information on member-consumers preferences regarding service standards-- ways that their electric cooperatives might improve service provisions--and member assessment of the quality of service should be available and used by PBSs.

Delegations of Authority. Specific delegations of authority (as well as accountability) to cooperatives could relieve some of the enormous management burden on the REB as the system as a whole expands, while maintaining REB's role as coordinator, overall policy maker and financier. Delegations of additional authorities to the PBSs are already under consideration by the REB.

REB Operations

Strategic Planning. The importance of rural electrification to economic growth and the attention given to the program by the government and donors alike will pose special demands on the REB's monitoring and planning functions. Ideally, a consumer impact monitoring system should be operational, with a regularly updated information on such impacts as income, employment, enterprise development and social factors such as school attendance. Consumer information should feed into program decisions to improve program efficiency and impact. The REB should be able to undertake financial and technical studies to support policy recommendations on tariffs and ways to reduce costs of service. Network extension plans should be based on clear economic, financial and social criteria. Technical assistance may be required to strengthen the REB's planning and monitoring capacity.

In summary, future technical assistance will focus on strengthening management and technical competencies of REB and the cooperatives to enable them to meet performance targets while effectively implementing a large expansion of the program. At the same time, the objective will be to transfer these competencies so that the RE program no longer requires outside, long term technical assistance after this assistance is provided.

While some contracted outside expertise may continue to be needed indefinitely, these needs should eventually be served through short term assistance, much of it locally-sourced. It may eventually be necessary for REB to operationalize linkages with a variety of local and international firms for technical assistance.

D. The Need for Power Generation

Massive expansion of the rural electrification consumer base will also require generation of additional power in Bangladesh. During periods of peak demand the national grid is unable to supply the country's needs and load-shedding is common. Significant rural expansion is not feasible if it is at the expense of existing consumers. Even under the best scenario, major new generation plants to augment the national grid supply will not be in operation for many years. Private power is moving forward, but slowly, and to construct large power plants to meet the increased demand will take 8-10 years at a minimum.

The PBSs presently have a power demand of about 250 MW and by the year 2000 will require about 300 MW. To circumvent the load shedding, it is the concept of REB that the PBSs should design and construct, under a BOO (Build Own and Operate) or BOOT (Build Own Operate and Transfer), a series of small generation plants that could provide power to the PBSs and during off-demand periods, sell excess power to the PDB. This would be similar to Independent Power Production in most countries of the world. The REB has a mandate to generate power for rural areas, and an initial project to do so is underway with assistance from the Asian Development Bank. A number of cooperative based small plants could effectively ameliorate the medium-term power shortage facing the RE system.

1.2 Title

Project Number : 388 - 0070 :

Title : Rural Electrification in Bangladesh; An Assessment of Post - 1996 Technical Assistance Needs and of the Power Generation of the Rural Cooperatives.

1.3 OBJECTIVE.

General Objective :

(1) Examine future technical assistance needs of the Rural Electrification Board (REB) and rural electric cooperatives in maintaining and expanding electricity distribution in Bangladesh. The assessment will identify specific areas of institutional management and technical functions needing strengthening for a five-year period beginning in 1996. It will also outline technical assistance requirements for the period, and provide illustrative anticipated results and measures of success for such technical assistance.

(2) Examine the potential and implications of power generation by the rural electric cooperatives (PBSs), in particular by those cooperatives in which the cost of interrupted unreliable power is prohibitive and has severe adverse economic effects. One of the major problems with the PBSs becoming financially viable is the frequent load shedding imposed on the PBSs by the sole power generation entity, Bangladesh Power Development Board (PDB) Currently, during peak demand time, the PDB generation facilities can be as much as 500 MW short and are forced to load-shed to maintain service to priority customers. This scenario will remain for an indeterminate time as the construction of new power facilities are dependent upon PDB improving its operations.

This assessment will provide analytical input into the consideration of new technical assistance support for rural electrification in Bangladesh.

1.4 Statement of Work

A. General Considerations :

There are two parts to the Statement of Work for this assessment, corresponding to the two objectives stated in Section I. Each part will be conducted by a subteam and the subteams will produce separate reports.

The team leader will be responsible for coordination and management of the subteams, and will lead the production of each report.

The primary responsibility for accomplishment of the tasks resides with the contractor. For each subteam, the contractor will develop a schedule and a workplan for completing all tasks including the use of short term personnel within the first 3 days of the team's arrival in Bangladesh. This workplan must be approved by USAID/B. The contractor will periodically coordinate its work with USAID/B, per Section VI, below.

The contractor shall handle administrative actions including scheduling and planning, logistics, communications and computer/secretarial services.

Tasks, methodology, and team member qualifications are detailed below for each of the two parts of the assessment.

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B. Part One - Assessment of Post-1996 Technical Assistance Needs (Distribution)

1. Purpose of the Distribution Assessment.

The assessment will (1) identify areas of institutional strengthening where technical assistance will be needed during the 1996-2001 period; (2) indicate specific institutional improvement objectives, measures and targets which could serve as indicators of effectiveness of technical assistance and identify concrete results and illustrative "deliverables" anticipated from needed technical assistance; (3) identify skills, experience mix and timing for technical assistance inputs.

The team should assume that future technical assistance will be performance - based and linked to clearly identified objectives, with proposers asked to identify approaches and detail the deliverables required to reach results. The team should also assume that, in future assistance, international long-term advisors may be joined by both local and international short term advisors. Ideally, long term personnel will be reduced over time and all long term personnel will depart in advance of project and to enable a period of REB operations with support limited to short term advisors.

2. Tasks

a. Identification of Technical Assistance Needs

In identifying areas of institutional strengthening requiring technical assistance, the contractor will need to examine the following :

REB Operations : Review overall institutional management, strategic planning, performance monitoring, systems operation and maintenance, procurement and materials flow, financial management, and accounting systems. Also review REB activities in organizing PBSs, assisting PBSs with engineering and operational problems, encouraging member participation, and cooperative strengthening.

PBS Operations : Review regular responsibilities of board members and staff. Review "business functions" such as meter reading and billing, member services programs, maintenance programs and expansion activities. Review use of private consulting engineering expertise and other functions which are contracted out. Review ways in which PBSs collect and use information from consumer-members.

Training : Review all aspects of technical and institutional training to meet both REB and PBS needs, including management, financial, and technical training and address needs regarding training planning, training management, curriculum development and training of trainers. In addition, review the needs for international training.

Using the information from these reviews, summarize areas of institutional strengthening in which technical assistance will be required. In addition, the contractor may include the need for "support" (as opposed to distribution expansion) commodities needed to help meet these institutional needs. (Note: exclude computer hardware and software needs, which will be detailed under a separate assessment.)

b. ***Results Analysis***

For each of the areas of institutional strengthening presented above, the contractor should identify specific, appropriate :

(1) institutional objectives, or what objectives will be met in REB operations, PBS operations, and training should be met as a result of the future technical assistance;

(2) possible measures and targets which would indicate that these institutional objectives have been met;

(3) specific "results" which technical assistance provider(s) would need to achieve in order to enable the above institutional objectives.

c. ***Local Sourcing***

The team should review, for all areas of technical assistance need outlined above, the availability of appropriately skilled and experienced experts in Bangladesh, including both local firms and individuals. Wherever assistance can be locally sourced, this should be planned.

d. ***Input Options***

Using the information from 1,2, and 3, above, present illustrative composition, skills mix and timing of technical assistance inputs. Options should be considered given funding limitations presented by USAID/Bangladesh. Illustrative additional training costs should also be presented.

3. Methodology and Data Sources

The assessment subteam, in consultation with USAID, shall be responsible for determining an appropriate methodology. USAID suggests the following approach:

- review of key secondary sources such as official USAID project documents including inter alia: past evaluations, project paper supplement, NRECA contract and subcontracts, quarterly and annual reports, and pertinent REB reports;
- review of REB/PBS management information system;
- interviews with USAID, REB, and NRECA staff;
- interviews with key BDG officials and with officials of other donor organizations involved in rural electrification in Bangladesh;
- field visits to selected PBSs and collection of field data. This should include interviews with PBS staff, board members and consumer members. Interviews with consumer members should address customer service preferences and concerns.

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C. Part Two: Assessment of Power Generation by the Rural Cooperatives.

1. Purpose of the Power Generation Assessment

The power generation assessment will (1) examine the economic cost of power interruption/shedding in areas of high productivity/export oriented (such as in selective tea growing areas); (2) analyze the feasibility of small power generation, the hook-up to the user, the tariffs, fuel availability and the potential of selling excess power to the PBD; (3) examine technical assistance requirements for small power generation.

2. Tasks

The scope of work for conduct of the power generation assessment consists of the following tasks :

Task 1.

Power Requirements at Selected PBSs

In collaboration with the Government of Bangladesh (GOB), the REB and the PBS's, prepare a short-list of rural electrification cooperatives suitable for consideration as power generators. The basic criteria for preparing the list must be the cost-impact that interrupted power has on the local (and national) economy.

Determine the current and future power requirements of these PBSs and estimate the cost of not having this power. Examine needs/demand at PBSs in the vicinity. Examine the potential of emergency power supply from the PDB. Examine distribution issues i.e. from the power generating PBS to other PBSs (rather than selling excess to PDB) in view of the low voltage line that exists.

Task 2.

Analyze Feasibility of Private Power.

For the selected PBSs, evaluate the existing framework that allows for the construction and operation of cooperative type power facilities. Describe and/or discuss conditions and circumstances by which the PBSs and local private firms can be organized for an efficient allocation of electricity supply. With selected industrial customers: discuss premiums they are willing to pay for uninterrupted high quality power, performance contracts, etc.

Task 3.

Explore Opportunities for Private Investment in Power Facilities in Each PBS.

Discuss approaches for the participation of private sector investors in the power facility and recommend strategy options for REB and PBSs. The objective of this task is, among others, to shed light on the pros and cons of various private development schemes suitable for small power facilities and currently being adopted by other countries. schemes such as BOO, BOT, BOL and BOOT should be examined. Each option must be accompanied by examples to demonstrate the suitability and viability of project financing.

Task 4.

Examine the Introduction of a Second Power Generation Agency in Bangladesh.

Under this task the contractor will examine the implications of creating an additional (to PDB) power generation organization. Regulatory aspects, Power and Fuel Purchasing Agreement aspects and electricity tariffs need to be carefully examined. Issues related to fuel availability, excess power sell-off and emergency power supply from PDB (at time of break-down or maintenance) will also be examined - e.g. examine fuel availability at selected PBSs, in particular - gas.

Task 5.

Institutional Reform/Strengthening

Consistent with the analyses above, this task will examine the need for institutional strengthening, inside and outside the REB, to better support the introduction of private power into the rural cooperatives. Management issues, training issues and other institutional issues that could present barriers to private power in the REB will be examined.

Task 6.
Private Sector Business, Fiscal and Investment Issues.

This task will include additional aspects associated with the development of private power in the PBS's as identified by the expertise of the contractor's team and consistent with the unique Bangladesh situation.

Task 7.
Technical Assistance Requirements

Under this task, the contractor will identify and outline the technical assistance the REB and PBSs will require, should (private investment) power generation be feasible.

Task 8.
Environmental Considerations.

Examine the environmental implications of small power generation by the PBSs. This task should be undertaken only if the team finds the generation option feasible.

3. Methodology and Data Sources

The assessment subteam, in consultation with USAID, shall be responsible for determining the appropriate methodology to perform this work. USAID suggests the following approach:

- interviews with key BDG officials and with officials at PDB, DESA, REB and PBSs;
- interviews with USAID and NRECA staff in country;
- review of REB/PBS management information systems;
- review REB/PBS power demand projections as well as BPDB's projections of demand and supply and the recently completed Power System Master Plan, if available;
- field visit to selected PBSs and collection of field data. This should include interviews with PBS staff, board members and consumers;
- interview with Government, and possibly private, fuel supply entities.

E. Performance Period and Level of Effort

The contractor's work shall begin in Bangladesh o/a September, 21, 1995 and is expected to end o/a January 12, 1996. The team leader Mr. James Morriss shall travel to Bangladesh in advance of the rest of the subteam to assemble written sources, conduct an initial review of documentation and arrange for administrative support. This will give the subteams a headstart in developing their workplans and generally improve the efficiency of the assessment.

Two weeks after USAID/B and the Rural Electrification Board have received the final reports of the assessment and analysis, the Team Leader and the Sub-Team Leader will travel to Bangladesh and lead discussion of the final reports with the REB, USAID/B and other donors and interested entities. The effort will take one week each of both the Team Leader and the Sub-Team Leader.

F. Team Meetings and Debriefings

Each subteam shall meet upon arrival with the Director of the Office of Project Development and Engineering (PD&E), the RE III Project Officer and other Mission staff identified by the Project Officer. Each subteam will hold an initial work planning meeting with the Rural Electrification Board Chairman and REB staff delegated by him.

Each subteam shall present a workplan, outline of their final report, and their assessment methodology to USAID/B for approval by the Director of PDE and the Project Officer within three work days of arrival. The team leader and other subteam members, as appropriate, shall meet weekly thereafter with the Project Officer to provide oral reporting on the progress of the assessment.

The team leader, and other members of the subteams as appropriate, shall conduct formal debriefing (s) for USAID/B and selected BDG officials prior to each team's departure from Bangladesh. The subteams shall submit three copies of a draft version of the their assessment reports to USAID/B and to G/EN/EET in USAID/W four days prior to this debriefing.

USAID and REB officials will review the draft reports. USAID will convey its comments on the drafts and those of the REB, in writing, to the contractor no later than 25 working days after receipt of the drafts. As noted above the Contractor shall submit the final version of each report to USAID within four work weeks of receipt of comments.

1.6 Reports

Each of the two report is to be used by USAID and the BDG as a reference for future activity planning including identification of results, measures and targets and preparation of scope(s) of work for needed technical assistance.

The Contractor shall submit the final version of each report to USAID in three copies within four weeks of receiving USAID's and REB's comments on the draft of the report. Each subteam's report shall contain the following :

- Executive Summary: Approximately 5-7 single spaced pages, addressing all areas of investigation and analysis.
- Body of the Report: The report shall provide the evidence and analysis to support the findings and The report shall not exceed 50 single spaced pages, unless otherwise agreed by USAID in advance.
- Annexes: Shall include at least the following: description of review methodology; bibliography of interviewed; and selective presentation of additional and qualitative information.
- Upon completion of the final briefings, the team will brief report of activities during the discussion of the reports with emphasis on the presentation, discussion and conclusion, recommendations and findings that develop the performance period.

1.7 TECHNICAL DIRECTIONS

Technical Directions during the performance of this delivery order shall be provided by the Project Officer as stated in Block 5 of the cover page pursuant to Section F of the contract.

1.8 TERM OF PERFORMANCE

a. Work shall commence on the date noted in Block 7 of the cover page. The estimated completion date is reflected in Block 8 of the cover page.

b. Subject to the ceiling price of this delivery order and the prior written approval of the Project Officer (see Block No. 5 on the Cover Page), the contractor may extend the estimated completion date, provided that the extension does not cause the elapsed time for completion of the work, including the furnishing of all deliverables, to extend beyond 30 calendar days from the original estimated completion date. Prior to the original estimated completion date, the contractor shall provide a copy of the Project Office's written approval for any extension of the term of this delivery order to the Contracting Officer; in addition, the contractor shall attach a copy of the Project Officer's approval to the final voucher submitted for payment.

c. It is the contractor's responsibility to ensure that the Project Officer-approved adjustments to the original estimated completion date do not result in costs incurred that exceed the ceiling price of this delivery order. Under no circumstances shall such adjustments authorize the contractor to be paid any sum in excess of the delivery order.

d.Adjustments that will cause the elapsed time for completion of the work to exceed the original estimated completion date by more than 30 calendar days must be approved in advance by the Contracting Officer.

1.9 DUTY POST

The Duty Post for this delivery order is Bangladesh.

1.10 ACCESS TO CLASSIFIED INFORMATION.

The contractor will not have access to classified information.

1.11 LOGISTIC SUPPORT

The contractor shall be responsible for all logistic support needed to successfully complete the contract.

1.12 WORKWEEK

The contractor is authorized up to a six-day workweek in the field with no premium pay.

1.13 Authorized Geographic Code

The authorized geographic code for procurement of goods and services under this order is 941 and Bangladesh.

ANNEX - 2

PART - 2 : ASSESSMENT OF POWER GENERATION

BACKGROUND DOCUMENTS

INDEX

BACKGROUND PAPER NO. 1

NATURAL GAS AVAILABILITY AND DISTRIBUTION

1.0 OBJECTIVE:

This paper discusses the present and projected domestic supply of natural gas and its availability throughout Bangladesh for generation of electricity.

2.0 BACKGROUND:

Bangladesh Oil, Gas & Mineral Corporation (Petrobangla), a Government Corporation under the Ministry of Energy and Mineral Resources is responsible for the oil and gas resource of the country. The gas system is supported by 17 existing gas fields in the eastern portion of Bangladesh including more than 10 Tcf of net recoverable gas reserves. At the FY 1994 consumption rate of 210 Bcf, the existing gas supply would provide nearly fifty years of supply. However, the gas consumption rate is projected to increase at an annual rate of eight percent, so the present reserves will only support the next twenty-five years of projected requirements. Several experts have reviewed the geology and are confident that substantial amounts of additional natural gas will be found. Currently, eight different exploration ventures are at various stages of investigating the gas potential and Petrobangla is developing Production Sharing Contracts with the various interests.

The location of the existing gas fields has allowed the development of a gas transmission and distribution system for the eastern portion of the country; in the western portion there is no distribution system as a result of the lack of gas fields and the major investment required to cross the Jamuna and Ganges Rivers. The Power System Master Plan shows that the gas transmission and distribution facilities will be installed after the new Jamuna bridge is completed sometime after 1998. The existing gas transmission system has two compression stations currently not needed, so there appears to be substantial transmission capacity to collect the gas from the fields and deliver it to the consumer. The Power System Master Plan anticipates that half of the available gas supply will be used for the production of electricity.

To attract gas field exploration, Petrobangla is offering the developers gas output contracts that fix the value of the gas to the world market rather than the present price being charged by Petrobangla. A new gas pricing scheme currently is being formulated to gradually raise the domestic gas price to the market price over the next five years. The developers will have the option to sell any excess output to the export market. Petrobangla will share in the net revenues of the new development after the developer recovers its investments in the project.

3.0 ASSESSMENT:

The gas supply in Bangladesh will remain adequate for at least the next twenty years even if no additional reserves are found. The new exploration incentives being offered by the GOB should create an ample natural gas supply through the planning horizon. Small gas generating units should be sited on or near the existing gas distribution lines during the next ten years. In order to assure adequate operating pressure is available for the generators, all units should be able to accept low pressure (5 psi) gas without loss of performance. The projected amount of small generation capacity to be added by PBSs is less than five percent of the total BPDB projected requirement (200 to 300 aMW of more than 6900 aMW, respectively). The price of natural gas is expected to increase to all energy sectors and that increase will be passed through by BPDB in its electric tariff.

The fuel supply on the western portion of the country is and will be liquid fuels, HFO, HFSO, gasoline and diesel. All of these fuels have a much higher price than natural gas at this time and, therefore, the cost of using them as a fuel for generation of electricity is more than twice the cost of gas. While it may be some time before the gas transmission line is finished, connecting the eastern fields to the west, there is a possibility that a western field could be developed to supply some of the western needs via a smaller gas distribution system. This may allow the introduction of small gas generation in the western region prior to the completion of a national gas grid.

4.0 SUMMARY:

Adequate natural gas is available in the eastern portion of the country to support the proposed small generation program for supplementary PBS power supply. In the western areas, using higher cost fuels to generate electricity may be justified until gas is available.

No 1

BACKGROUND PAPER NO. 2

DIESEL FUEL POWER GENERATORS V GAS TURBINES V GAS ENGINE

1.0 OBJECTIVE :

This paper compares the different types of machines now being used internationally for generation of power in small quantities (1-20 MW) to identify the best choice for this purpose in those PBSs most at risk as to their sustainability because of the effects of power cuts.

2.0 ROLE OF SMALL POWER GENERATION :

Traditionally, small power generators were used in remote locations where central station electricity was not available, or in industrial plants where standby generators were necessary to maintain essential services if the main supply failed. They are used in off-shore installations and, of course, as prime movers in small sea-going vessels.

Within the last two decades, with greater emphasis being given by power utilities to demand-side management, and to achieving maximum possible efficiency and minimum overall energy costs, installation of small power generators has increased. As a consequence, manufacturers have made many improvements to the design of these plants, making them more reliable and easier to operate without the need for highly-trained staff. They often are provided with facilities for remote diagnostic data analysis and condition monitoring.

3.0 FEATURES OF DIFFERENT TYPES OF PLANT :

3.1 Gas turbines (open cycle)

3.1.1. These are widely used and are readily available in sizes from one to twenty MW. Typical uses include :

- Cogeneration at major industrial plants where the electrical and heat output can both be utilized to achieve high overall efficiency.
- Provision of electricity, heat and air conditioning at large institutions, hotels etc.
- Base-load power in remote areas where an electricity infrastructure is not present or is not reliable.
- Provision of power at peak times to a large industrial consumer in order to reduce peak demand on the power utility and thus reduce tariff charges.

3.1.2 These turbines can usually operate on a variety of fuels, both gaseous and liquid. They can burn a wide variety of natural gases and light distillate oils. The preferred fuel is gas for easiest operation and lowest maintenance cost. When fired on gas, they will have low exhaust emissions and will meet normal environmental standards.

3.1.3 Gas turbines in these small sizes will achieve efficiencies of approximately thirty percent when operating at full output, without any use being made of heat in the exhaust gas.

It is an inherent feature of gas turbines that efficiency declines significantly at reduced output.

If use can be made of heat from exhaust gases, overall thermal efficiency can be in the order of forty-five to fifty percent.

Prices of such gas turbines are in the range US $ 300-$ 400 per KW. It is estimated they could be provided in Bangladesh at an installed cost of $ 600 per KW. Operation and maintenance costs (not including fuel) are estimated at approximately three percent per annum of installation cost.

3.1.4 The best circumstances for use of small gas turbines would include.

- continuous operation on natural gas
- continuous operation at full output
- utilization of exhaust waste heat for industrial process, airconditioning or direct heating.

3.2 Diesel engines :

3.2.1 These engines are well proven in service over many years, on land and at sea. Their reliability has been continuously improved and their operation is relatively simple. They deliver a higher thermal efficiency than open-cycle gas turbines and the efficiency is maintained at varying levels of output, unlike gas turbines where efficiency declines significantly at reduced levels of output.

3.2.2 These machines also generate heat, which is removed by jacket-cooling water and which can be used for industrial process or other purposes. The heat provided will be at a lower temperature than that released by gas turbines and it is readily usable.

Because diesel engines burn oil, emissions will usually contain sulfur oxides in addition to those emitted from gas turbines. They are thus not as environmentally friendly as gas-fired engines. Because of their relatively small size and natural dispersion, these emissions are usually acceptable.

3.2.3 Diesel engines can be divided into three categories :

- high speed (greater than 1000 rpm)
- medium speed (400 - 750 rpm)
- low speed (80 - 150 rpm)

The following table outlines their general characteristics :

Type	Speed Range (rpm)	Size	Fuel	Efficiency	Capital Cost/KW $/KW	O&M Cost $/MW h
High speed	> 1000	< 2.5 MW	Distillate	34%	475	16
Medium speed	400 - 750	2 - 15 MW	Heavy fuel oil	36-40%	600 - 800	6 - 11
Low speed	80 - 150	10 - 50 MW	Residual oil	44%	1100	5

In general, the poorer the fuel, the lower the speed which is selected. Costs indicated in the above table are the estimated total cost for an 'engineer/procure/ construct' (EPC) turnkey-type installation which includes auxiliary plant for a number of machines. The operation and maintenance cost is averaged over the plant lifetime and includes lubricating oil cost.

3.3 Gas engines :

3.3.1 The increased world-wide availability of natural gas has renewed interest in gas engines and their use has rapidly increased during the last decade. Generally based on the design of long-established diesel engines, gas engines use similar design features. Unlike diesel engines, however, which use compression ignition, gas engines use electronic spark ignition and air/fuel ratio control. This allows adjustments to be made to the ignition process to optimize performance from a particular gas type, and to minimize emissions. Like diesel engines, they are highly reliable, durable, and easy to operate and maintain.

3.3.2 Gas engines are readily available in sizes from 3 KW to 50 MW, and operate at efficiencies of approximately thirty-three percent to thirty-eight percent (not including any benefit from waste heat which can be used for industrial processes, heat absorption refrigeration, etc.).

The total cost of a medium-size machine, (i.e., 1 MW rating) delivered on site and installed in Bangladesh is estimated at US$ 600 per KW. (This estimate does not include any amount for transformation or transmission because use of only existing facilities is contemplated.)

3.4 It is a common feature of each above-mentioned type of small power plants that maximum efficiency is delivered near full-rated output and that overall thermal efficiency is maximized by utilizing the waste heat which is generated during combustion. It would therefore be important that the detailed engineering for such plants should determine the optimum size and combination of individual generating units and identify the optimum location for such plants taking into account proximity to major loads, network features and opportunity for waste heat utilization.

4.0 CONCLUSION :

The comparison of basic types of small power generators which are readily available indicates that gas engines should be used in Bangladesh in those PBSs where natural gas is available.

In areas of Bangladesh where gas is not available, low-speed or medium-speed diesel generators should be used, depending on the availability and price of oil suitable for either type of machine. If base-load operation of diesel plants is found not to be economic because of the price of fuel, careful consideration should be given to installation of a small number of diesel generators in selected PBSs to make up the short-fall in power supply during those peak hours when some load is disconnected.

All of the plants which are installed should be designed for operation in parallel with the main electricity system, so as to allow injection of any surplus electricity into the grid.

In every case, plants should be installed in sizes and configurations which ensure steady operation as near to full output as is practicable, and preferably in locations where use can be made of the waste heat.

BACKGROUND PAPER NO. 3

DISTRIBUTION SYSTEM CONSIDERATIONS

1.0 OBJECTIVE:

This background paper investigates the 11 KV distribution and 33 KV transmission system to determine the feasibility of transporting generating capacity from a small generation plant to the adjacent load centers. The size of the generating projects will be a function of the load density around the generation station. It is intended that the output of the individual generating stations not be transmitted into the PDB 132 KV system, but used within the 11 KV and 33 KV systems to reduce the system integration concerns.

2.0 BACKGROUND:

The main 11 KV distribution feeders are three phase, 4/0 ACSR, and extend radially from the distribution substations. The location for the small generation plants should be near the load center, typically near the industrial load, for the service area. The maximum generating plant size will be limited by the capability of the existing distribution, substation and/or transmission facilities accessible to the generating plant.

While conductor thermal capacity is the theoretical constraint, system losses and voltage profile are the limiting constraints in transporting bulk power over low voltage systems from point to point. For this study, we have limited the total voltage regulation to no more than five percent, (i.e., no more than five percent voltage drop). The associated energy loss should be less than three percent over average usage patterns. This analysis assumes that no new distribution or transmission lines will be added to distribute the small generation plant's production, but rather the existing or planned distribution facilities will be used without system upgrading. If system upgrading is needed, then the added investment should be added into the cost of production to gain a true incremental cost of the new generation.

The second consideration concerning the installation of small generation is the integration of the resource into the distribution system and the ability to connect and disconnect the generation plant from the main system. Both the generation system and the distribution system require selective protection devices that allow the systems to parallel and isolate from each other in the event of external or internal service interruptions. These integration and protection schemes are commercially available and are easily installed and operated. Some consideration must be given to the need for remote isolation of the system from the main grid during load-shedding periods and subsequent load-shedding of portions of the system to match the load to the available generation capacity.

3.0 ANALYSIS:

Using three-phase 4/0 ACSR conductor and 11 KV distribution, the following table shows that the loads can be transferred the following point-to-point distances with five percent voltage regulation:

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LOAD-CARRYING CAPABILITY OF 11KV DISTRIBUTION LINE
4/0 ACSR CONDUCTOR

LOAD (KW)	DISTANCE (KM)
2,000	12.3
4,000	6.2
6,000	4.1
8,000	3.1
10,000	2.5

LOAD-CARRYING CAPABILITY OF 33 KV TRANSMISSION LINE
4/0 ACSR CONDUCTOR

LOAD (KW)	DISTANCE (KM)
2,000	110
4,000	55
6,000	37
8,000	28
10,000	22
12,000	18

If the 33 KV system is used, the 33 KV to 11 KV substation transformer must be considered in determining the system load transfer capacity. The typical PBS substation does not exceed 10,000 KVA so the 33 KV capability will be limited to the transformer capacity in a typical situation.

4.0 CONCLUSIONS:

The above tables show that the maximum generation plant capacity is limited to the load in the vicinity of the plant plus the transformation capacity of the 33 KV substation. If the generation plant is located at a substation, the maximum plant capacity can be 20 MW. Larger installations will require additional transformation capacity and could require increased 33 KV transmission line capacity. When selecting generation plant sites, a site near the existing substations will provide the most flexibility for distributing the power. However, if there is significant concentrated industrial load, it may be appropriate to site the plant adjacent to it. This is particularly desirable if the industry has use for the waste heat.

BACKGROUND PAPER NO. 4

INDUSTRIAL PERSPECTIVE OF POWER SUPPLY

1.0 OBJECTIVE:

This background paper covers (1) the economic impact of load-shedding as a result of lost production and product to industry, and (2) the financial impact of the loss of industrial and large general consumer load to selected PBSs.

2.0 FINDINGS:

2.1 Losses to industrial production and product:

Little quantifiable information was available from the PBSs or other sources for measuring the value of the lost product and/or production, or the increased cost of production, caused by load-shedding. However, the following information was gleaned from various sources concerning the impact of load-shedding:

- The estimated annual economic loss in Dhaka is estimated to be 16 billion Taka.
- The tea industry loses more than ten percent of its production.
- One interruption caused the spoilage of fish valued at one crore Taka due to lack of ice production.
- Each interruption causes the loss of three days' production of polymer yarn in the textile industry.
- Chronic interruptions in the garment industry delay and reduce production and create overtime labor costs, plus increased costs for express shipping, and the loss of sales from production delays.
- In Chuaganga the sugar mill is "facing economic crisis due to production failures" as a result of daily power interruptions.

2.2 Losses to PBSs from industries leaving the system:

Through interviews with PBS General Managers and the PBS financial and statistical reports, we were able to gain some good information concerning the importance of industrial and general consumers in the viability of the PBSs. The GMs expressed concern about the loss of large loads and the associated revenues as a result of not being able to provide a reliable power supply. The GM of Narsingdi PBS 1 submitted a proposal to REB to install small generation units in order to retain industrial customers that have given notice to leave the system if service is not improved. We interviewed several industrialists concerning power supply and in each instance, the industry was installing its own electrical generation for the continuous process loads and, in most cases, the ancillary electrical load making the industry a self sufficient island in the middle of the serving electric system, be it PBS, BPDB or DESA. In some cases the only input into the industry is a gas supply and all other infrastructure (i.e.: water, sewer. communications and road) is installed by the industry.

3.0 ANALYSIS:

3.1 Based on the information provided by industrial representatives, it is clear that the trend is for self-generation for continuous process loads. The economic loss due to

one interruption justifies the investment. For the smaller industry where short interruptions do not cause serious production problems, self-generation is not a high priority for the industry. The extra effort in operating and maintaining the small unit is viewed by those industries as not worth the effort and they would rather have the service provided by the electric utility.

3.2 The economic impact of selected PBSs losing a portion of their industrial and general service load was analyzed. We selected the following PBSs and reduced the FY 1995 energy sale and revenue amounts to those consumer classes to determine the sensitivity of the net revenues:

Dhaka PBS-1
Moulvibazar PBS-1
Narsingdi PBS-1
Jessore PBS-2

The above PBSs were selected because they had been identified as potential sites for small generation and they all had significant non-domestic energy sales. Jessore PBS-2 is the only PBS where natural gas is not available and was included in the analysis to measure the impact of fuel cost. The table following this paper includes a summary of that analysis. The following alternative assumptions were made in the analysis:

- Industrial and General Service sales were reduced by half and the energy purchases and costs were reduced. (In Moulvibazar, the reduction is based on the loss of the tea garden load).
- Small generating units are installed to serve the "at risk", load (half of the Industrial and General Power sales).
- Small generating units are installed to serve all of the PBSs' energy requirements.
- Small generating production costs were based on the units costs developed in Background Paper No. 11, Small Generation Plant Economics.

The significance of this analysis is very important. It shows the following:

- The greater the percentage of Industrial and General Service sales to total sales, the greater the impact on Operating Margins when the sales are reduced.
- In all PBSs but Jessore PBS-2, it would require a retail rate increase of approximately 25 percent or increased energy sales to other consumer classes of over 65 percent to achieve the equivalent Operating Margins. Jessore PBS-2 has a substantially lower percentage of Industrial and General Service sales so the Operating Margins are not impacted to the same extent.
- If the PBSs did not experience load-shedding, the Operating Margins would increase form six to fifteen percent.
- In all PBSs but Jessore PBS-2, if the PBSs installed small generation to serve the "at risk" load in the range of 50 to 60 percent plant load factor, the Operating Margins would be equivalent to purchasing the energy from BPDB. Jessore PBS-2 would only achieve half of the Operating Margins under the same condition due to the higher cost of fuel.

- In all PBSs but Jessore PBS-2, if the PBSs installed small generation to serve their entire requirements, they would need to achieve a plant load factor of more than 50 percent to maintain the equivalent Operating Margins. If the generating plant factor is near 40 percent, the Operating Margins diminish substantially and would require substantial increases in the PBSs' retail rates.

4.0 CONCLUSIONS:

From the above analysis it is clear that the loss of Industrial and General Service consumers will have a significant economic impact on the Operating Margins of the PBSs. Also, for the PBSs adjacent to natural gas supplies, small generation to serve the "at risk" load will have little negative effect on the Operating Margin, but will improve the service reliability to this load, and will reduce the risk of the industries installing their own generation and leaving the PBS.

TABLE - 1
Financial and Tariff Impacts of Alternative Responses to Load-Shedding
Summary of Results

	Moulvibazar	Dhaka-1	Narsingdi-1	Jessore-2
Total kWh sales	31,814,412	137,881,9	52,907,94	29,313,42
Est'd kWh loadshed	1,908,865	8,272,915	3,174,476	1,758,806
KWh at risk to alternate generation	10,000,000	50,591,57	18,783,77	6,884,786
Impacts if "at risk" load is lost				
Rate increase required to replace margins	27%	24%	23%	15%
Sales increase required to replace	68%	66%	65%	35%
Small power installed (megawatts)	3	9	6	2
Operating margins (in Taka)				
1994-1995	15,110,124	97,761,23	32,877,78	12,601,96
Case 1: No PDB loadshed	17,151,203	104,904,3	35,967,47	14,516,64
Case 2: Lose large customers	210,606	46,046,04	10,763,15	3,571,160
Add small power for "at risk" load				
Case 5: 40% Load Factor	10,949,820	86,760,75	29,207,89	3,326,480
Case 6: 50% Load Factor	13,956,864	96,151,99	36,384,65	5,054,729
Case 7: 60% Load Factor	15,153,238	106,000,5	43,866,26	6,935,401
Case 8: 70% Load Factor	20,412,456	116,258,9	51,621,19	8,952,729
Case 9: 80% Load Factor	23,776,908	126,722,4	59,512,77	11,038,38
Replace PDB with Small Power				
Case 10: 40% Load Factor	-2,449,113	28,133,22	15,380,20	-
Case 11: 50% Load Factor	8,133,633	73,998,26	32,979,50	-
Case 12: 60% Load Factor	15,520,940	106,014,4	45,264,72	-8,226,308
Case 13: 70% Load Factor	21,052,830	129,989,3	54,464,35	-580,779
Case 14: 80% Load Factor	25,313,416	148,454,4	61,549,78	5,307,702
Average Revenue per kWh (94-95)				
System	2.75	2.59	2.89	2.82
Domestic	2.02	1.89	2.17	2.37
Commercial	4.08	3.78	4.27	4.01
Irrigation	4.04	2.31	2.46	2.43
Charitable Institutions	2.99	2.50	2.68	2.78
General Power	3.17	2.85	3.17	3.32
Large Power	2.39	2.68	2.91	2.87
Street Lights	4.13	2.67	2.63	2.67

BACKGROUND PAPER NO. 5

INTRODUCTION OF A SECOND POWER GENERATION AGENCY IN BANGLADESH.

1.0 OBJECTIVE :

This paper considers the implication of creating an additional (to PDB) power generation organization in Bangladesh.

2.0 BACKGROUND :

2.1 There are many problems facing the electricity industry in Bangladesh. Generating capacity is inadequate to meet demand, and frequent power cuts are made. Electricity is not yet available to many citizens. There is need for heavy investment in the Power System infrastructure in order to meet continued growth in demand, which is expected to average 8.7 percent per annum in the period 1995-2020. This heavy investment cannot be provided by the Government of Bangladesh, which has many other demands on it for improvements in education, health and social welfare. In common with other countries in Asia, Eastern Europe, the Mediterranean Basin and Africa, it will be necessary to attract private investment in order to fund the heavy development cost of new power stations and power transmission/distribution systems.

A significant proportion of private investment funds will have to come from outside Bangladesh; it is unlikely that there will be adequate private funds available in-country for this purpose.

Bangladesh will be competing for external private funds with countries such as Egypt, Turkey, India, Malaysia, Thailand, Vietnam, Philippines and China. Private funds tend to seek the lowest possible risk environment and the maximum possible return on investment. The lower the perceived risk in a location, in terms of political stability, well-established regulatory and legislative frameworks, assurance of firm fuel supplies and a guaranteed, bankable contract for purchase of the power produced, the lower will be the required rate of return on funds provided. It is thus important to put in place in Bangladesh the most favorable environment possible to attract private investment in the electricity supply industry.

2.2 Two key ingredients for successful development of Independent Power Plants are:

- Secure, guaranteed provision of fuel on a long term basis; and
- Power purchase agreement from a financially-strong entity which undertakes to take all of the power output for the "financial life" of the plant.

These two elements are critical. It is interesting to note that in some countries, sovereign Government guarantees were required on the power purchase agreements, as the power companies were not perceived to be financially stable enough to ensure that their commitments would be honored.

The backround, therefore, for sustainable independent power projects, funded externally, requires that a sound regulatory and legislative framework should be in place, and that the power industry should be financially strong with inflow of revenues such that long-term commitments can be entered to purchase new quantities of power on a long-term basis.

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Since it is the distribution/supply part of the power industry which interfaces directly with customers and collects all revenues, it is essential that this part should be efficiently managed. In preparing the environment for successful independent power projects, the ability of the distribution arm of the power industry to manage its affairs requires priority attention; in essence it will be required to provide the monies to repay investors and the fuel suppliers.

2.3 The electricity supply industry in Bangladesh has been vertically integrated - (i.e., the same authority, BPDB, was responsible for generating power, transmitting and distributing it. DESA was formed in 1991 to take over distribution of electricity within Dhaka and its immediate surrounding area. In 1977, REB was established to develop rural electrification; it purchases power from BPDB, for sale to customers through the PBSs. Until now, BPDB has been the only entity with generating capability.

3.0 CHANGES IN THE POWER INDUSTRY:

3.1 In many countries throughout the world, the Electricity Supply Industry has been restructured as governments have come to realize that electricity supply does not have to be a government monopoly, and it does not need to provide the large funds needed for new facilities to meet continued growth in demand.

Typically, the restructuring involves one or more of the following changes :

3.1.1 Introduce competition (i.e., provide an environment which facilitates and encourages competition in different segments of the industry).

3.1.2 Strengthen regulation (i.e., make regulation more explicit and establish formal regulatory bodies).

3.1.3 Break into separate companies (i.e., divide the existing companies vertically and/or horizontally).

3.1.4 Change ownership (i.e. either privatize a state-owned utility or consolidate through mergers or acquisitions).

These four changes have been used, to varying degrees, in ways that reflect the needs and context of each country. Much of the behavioural change which has formed the basis for performance improvement in other countries has arisen through the change from public to private ownership. While changes in organizational structure have created the potential for greater efficiency, the incentive for improvement has come mostly from the imperatives of operation within the private sector.

In addition to structural changes, there is the possibility of fundamentally overhauling the management approach within the companies of the industry. This is facilitated by the competitive and shareholder pressures which follow structural change.

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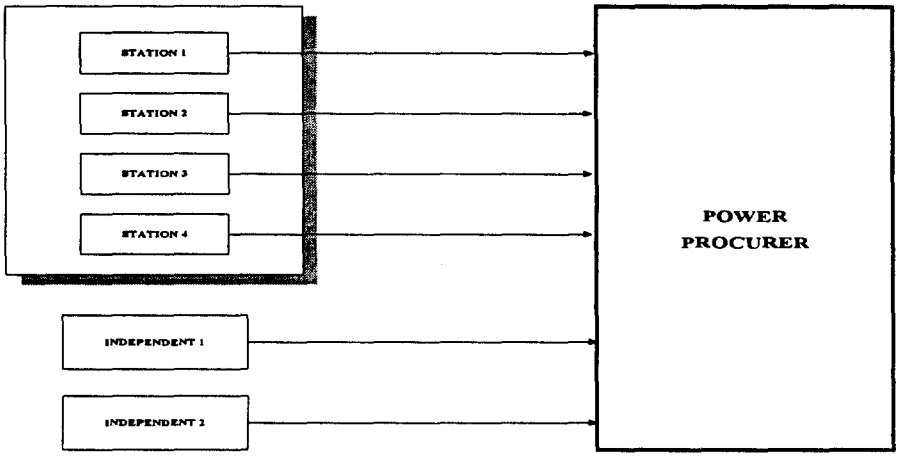
4.0 COMPETITION:

4.1 Competition facilitates efficient resource allocation and provides a powerful incentive for companies to improve their performance. While competition has been absent from the electricity industry in most countries in the past, competition is now viewed as a key element in improving overall performance of this industry which has a very important role in national economic development.

4.2 Ownership and operation of the transmission and distribution networks are in most cases natural monopoly activities; it is not practical to duplicate them. It is easier to introduce competition in power generation. Since generation costs typically represent 65 percent of the cost of electricity delivered to end-users, it is important to allow competition in this part of the industry.

4.3 The creation of competition in power generation requires the formation of a wholesale market for bulk power. This can be achieved by establishing a 'power procurer' who would enter into contracts with existing power stations and with new independent power plants for wholesale supply. He would also invite bids from generators to meet anticipated future capacity needs. Bids could be made by independent power producers, by existing plants in adjacent countries able to provide a grid link, or by BPDB. The power procurer would be required to purchase power at lowest possible cost, subject to social, strategic and technical constraints, through an open transparent and competitive bidding process. The methodology for introducing this form of competition in the generation function is well established. It may be an appropriate form for Bangladesh.

The power procurer would determine a 'wholesale' price for power delivered to the grid. The price of power delivered from the grid to the distribution system would include the costs of operating the transmission system, and the final costs of supply to customers would be determined to take into account the costs of developing and operating the distribution system. The increments of costs to be added to the wholesale price of electricity to reflect transmission and distribution costs would be determined in an open and transparent manner, to the satisfaction of the Regulator. Tariffs would be determined to reflect time-of-day costs, and the total cost of providing supply at each voltage level.



5.0 REGULATIONS:

It is essential for creation of fair and open competition and for the attraction of private capital that formal regulation of the industry should be established. Provision of a new, independent 'Industry Regulator', to ensure clear and formal regulation for the entire electricity supply industry, is an essential precondition for introducing competition and ensuring efficiency.
There are two major regulatory roles:

- Supervising competitive markets (i.e., establishing the ground rules for competitive markets, ensuring compliance with these rules, providing a sufficient degree of stability to attract new entrants such as independent power producers, and providing a court of appeal for industry participants.

- 'Incentivizing' superior performance (e.g. by setting or limiting contract/transfer prices or tariffs, by setting financial and operating targets, and by monitoring business performance against targets).

It is noted that terms of reference for consultancy services already have been drawn up which will provide guidance on reform of the power sector in Bangladesh. These services will include design of a regulatory framework and determination of a strategy for facilitating completion of Build-Own-Operate (BOO) projects to improve power supply reliability and provide new capacity to meet growth in demand.

6.0 CONCLUSION :

Introduction of competition in the power industry in Bangladesh is essential in order to improve overall efficiency and to meet future demand for electricity. This can best be achieved by creating a wholesale market for power, which would be managed by a 'Power Procurer'. The 'Power Procurer' concept does not involve the establishment of a second power generation agency. It rather envisages an agency which will ensure that many participants will undertake power generation, in an open and competitive way, with the total industry under control of an independent regulator.

BACKGROUND PAPER NO. 6

PRIVATIZED PROJECT APPROACHES

1.0 OBJECTIVE :

This paper discusses different approaches to private sector participation, such as, BOO, BOOT and BLT, their pros and cons, and their applicability to small power generation as envisaged in the scope of the study.

2.0 DEFINITIONS :

2.1 BOOT (build - own operate - transfer)

BOOT is a form of privatized project development in which a government or power utility grants a concession of defined and limited duration to private sector sponsors to build a project, hold an ownership position, arrange the balance of financing from third parties and operate the project for the life of the concession. Normally the concession life is far less than the economic life. Usually the project ownership transfers to the utility government at no cost after the sponsors recover their equity, pay off debt and earn a fair return on investment (ROI).

2.2 *Sponsors :* usually comprise a major international engineering/construction firm and one or more major equipment suppliers. There are now more than 100 independent power development companies operating worldwide.

2.3 *Project Company :* entity authorized by the host government or utility to build, own and operate the project. Participants may include local partners, lenders, major contractors and host government in addition to the sponsors.

2.4 BOT (Build-Own-Transfer) is essentially the same as BOOT.

2.5 BOO (Build-Own-Operate) is similar to BOT/BOOT, except that the project company has a concession life as long as the expected economic life of the facility. At the end of the concession, the project ownership transfers to the governmentor utility.

2.6 B(O)LT (Build-Lease-Transfer) is a form of commercial structure similar to BOO. In BLT, the sponsors form a project company to contract for, finance and own the project facility. A government agency or utility enters into a lease agreement with the lessor project company. The lease payment obligation is conditional only upon the lessor company successfully delivering the constructed facility having passed its performance tests. Upon successful completion, the lessee agency/utility operates it as part of its system. Usually the ownership of the facility is transferred to the operator-leasee at the end of the lease term.

3.0 BASIC ISSUES :

In any private sector project, there are three basic issues :

- Company structure
- Sources of funds and financial structure
- Security packages and risk allocation

As mentioned earlier, typical company structure uses an incorporated joint venture. This

facilitates limitation of liabilities, ability to raise money and eligibility for various incentives (tax, etc.).

The financial viability over the intended life of the project must be clearly demonstrable to the potential investors and lenders. Key items are source of revenue (long-term power purchase agreement with a creditworthy customer) and cost of the project (long-term fuel supply contract to assure predictable operating costs). It may be mentioned that both the power purchase and fuel purchase agreements usually incorporate a take-or-pay condition to assure a sound economic basis for the project.

Security packages to the lender and investor to protect them against various risks are key to obtaining requisite funds and to assure the sponsors of financial security.

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4.0 PROS AND CONS :

Before discussing the pros and cons of the commercial structure for a private project, it is important to make a few observations.

4.1 The major drivers for a privatized project are :

- Need for major infrastructure projects
- Host government short of resources and borrowing power
- Major international contracting firms looking for creative ways to promote new work
- Development of private sector to enhance the efficiency and productivity of industries

4.2 For capital-intensive projects BOT allows too short a time for the recovery of equity and pay-off of debts. It usually takes several years for a project to become financially stable and profitable. BOL entails handing over the operations to an agency/utility and consequent loss of control over efficiency and adept management. Therefore, BOO is the most widely-used scheme for building large-scale electric generation projects.

4.3 Pluses and minuses :

The privatized approach (BOO, BOOT, etc.) involves major pluses and minuses from the Government perspective and the sponsor's perspective as follows :

Government Perspective :

PLUSES	MINUSES
• Off the government balance sheet	• Financeability outcome uncertain
• Can access new sources of funds	• Must allow market cost-recovery pricing
• Spread the risk	• Higher financing costs
• Private sector efficiency	• Lose operating control
	• Development slow, costly, risky

Sponsor's Perspective :

PLUSES	MINUSES
• Sole source business opportunity	• Development takes more time/$/risk
• Above-average profit margin	• Competition erodes margins
• Spread risk	• Complex deals
• Capped liabilities	• Diverse interests, conflicts
• Can control with minimum cash exposure	• International political uncertainties

5.0 APPLICABILITY TO SMALL POWER GENERATION :

In view of the small, standardized plant concept that is being considered for the PBSs, the capital outlays as well as the scope of engineering, procurement and construction efforts are fairly small in value. Therefore, the chances of getting participation from foreign sponsors are very remote and, consequently, the use of privatized schemes (BOO, BOL, etc) are not relevant.

However, the principle of BOO can still be applied in the local Bangladesh context, whereby the projects could be executed through the sponsorship of PBSs, local investors and industries that will directly benefit from a particular plant. A modification of this approach could be for the PBSs to take advantage of captive plants being built by industries by participating in the investment and/or providing special terms/conditions as incentives.

5.1 Preliminary indications are that several industries are favorably disposed to the private power idea.

5.2 The major issues in attracting private sector investment appear to be

Financial Viability :

- power sale rate (market cost-recovery pricing) in light of the existing subsidized rates (to allow reasonable rate of return to investors and debt servicing)
- fuel cost (same comment as above)
- power purchase guarantee (authority of the PBSs to run the plant with high load factor, using BPDB as stand-by source)
- equity recovery period (local investors want their investment recovered in a short time, which means repayment of bank loans and PBS recovery of its investment would have to wait)
- guarantees to the private investor from a creditworthy organization (e.g. a commercial bank)
- the legal structure or status of the PBSs as non-governmental

An item of significance is the commercial structure for a privatized project (e.g. a project company that is a joint venture).

Since the PBSs do not have a legal status of their own, it is doubtful whether they can elicit equity or loan participation from an industry or investor.

The REB needs to address this issue for the establishment of a process by which a PBS can build its own generating plant.

6.0 CONCLUSIONS/RECOMMENDATIONS :

6.1 Classic privatized project approaches utilizing competitive bidding and foreign sponsors would not be cost effective or practical for small power generation. The legal, legislative and other conditions necessary for application of such privatized scheme are years away.

6.2 REB/PBSs must formulate a set of terms and conditions that would elicit private, local investor participation.

6.3 Realistic production costs and revenues need to be established to present a viable project proposal to the investors and commercial banks.

6.4 In parallel, REB must initiate discussions with potential donor and bilateral organizations so the projects could be implemented expeditiously with REB/PBS and/or other funding sources.

BACKGROUND PAPER NO. 7

ASSESSMENT OF BPDB GENERATION EXPANSION PLANS

1.0 OBJECTIVE:

This paper examines aspects of the Power System Master Plan which impact on essential elements of this project's scope of work.

1.1 The Power System Master Plan for Bangladesh estimates the most likely level of power demand in the period 1995-2015, and proposes a least-cost generation expansion plan and an associated transmission plan which will meet this projected continued increase in demand.

1.2 The present power situation in Bangladesh is characterized by :-

1.2.1 Inability of the power system to meet existing demand for electricity. During fiscal 1995 load-shedding occurred on a total of 230 days and current available generation is considered to be in the order of 500 MW below the level needed to provide a reliable, continuous power supply. This situation is likely to continue for a number of years.

1.2.2 Electricity is not yet available to a large proportion of the population; the total number of electric connections at present is approximately 2.5 million. There is thus an unusually high potential for increased demand as electricity supply is extended to new areas, and as consumption per capita increases with improved living standards.

1.2.3 Total system losses are very high by international standards, at 33 per cent of net generation or 50 percent of total sales. It is reasonable to assume that, of this amount, only 13-14 percent are real technical losses, the balance being energy supplied to the system but not metered at consumer level, and therefore not billed and paid for. Revenue collection for energy which is metered and billed is also below par, with only 87 percent of billed sales being collected. This combination of large losses and inadequate collection results in unrealized income on the order of US $ 120 m per annum.

1.3 The Master Plan envisages an average energy sales growth rate of 8.7 percent per annum in the period 1995-2015, increasing gross peak demand and energy generation from 1875 MW and 9700 GWh to 9900 MW and 52,000 GWh, respectively.

Electricity sales are expected to grow from 6142 GWh in 1994 to 35,705 GWh by 2015, but at different rates during the 20-year period. During the period 1995-2000, with rural electricity development continuing along with general industrial expansion, average annual sales growth of ten percent is anticipated. Growth is assumed to drop to 8.9 percent in the period 2001-2005, to 8.1 percent from 2006-2010, and to 7.9 percent from 2011-2015.

Within these composite growth rates for the total system, it is envisaged that rural electricity sales will increase at 16.3 percent during the period 1994-2000, and at 9.6 percent during the period 2001-2005. This has implications for the optimal allocation of resources for development of the power system in Bangladesh. While

rural electricity accounts for only 12.5 percent of total electricity sales in Bangladesh, it is the fastest growing segment as development programs are implemented. However, it is also the sector which suffers most from supply interruptions. When power demand exceeds supply (and this happens frequently) rural loads are among the first to be shed.

1.4 There is a dichotomy here which is addressed in a separate paper. Is it feasible to further extend rural electricity networks when there is not enough generation capacity to provide a reasonable level of reliable supply? Should some of the monies spent on rural development include provision for small local generating plants? These could be used for base-load generation in the immediate years ahead. When national capacity becomes available to meet the demand, these small generating units would have further commercial use by operating at peak hours to reduce the national need for peaking capacity. The Master Plan projects LOLE (Loss of Load Expectation, i.e. load-shedding) on 15.6 days in 1996, 27.2 days in 1997, 15.7 days in 1998, 6.6 days in 1999 and 9.6 days in the year 2000. These are statistically-derived results based on the assumption that existing plant is maintained to a high standard and that new plant comes into service on time. There is reason to believe, based on experience to date, that the results are unduly optimistic and that a higher incidence of load-shedding will continue to arise.

1.5 The Master Plan addresses the issue of demand-side management and identifies the savings in energy which could be achieved if appropriate programmes are put in place and if tariffs are designed to include true cost signals and time-of-day features. It takes considerable time to achieve results from demand-side management initiatives; however, they are essential to the cost-effective operations of power companies and can deliver substantial financial benefits. Such initiatives should be taken as soon as possible, drawing on a wide range of international experience and adapting it to circumstances in Bangladesh.

2.0 OPTIONS FOR INCREASING POWER GENERATION:

2.1 The Master Plan identifies the lowest-cost options for providing adequate generating capacity to cater for demand growth ahead. It considers that there will be adequate gas supplies to permit new generation to be gas turbines, operating in open-cycle and combined-cycle mode, for peaking and base load duties, respectively. While least-cost planning indicates that the most economic unit sizes would be of the order of 100 MW for combined cycle and 500 MW for steam, it acknowledges that small units may be appropriate and practicable in particular cases.

2.2 The Master Plan does not fully address the issue of availability of generating plant which is a key one for every power utility. Plant availability can be consistently improved and maintained at a high level by a range of measures including :

- increased funding for availability improvement
- improved effectiveness of maintenance
- implementation of preventive maintenance programs
- improved plant procedures and training
- formation of generating plant examining task group to identify problem areas and bring them to top management attention
- regular plant management meetings to examine previous outage causes and solutions
- improved warehouse and repair shop facilities
- improved spare parts management programs
- improved reporting and analysis of failure.

In a situation where plant capacity is inadequate to meet demand, it is clearly essential to achieve maximum possible availability.

Availability improvement is a proven, cost effective way to increase the energy producing capability of a utility.

2.3 The Master Plan asserts there is enough peat to supply a 2 x 100 MW plan operating at 50 percent annual load factor for 40 years. Peat harvesting, using mechanized methods, provides cost-effective, sustainable employment. Improved combustion technology (fluidised bed) now permits conversion efficiencies similar to that of other primary fuels. Given that it is an indigenous resource, available in quantity, it deserves careful consideration as a power generation resource.

3.0 CONCLUSIONS :

3.1 There are a number of actions which can be taken to improve the reliability of power delivery in Bangladesh and which should be prioritized for implementation.

3.1.1 Implement a computerized revenue collection system, including meter reading and billing, to ensure that non-technical losses are minimized and that more monies are available for supply improvement.

3.1.2 Implement a crash program to improve generating plant availability and thereby reduce the extent to which load-shedding is necessary.

3.1.3 Review existing load-shedding procedures to ensure that the pain is spread fairly. A small rural enterprise should have at least as much right to continuous power supply as a domestic customer elsewhere.

3.1.4 Ensure that new power plant projects are managed to be completed on time.

3.1.5 Initiate demand-side management programs to achieve longer-term benefits in energy conservation.

3.1.6 Review the cost/benefit analysis of developing peat, given its social and energy potential.

BACKGROUND PAPER NO. 8

ENVIRONMENTAL CONSIDERATIONS IN USE OF SMALL GENERATING PLANTS

1.0 OBJECTIVE :

To identify issues which will arise from any decision to install small dispersed generating plants to alleviate the present power shortages in rural areas.

2.0 BACKGROUND :

Bangladesh has developed a comprehensive set of environmental guidelines. It is a signatory to a number of international conventions concerned with protection of endangered species, flora and fauna, and prevention/treatment of oil spillage. It has a national Environmental Pollution Control Ordinance, dating from 1977, which provides for control, prevention and abatement of pollution relating to land, water and air by industrial effluents and emissions. There is a well-developed awareness of an overall need to safeguard the environment in a highly populated country, while proceeding to develop an essential infrastructure to improve living standards.

Bangladesh is fortunate in having large resources of natural gas, which is the most environmentally-friendly energy source, with minimal associated emission, fuel-handling and waste-disposal problems.

Environmental impacts from existing power plants have not been serious. Natural gas is predominant in power generation and the amount of oil used is comparatively small.

3.0 The proposal for small, dispersed power-generating plants in the rural areas envisages natural gas engines in the East and oil-fired diesel engines in the West.

3.1 In general, the total environmental impact of small, dispersed power plants will be less than that of an equivalent total power facility at a single location. Maximum dispersion of emissions is a desired feature from any plant. Such dispersion is an intrinsic feature when a number of small plants are installed rather than a single equivalent. The consequences of accidents are also mitigated in dispersed plants (e.g., oil spillage, if it should occur, will be of smaller impact).

4.0 SMALL GAS-FIRED GENERATING PLANT:

4.1 The overall environmental impact of a gas-fired combustion plant is low. Emissions are low and only oxides of nitrogen and carbon are discharged into the atmosphere (sulfur dioxide and particulates are essentially absent). International guidelines for nitrogen oxide emission (NO_x) are expressed in μg/kJ of heat released. World Bank guidelines for nitrogen oxide emissions ((NO_x) are more stringent for gas-fuelled plants than for oil or solid fuel-fired plant. The guideline for gaseous fuels is 86 μg/kJ of heat released which is approximately equivalent to 50 PPM by volume.

This guideline is a relatively stringent one, directed at large gas turbine installations. One can question whether it is necessary to comply with it in the case of small, dispersed plants if it involves additional costs. Standard small gas turbines, without low NO_x equipment, would normally exceed these limits,

and are widely used in the western world. If full compliance with the 50 ppm guidelines were considered necessary, such turbines fitted with water injection facilities can be readily obtained at an additional cost in the order of five to ten percent, including provision for a distilled water plant. It is not considered necessary to take any measures to reduce emissions from gas engine plants which are proposed in this report.

4.2 There is minimal risk of environmental damage from the fuel supply in this case (i.e., gas). Even in the case of an unplanned release of gas to atmosphere, the consequences are minimal as dispersion is rapid and complete, and there is no "clean up" requirement.

4.3 The plant installation can be designed to ensure that noise levels come within acceptable international standards. Such plants often are installed at hotels, hospitals and other civic institutions where minimum noise levels are required. Installation of inlet and exhaust silencers are standard and, if necessary, a free-standing enclosure can be built around the plant, designed to mitigate further noise levels in the vicinity.

5.0 SMALL DIESEL GENERATORS:

5.1 These are proposed for installation at a number of locations in the West where natural gas supplies are not yet available. These would burn heavy fuel oil (HFO) sourced from surplus product at the Chittagong refinery.

While the emissions resulting from burning HFO are greater than those from natural gas, the total impact from a very small number of small diesel plants in the West would be insignificant. These emissions include Sulfur Dioxide (SO_2) as well as Nitrous Oxides (NO_x) and carbon oxides. On a large scale, SO_2 emission can become an emotive issue, as it is associated with acid rain and damage to vegetation in highly industrialized western countries. In large coal/oil plants (1000 MW and above) in these countries, removal of SO_2 from flue gases may be mandatory and adds considerably to their cost. Removal of the relatively small SO_2 emission from small diesel engine plants is not normally a requirement as the cost involved would not be justified in relation to the small amount of emissions involved and the intrinsic dispersion of them.

5.2 Potential Damage from Oil Spillage

Supply of oil to any plant always involves risk of spillage and possibility of damage to water courses and vegetation if adequate safeguards and care are not taken.

The design of such diesel plants will normally include provision for minimizing this risk. Oil storage tanks should be surrounded by a containment wall so, in the event of leakage or spillage, oil will be contained in the immediate area of the tanks where it can be readily recovered. Diesel engine plants are regularly used in high population density locations. Their use in a few rural locations in the West of Bangladesh will result in negligible effect on the local environment.

5.3 Quantities of oil will have to be brought by road to the locations involved. The frequency of delivery can be determined by the size of storage provided on site, taking account of the local road network and distance to the nearest bulk supply terminal.

6.0 CONCLUSION:

Provision of a number of small power generating plants, using natural gas in the East and heavy fuel oil in the West, will not have a deleterious effect on the environment if plants are designed to normal international standard. In fact, the total environmental impact will be less than that from equivalent plant capacity centrally located because of the inherent dispersion involved.

Because of the small plant sizes involved, their type and the non-urban location intended for them, it is considered that no special precautions or expenditures are necessary to reduce their emissions.

BACKGROUND PAPER NO. 9

VIABILITY OF SMALL POWER GENERATION BY PBSs

1.0 OBJECTIVE :

This paper covers the need, the evaluation of PBSs, the type of machines, the economics, potential investors, foreign exchange needs, the benefits and disadvantages of small power generation by PBSs and recommendations.

2.0 THE NEED:

2.1 Power supply and demand

Review of numerous documents including the National Energy Policy, the Power Sector Reforms package, the Power System Master Plan, NRECA reports and newspaper articles indicates the following :

Current total installed generation capacity	2600 MW (approx.)
Current total effective capacity	1900 MW
Current total peak demand	1875 MW
Amount of load shed	up to 537 MW
Current total PBS load	270 MW
Planned increase in generation capacity (up to Yr.2000)	1200 MW
Projected increase in total peak demand (8% ave.)	200 MW/year
Projected total peak demand (up to yr. 2000)	975 MW
Projected increase in PBS load (20% ave.)	50 MW/year
Design reserve capacity (target)	25%

The actual peak demand is unknown since load-shedding preempted this situation. At the PBS level, the forecast demand for the next five to ten years is shown on Attachment 9-1. No information is available on the supply capability by the BPDB at the power take-off or delivery points to the PBSs.

The foregoing information points to the fact that even under the best circumstances, the current crisis of acute power shortage would continue for the next 5-6 years, and the desired reserve capacity level may not be reached for a significant time.

2.2 Reliability of power supply

The reliability of power supply continues to be poor, as evidenced by the following:

LOAD-SHEDDING IN THE PAST FEW YEARS

YEAR	NO. OF DAYS	MAX. MW
1990	49	160
1991	133	340
1992	241	550
1993	264	480
1994	270	537

Load-shedding is necessitated due to the aging of several generating units which are down for extended periods. The capacities of certain 132 KV grid substation transformers as well as certain 33 KV lines also are responsible for load-shedding in some cases.

In addition to load-shedding, power failures/interruptions occur due to other technical reasons. For example, load-shedding is estimated to average 175 hours per year based on Background Paper No. 11, Small Generation Plant Economics. But the actual shedding of PBS load is estimated to be two to three times this amount.

2.3 Impact :

The PBS revenue loss (energy sales) due to power interruptions was estimated at US $ 3,000,000 in 1992. While no information is available for later years, the load shedding has increased; so the revenue loss will be much greater.

The loss of production at the local or national level, and the impact on export revenues have not been systematically evaluated and, hence, are not available.

However, information from various officials and newspaper articles yielded the following:

- loss of Tk 500 Crore in the jute industry over several years
- loss of Tk 1 Crore in rotten fish (per article in newspapers of October 17, 1995
- sugar and textile mills unable to survive economically (newspaper report of October 17, 1995)
- tea industry claims loss of ten percent of their product

Such anecdotal evidence indicates perhaps a small fraction of the true total economic loss due to as reliable power which, if evaluated accurately, could be of staggering proportions.

The larger revenue sources of the PBSs are large industries that are sensitive to power availability and power frequency. These industries are installing their own generating units, causing diminished viability of healthy PBSs. Also, these industries purchase generating units of different sizes and manufacturers, thereby requiring them to maintain unique supplies of spare parts and independently train and maintain operating and maintenance personnel, contributing to an overall inefficient use of resources.

2.4 Rural electrification plans :

The Rural Electrification Program (REP) envisages coverage of 100 percent of the villages in Bangladesh by the year 2005. As additional lines (10,000 km/yr) are being constructed and new PBSs being formed, there is also a parallel drive to expand and intensify the existing PBSs to make them more financially viable. Such expansions are not accompanied by corresponding increases in generation capacity.

2.5 Conclusion :

The scenario of potential delays in the schedule of generation capacity expansion, coupled with sharp increases in demand, poses a challenge to the

continued success of REP and establishes an urgent need to generate requisite power in critical locations in the intermediate term (the next five to ten years).

3.0 EVALUATION OF PBSs

The PBSs forecast their power demands for a 25-year period to aid the planning of the distribution systems. This information was reviewed for all the PBSs. The BPDB provided information on the locations of the grid substations, their capacities and projected loads, as utilized in the Power System Master Plan studies. Since no ready information was available as to the actual allocated capacities to serve each PBS, it was not practical to determine the supply - demand discrepancy for each PBS.

It was therefore decided to utilize the interview process to identify candidate PBSs for local generation of power. Separate meetings with members of the REB staff and a group of four knowledgeable PBS general managers were held.

3.1 Criteria :

The following criteria were established to select the most critical PBSs :

- High economic losses
- High growth - short supply
- Fuel available (gas)
- Transmission feasible to adjacent PBSs
- Local investor probability
- Site access (river/road)

The criterion of transmission feasibility was included to facilitate grouping of some PBSs that could share the output of a small generating plant without accessing the 132 KV grid.

3.2 Shortlist :

As a result, the following PBSs were short listed and prioritized for local generation :

Priority	Location of Generation (PBS)	Sharing PBSs	Approx. Plant Size (MW)
1	Dhaka - 1	Tangail, Manikganj	10
2	Narshingdi - 1	Narshingdi - 2	5-10
3	Chittagong - 2	Chittagong-1, Cox's Bazar,	5-10
4	Moulvibazar	Sylhet, Hobiganj,	10
5	Comilla - 2	Comilla-1, Feni, Chandpur,	10
6	Jessore - 2	Jessore-1, Satkhira	5-10
7	Bogra	Natore-1	5-10
8	Dinajpur-1	Rangpur-2	5

It should be pointed out that the last three PBSs were ranked low, only because natural gas is not available. The priorities were assigned solely to establish relative rankings, even though all of the identified PBSs are in an equally critical situation. Therefore, the three PBSs in the west zone will be addressed in the recommendations on a comparable note of urgency.

4.0 TYPE OF MACHINES :

The National Energy Policy, the Power System Master Plan and interviews with various organizations clearly indicate that natural gas is the prefered energy source. Alternate technologies (e.g., solar, wind, small hydro, etc.) were not investigated for this study, and would not in any event, provide the ready solutions which are now required.

Gas supply is widely available in the eastern part of the country. Discussions with Petro-Bangla indicate it will take ten to fifteen years before gas transmission and distribution lines are operational in the western region.

Based on the above, gas engine generators of about 4-6 MW rating are recommended to be installed in the short-listed PBSs where gas supply is available. Depending on the expected load, two to four units should be used at the individual sites. On the west, equivalent size, medium-speed diesel generator units that could use heavy oil or gas are recommended.

In making the above recommendations, it is recognized that (a) simple-cycle gas turbine efficiencies are in the range of 30-32 percent, while combined-cycle machines and cogeneration units have much higher efficiencies; and (b) heavy or residual oil would be needed for the diesel generators.

The recommended sizes of machines are available in prepackaged designs and could be used if transportation would not present any difficulties. The manufacturers should be consulted on this issue.

5.0 ECONOMICS :

5.1 Considerations :

Where several options are available, economic studies are usually performed to evaluate capital costs, operating and maintenance costs, economic life of the plant, etc. In an overview situation covered by this study, the most important considerations are $/KW of installed cost and $/KWh production cost.

The major component of the installed cost is the equipment cost, since engineering, construction and building cost of the small plants under consideration would be a small fraction of the equipment cost (less than ten percent). Major component of the energy production cost would be the fuel cost and, in this case, the choice of fuel is limited. The time frame under consideration for installing small power generation is the next five to ten years, before large plants become operational, to satisfy the demand. Therefore, natural gas is the fuel for the East and heavy oil/residuals for the West.

5.2 Price of gas and electricity :

To assess the viability of small power generation, it is important to use a reliable price of natural gas (major component of production cost) and the unit price of electricity (for revenue). Both these components currently are subsidized. Major tariff reforms are under way and forecast rates are not available. Therefore, typical rates currently used by the PBSs will be considered.

5.3 Equipment prices/Total installed cost:

Based on available information, gas engine generators cost about $ 400,000 per MW rating. A 10 MW plant (2x5 MW units) would cost about $ 500-600 /KW installed. A typical medium speed diesel generator installation of similar size would be $ 600-700/KW.

5.4 Economic evaluation :

Background Paper No.11 - Small Generation Plant Economics examines the production cost of electric power under various load factors, interest rates, maintenance costs, capital costs, etc. Discussions were held with several industries who have installed their own generating sets and a local equipment supplier.

Based on all the information available, the total installed cost of gas engine generator units are in the range of $ 500 - $ 600/KW, including allowance for utility interconnection equipment. For diesel generator sets, such costs would be approximately comparable depending on approximately comparable depending on the manufacturer.

Production costs would be competitive with costs charged by BPDB or DESA to PBSs, provided reasonable load factor is maintained and fuel costs and financing costs are comparable to those charged for the energy projects.

5.5 Conclusion :

Small power generation can be cost-competitive. It is not in competition with or threat to large scale generation facilities, since the aggregate of such small plants would be 100-200 MW. In fact these may ultimately help the BPDB as peaking units.

6.0 POTENTIAL INVESTORS :

6.1 The assessment team had discussions with several industry representatives.

There was favorable reaction from the tea industry representatives who stated that, in the interest of reliable power supply, investment participation could be arranged. A garment industry owner echoed the same opinion. Large manufacturing companies are interested in providing their own generation, since their production cost is far below the DESA or PBS rates, in addition to having reliable power. Some potential investors believe that, a PBS is a government operation, and getting into an investor relationship or providing loans is not practical.

6.2 Conclusion :

Depending on the particular PBS involved, local industry investment is a possibility. If the private legal status of the PBSs is affirmed and publicized, it would create a favorable environment for investor participation in the small power facilities.

7.0 FOREIGN EXCHANGE NEEDS :

Since the power plants envisioned comprise small, standard equipment, and do not involve significant engineering, procurement and construction activities, international investors may not be attracted to the project.

Therefore, the options appear to be either the traditional import process using foreign exchange through the Government of Bangladesh, or assistance from donor countries. Since the viability of the Rural Electrification Program depends on adequate and reliable power supply, this generation proposal merits special consideration by the donor countries. The REB should pursue this course; however, if it would take a unduly long time to line up such assistance, traditional foreign exchange should be pursued, since time is of the essence.

By combining the needs of as many of the recommended PBSs as possible,and using a standardized unit size and manufacturer, the foreign exchange needs for both capital equipment, spare parts and training can be minimized.

8.0 BENEFITS AND DISADVANTAGES OF SMALL POWER GENERATION :

8.1 Benefits :

- Solve the power shortage problem locally
- Fast construction
- Minimize industry losses
- Smaller capital outlays
- Units can be moved later to another location
- Does not require BPDB grid access for transmission of power
- Different plants can be sponsored by different donor countries
- Road/River access restrictions minimal
- Minimize system loss
- Alternative to captive generation by industries using different equipment, spares, O&M personnel etc.
- Save loss of major revenue sources
- Better use of PBS resources/savings
- Units could be switched to peaking duty when shortage crisis eases.

8.2 Disadvantages :

- Efficiency of simple cycle is less than combined cycle or cogeneration.
- Mistakenly perceived as high cost per KW of installed capacity.
- Not sponsored by any donors yet.
- May require foreign exchange from Government reserves.
- Requires trained O&M personnel.
- The West does not have gas, so oil would be the fuel.

9.0 RECOMMENDATIONS :

9.1 The REB should take immediate action to expedite the construction of small power generating plants so they are operational within the next 12-18 months.

9.2 Donors committed to making the Rural Electrification Program a continued success, should consider providing necessary assistance to the small power generation facilities; if not, the pace of extending new lines to unserved areas should be reevaluated.

9.3 Discussions with potential investors should be started expeditiously to put together a set of incentives, terms and conditions, and/or to explore utilization of captive power facilities for PBS shortages.

9.4 Gas engine generators on the East and diesel generators on the West should be utilized.

9.5 Agreement on gas prices should be reached as soon as possible.

9.6 Creation of private legal status of PBS would encourage investor participation.

PBS–WISE LOAD FORECAST UPTO YEAR 2005.

SL No.	Name of PBS	Peak Demand (in MW)										
		Yr. 95	Yr.96	Yr.97	Yr. 98	Yr.99	Yr2000	Yr2001	Yr2002	Yr2003	Yr2004	Yr2005
1	Dhaka PBS	28.200	31.020	34.122	37.534	41.288	45.416	49.958	54.954	60.449	66.494	73.144
2	Comilla–1	13.950	15.345	16.880	18.567	20.424	22.467	24.713	27.185	29.903	32.893	36.183
3	Jessore–2	9.750	10.725	11.798	12.977	14.275	15.702	17.273	19.000	20.900	22.990	25.289
4	Natore–1	8.010	8.811	9.692	10.661	11.727	12.900	14.190	15.609	17.170	18.887	20.776
5	Sirajgonj	10.200	11.220	12.342	13.576	14.934	16.427	18.070	19.877	21.865	24.051	26.456
6	Moulovibazar	10.960	12.056	13.262	14.588	16.047	17.651	19.416	21.358	23.494	25.843	28.427
7	Jessore–1	12.130	13.343	14.677	16.145	17.760	19.535	21.489	23.638	26.002	28.602	31.462
8	Tangail	21.210	23.331	25.664	28.231	31.054	34.159	37.575	41.332	45.466	50.012	55.013
9	Chandpur	9.200	10.120	11.132	12.245	13.470	14.817	16.298	17.928	19.721	21.693	23.862
10	Natore–2	7.230	7.953	8.748	9.623	10.585	11.644	12.808	14.089	15.498	17.048	18.753
11	Hobigonj	8.430	9.273	10.200	11.220	12.342	13.577	14.934	16.428	18.070	19.877	21.865
12	Pabna–2	4.400	4.840	5.324	5.856	6.442	7.086	7.795	8.574	9.432	10.375	11.412
13	Pabna–1	6.020	6.622	7.284	8.013	8.814	9.695	10.665	11.731	12.904	14.195	15.614
14.	Satkhira	5.53	6.083	6.691	7.360	8.096	8.906	9.797	10.776	11.854	13.039	14.343
15.	Feni	9.96	10.956	12.052	13.257	14.582	16.041	17.645	19.409	21.350	23.485	25.834
16	Mymensingh–1	17.40	19.140	21.054	23.159	25.475	28.023	30.825	33.908	37.298	41.028	45.131
17	Rangpur–1	7.83	8.613	9.474	10.422	11.464	12.610	13.871	15.258	16.784	18.463	20.309
18	Dinajpur–1	9.14	10.054	11.059	12.165	13.382	14.720	16.192	17.811	19.592	21.552	23.707
19	Kushtia	5.06	5.566	6.123	6.735	7.408	8.149	8.964	9.861	10.847	11.931	13.124
20	Madaripur	4.89	5.379	5.917	6.509	7.159	7.875	8.663	9.529	10.482	11.530	12.683
21	Barishal–2	8.97	9.867	10.854	11.939	13.133	14.446	15.891	17.480	19.228	21.151	23.266
22	Joypurhat	6.34	6.974	7.671	8.439	9.282	10.211	11.232	12.355	13.590	14.949	16.444
23	Bagerhat	2.53	2.783	3.061	3.367	3.704	4.075	4.482	4.930	5.423	5.966	6.562
24	Rangpur–2	5.67	6.237	6.861	7.547	8.301	9.132	10.045	11.049	12.154	13.370	14.707
25	Pirojpur	1.20	1.320	1.452	1.597	1.757	1.933	2.126	2.338	2.572	2.830	3.112
26	Jamalpur	8.12	8.934	9.828	10.810	11.891	13.081	14.389	15.827	17.410	19.151	21.066
27	Chittagong–2	12.12	13.332	14.665	16.132	17.745	19.519	21.471	23.618	25.980	28.578	31.436
28	Thakurgoan	5.80	6.380	7.018	7.720	8.492	9.341	10.275	11.303	12.433	13.676	15.044
29	Bogura	10.24	11.264	12.390	13.629	14.992	16.492	18.141	19.955	21.950	24.145	26.560
30	Narsingdi–1	12.87	14.157	15.573	17.130	18.843	20.727	22.800	25.080	27.588	30.347	33.381
31	Noakhali	7.24	7.964	8.760	9.636	10.600	11.660	12.826	14.109	15.520	17.072	18.779
32	Meherpur	4.86	5.346	5.881	6.469	7.116	7.827	8.610	9.471	10.418	11.460	12.606
33	Chittagong–1	5.76	6.336	6.970	7.667	8.433	9.277	10.204	11.225	12.347	13.582	14.940
34	Sylbet	3.65	4.015	4.417	4.858	5.344	5.878	6.466	7.113	7.824	8.607	9.467
35	Kishoregonj	5.01	5.511	6.062	6.668	7.335	8.069	8.876	9.763	10.739	11.813	12.995
36	Naogoan	8.47	9.317	10.249	11.274	12.401	13.641	15.005	16.506	18.156	19.972	21.969
37	Narsingdi–2	4.98	5.478	6.026	6.628	7.291	8.020	8.822	9.705	10.675	11.743	12.917
38	Barisal–1	0.98	1.078	1.186	1.304	1.435	1.578	1.736	1.910	2.101	2.311	2.542
39	Laxmipur	1.99	2.187	2.405	2.646	2.911	3.202	3.522	3.874	4.261	4.688	5.156
40	Patuakhali	1.21	1.331	1.464	1.611	1.772	1.949	2.144	2.358	2.594	2.853	3.138
41	Dinajpur–2	0.57	1.300	2.800	3.800	4.180	4.598	5.058	5.564	6.120	6.732	7.405
42	Netrokona	0.98	2.120	3.170	3.487	3.836	4.219	4.641	5.105	5.616	6.177	6.795
43	Manikgonj	1.50	2.650	4.300	4.730	5.203	5.723	6.296	6.925	7.618	8.379	9.217
44	Commlla–2	0.45	3.400	5.300	5.830	6.413	7.054	7.760	8.536	9.389	10.328	11.361
45.	Cox's bazar	4.50	4.950	5.445	5.990	6.588	7.247	7.972	8.769	9.646	10.611	11.672
	TOTAL	335.51	374.68	417.30	459.75	505.73	556.30	611.93	673.12	740.44	814.48	895.93

BACKGROUND PAPER NO. 10

POWER SECTOR REFORMS

1.0 OBJECTIVE :

The purpose of this paper is to (a) identify the various initiatives undertaken by the Government of Bangladesh (GOB) to facilitate the privatization process in the power sector, and (b) review the current status of their implementation and assess of the timeframe when international investor entry would be feasible.

2.0 BACKGROUND :

The power sector in Bangladesh is organized under the Ministry of Energy and Mineral Resources (MEMR) of GOB. The GOB, through MEMR, wholly owns and supervises the Bangladesh Power Development Board (BPDB), the Dhaka Electric Supply Authority (DESA) and the Rural Electrification Board (REB).

BPDB is responsible for all generation and bulk transmission in the country. DESA distributes power in the Dhaka area directly as well as through REB. The REB distributes power in all rural areas and has the mandate to generate power as required.

As a result of unacceptable performance by BPDB and DESA in several areas, the donors suspended new lending in 1990. Various power sector reforms were agreed to between the GOB and donors in 1992 to restart the lending process.

3.0 SUMMARY OF REFORMS AND STATUS :

Attachment 1 provides the status and a brief description of the major actions underway.

Attachment 2 is a detailed description of the activities covered by Attachment 1. The area of legislative and regulatory changes is covered in the draft report dated October 2, 1995, prepared by the Administrative Staff College of India (ASCI) and funded by ADB, under Project No. TA-1743.

From the point of view of a private international developer, the crucial activities are:

- Establishment of the Regulatory Authority
- The legal enactments and changes to existing laws
- Private sector participation in generation, and
- Tariff rationalization.

As can be seen from Attachment 1, some of the above activities are delayed and some are now forecasted to be completed by August, 1996. The ASCI draft report says that detailed work needs to be done after the GOB approves the approaches defined in this report.

4.0 ASSESSMENT :

The reforms envisioned by the GOB are quite extensive and consistent with the approaches being practiced in the developed world.

There is potential for slippage in the implementation schedule due to the general elections scheduled for March, 1996. Assuming there is some delay, the completion of

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all the key activities identified above may occur by the end of 1996. The first truly private project may be bid in the beginning of 1997 and awards made by the middle to third quarter of 1997. Even this schedule is optimistic.

However, in the context of the small private power generation under study by the assessment team, the entire set of activities would not be applicable, since the chances of international investor participation are very remote.

The actions recommended to attract local investors and donor assistance are covered in Background Paper No. 9, Viability of Small Power Generation.

BANGLADESH: STATUS OF POWER SECTOR REFORMS

	Activity	Donor	Schedule as per Donor Meeting of December 1994	Status as of mid-September 1995
1.	Power System Master Plan	ADB	Completion by Sep 1995.	Completed as scheduled. Tripartite meeting on draft final report held on 17 Jun and final report received on 11 Sep 1995.
2.	Financial Management Upgrade of BPDB and DESA	ADB	Completion of studies by Sep 1995 and of implement-ation by Jun 1997.	Studies completed as scheduled. Pilot implement-ation will start in Oct 1995. Completion of total imple-mentation expected by Jun 1997.
3.	Pilot System Loss Reduction	JICA/ OECF	PCP approval by Mar 95. Appoint-ment of consultants by Aug 95.	Delayed by several months. PCP expected to be approved by Oct 95. Consultants expected to be appointed by Dec 95.
4.	Meghnaghat Solicited Bidding	ADB	PCP approval by Feb 95. Appoint-ment of solicitation consultants by May 95. Implementation to be completed by Jun 96.	Delayed by several months. TA grant approved by ADB on 30 May 95. PCP approved by ECNEC on 26 Jul 95. Engineering consultants appointed by BPDB in Sep 95. Solicitation consultants expected to be appointed in Dec 95. Implementation expected to be completed by Oct 96.
5.	Establishment of Power Cell/ Regulatory Authority	IDA	TAPP approval by Feb 95. Technical support for Power Cell and its activities from Mar 95 to Dec 96.	Delayed by several months. TAPP approved on 4 May 1995. Acting Director General of Power Cell appointed in Jul 95. Technical support will be funded by IDA from Japan's PHRD.

PCP = Project Concept Paper
SPEC = Special Project Evaluation Committee of Planning Commission
TAPP = Technical Assistance Project Proforma
ECNEC= Executive Committee of National Economic Council
PHRD = Population and Human Resources Development Fund of Japan

Activity	Donor	Schedule as per Donor Meeting of December 1994	Status as of mid-September 1995
6. Electricity Legislation Review	ADB	Appointment of consultants by Apr 95. Completion of the review by Sep 95.	Delayed by several months. Consultants fielded on 14 Aug 95. Final recommendations expected by Dec 95. Delinked from the Power Cell creation.
7. Tariff Rationalization[a]	IDA	TAPP approval by Mar 95. Commencement of study by Jun 95 and completion by Jun 96.	Delayed by several months. TAPP approved in Mar 95. Grant agreement with IDA expected to be signed before end Sep 95. Consultants expected to commence the study by Feb 96 and to complete it by Aug 96.
8. Private Sector Participation in Generation[a]	IDA	Appointment of consultants by Apr 95. Completion of the study by Dec 95.	Delayed by several months. Approved as part of TAPP for the Power Cell. Grant agreement with IDA expected to be signed before end Sep 95. Consultants expected o commence the study by Feb 96 and to complete it by Aug 96.
9. Rationalization of Distribution[a]	IDA	TAPP approval by Oct 95. Appointment of consultants by Mar 96. Completion of the study by Sep 96.	TAPP expected to be approved before end Sep 95. Grant agreement with IDA expected to be signed by Oct 95. Consultants expected to commence the study by Feb 96 and to complete it as scheduled by Sep 96. Rationalization of distribution between DESA and REB covered under ADB's Ninth Power Project (no need for detailed study).

[a] To be handled by the Power Cell.

Activity	Donor	Schedule as per Donor Meeting of December 1994	Status as of mid-September 1995
10. Corporatization of DESA	ADB/ ODA	PCP approval by Jul 95. Appointment of consultants by Dec 95. Completion of the study by Jun 96.	Delayed by several months. Outline proposal submitted to GOB after GOB/ODA/ADB discussions as part of ADB's Ninth Power Project. PCP expected to be approved by Dec 95. Delinked from the Power Cell.
11. Unbundling of BPDB	ADB/ IDA	PCP/TAPP approval by Jul 95. Appointment of consultant by Dec 95. Completion of the studies by Jun 96.	Delayed by several months. Outline proposal for Transmission Company discussed between GOB/ BPDB/ADB as part of ADB's Ninth Power Project. PCP expected to be approved by Dec 95. Delinked from the Power Cell. Distribution function covered by activity No. 9.

BANGLADESH: POWER SECTOR REFORM

TERMS OF REFERENCE FOR CONSULTANCY SERVICES

BACKGROUND

Sector institutions

1 Three parastatal organizations, the Bangladesh Power Development Board (BPDB), Dhaka Electricity Supply Authority (DESA) and the Rural Electrification Board (REB) share responsibility for the power sector in Bangladesh. All three organizations operate under the direction of the Ministry of Energy and Mineral Resources (MEMR) and issues such as staffing levels, appointments and investment decisions are tightly controlled according to government service policy norms. BPDB is a vertically integrated utility and currently has a monopoly of generation and transmission services in the country. In addition, it provides bulk supply to the other utilities and handles retail distribution in many parts of the country. DESA and REB are responsible for the distribution function in their respective areas. DESA was established in 1991 by separating out one of the zonal distribution units of BPDB and supplies power within the metropolitan city of Dhaka and some of its isolated suburbs. REB is responsible for overseeing expansion of distribution systems to rural areas through a system of rural cooperatives (Palli Bidyut Samities, PBSs), which carry out the utility operating function. At present there are 45 operating PBSs each of which is owned by its members (consumers, both existing and prospective) whose rights are exercised through elected Boards of Management. The role of REB is in establishing the PBSs, financing and constructing the initial network development (and subsequent major improvements) and providing supervisory control and technical expertise for its operational activities. Of the overall sales to final consumers BPDB accounts for 49%, DESA 38.5% and the PBSs 12.5%. The percentage of consumers served by the three institutions are however 41.2%, 18.4% and 40.4% respectively.

2 The operational performance of BPDB has been unsatisfactory over a number of years characterized particularly by high system losses and poor collection of receivables. The situation is aggravated by poor accounting standards and weak management control in its various operational activities. At one stage (prior to FY 1991), less than 50% of the value of power generated was being recovered from its consumers. At this time DESA was created in an attempt to improve accountability in a localized area but the performance over the first few years of operations provide little hope in its ability to address ingrained inefficiencies of the system acquired from the predecessor organization. Currently aggregated (gross) system loss of BPDB and DESA combined is of the order of 34.5% and overall collections 86.8% of billing resulting in an overall collections to generation ratio of 58.0%. Although some improvement in sector performance has been observed with the introduction of new commercial operations procedures since 1992, endemic institutional problems in the parastatals are a serious impediment to fundamental and systemic improvements deemed necessary to bring these institutions to acceptable performance levels. In contrast, the performance of REB/PBSs is significantly better in all respects. Since the inception of the rural cooperative power utility concept in 1978, the REB/PBS arrangement developed an institutional culture at substantial variance with that of government parastatals. Currently the aggregate performance of all PBSs record a system loss of 15.5% and a collection level of 99%. The PBSs also maintain retail tariff levels (determined individually by each PBS) at about 25% higher than that of BPDB and DESA. However, since the PBSs are restricted to rural loads and are also deprived of the many load centers consisting of small towns and bazaars within their overall

operational area, their financial standing is weak in spite of good operational practice and a subsidized bulk supply tariff.

Sector Reform

3 Concerned over the repeated failure to effect a turn around of performance of the two parastatal organizations, the Government of Bangladesh (GOB) appointed an inter-ministerial committee in February 1993 to review the necessity and feasibility of private investment in the power sector. Having studied the issues involved, the committee reported that basic reform of sector institutions was required to complement private sector participation and that fundamental problems in the sector need to be resolved to ensure sustainable improvement of sector performance. For this purpose an overall sector reform program has been recommended with the objectives of achieving full commercial operation of the operating entities, attracting private capital to reduce the burden on public finances and establishing suitable tariffs and transfer pricing mechanisms to enable the sector institutions to attain financial viability. The recommended program which has been accepted in principle by GOB consist the following:

- introducing private participation in the sector by:
  - (a) competitive tenders for BOO projects,
  - (b) contracting out services,
  - (c) establishing wheeling arrangements for sales to large consumers from independent power producers (IPPs):

- corporatization and commercialization of DESA with management and financial autonomy and independence:

- restructuring BPDB along functional lines by establishing two autonomous and independent corporatized entities:
  - (a) a generation and transmission company (separation of the two functions to be considered at a later date)
  - (b) a distribution company;

- rationalization and re-demarcation of distribution areas to improve viability of operating units and introducing private participation in distribution (franchising, etc.) on an experimental basis;

- establishment of an independent regulatory authority to oversee the reorganized sector including tariff issues (initially this unit will function under MEMR):

4 In order to carry out the reform program a new organizational unit, the 'Power Cell', is being set up in MEMR. The new unit will be headed by a Director General and is expected to be staffed by a team consisting of 3 Directors, 8 Deputy Directors, 16 Assistant Directors and about 28 other support staff. The Power Cell will be responsible for coordinating all related activities and conducting the necessary studies and preparatory work. GOB has requested the World Bank (the Bank) for support in preparing and implementing the reform process. The current consultancy assignment will be managed by the Bank out of funds provided by the Japan under the Policy and Human Resources Development (PHRD) grant facility. New lending operations to support reform measures in the sector are also expected to be finalized depending on the recommendations under this assignment. The necessary legal enactments and changes to existing laws governing sector operations is being addressed in another consultancy

assignment supported by the Asian Development Bank (ADB).

DESCRIPTION OF SERVICES OF CONSULTANTS:

5 The reform of the power sector in Bangladesh is expected to be a complex and lengthy process that requires a variety of inputs and skills. It should be considered as an evolutionary process leading to the desired overall goals over a period of time. The present assignment is expected to cover advice and assistance to GOB over a period of about one year and should help GOB clarify its overall goals, identify and elaborate the reform process and accomplish tasks set for the initial implementation period. The assignment is separated to five main tasks. These tasks (described below) are to be carried out according to the procedures described under the section 'procedures for execution of assignments'. While each task requires separate specialized skills they are also interrelated and need to be coordinated to establish a comprehensive and complete reform package. Consultants invited to participate may therefore combine with suitable partners to offer the complete range of services or alternatively offer their services only for certain tasks with the understanding of the need to interact extensively with others who may be selected to carry out the remaining tasks.

Task 1: Private Generation Projects on Build-Own-Operate (BOO) Basis

6 Private sector generation on a BOO basis is expected to be one of the earliest of the reform activities that could practically be realized. The Consultants will prepare a strategy for attracting the participation of international investors for BOO projects to enable GOB in meeting future generation shortfalls. Private investors will be required to establish project companies in Bangladesh which would own, finance and operate the power plant and enter into long term power purchase agreements with existing or expected future supply utilities. To facilitate private sector participation the Bank is preparing a lending operation to establish a Private Sector Infrastructure Development Fund (PSIDF) which would provide subordinated debt to finance part of the capital requirements and to provide necessary comfort to overcome political risks and poor country credit ratings. The Consultants will prepare a structured request for proposals (RFP) which will include a suitable prequalification process and necessary documentation on: invitation to applicants, information to applicants, instructions to applicants, security package, technical information and requirements, proposed tariff structure and required format for the bidder's offer. The security package should include draft agreements for project implementation (IA), power purchase (PPA), fuel supply (FSA) and land conveyance (LCA). The technical information to be provided should be limited to site specific matters while technical requirements will cover output, availability and supply characteristics as well as environmental conditionalities and other regulatory aspects to be complied with. The required documentation will be prepared initially in generic form to be discussed with GOB and the Bank. After clearance of such documents the Consultants will identify one site for which a RFP could be issued and assist GOB in finalizing and processing of the solicitation package. Assistance to GOB in evaluation of bids, carrying out negotiations and preparation of final contract documents is expected to be provided under a separate consultancy assignment, to be arranged subsequently.

7 In addition to the preparation of a package for solicited bidding the Consultants will also be required to provide limited assistance on the processing of unsolicited proposals currently under consideration by GOB.

8 The Consultants will also examine the potential for the performance improvement of existing thermal plant by (a) privatization on a Rehabilitate-Own-Operate basis and/or (b) rehabilitate with a long term maintenance/operate management contract. Advice to GOB on suitable procedures to carry out recommendations on these options (if deemed suitable) will also be required.

Documented outputs: a complete solicitation package for a BOO power project. recommendations on other privatization and related options for power generation.

Task 2: Restructuring of Power Sector Institutions

9 GOB has also decided on a strategy of unbundling BPDB and establishing the new entities independent and commercialized organizations. In addition GOB wishes to corporatize DESA to function in a commercialized environment. The new organizations are expected to remain under government ownership during the initial period but the ownership structure could change at some time in the future. The Consultants will review current plans and provide suitable proposals along with a dated action plan to carry out the restructuring, corporatizing and commercialization exercise. Proposals for establishing the new entities should optimize their technical and commercial characteristics in order to ensure their economic viability. An important policy decision already accepted by GOB in connection with the restructuring of sector organizations is the need to rationalize service areas of the distribution entities, in particular to ensure that the supply areas of PBSs do not lead to investment and operational inefficiencies. The Consultants will ensure that the rationalization goals are addressed in the restructuring exercise leading to optimum arrangement of operational boundaries.

10 GOB's policy on sector reform also envisages the participation of the private sector in certain operations and functions presently carried out by in-house arrangements. The consultants will determine the feasibility of introducing private sector participation in various operational activities – considering both the national and international private sector– and develop pilot schemes to introduce such participation. Means of developing private sector interest in such ventures will be investigated and assistance provided in implementing the pilot schemes.

11 The Consultants will also assess the impact of the restructuring exercise on the various sector institutions and on GOB's finances to support sector activity. In evaluating such impact the Consultants will take into consideration the efficiency gains to be expected from the new organizations as well as the benefits of implementing the tariff proposals detailed in paras 13 and 14 below.

Documented outputs: recommendations for restructuring of BPDB and DESA, overall rationalization of distribution sector, recommendations for private sector participation in operational activity.

Task 3: Tariffs and Financial Restructuring Measures

12 In order to complement the institutional reforms envisaged under tasks 1 and 2 above, the Consultants will be required to prepare proposals for an overall tariff reform exercise as well as for financial restructuring measures to ensure commercial operations between the various stake holders. These assignments are grouped under two sub tasks as follows:

Sub Task 3A: Tariff Reform

13 The Consultants will develop a Long Range Marginal Cost (LRMC) of power supply indicating the cost of providing supply at various voltage levels. The most practicable and appropriate method of determining LRMC shall be used, but should not be less accurate than the Average Incremental Cost (AIC) method often used for computations of this nature. Costs should also be broken down to demand and energy components. Based on the findings of the above referenced studies the Consultants will develop a transfer pricing mechanism to be applied in the context of sector restructuring including bulk power purchases from IPPs, sales to the new distribution organizations and wheeling charges for transmission access.

14 The supply costs determined at various voltage levels will also be resolved by class of consumer and the Consultants will recommend a suitable tariff structure to be applied at retail level by the supply organizations expected to be operational consequent to the restructuring exercise (Task 2).

Documented outputs: LRMC of power supply by voltage level and class of consumer; recommendations on: power purchase rates from IPPs, bulk sales to distribution utilities, wheeling charges for transmission access and retail tariff structure/s.

Sub task 3B: Financial Measures

15 The Consultants will undertake an overall review the existing financial situation of GOB power sector enterprises as well as the financial relations between these enterprises and GOB. Thereafter the Consultants will define financial restructuring measures required to provide a commercial basis for each of the power sector institutions recommended under the restructuring program in Task 2 to ensure compliance with sound financial and managerial principles. Recommendations will also be provided on the procedures and principles to be applied for asset valuation for the restructured institutions and the treatment of assets/liabilities to be transferred between them.

16 Ten year financial projections for the restructured sector institutions will be prepared considering the current projections of demand, the rationalization, modernization and expansion programs, and the pricing options reviewed in sub-task A. The Consultants will recommend necessary changes to enable the sector institutions to achieve financial autonomy including the payment of any subsidy due by GOB to the sector institutions in the context of targeted externalities. On completion of these tasks the Consultants will assess the impact of the restructuring process on the GOB's finances.

Documented outputs: proposals for financial restructuring of proposed institutions, asset valuation and transfer of assets/liabilities; ten year financial projections for individual institutions and impact on GOB finances.

Task 4: Establishment of a National Power Regulatory Authority

17 The Consultants will design a regulatory framework to facilitate the operation of the various sector entities free from external or state controls. The regulatory structure will ensure the transparency and fairness in pricing of electricity. It should ensure that the sector entities will be able to carry out sustained operations generating sufficient revenues for expansion and improvement programs while also providing sufficient returns on investment. It should also promote competition, define service and safety obligations and protect the rights of consumers and third parties. The Consultants will assist

GOB in establishing the regulatory body, detailing its powers, activities and operating mechanisms, and formulating suitable appointment procedures.

18 The Consultants will review proposed changes to the legal enactments being prepared with assistance from another consultancy assignment to provide an enabling legal framework for the intended reforms.

Documented outputs: proposals for establishing a regulatory authority and definition of its role and powers, review of legal changes contemplated by GOB

Task 5: Strategic Framework and Overall Implementation Plan

19 The Consultants will draw up proposals to establish a strategic framework as well as an overall implementation program to carry out the tasks enumerated above. Current plans and programs of GOB in connection with sector reform will be reviewed and the Consultants will assist in further refining GOB's objectives and goals and develop a policy document and strategic plan with linkages to GOB's overall development policy. The document will elaborate the reform process and set out a detailed time bound implementation plan suitably grouped to various phases in the process. Recommendations will cover the sequencing and phasing of the various activities and description of measures to be taken at each stage. It will therefore include coordination of the other tasks and general responsibility in directing and guiding the reform process. Advice on policy issues and the handling of strategic and public relations aspects including Government announcements to ensure that both the public image of the reform exercise and investor confidence is not eroded, will also be required from the Consultants.

20 The task will include routine assistance and guidance to the Power Cell on implementation measures in the various activities to be encountered during the period of the assignment. On a periodic basis, the Consultants will review the implementation plan and make necessary alterations and modifications and advice GOB on alternative courses of action desirable. Two or three workshops of one to two days will be organized to review and discuss with GOB the findings, conclusions and recommendations of each phase of the work program and to map out the next steps. The implementation process will be made transparent, encouraging a dialogue with all stakeholders in the sector. In particular the Consultants will assist GOB to establish a dialogue with employees, explaining the goals and procedures that will be followed and alleviating fears and misconceptions. With respect to employee issues, recommendations will be provided concerning packages of alternative employment, re-training, early retirement and compensation for involuntary separation. The Consultants will prepare a monthly report summarizing the progress of activities in the reform program.

Documented outputs: power reform policy document, detailed implementation plan, monthly reports on progress of reform activities.

PROCEDURES FOR EXECUTION OF THE ASSIGNMENT

Training of Counterpart personnel

21 One of the goals of assignment is to provide training to the counterpart personnel of the Power Cell in establishing and implementing reform related activities. The Consultants will provide the required guidance and training to such staff and will also utilize their services in carrying out the

assignment. Selected visits to developing and relevant developed countries will also be arranged to obtain first hand knowledge and experience of issues and problems faced in implementing a reform program.

Support from Local Consultants

22 In addition to the counterpart staff of the Power Cell the Consultants are encouraged to hire local consultants to assist in carrying out their duties. The selection of such services may be established after award of contract with the approval of the Bank. Any assistance required in the selection of such local Consultants will be provided by the Power Cell. Details of proposed arrangements should be elaborated in the offer.

Inputs to be provided by GOB

23 A full complement of counterpart staff will be assigned to the Power Cell which will be entrusted exclusively with sector reform related activities. The Cell will be headed by a Director-General and will have three directorates with responsibility for (a) private power development, (b) restructuring sector entities and implementation program, and (c) planning and tariff formulations. The Consultants will utilize the staff of the Cell in carrying out their day-to-day work. The Consultants will also be supplied with all available information on operational statistics, previous studies carried out in the sector and existing and proposed legislative enactments bearing on the power sector. Suitable office space, secretarial facilities and local transport will also be provided by GOB.

General procedures and reporting requirements

24 The Consultants will closely liaise with the Power Cell in carrying out the tasks while at the same time training the counterpart personnel in the related functions. The Consultants will be flexible in their approach formulating the strategies and policies to enable implementation of the reform process in a sustainable manner in the context of the particular situation in Bangladesh. Each of the specific reports detailed under each task description above will first be prepared in draft form and discussed with the Bank and GOB and finalized after obtaining relevant comments. In addition the Consultants will prepare an inception report after 3 weeks of commencement and regular and concise progress reports (at intervals not exceeding 3 months) as well as a final report at the end of the assignment.

August 2, 1995
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BACKGROUND PAPER NO. 11

SMALL GENERATION PLANT ECONOMICS

1.0 OBJECTIVE:

This background paper investigates the required investment and operating cost associated with the production of electricity for small generation plants of 1,000 to 20,000 KW. The size and type of each generating unit is dependent on the location of the installation, so this paper includes, gas, diesel and heavy fuel oil type generation.

2.0 BACKGROUND:

The present electrical generating capability of the BPDB is not sufficient to meet the energy requirements during the daily peak load period of most work days of the year. While the BPDB has installed capacity which, if running, could serve the projected peak load, much of the capacity is not available. The load shedding required to match the load to the available generation is more frequent and of longer duration for PBS systems than for the BPDB and DESA systems. This is a result of the priority given to the loads being served and the rural load, with less industrial load, is placed in a lower priority than the urban load.

The recently published Power System Master Plan (PSMP) prepared for BPDB by ACRES analyses the total power supply requirements of the entire electric sector including BPDB, DESA and REB/PBSs but does not address the present situation of load shedding. The plan shows a 60 MW peak shortage in 1994 and projects a need for 1,160 MW of additional generation capacity in the next five years, an annual growth rate of 9.1 percent. The magnitude of the capacity requirements shown within the plan can not be served solely by the installation of small 1MW to 20MW generation plants so the recommended generation plan does not include a major role for small generation. Small generation was suggested for special isolated applications in the Chittagong Hills area and was estimated to have an investment cost of over $2,000 per KW. The PSMP, while a comprehensive analysis, does not realistically address the existing shortfall of capacity or include a recommendation for reducing the deficiency for at least five years, (the time to finance, design, construct and commission a new 200 MW project).

Both in interviews with and materials provided by PBS General Managers, the PBSs claim that the industrial loads can not tolerate the load shedding and will leave the PBS system if supply is not improved. New industries are reluctant to connect to the PBS systems, not because of price, but because of the power interruptions. When asked if the industries would pay more for reliable energy, the GMs indicated that a 10 to 20 percent premium could be collected for quality electric service. Small power generation is presently being used in industry and its use is expanding. In interviews with various industries, (textiles, chemicals, pharmaceuticals, and other process type industries), we learned that they prefer to install electrical self-generation to assure an adequate and reliable power supply and to save on electricity costs. The industries indicate that their total electrical production costs, including repayment of investment, is in the range of 1.5 Taka per kWh at 80 percent load factor. One of the generator suppliers interviewed stated that he installed 40-1 MW units in 1994, and projects that he will install 50 and 75 -1 MW units in 1995 and 1996, respectively.

Based on information provided by local small generation unit suppliers and generic information from other sources, the expected installed cost of a small natural gas generation project will be $450 to $600 per KW (18,000 to 24,000 Taka per KW). The unit cost of small generation compares favorably to the installed cost of a 300 MW unit

($1,100 to $1,500 per KW) and is substantially lower than the $2,000 per KW used for small scale generation in the PSMP. This installed cost has also been verified by local industries who have installed units over the past three years. The installed cost does not include modifications that may be required in the electric distribution system or any costs associated with associated cogeneration equipment. The thermal efficiency of the small units is in the range of 25 to 33 percent without the use of waste heat and can increase to over 45 percent if waste heat can be used for process steam.

3.0 ANALYSIS:

The following table shows the total cost of generation from a natural gas-fueled internal combustion engine based on various load factors:

ECONOMIC EVALUATION
SMALL SCALE GENERATION PLANT

Basis of Analysis:

Size of generating units: KW	2,000	10,000
Generation efficiency in percent:	25%	33%
Installed investment Taka/KW:	24,000	18,000
Fuel cost/MCF:	47.68	47.68
Fuel cost per KWh: @47.68 Taka/MCF	0.65	0.49
Loan amortization period in years:	5	10
Loan annual interest rate:	6	10
Operation costs, % of investment:	2%	4%
percent plant factor:	40%	80%

CASE NUMBER 1: SMALL UNIT, HIGHER INVESTMENT

			PLANT FACTOR					
		HRS/YR	40%	50%	60%	70%	80%	90%
HOURS		8760	3504	4380	5256	6132	7008	7884
FIXED COSTS:								
DEBT SERVICE	**5YR**							
6%	5,520		1.575	1.260	1.050	0.900	0.788	0.700
8%	5,760		1.644	1.315	1.096	0.939	0.822	0.731
10%	6,000		1.712	1.370	1.142	0.978	0.856	0.761
12%	6,240		1.781	1.425	1.187	1.018	0.890	0.791
	10YR							
6%	3,120		0.890	0.712	0.594	0.509	0.445	0.396
8%	3,360		0.959	0.767	0.639	0.548	0.479	0.426
10%	3,600		1.027	0.822	0.685	0.587	0.514	0.457
12%	3,840		1.096	0.877	0.731	0.626	0.548	0.487
OPERATING COSTS								
MAINTENANCE								
2% OF INV.	480		0.137	0.110	0.091	0.078	0.068	0.061
3% OF INV.	720		0.205	0.164	0.137	0.117	0.103	0.091
4% OF INV.	960		0.274	0.219	0.183	0.157	0.137	0.122
FUEL COST @ 25% TO 33% EFFIC.			0.250	0.270	0.290	0.310	0.330	0.330
47.68 Taka/MCF			0.65	0.60	0.56	0.52	0.49	0.49
TOTAL COST PER KWH - TAKA								
LOW MAINTENANCE								
5 YR @ 6% DEBT			2.363	1.972	1.703	1.503	1.349	1.254
5 YR @ 10% DEBT			2.500	2.082	1.794	1.582	1.418	1.315
10 YR @ 6% DEBT			1.678	1.424	1.246	1.112	1.007	0.950
10 YR @ 10% DEBT			1.815	1.534	1.337	1.190	1.075	1.010
10 YR @ 12% DEBT			1.884	1.589	1.383	1.229	1.109	1.041
HIGH MAINTENANCE								
5 YR @ 6% DEBT			2.500	2.082	1.794	1.582	1.418	1.315
5 YR @ 10% DEBT			2.637	2.192	1.885	1.660	1.486	1.376
10 YR @ 6% DEBT			1.815	1.534	1.337	1.190	1.075	1.010
10 YR @ 10% DEBT			1.952	1.644	1.429	1.268	1.144	1.071
10 YR @ 12% DEBT			2.021	1.698	1.474	1.308	1.178	1.102

CASE NUMBER 2: LARGER INSTALLATION, LOWER INVESTMENT

		PLANT FACTOR					
	HRS/YR	40%	50%	60%	70%	80%	90%
HOURS	8760	3504	4380	5256	6132	7008	7884
FIXED COSTS:							
DEBT SERVICE	**5YR**						
6%	4,140	1.182	0.945	0.788	0.675	0.591	0.525
8%	4,320	1.233	0.986	0.822	0.705	0.616	0.548
10%	4,500	1.284	1.027	0.856	0.734	0.642	0.571
12%	4,680	1.336	1.068	0.890	0.763	0.668	0.594
	10YR						
6%	2,340	0.668	0.534	0.445	0.382	0.334	0.297
8%	2,520	0.719	0.575	0.479	0.411	0.360	0.320
10%	2,700	0.771	0.616	0.514	0.440	0.385	0.342
12%	2,880	0.822	0.658	0.548	0.470	0.411	0.365
OPERATING COSTS							
MAINTENANCE							
2% OF INV.	480	0.137	0.110	0.091	0.078	0.068	0.061
3% OF INV.	720	0.205	0.164	0.137	0.117	0.103	0.091
4% OF INV.	960	0.274	0.219	0.183	0.157	0.137	0.122
FUEL COST @ 25% TO 33% EFFIC.		0.250	0.270	0.290	0.310	0.330	0.330
47.68 Taka/MCF		0.65	0.60	0.56	0.52	0.49	0.49
TOTAL COST PER KWH - TAKA							
LOW MAINTENANCE							
5 YR @ 6% DEBT		1.969	1.657	1.440	1.278	1.152	1.079
5 YR @ 10% DEBT		2.072	1.740	1.508	1.337	1.204	1.125
10 YR @ 6% DEBT		1.456	1.246	1.098	0.985	0.895	0.851
10 YR @ 10% DEBT		1.558	1.329	1.166	1.043	0.947	0.896
10 YR @ 12% DEBT		1.610	1.370	1.200	1.073	0.972	0.919
HIGH MAINTENANCE							
5 YR @ 6% DEBT		2.500	1.767	1.531	1.356	1.221	1.140
5 YR @ 10% DEBT		2.209	1.849	1.600	1.415	1.272	1.186
10 YR @ 6% DEBT		1.593	1.356	1.189	1.063	0.964	0.912
10 YR @ 10% DEBT		1.695	1.438	1.257	1.122	1.015	0.957
10 YR @ 12% DEBT		1.747	1.479	1.292	1.151	1.041	0.980

The above table shows that the cost of generation decreases to as low as 1.0 Taka per kWh at higher plant factors and can be produced at a cost within the range of BPDB charges of 1.41 Taka per kWh at plant factors of 50 to 60 percent. The above analysis also verifies the industrialist assertion that they can produce energy at a lower cost than they can purchase it from PBSs.

215

Based on information provided by one equipment supplier, the cost of energy from a 2,500 KW generator using HFO fuel would increase the unit cost of production by about 50 percent at the higher plant load factors and nearly equivalent at lower plant factors. The following table is a summary in Taka per kWh of a set of economic studies provided by Caterpillar for various load factors and fuels:

UNIT SIZE	FUEL	12% INTEREST LOAD FACTOR				6% INTEREST LOAD FACTOR	
		50%	60%	70%	85%	53%	85%
1685KW	GAS	2.36	1.68	1.32			1.12
1020KW	GAS	1.32					0.92
3385KW	GAS	1.76	1.36	1.20			1.04
2500KW	HFO	2.36		2.08	1.96	2.20	1.84
5400KW	DIESEL	4.32	4.08	3.76			3.60

The above costs are based on the present cost of fuels in Bangladesh and a ten-year loan term. The information provided by the vendor is within the range of costs developed in the previous table for natural gas generation.

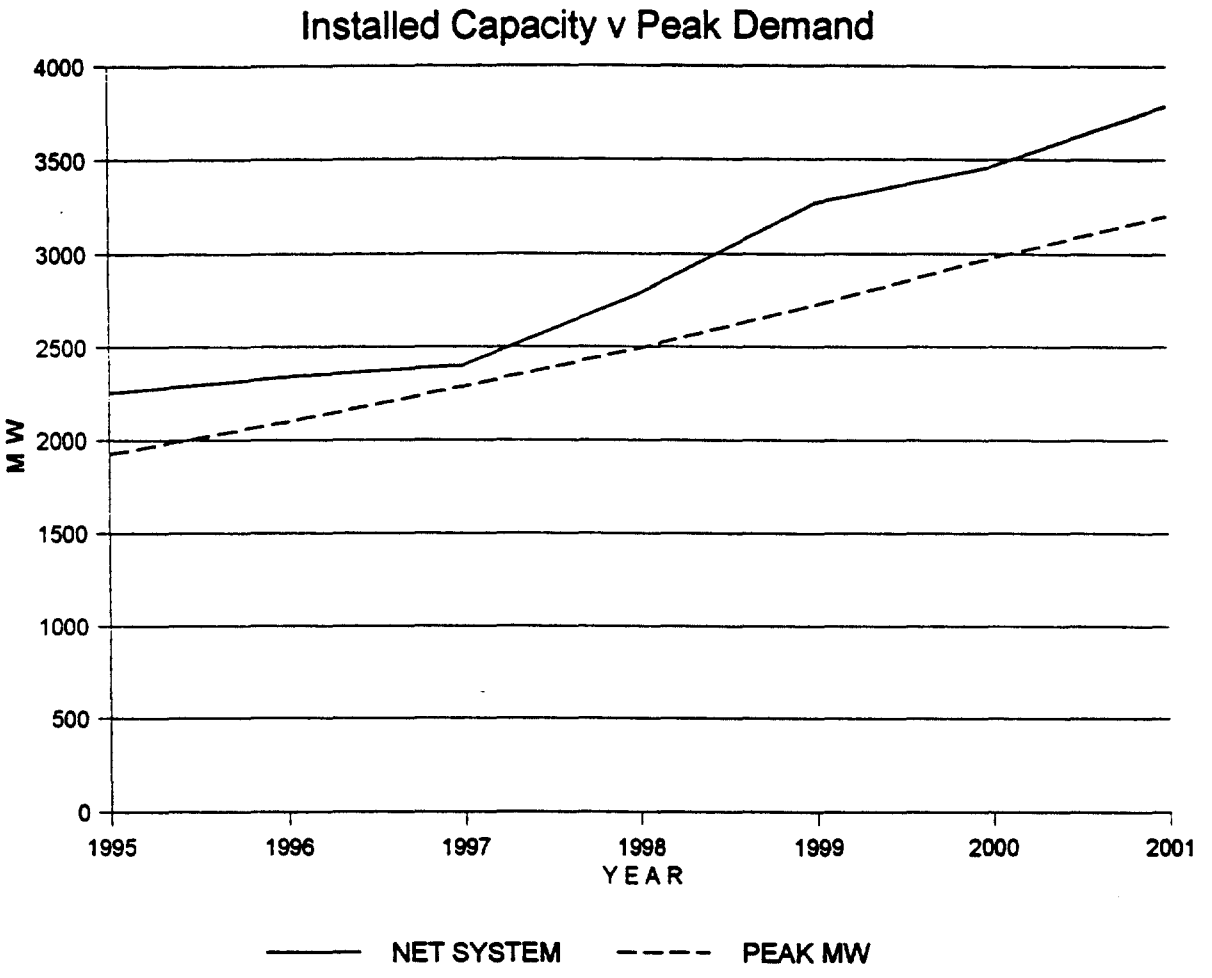
4.0 CONCLUSIONS:

Small generation fueled by natural gas is competitive with the present BPDB power rates and should be included in the generating resource portfolio of the PBSs. The units can be installed and operating within six months of ordering and can be used to improve the power supply shedding problem for some of the PBSs. The industries who have installed their own generation have gained a reliable power supply at a lower cost and therefore will not reconnect to the PBS system. The PBSs, by providing supplemental generation, may be able to keep the existing industrial consumers on their lines and maintain this important segment of revenue for the PBSs. **The small generation units are competitive with BPDB and provide an excellent short-term resource solution to those PBSs who need a reliable power supply.**

ECONOMIC EVALUATION
SMALL SCALE GENERATION PLANT
NATURAL GAS IC ENGINES

Basis of Analysis:	SMALL	LARGER
Size of generating units: (KW)	2,000	15,000
Generation efficiency in percent:	25%	33%
Installed investment Taka/KW:	24,000	18,000
Fuel cost/MCF:	47.68	47.68
Fuel cost per KWh: @47.68 Taka/MCF	0.65	0.49
Loan amortization period in years:	5	10
Loan annual interest rate:	6	10
Operation costs, % of investment:	2%	4%
Percent plant factor:	40%	80%

Note: For this analysis, efficiency increases with plant factor and unit costs decrease with unit size.



YEAR	1995	1996	1997	1998	1999	2000	2001
PLANNED INSTALLED CAPACITY	2251	2339	2402	2780	3268	3460	3788
FORECAST PEAK	1925	2097	2285	2492	2721	2974	3206

ANNEX - 3

RESUMES OF ASSESSMENT TEAM MEMBERS CONTRIBUTING TO PART TWO

1. JAMES A. MORRISS
2. MUTHURAMAN S. IYER
3. DAVID R. HITTLE
4. FREDERICK M. FREYMILLER
5. LEWIS HEALY

JAMES A. MORRISS

Energy Sector Experience

1977 - 1995	Executive Vice-President/General Manager, Texas Electric Cooperatives, Inc. Management responsibility for a trade association serving the 80 electric cooperatives in Texas including 175 employees and a $ 25 million annual budget in three divisions. Association Division: traditional trade association services including governmental representation, regulatory and compliance monitoring, employee training, consumer communications and various management services. Treating Division : acquisition, treatment and delivery of power poles; annual production 125,000 poles. Transformer Division: repair of distribution and power transformers, regulators, reclosers, etc.
1973 - 77	Manager of General Services Texas Electric Cooperatives, Inc. Management responsibility for activities in economic development, communications, publications, training and management services.
1981	Initial in-country survey for electric cooperative feasibility; community meetings; selection of two possible sites for cooperative development; under auspices of Ministry of Agriculture of Paraguay.
1985	Instructor for cooperative management course for directors and employees of electric cooperatives in Costa Rica.
1989	Organizational audit of DISCEL, national agency for distribution of electricity in El Salvador.
1989	Training needs analysis for the national power agency in Honduras.
1991 - 95	Performance capability audit for Servicio Nacional de Electricidad (utility regulatory agency) in Costa Rica; in-depth analysis of organizational structure, personnel training needs, performance capability and proposed reform legislation to update the agency's mandate. Follow-up projects over four years.

Education and Affiliations

B.A. (Business/Communications) University of Texas, Austin 1951
Director, NRECA International Foundation
Recipient, NRECA International Award 1994
Past President, Rural Electric Statewide Managers Association.

MUTHURAMAN S. IYER

Energy Sector Experience

1990 - Present	Chief Electrical Engineer, Bechtel San Francisco Regional Office. Management responsibility for the functional department of up to 400 electrical engineers and designers assigned to all business line projects including thermal, hydro and renewable energy projects. In this capacity provided functional oversight (technical, budget and staffing) for several privatized power plants e.g. Crockett, Scrubgrass, March Point. Between 1992 and 1994, managed the coordination and integration of the electrical work processes across all the Bechtel offices world-wide.
1988 -1989	Transition Engineering Manager, responsible for establishing design activities in the Pottstown office.
1984 - 1988	Senior Project Engineer, responsible for all engineering activities on a large power project. Directed a multi-discipline engineering team of up to 600 engineers and designers, with engineering budget of 3 million manhours and $ 225 million for the $ 2.8 billion facility. Managed interfaces between engineering and construction, procurement, sub-contracts and startup organizations. Interfaced with senior client and Bechtel management.
1981 - 1984	Assistant Project Engineer (Planning and Control) for a large power project.
1979 - 1981	Resident Project Engineer, directing the on-site engineering team of multi-discipline personnel and providing timely resolution to construction and startup problems, on a large power project.
1978 - 1979	Engineering Group supervisor, responsible for all the electrical engineering activities for the Waste Isolation Pilot Project (DOE).
1971 - 1978	Varying positions from Design Engineer, System Design Group Leader, Assistant Group supervisor and Engineering Group Supervisor. Supervised up to 60 electrical engineers and designers.
1962 - 1971	Worked for ASEA Electric (India) Pvt. Ltd as : Senior Engineer, responsible for bid preparation, contract finalization and design, testing and commissioning of power and distribution equipment. Trained in ASEA (Sweden) in relays and protective systems, switchgear, instrument transformers etc.
1961	Commercial Engineer, Madras State Electricity Board, India, responsible for load forecasting and substation sizing for rural electrification.

Education and Affiliations

B.S. (Electrical Engineering), University of Madras, India
M.S. (High Voltage-Power Engg.), Institute of Science, Bangalore, India
M.B.A. (Management), Golden Gate University, San Francisco, USA
Registered Professional Engineer, California, USA
Member, Diversity Advisory Council, Bechtel, San Francisco.

DAVID R. HITTLE

Energy Sector Experience

1967 - Present. **President.** D. Hittle & Associates, Engineers and Consultants, Richland, Washington (USA)

Senior Principal Electrical Engineer responsible for the entire electric utility engineering activities of a small engineering firm of 15 people. Services include system planning reports, construction work plans, load forecasts, financial forecasts, construction budgets, operating budgets and retail rate studies, including cost of service and revenue requirement analyses for electric cooperatives and public utility systems throughout the Pacific Northwest of the United States. Prepared the engineering and feasibility studies for the formation of two new electric utilities and assisted in the negotiations for power supply and financing. Designed and inspected substations and distribution and transmission lines. Represented small electric utilities in negotiations for long-term power supply and in wholesale electric rate issues. Prepared integrated resource plans, including conservation and renewable resources, for selecting future electrical energy resources.

1992 - 1995. American Samoa. Assist the American Samoa Power Authority to secure its first and subsequent private financing for expanding the generating capacity of the electric system; prepared a comprehensive electric load forecast, revenue requirements and retail rate analysis; developed a comprehensive electrical system plan and five-year construction program including system protection; assisted in negotiations with the major industries and American Samoa Government in special contracts and arrangements for electrical service.

1984. National Rural Electric Cooperative Association, International Programs, Member of the Rural Electric Seminar Team in Kumming, China. The team was sponsored by the China Institute of Science to gain knowledge of the rural electric program of the U.S.

1992-1994 NRECA USAID, Philippines. Revised engineering guidelines for the National Electrification Administration, updating existing documents and developing new guidelines for changed requirements, needs and technology. The project included three NEA counterparts and was expanded to require four in-country visits totaling more than six man-months.

Education, Registration and Affiliations

B.A. Business Administration, Accounting. University of Washington, Seattle. 1959
Electrical Engineering Courses, University of Washington, Seattle, 1960-1965
Registered Professional Engineer. Washington, 1965; Oregon, 1978; Idaho, 1990.
Member of IEEE, National Society of Professional Engineers and American Society of Consulting Engineers.

FREDERICK M. FREYMILLER

Energy Sector Experience

1988-Present	**Manager, Rates & Economics,** Chugach Electric Association, Anchorage, Alaska. Revenue requirements, allocated cost of service and rate design for wholesale and retail cooperative customers. Rate forecasting. Capital credit allocation. Financial analysis. Refinancing of REA debt. Equity management plan. Cost of capital. Strategic planning. Merger/acquisition analysis. Budget. Integrated Resource Planning. Economic analysis. Load research.
1982-1987	**Director, Allocated Cost Studies,** Montana Power Company, Butte, Montana. Marginal and accounting cost studies for electric and natural gas utilities. FERC-based revenue requirements for cooperatives. Contract rates for Yellowstone National Park. Rate forecasts. Rate impact analysis. Strategic planning. Economic analysis. Phase-in plan to smooth rate impacts of large generation plant addition.
1980-1982	**Senior Analyst, Special Studies,** Montana Power Company, Butte, Montana. Rate forecasts for electric and natural gas. Load research. Testimony on rate design issues in response to Public Utilities Regulatory Policies Act (PURPA). Economic analysis.
1978-1980	**Load Analyst,** Montana Power Company, Butte, Montana. Load research. Statistical sampling. Questionnaire design and analysis.
1976-1978	**Rate Analyst,** Madison Gas & Electric, Madison, Wisconsin. Load research. Statistical sampling. Questionnaire design and analysis. Time-of-Day rates.
1974-1976	**Graduate Research and Teaching Assistant,** Kansas State University, Manhattan, Kansas. Utilization of computerized statistical techniques to investigate relationships among types of cooperatives and financial ratio values.
1970-1973	**Peace Corps Volunteer/Volunteer Coordinator,** Paraguay, South America. Agricultural Extension.

International Power Sector Consultancy

Short-term consulting assignments for NRECA-IPD in Belize, Bolivia, Costa Rica and El Salvador. Regulation, financial analysis, cooperative financing alternatives, economics of power supply alternatives, utility sector restructuring.

Education

1976 M.S., Agricultural Economics, Kansas State University, Manhattan, Kansas.
1970 B.B.A., Accounting, University of Wisconsin, Madison, Wisconsin.

LEWIS HEALY

Energy Sector Experience

Thirty-five years experience in the power industry at senior levels;
12 years delivery of consultancy service to utilities in many countries.

1992 - 1995 Group Managing Director, Electricity Supply Board, International (ESBI), Dublin, Ireland.

Responsible for consultancy business of ESBI, 600 employees, $ 80 M. turnover p.a.

1991 - 1992 Managing Director, ESBI - UK.
Responsible for all ESBI operations in the UK, including mobilisation for operation and maintenance of Corby Power Station, in which ESB has equity. $ 25 M turnover p.a., 120 employees.

1989 - 1991 Director, Middle East for ESBI Group; management of joint venture Engineering Services Company (SCH/ESB) in Riyadh and project implementation in adjoining countries.

1987 - 1989 Self employed business consultant, specialising in market research and new product launch.

1983 - 1987 Marketing Manager ESB.
Responsible for maximising profitable sales growth, for electricity pricing, metering, demand-side management.

1978 - 1983 Resident Manager, Bahrain, for ESBI.
Providing a range of services to the Ministry of Works Power and Water in generation, transmission, distribution, and associated business functions.

1972 - 1878 Supplies Engineer, ESB. Responsible for procurement and physical distribution of all materials used in ESB.

1966 - 1969 Engineer, Dublin District. Responsible for construction of new electricity substations in the Dublin region; provision of an advisory service to industry and the commercial sector on the cost-effective use of electricity.

1965 - 1966 Engineer, Distribution Department, ESB. Design of urban and rural networks; least-cost studies on provision of power to isolated rural areas.

1970 - 1972 Industrial Relations Officer, ESB
Negotiation of wage agreements with employee categories.

1960 - 1965 Engineer, System Operation Department, ESB,
Analytical Studies; System Control; Load Dispatch.

Education, Registration and Affiliations

Bachelor of Engineering (Electrical) University College, Dublin
Chartered Engineer, Fellow of Institute of Engineers
Member of Institute of Management Consultants
Member of Institute of Directors

ANNEX - 4

REVIEW METHODOLOGY

The assessment for Part Two of the task was carried out as follows:

- Review of documents listed in Annex 5 by the team members.
- Preparation of detailed interview questionnaire, copy attached.
- Additional data collection as needed from various organizations. Attached "Information Request Form" was used for many such requests.
- Interviews with USAID and NRECA staff.
- Interviews with GOB/REB/BPDB/DESA staff.
- Interviews with ADB, Petrobangla, industrialists, equipment manufacturers and commercial banks.
- Visits to PBS offices; meeting with PBS Board of Directors.
- Meeting of several PBS General Mangers and the assessment team.
- Preparation of background papers on selected topics, (see Annex-2).
- Research and calculations on various facets of generation costs.
- On-going brainstorming sessions among the team members.

INFORMATION REQUEST FORM

IRF NO: _____

NAME OF REQUESTER : _____ **DATE :** _____

Information Needed :

Name of Individual to provide the response :

Telephone No :

Response :

Responder :

PART 2 : ASSESSMENT OF POWER GENERATION BY PBSs

QUESTIONNAIRE

DATE:_____

INTERVIEWER:_____ INTERVIEWEE:

No.	Item	REB	PDB	GOB	PBS	NRECA	USAID	OTHER
1.0	***POWER SUPPLY AND DEMAND***							
1.1	How acute is the shortage of power supply to the PBSs ?	√	√	√	√	√	√	
1.2	How much in the next 5 years ?	√	√	√	√	√		
1.3	What is the basis of your estimate of MW shortage ? Any reports available ?	√	√		√	√		
1.4	Are PDB's plans for new generation (MW and time frame) shown in Power System Master Plan, realistic ?	√	√	√		√	√	
1.5	What are the major road blocks that will defeat the plans ?	√	√	√		√	√	
1.6	What regions/PBSs are short of power ?	√	√		√			
1.7	What limitations or difficulties do you anticipate in supplying emergency power at the select PBS's where there is shortage of power & who may build privatized plants ?	√	√	√				
1.8	Do you have statistics of power supply reliability (failures, interruptions, brown-outs, etc) in the PBS's with economic consequences ?	√						
1.9	Do you have any criteria for load shedding.	√	√					
1.10	Power supply questions 1.10.1 How much of the load shedding is • due to generators constraint ? • due to transformation constraint ? • due to transmission line capacity constraint ?	√	√		√			
1.11	What geographical areas are more capacity constrained than others and reasons.			√				
2.0	***ECONOMICS***							
2.1	What are the economic consequences of power interrup-tions ? (in the PBSs short of power - See 1.6 above).	√		√	√			
2.2	Is the loss/impact at the local level or the national level ?	√		√	√			
2.3	Do the consequences impact exports ?	√		√	√			
2.4	If so, what is the order of magnitude in MM Taka or $? How was it arrived at ?	√		√	√			
2.5	Are any major industrial development opportunities in your PBS's likely to drop off because of power shortage in the next 2-5 years ?	√		√	√			

QUESTIONNAIRE (continued)

No.	Item	REB	PDB	GOB	PBS	NRECA	USAID	OTHER
2.6	What premium are you or the sensitive industries in your PBS willing to pay for high quality power ?			√	√			
2.7	What is the definition of high quality power ?				√			
2.8	How can private power compete with subsidized public tariffs ? What are your suggestions ?	√		√	√			
2.9	Do you have any plan for phasing out subsidies reflected in tariffs ?	√	√	√				
2.10	Have any economic studies been performed on small power generation (diesel generator, gas turbine generator, combined cycle, cogeneration, etc) ?	√			√			
3.0	*SOLUTIONS/STRATEGY*							
3.1	Do you have any solutions to the shortage problem ?	√	√	√	√	√	√	
3.2	Can the solutions be implemented without REB/PDB/GOB efforts/initiatives ?			√	√	√	√	
3.3	If not, what kinds of initiatives are needed ?				√	√	√	
3.4	Do you consider small power generation as an answer in the near term ?	√	√	√		√	√	
3.5	Who should generate this power ? PDB or private ?	√	√	√		√	√	
3.6	If private, Who ? PBS's ? Why ?	√	√	√		√	√	
3.7	Which PBSs you consider to be viable for small power generation ?	√	√			√	√	
3.8	What criteria did you use in selecting such PBSs ?	√	√			√	√	
3.9	What sizes of generating units you envision to be built by these PBS's ?	√	√			√	√	
3.10	What fuel source do you consider feasible ?	√	√	√				
3.11	Where are the fuel sources ?	√	√			√	√	
3.12	Are there PBSs that are viable for local generation and are close to fuel centers ?	√				√	√	
3.13	How can you supply fuel to the PBS's that are remote ?	√		√				
3.14	What are the fuel industry (natural gas) plans to distribute gas, esp. to regions short of power ? Who are the fuel suppliers ?	√	√	√				
3.15	How often is electric power interrupted in your PBS ?				√			
3.16	What industries are sensitive to power failures in your PBS now or in the next 2-5 years ?				√			
3.17	Do any of the major industries in your PBS use steam or heat in sizable quantities in their product process ?				√			
3.18	Can cogeneration be an option ?				√			
3.19	Do you have environmental or other regulations that will not allow small power generation in your PBS's ?	√			√			

QUESTIONNAIRE (continued)

No.	Item	REB	PDB	GOB	PBS	NRECA	USAID	OTHER
4.0	***PRIVATE INVESTMENT***							
4.1	How do you expect that small power construction would be financed ?	√			√	√	√	
4.2	If private investors are feasible, do you know of any specific people ? and their names.	√			√			
4.3	How do you expect to meet the foreign exchange component of the project ?	√			√	√	√	
4.4	Do you know of any business schemes that can use foreign and local investors ? (BOT, BOO, etc)	√				√	√	
4.5	What are the major barriers to such plan ? Legislative, regulatory, etc.			√		√	√	
4.6	What would be the process for developing private projects (approval process) ?	√		√			√	
4.7	What are the "pros" for private (PBS) generation ?	√	√		√	√	√	
4.8	What are the "Cons" for private generation ?	√	√		√	√	√	
4.9	Do you see any conflict among PDB, REB, PBS's, and RPC ?	√	√		√	√	√	
5.0	***GOVERNMENT SUPPORT***							
5.1	What incentives have been laid down or are being proposed to encourage private power ?	√		√		√	√	
5.2	What is the schedule for the Government to enact legislation to encourage private power, in the following areas : • Taxation • Customs (tariffs) • Currency convertibility • Profit/capital repatriation • Foreign investment protection • Financing of projects • Dispute resolution • Business structure	√		√			√	
5.3	Are there any regulatory rules or measures being pursued to support private power; in • Power purchase (agreements or revenue guarantees) • Infrastructure (Utilities, roads, waste disposal etc). • Fuel Purchase/prices • Depreciation. • Tax moratorium periods. • Permitting/Licensing (process & requirements).	√		√			√	
5.4	Is the Government engaging outside advisors to help with privatization process implementation ?(legislative, regulatory, legal, insurance, contracts, etc).			√			√	
6.0	***TECHNICAL ASSISTANCE***							
6.1	Is there a pool of trained personnel for operating and maintaining gas turbine generators ? Also engineering of small generating plants ?	√			√	√		
6.2	What kinds of technical assistance will be needed if PBSs become generators ?	√	√		√	√	√	

ANNEX - 5

BIBLIOGRAPHY OF DOCUMENTS REVIEWED

The Rural Electrification Board Ordinance (1977)

National Energy Policy (DRAFT - Aug. 1995)
Ministry of Energy and Mineral Resources

Mid-term Evaluation of the Rural Electrification III Project in Bangladesh
by Associates in Rural Development, Inc. for USAID (December, 1993)

Annual Report 1992-93 Rural Electrification Board (June, 1993)

Annual Report 1993-94 Rural Electrification Board (June, 1994)

REB/NRECA Strategic Plan
by NRECA International Ltd., Dhaka (1993)

Bangladesh Power Sector Reform
(terms of reference for consultancy services) (August, 1995)

Power System Master Plan for Bangladesh : Final Report (August, 1995)
Directorate of System Planning, Bangladesh Power Development Board Asian Development Board

Power Sales, Interconnection and Operating Contract Between Rural Power Company and Bangladesh Power Development Board
(third discussion draft; March 21, 1994)

Bangladesh Power Sector Donor Coordination Meeting
(Aide Memoire, Sept. 10-13, 1995)

Power Sector Reform and Rehabilitation Project
(Technical assistance funding proposal for Policy and Human Resources Development Fund)

Consultant Quarterly Progress Report : April - June 30, 1995
Robert E. Schiller, Chief of Party, NRECA - Bangladesh

Consultant Quarterly Progress Report: July - September, 1995
Robert E. Schiller, Chief of Party, NRECA - Bangladesh

Memorandum and report on "role of small gas generation plant in PBS power distribution" by Md. Bazlur Rashid, General Manager, Narsingdi PBS-1 (April 13, 1995)

Organisational Review (Oct. 1993): Tangail PBS-1

Dhaka PBS-1 At a Glance (June, 1995)
Review of operating statistics

PBS Accounting Procedure Manual (1987) Vols. I and II

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Curriculum Plan for REB, PBS and Associated Personnel
REB Training Directorate (revised June, 1995)

Course Outlines for Management and Institutional Section
REB Training Directorate (Oct. 10, 1993)

Training Report for September, 1995

Quarterly Training Report July-Sept. 1995

Summary of Discussion and Plans for Implementing Additional Autonomy at Local PBSs Robert Schiller, NRECA (Dec. 9, 1993)

Pre-Feasibility Study of Proposed Project for Intensification and Expansion of REB Programme in Feni, Noakhali, Laxmipur and Patuakhali PBSs
(Vol. 1,2,3,4,5 Sept. 1993).
Royal Danish Embassy - Dhaka, Bangladesh

Report of the Pre-Identification Study on the Project Proposal Submitted by REB for the Expansion and Intensification of 15 PBSs (With Special Focus on the Programme's Impact on Poverty Alleviation)
by Dr. Mustafizur Rahman for Royal Netherlands Embassy (March, 1994)

The Bangladesh Rural Electrification Project (End-of-Project Evaluation)
Canadian International Development Agency (commodity procurement for eight PBSs)

Statement of DSL of PBS (Schedule of Amortization Due & Payment)
PBS Loans & Audit, REB

Comparative schedule of amount due & payments made (1992-95)
PBS Loans & Audit, REB

Audit Reports as of June 30, 1994 (6 PBSs)
PBS Loans & Audit, REB

Operational Plan of PTAs between REB & PBS
Robert E. Schiller, NRECA

Actual & Forecasted Revenue Accounts of REB
Robert E. Schiller, NRECA

Instructions - Series 100
Ed Wheeler, NRECA

Accounting Standards & Auditing Guidelines
Willard Garrett, NRECA

Routine Review of Financial Activities for Moulvibazar, Jessore 1, Cox's Bazar & Narsingdi 1) - Office Systems, REB

REB Form 550 (PBS Financial & Statistical Report) for 45 PBSs
Robert E. Schiller, NRECA

NRECA Report to REB & Donors (Bangladesh RE for FY 1995 & Activities for Today & the Future) - Robert E. Schiller, NRECA

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Diskette containing F/S for PBS (June 1992 - 95)
Robert E. Schiller, NRECA

Routine Review of Financial Activities for (Dhaka 1 & Natore 2)
Office Systems, REB

Evaluation Manual, Office System Branch
Ben Schafer, NRECA

Management Audit Report, Meherpur PBS
Ben Schafer, NRECA

Diskette containing REB Form 550 for all PBSs (for FY 1994 & 1995)
Rates & Contract Cell, REB

Audit Report for June 30, 1993 for REB

Audit Report for June, 30, 1994 for REB

Unaudited F/S (June 1995) for REB

Contract of Loan (sample format)

Diskette containing : Willard Garrett, NRECA
(1) Draft of Policy for Establishing a Revolving Fund
(2) Instruction Series 200
(3) REB unaudited F/S for 1992 - 94
(4) Format of REB Form 550

REB Instruction 600 - 16 (REB General Accounts Manual)

PBS Instruction 200 - 23 (PBS General Accounts Manual)

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REB Management Information System, for the Month of July, 1995

PBS Retail Rate Schedule & Rate Summary, FY 1994-95

PBS Budgets 1994-95 and 1995-96, Compiled by REB Finance Directorate, Loans and Audits.
(Selected portions translated to English)

Project Status Report: October 1, 1994 - March 31, 1995,
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REB Assumptions for PBS Financial Forecasts Requested by World Bank, 1995

REB Summary of Retail Rates Charged by PBS by Rate Class by Tariff Category,
Rate Cell, FInance Directorate, September 20, 1995

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Rural Electrification Project Bangladesh, 1995

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The Subsidy Issue in REB: Case study of Nilphamari PBS - Preconstruction Viability Projections,
NRECA International Ltd., with assistance of REB Officers, July 1993

The Rural Homeless in Bangladesh
Tahmeena Rahman (UNICEF) Nov. 1991)

Department of Environment - A Brief
Government of Bangladesh (August, 1991)

Enforcement Measures of Bangladesh Environment Protection Act
Md. Abdul Malek, Dept. of Environment

Training Manual on Environmental Management in Bangladesh
Department of Environment

ANNEX - 6

LIST OF AGENCY REPRESENTATIVES CONTACTED

USAID

Dick Brown, Mission Director
Lisa Chiles, Deputy Mission Director
Rosalie Fanale, Director, Project Development & Engineering (PDE)
Michael Foster, Project Development & Engineering (PDE)
Gilbert Haycock, Chief Engineer, PDE
Md. Kamaruzzaman, General Engineer, PDE
Emilie McPhie, Program Officer
Frank Caropreso, Deputy Controller
Craig Anderson, Environment/agriculture officer
Farouk Choudhury, Economist

Rural Electrification Board (REB)

Brigadier Muhammad Enamul Huq, Chairman
Mahmud Hassan Mansur, Member (Finance)
M.A. Wadud, Member (PBS & Training)
Md. Abdus Samad, Member (Engineering)
Md. Kamruzzaman Khan, Executive Director, PBS
A.K. M. Mofizul Islam, Secretary (Chairman's Office)
Lutful Kabir, Director, Personnel Administration
Shahid Uddin Ahmed, Director, Program Planning
Md Tauhidul Islam, Chief Engineer, Projects
Abdul Halim Mollah, Chief Engineer, Planning/Operations
Md. Khalilur Rahman, Controller, Accounts & Finance
B.D. Rahmatullah, Director, (SE & D)
G.A. Mohiuddin Quadry, Director, PBS Loans & Audit
D.J. Chowdhury, Director, System Operations, (south)
M. Sajedul Karim, Director PBS (south)
Md. Afzal Hossain, Director PBS (central)
Latifur Rahman, Director, Finance
Sk. Ahmed Ali, Director, Accounts
Belayet Hossain Chowdhury, Deputy Director, Program Planning
Kaisar Ahmed, Deputy Director, Planning
Md. Shahidul Alam, Deputy Director, Khulna Central Warehouse
Md. Tariq Haider, Deputy Director, Accounts
Anwar Hossain, Assistant Director, Khulna Central Warehouse
Mohammad Shahjahan, Assistant Director, Finance
Mohammad Morshed, Assistant Director, Finance
Shah Newaz Khan, Assistant Director (Evaluation) Program Planning
Abu Naim Mohammad, Director of Training
Mahbub Alam, Deputy Director, Engineering/design
Shawkat Ali Khan, Deputy Director, Engineering/design
Md. Bajlur Rahman, Deputy Director, PBS Loans & Audit
Akul Chandra Paul, Assistant Director, PBS Loans & Audit
Swapan Kumar Das Gupta, Assistant Director, PBS Loans & Audit
Engr. Sheikh Al-Harun Islam, Assistant Engineer, Renewable Energy Cell
Shahriar Ahmed, Assistant Director, Program Planning

National Rural Electric Cooperative Association (NRECA)

Robert Schiller, Chief of Party
Dr. John E. Andrews, Institutional Training Advisor
Willard E. Garrett, REB Finance Advisor
Ben M. Schafer, PBS Finance Advisor
Virgil L. Schafer, Engineering Advisor
Jack French, Engineering Advisor
Ken Breunig, Construction Advisor
Ed Wheeler, Technical Training Advisor
Vern Rauscher, Systems Operations Advisor

PBSs

Saleh Ahmed, General Manager, Dhaka PBS-1
Syed Nurul Islam, General Manager, Tangail PBS-1
Md. Bazlur Rashid, General Manager, Narsingdi PBS-1
Md. Serajul Haque, General Manager, Narsingdi PBS-2
Fazlul Halim, General Manager, Moulvibazar PBS
Board of Directors, Moulvibazar PBS
Abdur Rab Miah, General Manager, Habiganj PBS
Md. Abdur Rashid, General Manager, Cox's Bazar PBS
F.M. Faridul Hoque, General Manager, Jessore PBS-2
Md. Abul Kalam, Asst. General Manager-Finance, Jessore PBS-2
Md. Nizamuddin Sarkar, General Manager, Jessore PBS-1
Board of Directors, Jessore PBS-2
Abdul Samad, Asst. General Manager-Finance, Jessore PBS-1
Maya Ranin, Cashier, Jessore PBS-1

Others

Dr. Atiur Rahman, Team Leader, Unnayan Shamannay
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Shilu Abed, Advisor Aarong
Afroz Rahim, Rahimafroz Bangladesh Limited
Dr. Akhtaruz Zaman (Surgeon),(Rotary Village Project)
Dr. Md. M.Manzurul Haque, Industrial Engineering Services Limited
Hafiz G.A. Siddiqui, Professor/Academic Dean, North South University
A.M. Shaukat Ali, Chairman, Project Builders Ltd.
Kutubuddin Ahmed, Managing Director, Envoy Group (garment manufacturing)
M. A. Haque, Managing Director, Greenland Engineers & Tractors Co. Ltd.(GETCO) (Caterpillar agent)
Nazmul Haque, General Manager, Greenland Engineers & Tractors Co. Ltd.(GETCO) (Caterpillar agent)
Syed Naved Husain, Executive Director, Beximco Investment Co. Ltd.
Sahabuddin Ahmed, Managing Director, Kader Synthetic Fibres Ltd.
Kazi Kamal Uddin Emran, Director, Engineers & Consultants Bangladesh Ltd, Dhaka
Golam Mustafa, Managing Director, Janata Bank
A.H. Ekbal Hossain, Deputy General Manager, Janata Bank
M.A. Quasem, General Manager (Estates), James Finlay PLC, Srimangal
R.L. Stone-Wigg, Director, James Finlay PLC, Glasgow
Wahidul Haq, General Manager, Deunde Tea Company, Habiganj
Yacoub, General Manager, Satgao Tea Estate
S.Alamgir, Director, Jamuna Group of Companies
M.A. Baset, General Manager, Jamuna Group of Companies
Mahmuduzzaman Khan, Managing Director, Prakaushal Upadeshta Ltd.
Syed Md. Iqbal Ali, senior Fellow, Bangladesh Centre for Advanced Studies
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Dr. Anwar Hossain, Advisor, Bangladesh Centre for Advanced Studies

Donor Agencies

Arun Banerjee, Chief, Energy and Infrastructure Unit, World Bank
Shamsuddin Ahmed, Senior Project Officer, Asian Development Bank, Dhaka

Government Agencies

S.K.M. Abdullah, Chairman, Petrobangla
Mosharraf Hossain, Director of Planning, Petrobangla
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Md. Shajahan, Deputy Secretary, Ministry of Energy and Mineral Resources
Rafiqul Hossain, Deputy Chief, Ministry of Energy and Mineral Resources

Bangladesh Power Development Board

Manzur Murshed, Member, Planning & Development
Md. Abdul Jalil, Director, System Planning
Delwar Hossain, Deputy Director, System Planning

DESA

Giasuddin Mollah, General Manager, DESA, Dhaka