



Joint UNDP/World Bank Energy Sector Management Assistance Program

Activity Completion Report

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APRIL 1984

Energy Sector Management Assistance Program

The Joint UNDP/World Bank Energy Sector Management Assistance Program (ESMAP), started in April 1983, assists countries in implementing the main investment and policy recommendations of the Energy Sector Assessment Reports produced under another Joint UNDP/World Bank program. ESMAP provides staff and consultant assistance in formulating and justifying priority pre-investment and investment projects and in providing management, institutional and policy support. The reports produced under this Program provide governments, donors and potential investors with the information needed to speed up project preparation and implementation. ESMAP activities can be classified broadly into three groups:

- Energy Assessment Status Reports: these evaluate achievements in the year following issuance of the original assessment report and point out where urgent action is still needed;
- Project Formulation and Justification: work designed to accelerate the preparation and implementation of investment projects; and
- Institutional and Policy Support: this work also frequently leads to the identification of technical assistance packages.

The Program aims to supplement, advance and strengthen the impact of bilateral and multilateral resources already available for technical assistance in the energy sector.

Funding of the Program

The Program is a major international effort and, while the core finance has been provided by the UNDP and the World Bank, important financial contributions to the Program have also been made by a number of bilateral agencies. Countries which have now made or pledged initial contributions to the programs through the UNDP Energy Account, or through other cost-sharing arrangements with UNDP, are the Netherlands, Sweden, Australia, Switzerland, Finland, United Kingdom, Denmark, Norway, and New Zealand.

Further Information

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BANGLADESH

ENERGY ASSESSMENT STATUS REPORT

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I. INTRODUCTION

1.1 The major energy problems in Bangladesh are the high cost of oil imports to meet the country's energy needs, about 60% of export earnings in recent years, and declining resources of wood and other traditional fuels estimated to supply roughly two-thirds of total energy consumption.

1.2 In October 1981, a UNDP/World Bank Energy Assessment Mission visited Bangladesh to analyze the major issues and options and to prepare an action program for the energy sector in the medium term. The mission found that part of the high cost of meeting the country's energy requirements was a reflection of the inefficiency of energy use. There were substantial losses in the conversion, transmission and distribution of electric power, frequent and costly power outages, losses and inadequate security of supply in the gas sector, an imbalance between oil refinery production and the country's petroleum product demand pattern and considerable scope for improving the efficiency of energy use in industry.

1.3 The mission's review of the indigenous commercial energy resource base noted the absence of petroleum reserves and fairly limited economically exploitable coal, peat and hydropower potential, but stressed the importance of developing Bangladesh's substantial recoverable gas reserves (about 10 trillion cubic feet). It pointed out that these reserves, if managed effectively, could contribute greatly to improving the country's severe commercial energy deficit and balance of payments problems. As for traditional energy resources, the mission called attention to the poor forest endowment, stagnating or declining availability of crop and animal wastes and the need to begin a massive tree planting program for rural areas combined with programs to improve the efficiency of traditional energy use.

1.4 The major findings of the assessment mission were presented in its final report Bangladesh: Issues and Options in the Energy Sector, published in October 1982. These findings related to: (a) the development and use of natural gas; (b) improvements to refinery configuration; (c) improvements in efficiency of energy use by the two major commercial energy consumers (industry and power); (d) the appropriate level and structure of commercial energy prices; (e) prospects for the development of rural and renewable energy resources; and (f) training and manpower development for better management of public sector energy agencies. The report also noted that Bangladesh had been successful in securing large amounts of bilateral and multilateral assistance for energy development but that greater aid coordination was needed to avoid duplication and improve project management.

1.5 This status report briefly outlines significant developments in the energy sector that have occurred since 1981, and in particular the actions taken by the Government of Bangladesh (GOB) to implement the

major recommendations made by the Energy Assessment. The report also reviews ongoing technical assistance to the energy sector by the international donor community and identifies some of the priorities for further technical assistance to the energy sector.

II. MAIN DEVELOPMENTS IN THE ENERGY SECTOR: OCTOBER 1981 - NOVEMBER 1983

Energy Demand and Supply Trends

2.1 The growth of commercial primary energy demand averaged 7.3% per year between FY78 and FY82 with large yearly fluctuations. In FY83, however, overall energy demand actually declined by 4%, due mainly to depressed economic conditions; GDP grew by only 2.5% in FY83 compared to 5.9% in FY81. The major recent change in the composition of energy supply has been the replacement of imported petroleum by domestic natural gas. Between FY81 and 83, petroleum demand declined by 14%, while natural gas demand grew by 36%. However, petroleum imports are still very costly to the economy, accounting for about 60% of export earnings mainly due to poor export performance. Currently, total commercial primary energy demand is on the order of 3 million toe with the following shares by fuel: natural gas, 51%; petroleum, 42%; and the remainder (coal and hydro) 7%. Trends in energy demand by product are presented in Table 1 of the Statistical Annex (SA).

Energy Pricing

2.2 Petroleum Products. The prices of all major petroleum products have been raised at or above their economic cost (see SA Tables 2 and 3). Furthermore, the Ministry of Energy and Mineral Resources is now authorized to increase petroleum prices by up to 10% automatically, in response to increasing costs.

2.3 Natural Gas. The Energy Assessment made preliminary estimates that the levelized cost of gas to bulk consumers in the Eastern Zone of Bangladesh ranged from TK 17.05/MCF (US\$.90/MCF) to TK 12.4/MCF (US\$.66/MCF). The July 1982, tariffs for bulk consumers were raised to about 80% of the lower level of this range. Recently, the long run marginal supply cost of gas was recalculated by IDA staff to take account of depreciation of the Taka between 1981 and 1983 and capital goods import inflation. The estimate now ranges from TK 16.3/MCF to TK 27.0/MCF. Based on these costs, bulk tariffs after the July 1983 increases amount to 70% of the lower end of this range. (See SA Table 4). The Energy Assessment also pointed out that tariffs for residential consumers were about one-third the cost of servicing them. In June 1983, monthly charges for unmetered consumers were increased from TK 35 to TK 45 for one burner households (28%) and from TK 65 to TK 80 for two burner households (23%). The extent to which natural gas prices should be raised will depend on various factors including the cost of supply, the amount of domestic financial resource mobilization required and the potential impacts on consumer. A gas tariff study will soon address this issue.

2.4 Electricity. Although progress has been made in raising tariffs, the average BPDB tariff increase from TK 0.99/kWh in FY82 to TK 1.30 in FY83 still brings electricity tariff levels to about 75% of

the present LRMC estimate (TK 1.75/kWh). The most recent tariff structure is given in SA Table 5 which reflects an average tariff increase from TK 1.33 in FY83 to TK 1.48/kWh in March 1984. At the same time an automatic fuel price adjustment clause of up to 10% was added to the tariff-structure. Also, there are plans for restructuring tariffs to reflect costs associated with peak and off-peak loads and a changeover to time of day metering is under implementation. A new tariff proposal is now under study by the Bank.

Energy Sector Organization

2.5 Recent developments include the start, in August 1983, of a ADB/UNDP financed Energy Planning Project to assist the Planning Commission formulate a long-term energy plan covering the next 20 years. The Bangladesh Petroleum Institute (BPI) has been created to centralize training, geological data analysis and advisory services for hydrocarbon exploration and development. A director has been appointed but BPI is not yet fully staffed and GOB needs to determine the extent to which similar functions currently performed by Petrobangla and the Geological Survey should be transferred to BPI. There have been two developments in the organization of renewable energy work: renewable energy planning is now the responsibility of the recently established Renewable Energy and Energy Economics section of the Planning Commission and project implementation in this sector is now carried out by the Energy Division of the Ministry of Energy and Mineral Resources. Also within the Ministry, an Energy Monitoring Unit (EMU) has been established to oversee energy conservation activities.

Energy Investment in the SFYP

2.6 During the April 1982 Aid Group Special Session on Energy, IDA offered assistance to the Government of Bangladesh (GOB) in preparing a detailed Priority Investment Program for Energy (PIPE) for the near term FY83-85. This project subsequently was carried out under the UNDP/World Bank Energy Sector Management Program (ESMP). PIPE resulted in an energy investment project portfolio put together by GOB, IDA and other aid agencies. Most of the PIPE projects have been included in the latest version of the Second Five Year Plan (SFYP) which indicates total energy investment in 1979/80 prices of TK 20.52 billion (US\$1.3 billion) or 18.5% of all public sector investment for the period from FY81 to FY85. This allocation is about 30% lower than that indicated in the original SFYP, reflecting GOB's tight budget, but it still accounts for about a fifth of all public sector investment over the plan period.

2.7 The electric power sector accounts for about 70% of total energy sector investment. Of the total TK 14.36 billion (US\$0.92 billion) allocated to this sector, 86% is for BPDB's generation, transmission and distribution program. The rest is for Rural Electrification Board (REB) programs of electricity distribution through consumer cooperatives (Pally Bidyut Samity or PBS). Most of the TK 6.14 billion (US\$0.39 billion) allocated to the hydrocarbon sector (95%) is for Petrobangla's exploration and development programs with the remaining

5% divided among the Bangladesh Petroleum Corporation (for extending LPG recovery, a lubricating oil plant and new tankers), the Geological Survey of Bangladesh and the Ministry of Energy. The rest of the energy allocation, TK 1.49 billion is for renewable energy development.

III. STATUS OF ENERGY ASSESSMENT RECOMMENDATIONS

Management Capability of Public Sector Energy Companies

Recommendations

Status

Update the technical and managerial skills of the senior refinery staff.

GOB has begun a training program with assistance from IDA as part of the Energy Efficiency and Refinery Rehabilitation Project to upgrade the skills of existing and new refinery staff. Some senior refinery staff will be sent abroad to attend seminars and to foreign refineries for exposure to modern refinery management over a three-year period. Junior engineers, draftsmen and operators will receive both classroom and on the job training. The detailed design of the program is expected to be completed shortly. The ADB/UNDP Energy Planning Project will help in the ongoing assessment of long-term training needs.

(a) Natural Gas Subsector

Institute a power development program for the electric power and natural gas sectors, including training, better remuneration, and additional qualified staff.

The Government has initiated a training program with assistance from IDA in a Petroleum Exploration and Promotion Project which includes a component for seismic data acquisition and training in its processing and interpretation, as well as other areas of petroleum geology. It also provides technical assistance to upgrade Petrobangla's financial system and review the company's legal framework for oil exploration, focusing on ways to strengthen the company's capability to negotiate production sharing contracts with foreign oil companies. In addition, a hydrocarbon data bank is being developed and staff trained to operate it with assistance from USAID. The Bangladesh Petroleum Institute (BPI), recently established with a grant from UNDP, is expected to function as a center for data gathering and analysis, and for training.

(b) Electric Power Subsector

In the electric power sector, GOB has embarked on a Power System Master Plan Project, with assistance from the ADB, which will provide resident experts in load forecasting, thermal generation, hydropower generation, transmission network planning and power system economics to assist a special planning cell of BPDB prepare a least cost system expansion plan. The study will be conducted in Dhaka using available computer facilities and additional facilities provided for under the Project. Training in system studies is also being provided under a cooperative program with the Electricity Generating Authority of Thailand.

(c) Civil Service Remuneration

The problem of low remuneration in the public sector energy agencies, as in most government agencies in Bangladesh, has not been addressed.

Hydrocarbon Development and Utilization

Take measures to attract foreign oil companies back to oil exploration.

GOB has begun a program of exploration promotion which includes seismic surveys, a data processing center, and a hydrocarbon habitat study. This program is assisted by IDA and the resulting analyses will be used by GOB in a promotional package for interested international oil companies.

Initiate a program of extensive seismic work in the Western Zone where a fairly dense regional grid is required to identify promising structures.

The Government is conducting seismic work in the Western Zone with assistance from IDA, the Federal Republic of Germany and United Kingdom.

Undertake production seismic work, using modern technologies and equipment, in the producing gas fields and the peripheral

GOB is carrying out seismic surveys for seven producing gas fields in the East covering 900 line km. These surveys are receiving assistance under IDA Petroleum

areas in the Eastern Zone to define more accurately the size of recoverable gas reserves.

Exploration Promotion Project. Seismic and exploration drilling are also being undertaken in Fenchuganj with French assistance. With Saudi assistance two exploratory wells are being planned in Patharia area.

Maximize utilization of gas in power generation, industry and commerce.

A number of projects and studies have been completed or are in progress to promote gas utilization to the maximum extent possible. The East-West electricity Interconnector, completed in 1982, is now bringing gas based electricity to the West. The Bakhrabad-Chittagong pipeline, completed in 1983, will supply natural gas to the steel mill, power station, paper mill and other industries located in and around Chittagong. There are also a number of projects to increase gas utilization through exploitation of existing fields. These include the Sylhet Tea Estate Gas Supply Project, and the Southwest Bangladesh Gas Transmission and Distribution Project (in Comilla, Feni, Laksham, Chandpur and Chittagong District). Furthermore, several feasibility studies have been completed or are underway in the following areas: use of compressed natural gas in road transport, LPG recovery from natural gas and a gas pipeline to the Western Zone.

Pursue further study of gas export alternatives.

The Government has a project to identify the prospects for direct export of gas and/or its use as petrochemical feedstock for potential export projects. It will also assess the investment requirements, evaluate their economic benefits, rank them according to priority and recommend an incentive structure for attracting foreign private capital. This project is a component of the IDA assisted Energy Efficiency and Refinery Rehabilitation Project. A consulting firm has been selected to carry out the study and work is expected to begin in the second quarter of 1984.

Consider an East-West gas pipeline.

Petrobangla is giving the East-West Gas Pipeline Project top priority in terms of seeking funds for future investment. The total cost of the project is estimated on the order of US\$500-700 million. The consultancy firm of Rendell, Palmer and Tritton has prepared a study which finds the gas pipeline to the West economically viable (independent of gas exports to India), based on GOB gas demand projections for the Western Zone which result from planned investment projects in electric power and fertilizer production. However, the report does not address the economic viability of setting up these projects in the Western Zone. An in-depth view of the issues unanswered by the previous study will be undertaken with assistance provided under IDA's Technical Assistance Credit.

Refinery Operations

Consider short term options to increase middle distillate output and reduce fuel oil and naphtha surpluses. These include the spiking of crude oil with diesel oil and detailed cost and engineering studies for a construction of a naphtha splitter for blending the heavy naphtha component with middle distillates.

The current SFYP includes studies to examine alternative uses of surplus products, including vis-breaking. GOB is receiving IDA assistance for construction of further LPG production facilities and a naphtha splitter as well as for conversion of the refinery for natural gas use.

Carry out detailed cost and engineering studies for debottlenecking the refinery and long-term options to meet the country's petroleum demand profile.

GOB is implementing this recommendation through a component of the IDA assisted Energy Efficiency and Refinery Rehabilitation Project which includes 320 man-months of consultant services to carry out a study to debottleneck the refinery and determine appropriate modifications over the long run to remove the imbalance between the petroleum product demand profile and refinery yield. The project includes detailed preparation of the refinery engineering package. A consulting firm has been selected to carry out the study which should be completed by

Planning Project will also look at long-term refinery needs and it is important that the efforts under these two projects be fully coordinated.

Consider further recovery of LPG from crude oil and finalize studies and install facilities for increased LPG recovery and storage.

The SFYP includes a proposal to expand LPG recovery in the refinery by an additional 15,000 tons (current production is about 6,000 tons) in order to promote more LPG substitution for kerosene. It is expected that additional storage sweetening plant cylinders, etc. will be financed through French assistance. Also, the Canadian International Development Agency is financing a study of LPG recovery from natural gas.

Improve safety, maintenance and reliability of refinery operations.

This recommendation is being implemented with IDA assistance under the Energy Efficiency and Refinery Rehabilitation Project which provides a component for the provision of equipment, materials and engineering services to carry out repair, replacement and maintenance of tanks, furnace, columns, etc., to restore the mechanical integrity and increase capacity utilization of the refinery by 15%.

Energy Efficiency

Carry out a study and execute a program to reduce power outages.

The power outage study, as outlined in the Energy Assessment has not been undertaken. According to BPDB, studies on tariff levels and reduction of power losses are a higher priority at the present time. BPDB indicated that the outage situation should improve with completion of additional generation capacity and added that it would perhaps be more appropriate to address the problem further after preparation of the Power Development Master Plan and completion of studies on tariffs and losses.

Carry out a program to reduce power losses, including improved metering, accounting, supervision and physical protection.

To this end, BPDB has submitted a project proforma to GOB for a System Loss Reduction Scheme which identifies the areas of loss and proposes an action program to reduce both technical and

non-technical losses. Its overall objective is to reduce system losses to 18% by 1985 through the replacement of defective meters and the installation of capacitor banks. The project has not yet received full GOB approval. BPDB has requested external assistance in evaluating the design of the project as well as the results of some of the preliminary loss reduction work already completed.

Carry out a detailed study to improve the physical reliability of the Dhaka gas transmission and distribution system. This study should include the following components: (a) identification of the cause of high consumption rates in the Titas system, (b) identification of measures and investment to improve its physical reliability, (c) recommendation of measures to deal with the severe pressure losses and (d) analysis of storage options for peak sharing.

Carry out a study to identify and correct the causes of gas losses in domestic sector.

Institute an energy conservation program, including detailed audits of major energy-intensive industries and power plants, preparation and execution of gas substitution projects and an energy management training program.

Efforts to determine the high consumption rates in the Titas system are described below. The gas technical assistance study for the Titas system and a project for a new pipeline from Titas to Dhaka parallel to the present one, both assisted by ADB, should address the remaining three components of the recommended study.

GOB has initiated a program to investigate these losses. It has installed about 700 meters in representative sample households to pinpoint the causes of seemingly excessive consumption. The next steps will be to estimate the costs of these losses and compare them to the costs of installing, operating and maintaining meters in around one million households.

GOB has initiated a sizeable energy conservation program under the IDA assisted Energy Efficiency and Refinery Rehabilitation Project. The energy efficiency component of this project has four parts: (a) 110 man-months of consultant services to assist the newly created Energy Management Unit (EMU) carry out a long term energy conservation program, including energy audits of 40

medium to large energy using enterprises; (b) eight mobile units with energy measuring equipment for EMU staff; (c) an overseas training program for EMU staff, and (d) a library of relevant energy conservation literature. About 85 of the 110 man-months are intended for the energy audit work. The Government intends to package the results of the audits into an industrial energy conservation project and seek donor assistance to carry it out. The audits are expected to begin in 1984 and will require about twelve months to complete.

Energy Pricing

The gas pricing study which the Government agreed to do in the Bakhrabad Credit should be undertaken urgently.

Bids for the gas pricing study, were reviewed by both GOB and IDA in November, 1983 and a consulting firm was selected to carry out the work. The study will address the issue of the appropriate tariff levels and structure.

The time schedules already agreed to by the Government for the bulk and retail tariff studies of the BPDB and PBS systems, as well as the implementation of the recommended tariffs need to be adhered to.

Terms of reference for the power tariff study to determine appropriate tariff levels have been drawn up by BPDB and are awaiting approval by the External Resources Division (ERD). The original timetable calls for the study to be completed by December 1984. It will recommend appropriate tariff targets to be implemented by July 1985.

Raise ex-refinery prices of diesel oil and kerosene by about 15-20% relative to September 1981 levels to remove subsidies. In the case of LPG, increase the price by about 200% at the ex-refinery level to reflect full opportunity cost. Also an automatic "trigger mechanism" should be established to pass along to consumers any increases in crude oil and product import costs.

Petroleum product prices have been raised twice since September 1981 and now all products are priced at or above their opportunity cost. The highest increase is in the ex-refinery price of LPG, which, as recommended by the energy assessment, is about 200% above the comparable September 1981 price. In addition, the "automatic trigger mechanism" proposed by the assessment has been implemented with a limitation: the Ministry of Energy and Natural Resources now has the authority to direct BPC to increase prices in response to increasing costs by up to 10% automatically.

Renewable Energy Development

Institute reforestation programs and prepare projects.

The Government has several ongoing projects to improve knowledge of the forestry resource base and increase afforestation, with assistance from ADB, IDA, UNDP/FAO, and the United Kingdom.

Study and carry out the development of charcoal production.

Studies subsequent to the Energy Assessment did not find charcoal development very promising due to the distance of production areas from consumption centers and competition from imported coal use in certain industries targeted as potential charcoal users.

Obtain technical assistance for improvement of renewable energy planning.

The Government plans to develop a local rural/renewable energy planning capability with assistance from IDA and the Dutch Government, but the program has not yet begun. Rural/renewable energy demand projections and long-term planning requirements will be covered under the ADB/UNDP Energy Planning Project.

Prepare projects on woodstove improvement, and testing and demonstration of solar and biomass technologies.

Pilot activities in the following areas are to be carried out with assistance from IDA and the Dutch Government: improved chulas, solar driers, solar water heating and air pre-heating, solar pumping, a solar/wind energy resource assessment and feasibility studies for biodigesters and improved non-residential wood burning devices such as brick kilns. The project has not yet begun. There are also several ongoing research and development projects in universities, government laboratories, and institutes, mostly focused on biogas and solar thermal applications, and the Directorate of Forestry is monitoring plantation of new fast growing trees.

Develop hydro potential, especially in the context of isolated local power systems.

A study of small hydro in Bangladesh was completed in November, 1981 with USAID assistance. The study found that small hydroelectric projects should be pursued for electrification of isolated rural areas, power supply for irrigation pumps and the creation of small, decentralized

industries in the countryside, generating needed employment opportunities. It recommended that prefeasibility studies be undertaken in the areas of Chittagong, Sylhet, Jamalpur, Dinajpur and Rangpur. So far, these studies have not been carried out.

IV. ONGOING TECHNICAL ASSISTANCE TO THE ENERGY SECTOR

Multilateral

4.1 Asian Development Bank (ADB). Complementing the medium-term (to 1984/85) UNDP/World Bank Energy Assessment and the subsequent PIPE program is the preparation of a long-term energy plan over a horizon of 20 years within which successive five year plans may be better formulated. An energy planning project (EPP), financed by ADB and UNDP, is now in progress with the existing Energy Planning Cell as the focus of its technical assistance. The project's terms of reference include the following:

- (a) review of growth trends of the Bangladesh economy;
- (b) analysis of energy consumption trends, future energy needs and demand management opportunities;
- (c) development of macroeconomic and energy use models to assist in projections, policy analysis and energy sector planning;
- (d) assessment of relevant energy supply options;
- (e) identification of the main issues and problems of ensuring energy supplies to rural areas and formulation of action proposals;
- (f) development of a relevant framework for formulating and evaluating energy pricing policies;
- (g) formulation of recommended sector development plans for the period 1982-2000 together with associated investment programs and policies; and
- (h) training of Bangladeshi professionals in the use of analytical tools and techniques of energy planning.

4.2 The project is being carried out by a consortium of British, Swiss, and Bangladeshi consulting firms. An inception report will be issued early in 1984 which will give the major orientation of the project. The interim results of the project will be discussed at a seminar in June 1984, to which the major donors will be invited, and an interim report will be issued shortly thereafter. In addition to EDP, the ADB is involved in technical assistance for natural gas development in the Titas area and the preparation of a Power Sector Master Plan Study. Both of these subsector studies are expected to be completed in time for their findings to be included in the interim report of EPP.

4.3 World Bank. Following the Energy Assessment, both UNDP and the Bank provided technical assistance to GOB in 1983 in establishing investment priorities for energy sector projects in the SFYP. Currently, the Bank has several ongoing investment projects with technical

assistance components: Energy Efficiency and Refinery Rehabilitation, Petroleum Exploration Promotion, Bakhrabad Gas Development and Ashuganj Thermal Power. Also IDA Technical Assistance Credit No. 5 includes a rural and renewable energy component which is receiving financing from the Dutch Government. Table 4.1 outlines the technical assistance components contained in these projects, as well as those areas under study by ADB. From this Table it appears that there are several important areas covered by both institutions and coordination is needed to clearly delineate the scope and phasing of the work program to best utilize available resources.

4.4 FAO/UNDP: Other multilateral agencies involved in technical assistance to the energy sector include FAO and UNDP. Both organizations are involved in a village forest inventory study and an inventory survey of selected forest resources in the Chittagong Hill Tracts. In addition, UNDP is co-sponsor of EPP and is supporting the development of the Bangladesh Petroleum Institute (BPI) and the establishment of an energy planning and implementation cell within the Ministry of Energy.

Bilateral

4.5 Most of the major energy sector studies and other forms of technical assistance, such as training programs, are being undertaken by the multilateral agencies mentioned above. Bilateral agencies are more involved in energy investment projects, though there is some technical assistance which is summarized briefly in the following paragraphs.

4.6 Canada. The Canadian International Development Agency (CIDA) is funding a feasibility study for LPG recovery from natural gas. Results are expected early in 1984. CIDA is also in the process of identifying further technical assistance projects.

4.7 Federal Republic of Germany (FRG). The FRG is funding exploration seismic surveys in the Hinge Zone of Western Bangladesh and is also providing other technical assistance to Petrobangla.

4.8 Sweden. The Swedish Government is funding a forestry development and training center at Kaptai.

4.9 United Kingdom (UK). The British Overseas Development Agency (ODA) is financing exploration seismic surveys in the Hinge Zone of the West. In addition, ODA is giving technical assistance to the forestry sector, through the financing of an inventory survey of wood resources of the Sunderbans Forest.

4.10 United States. USAID is assisting Petrobangla in establishing and operating a hydrocarbon data bank. Also, USAID is financing a study of the tectonic structure of Bangladesh with assistance from the Kansas Geological Survey. Both of these projects should improve the information base for the GOB's hydrocarbon exploration promotion program.

Table 4.1: Summary of Energy Sector Studies Under Preparation by ADB and IDA

| | <u>ADB</u> | <u>WORLD BANK</u> |
|---|--|---|
| <u>Overall Energy Planning</u> | | |
| Energy Demand Forecasts | Energy Planning Project | |
| Long Term Energy Plan and Investment Requirements | - | |
| Institutional Review | - | |
| Energy Efficiency Project. | - | Industrial energy audit and conservation program under IDA Energy Efficiency and Refinery Rehabilitation |
| <u>Energy Pricing</u> | | |
| Overall Review | - | |
| Gas Tariffs | - | Gas pricing study under the Bakhrabad Gas Development Project. |
| Electric Power Tariffs | Energy Planning Project | Power tariff study recommended under the Ashuganj Thermal Power Project. |
| <u>Hydrocarbon Exploration and Development</u> | | |
| Reserve Analysis/Exploration and Development | Energy Planning Project and Gas Technical Assistance Project | A hydrocarbon habitat study is included in the first Petroleum Exploration and Promotion Project. Seismic Surveys are also part of this project. |
| Gas Demand Forecasting | Energy Planning Project | |
| Gas Utilization Options | Energy Planning Project and Gas Technical Assistance Project | A study on compressed natural gas (CNG) under the Bakhrabad Gas Development Project. Studies on gas based exports and methanol research and development are included under the Energy Efficiency and Refinery Rehabilitation Project. |
| <u>Petroleum Imports/Processing</u> | | |
| Demand Analysis and Projection | Energy Planning Project | |
| Refinery Production Planning | - | A study on refinery options to balance petroleum product demand has been included in the Energy Efficiency and Refinery Rehabilitation Project. |
| <u>Electric Power</u> | | |
| Market Survey | Power Sector Master Plan | |
| System Studies | - | |
| <u>Other Energy Sources</u> | | |
| Coal and Peat Development | Energy Planning Project | |
| New Rural/Renewable Energy Options | - | Rural/Renewable Energy Technical Assistance Credit* |
| Rural/Renewable Energy Planning | - | |
| <u>Training and Manpower Development</u> | | |
| Overall needs | - | |
| Hydrocarbon Sector | - | |
| Electric Power Sector | Energy Planning Project and Power Sector Master Plan | |
| Rural/Renewable Energy Sector | - | Rural/Renewable Energy Technical Assistance Credit.* |

* Proposed.

V. PRIORITIES FOR FURTHER TECHNICAL ASSISTANCE

Overview

5.1 The broad-based ADB/UNDP Energy Planning Project (EPP) and several ongoing technical assistance projects in the major energy subsectors are covering most aspects of energy sector development in Bangladesh. The findings of these studies should help the Government prepare an energy planning framework for the Third Five-Year Plan (to 1990) and to determine overall priorities for technical assistance to the energy sector. However, there are two important areas where technical assistance need not await the outcome of ongoing studies: (a) improving the efficiency of operation and financial condition of the Bangladesh Power Development Board through a power loss reduction program and a study on the appropriate level and structure of power tariffs (b) identifying the market potential for small scale users of natural gas. Also in terms of all ongoing and future technical assistance to the energy sector, there is a need for GOB and the international donor agencies to improve the coordination of external financial resources available.

Electric Power Loss Reduction Program

5.2 Electric power system losses are about 38% of gross electricity generation in Bangladesh. BPDP already has prepared a project proforma, which estimates that 60% of these losses are due to technical problems in the distribution system and 40% due to non-technical problems, such as inadequate billing procedures, insufficient supply of meters, meter tampering and power theft, etc. The program proposes to reduce the combined technical and non-technical losses to 15% of generation by 1990. The plan to reduce technical losses includes the detection of inefficient connectors and the installation of new ones where needed and the installation of capacitors to correct the low power factor due to high line current and energy losses in the conductors. The program to reduce non-technical losses includes the installation of meters where connectors are presently unmetered and improvements to administrative procedures such as meter reading and checking, billing and revenue collection. The cost of the entire program is on the order of TK 13 million (US\$528,000) of which TK 8 million (US\$325,000) would be in foreign exchange.

5.3 While the mission was in Dhaka, the Planning Department of BPDB expressed interest in a brief evaluation of this program by an outside consultant who would review the design of the program, the results of its preliminary work and the types of equipment required and the cost estimates. The mission estimates that such a review would require about two to three staff months at a cost of about US\$30,000-50,000. Such an evaluation could be financed under the Joint UNDP/World Bank Energy Sector Management Program Assistance (ESMAP).

Electric Power Tariff Study

5.4 Although BPDB's financial condition has improved recently, from net financial losses of TK 257 million in FY81 and TK 390 million in FY82 to a small profit of TK 23 million in FY83, revenues still fall far below the TK 1 billion needed to meet at least 20% of BPDB's investment program from internally generated cash resources. To help improve the situation, a study is needed to determine the appropriate level and structure of power tariffs, which are significantly below the long run marginal cost of supply. Such a study was agreed to by GOB under a covenant of the Ashuganj Thermal Power Project, though no funds were allocated to it. According to BPDB, terms of reference for the study have been prepared and are awaiting GOB approval to seek the necessary external funding. The cost of the study is estimated to be on the order of US\$500,000. According to the agreed time schedule, the consultant study should be completed by December, 1984 and the recommended tariffs implemented by July 1985.

Market Potential for Small Scale Users of Natural Gas

5.5 The Government has also been attending to the needs of small industrial, commercial and residential consumers located close to the producing gas fields or along pipeline routes. While the economics of supplying natural gas to these categories of consumers is well established, the issue now arises of the economic viability of supplying gas to (a) clusters of small consumers (i.e., in and around small towns) located further away from existing supply sources and (b) agriculture-based (and therefore widely spread) users such as irrigation pumps and crop dryers. The related issue of the economic efficiency of installing small gas-based power generators as a way to make electricity available to isolated areas also needs to be addressed.

5.6 A first step towards assessing these issues, which condition future plans for wider gas distribution systems, would be to review the available data and the research projects already completed with a view to suggesting a cogent technical assistance program. It is estimated that such a preliminary step would require three staff months at a cost of about US\$50,000.

Better Coordination of External Resources

5.7 As stated earlier in this report, Bangladesh receives a large amount of multilateral and bilateral aid in the energy sector. The mission met with representatives of several major donor agencies working in Bangladesh, all of whom expressed the need for more effective coordination from both GOB and the donor community. Although meetings of the local Consultative Group (LCG) of donors have been helpful in maintaining a dialogue on activities in the energy sector, it was the general consensus that these meetings need to be supplemented by another mechanism with a "clearing house" function such as a periodic digest of priorities and related donor activities, highlighting areas where further technical assistance is needed. Other suggestions include more frequent

donor meetings and the establishment of a common information base (including energy balances, prices, projections, etc.) to be updated periodically and used in project preparation.

Table 1
Commercial Energy Consumption Trends, 1975/76 to 1982/83

(In '000 toe)/a

| Source | 1975/76 | 1978/79 | 1979/80 | 1980/81 | 1981/82 | 1982/83 | Annual Average Growth Rate | | Percentage of Consumption 1982/83 |
|----------------|--------------|--------------|--------------|--------------|--------------|--------------|----------------------------|------------------------|-----------------------------------|
| | | | | | | | 1975/76 to 1978/79 (X) | 1978/79 to 1982/83 (X) | |
| Coal /b | 223 | 177 | 177 | 177 | 177 | 177 | -7.4 | - | 3.6 |
| Petroleum /c | 1,221 | 1,488 | 1,569 | 1,549 | 1,616 | 1,334 | 6.8 | -2.6 | 42.0 |
| Natural Gas /d | 677 | 821 | 1,003 | 1,140 | 1,453 | 1,603 | 6.6 | 18.2 | 30.6 |
| Hydro /e | 40 | 48 | 49 | 49 | 58 | 58 | 6.3 | 4.8 | 1.8 |
| TOTAL | 2,161 | 2,534 | 2,800 | 2,955 | 3,304 | 3,174 | 5.5 | 5.8 | 100.0 |

/a Conversion Factors: 1 toe = 43.57 MCF of natural gas.
 = 0.932 long tons of petroleum products.
 = 1.5 tons of coal.
 = 3,016 kWh of electricity.

/b Data for 1979/80 and subsequent years are estimated figures.

/c Source: Bangladesh Petroleum Corporation.

/d Source: Bangladesh Oil and Gas Corporation.

/e Source: Bangladesh Power Development Board.

Table 2
PETROLEUM PRODUCT PRICES AND IMPORT PARITY
(US\$/barrel)

| | Ex-Depot Price/<u>a</u> Chittagong | Import Parity Price/<u>b</u> c.i.f. Chittagong | Ex-Refinery Price/<u>a</u> Chittagong |
|--------------------------|---|---|--|
| Premium Gasoline | 107.85 | 40.77 | 98.26 |
| Regular Gasoline | 95.19 | 36.11 | 86.27 |
| Jet Fuel | 59.97 | 35.35 | 57.35 |
| Kerosene | 46.83 | 35.35 | 43.82 |
| Automotive Diesel Oil | 46.81 | 33.55 | 42.80 |
| Fuel Oil | 35.04 | | 32.42 |

/a Effective from March 1983.

/b July 1983 f.o.b. Singapore prices plus freight to Chittagong (US\$1.25/bbl for clean products and US\$1.50/bbl for dirty products).

Note: Exchange rate July 1983 Tk 24.50 = US\$1.00.

Table 3
Petroleum Product Price Trends, 1981-83
(in Taka per gallon)

| | <u>September 1981</u> | | <u>July 1982</u> | | <u>March 1983</u> | |
|-----------------------------|-----------------------|-----------------|--------------------|--------------------|--------------------|-----------------|
| | <u>Ex-Refinery</u> | <u>Ex-Depot</u> | <u>Ex-Refinery</u> | <u>Ex-Depot</u> | <u>Ex-Refinery</u> | <u>Ex-Depot</u> |
| Premium Gasoline (HSDC) | 48.14 | 54.86 | 62.38 | 69.30 | 68.84 | 73.56 |
| Regular Gasoline (MS) | 44.27 | 50.32 | 57.55 | 63.80 | 60.43 | 66.68 |
| Jet Fuel (JP-1) | 30.90 | 32.75 | 40.17 | 42.02 | 40.17 | 42.02 |
| Kerosene (SKO) | 21.89 | 23.63 | 30.71 | 32.81 | 30.71 | 32.81 |
| Automotive Diesel Oil (USD) | 20.98 | 23.63 | 30.88 | 32.81 | 30.88 | 32.81 |
| Fuel Oil (FOHS) | 19.88 | 17.31 | 22.71 | 24.34 | 22.71 | 24.34 |
| LPG ^{1/a} | 50.00 | 54.36 | 50.00 ^b | 54.36 ^b | 95.00 | 105.60 |

^{1/a} Per cylinder (12.5 kg net).

^b With effect from August 12, 1982, price was raised to Tk 70/cylinder.

Notes: Exchange Rate September 1983 Tk 24.75 = US\$1.00.

Prices are in Chittagong Ex-Refinery and Chittagong Ex-Depot.

Table 4
Natural Gas Tariffs, 1981-83
(in taka)

| With Effect From | June 7, 1981 | | July 1, 1982 | | June 30, 1983 | |
|--|----------------|------------------|----------------|------------------|-----------------|------------------|
| | Bulk | Others | Bulk | Others | Bulk | Others |
| Cost of Gas/MCF (ex-field) (Including excise duty) | 7.53 (9.00) | 15.48 (14.00) | 9.50 (9.00) | 18.00 (17.50) | 10.00 (9.50) | 22.65 (21.65) |
| End Users Price/MCF (Inclusive of excise duty) | | | | | | |
| Bulk Customers: | | | | | | |
| Power | 9.30 | | 10.50 | | 11.30 | |
| Fertilizer | 9.30 | | 10.50 | | 11.30 | |
| Industrial | | 27.75 | | 31.00 | | 36.00 |
| Commercial | | 28.00 | | 31.00 | | 36.00 |
| Domestic | | | | | | |
| Metered | | | | | | |
| Unmetered/month: | | | | | | |
| Cooker-one burner | | 25.00 | | 35.00 | | 45.00 |
| Cooker-two burners | | 45.00 | | 65.00 | | 80.00 |
| Additional burner (each) | | 16.00 | | 27.00 | | 34.00 |
| Oven (each) | | 38.00 | | 58.00 | | 74.00 |
| Additional oven (each) | | 19.00 | | 29.00 | | 37.00 |
| Grill (each) | | 38.00 | | 58.00 | | 74.00 |
| Additional grill (each) | | 19.00 | | 29.00 | | 37.00 |
| Water heater up to 20 gallons (each) | | 76.00 | | 117.00 | | 147.00 |
| Water heater above 20 gallons (each) | | 93.00 | | 146.00 | | 184.00 |
| Dryer (each) | | 112.00 | | 175.00 | | 220.00 |
| Refrigerator (each) | | 93.00 | | 117.00 | | 147.00 |
| Gas light-garden/external use (each) | | 20.00 | | 27.00 | | 34.00 |
| Gas light-inside the room use (each) | | 10.00 | | 14.00 | | 17.00 |
| Minimum Charges/Month: | | | | | | |
| Domestic (unmetered) | | 20.00 | | 27.00 | | 34.00 |
| Commercial | | 140.00 | | 155.00 | | 180.00 |

Source: Petrobangla

Table 5: Bangladesh BPDR Electricity Tariff Structure
(March 1984)

| <u>Consumer Group</u> | <u>Minimum Charge</u> | <u>Unit Rates a/</u> |
|---|--|--|
| LOW AND MEDIUM VOLTAGE | | |
| (A) Domestic <u>b/</u> | - | (i) Monthly consumption up to 250 units 60 paisa/KWh (ii) Monthly consumption 250 to 400 units 85 paisa/KWh (iii) Monthly consumption over 400 units 225 paisa/KWh |
| (B) Irrigation Pumping | <u>Actual Charges:</u> Tk 250 per HP/year Tk 1,000 (single phase) Tk 3,000 (triple phase) | 100 paisa/KWh |
| (C) Industrial (up to 50 KW) | | (i) Without time-of-day meter 170 paisa/KWh (ii) With time-of-day meter Off-peak hours 120 paisa/KWh Peak hours 400 paisa/KWh |
| (D) Ceremonial/Temporary Purposes | Tk 200 (single phase) Tk 1,000 (triple phase) | 400 paisa/KWh |
| (E) Commercial | Tk 30 to Tk 500 per month depending on contracted load | (i) Monthly consumption up to 100 units 185 paisa/KWh (ii) Monthly consumption over 100 units 250 paisa/KWh |
| HIGH TENSION BULK | | |
| (F) Consumers above 50 KW (other than jute mills) | Tk 3,500 | (i) Without time-of-day meter 170 paisa/KWh (ii) With time-of-day meter Off-peak hours 100 paisa/KVAH Peak hours 325 paisa/KVAH |
| (G) Jute Mills above 50 KW | Tk 3,500 | 145 paisa/KWh |
| EXTRA HIGH VOLTAGE | | |
| (H) 5 MVA or above (other than REB) | Tk 65 per KW per month | (i) Without time-of-day meter 155 paisa/KVAH (ii) With time-of-day meter Off-peak hours 90 paisa/KVAH Peak hours 300 paisa/KVAH |
| (I) REB/Pallihidynt Samity | Tk 50 per KW per month | 78 paisa/KWh |

a/ In addition, Government Electricity Duty of 5 paisa/KWh applies.

b/ For hospitals, educational and charitable institutions, and religious establishments, the unit rate is 70 paisa/KWh for monthly consumption up to 1,000 units and 200 paisa/KWh for monthly consumption over 1,000 units, with a minimum charge of Tk 15 for single phase and Tk 90 for triple phase.

* 100 paisa = Tk 1.

Source: BPDB.

Table 6: Second Five-Year Plan - Energy Investment Plan
(in 1980 Tk million)

| | Electric Power | Oil and Gas | Renewable/Rural Energy |
|--------------|-----------------------|--------------------|-------------------------------|
| 1980-82 | 4,430.3 | 2,222.9 | - |
| 1982/83 | 2,206.2 | 1,838.5 | - |
| 1983/84 | 3,574.6 | 2,926.5 | 6.4 |
| 1984/85 | <u>4,148.9</u> | <u>1,922.1</u> | <u>8.5</u> |
| Total | 14,360.0 | 6,145.1 | 14.9 |

Source: Bangladesh, Second Five-Year Plan, 1980-85, Ministry of Finance and Planning.

Energy Sector Management Assistance Programme

Activities Completed

| <u>Energy Assessment Status Report</u> | | <u>Date Completed</u> |
|--|--|-----------------------|
| Papua New Guinea | | July, 1983 |
| Mauritius | | October, 1983 |
| Sri Lanka | | January, 1984 |
| Malawi | | January, 1984 |
| Burundi | | February, 1984 |
| | | |
| <u>Project Formulation and Justification</u> | | |
| Panama | Power Loss Reduction Study | June, 1983 |
| Zimbabwe | Power Loss Reduction Study | June, 1983 |
| Sri Lanka | Power Loss Reduction Study | July, 1983 |
| Malawi | Technical Assistance to Improve the Efficiency of Fuelwood Use in Tobacco Industry | November, 1983 |
| Kenya | Power Loss Reduction Study | March, 1984 |
| | | |
| <u>Institutional and Policy Support</u> | | |
| Sudan | Management Assistance to the Ministry of Energy & Mining | May, 1983 |
| Burundi | Petroleum Supply Management Study | December, 1983 |