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**STAFF APPRAISAL REPORT**

**BANGLADESH**

**LIQUEFIED PETROLEUM GAS (LPG)  
TRANSPORT AND DISTRIBUTION PROJECT**

**April 30, 1991**

**Industry and Energy Division  
Country Department I  
Asia Region**

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### CURRENCY EQUIVALENTS

Currency Unit	=	Taka (Tk)
US\$1.00	=	Tk 34.90
Tk 1.00	=	US\$0.0287

### WEIGHTS AND MEASURES

1 barrel (bbl)	=	0.159 cubic meter (m <sup>3</sup> )
1 cubic foot (CF)	=	0.028 (m <sup>3</sup> )
1 British thermal unit (Btu)	=	0.252 kilocalorie (kcal)
1 metric ton (mt) of oil, 0.85 sp.gr.	=	7.4 bbl
1 kilometer (km)	=	0.621 mile
MCF	=	thousand standard cubic feet
MMCFD	=	million standard cubic feet per day
mtpy	=	metric tons per year
BCF	=	billion cubic feet
TCF	=	trillion (1,000 billion) cubic feet

### ABBREVIATIONS AND ACRONYMS

ADP	-	Annual Development Plan
BFA	-	Bakhrabad Franchise Area
BGFCL	-	Bangladesh Gas Fields Company Limited
BGSL	-	Bakhrabad Gas Systems limited
BPC	-	Bangladesh Petroleum Corporation
CNG	-	Compressed Natural Gas
CNGCL	-	Compressed Natural Gas Company Limited
ERL	-	Eastern Refinery Limited
ESAC	-	Energy Sector Adjustment Credit (Cr.1999-BD)
FYP	-	Five-Year Plan
GOB	-	Government of Bangladesh
ICB	-	International Competitive Bidding
IDA	-	International Development Association
LFS	-	LPG Feasibility Study
LPG	-	Liquefied Petroleum Gas
LPGL	-	Liquefied Petroleum Gas Limited
NGL	-	Natural Gas Liquid(s)
Petrobangla	-	Bangladesh Oil, Gas and Minerals Corporation
RPGCL	-	Rupantarita Prakritik Gas Company Limited
SGDP	-	Second Gas Development Project (Cr.1586-BD)
SGFCL	-	Sylhet Gas Fields Company Limited
TA	-	Technical Assistance
TFA	-	Titus Franchise Area
TGTDC	-	Titus Gas Transmission and Distribution Company
UNDP	-	United Nations Development Programme

### FISCAL YEAR

July 1 to June 30

BANGLADESHLIQUEFIED PETROLEUM GAS (LPG) TRANSPORT AND DISTRIBUTION PROJECTDevelopment Credit and Project Summary

Borrower: People's Republic of Bangladesh

Beneficiaries: Rupantarita Prakritik Gas Company Limited (RPGCL) and Liquefied Petroleum Gas Limited (LPGL), which are subsidiaries of the Bangladesh Oil, Gas and Minerals Corporation (Petrobangla) and the Bangladesh Petroleum Corporation (BPC), respectively.

Amount: SDR 49.8 million (US\$67.2 million equivalent)

Terms: Standard, with 40 years maturity

Onlending Terms: 10% per annum on repayment terms of 15 years, including 5 years of grace. The Government would onlend US\$26.6 million of the proceeds of the Credit to RPGCL for the LPG storage and transport component, and US\$40.6 million to LPGL for the LPG bottling component. The Beneficiaries would bear the foreign exchange risk.

Project Description: The Project would support the downstream transport and distribution of LPG (or bottled gas) to be produced from the northeastern gas fields. Project components include storage facilities, an LPG pipeline, two LPG bottling plants and rehabilitation of an existing plant, LPG cylinders and pressure regulators, and technical assistance in the areas of project support, capacity-building and policy development. The Project would pursue LPG pricing reforms, promote joint Petrobangla and BPC sector planning, facilitate private sector involvement, promote environmental and operational safety in the petroleum sector, and enhance the role of Bangladeshi women in the retail distribution of LPG cylinders and more energy-efficient cooking stoves.

Benefits and Risks: The Project would assist in reducing the foreign exchange drain from oil imports, alleviating biomass energy shortages and promoting social equity between the country's eastern region and less-developed western zone. Two of the Project's innovative technical assistance components would also pioneer in promoting environmental and operational safety in the petroleum sector, and in enhancing the development role of Bangladeshi women. Implementation delays are the main Project risks. Construction delays would be minimized by providing for effective implementation supervision and project management for both RPGCL and LPGL. Suitable conditionalities to ensure adequate financial performance would minimize the risk of delays due to resource constraints.

Estimated Project Cost:

	<u>Local</u>	<u>Foreign</u>	<u>Total</u>
	[--- ---]	US\$ million	[-----]
<u>RP Gas Co. Ltd. (RPGCL)</u>			
A. Storage for LPG and Condensates	1.0	5.9	6.9
B. Ashuganj-Elenga LPG Pipeline	1.5	9.4	10.9
C. Directional Drilling	0.3	1.9	2.2
D. Implementation Supervision		2.0	2.0
E. Management & Operations Assistance/Training and Studies		2.2	2.2
F. Technical Assistance	---	<u>0.8</u>	<u>0.8</u>
SUBTOTAL	2.8	22.2	25.0
 <u>LP Gas Co. Ltd. (LPGL)</u>			
G. LPG Bottling Plants:			
Elenga	1.0	5.8	6.8
Kailashtila	0.4	2.2	2.6
Chittagong (Rehabilitation)	0.2	0.4	0.6
H. Cylinders, Valves, Regulators	10.9	12.0	22.9
I. Storage	1.2	8.3	9.5
J. Implementation Supervision		1.0	1.0
K. Management & Operations Assistance/Training and Studies		2.3	2.3
L. Technical Assistance	---	<u>0.7</u>	<u>0.7</u>
SUBTOTAL	13.7	32.7	46.4
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Base Cost Estimate	16.5	54.9	71.4
Physical Contingencies (10%)	1.7	5.5	7.1
Price Contingencies	<u>3.1</u>	<u>8.7</u>	<u>11.9</u>
Total Project Cost	21.3	69.1	90.4
Interest During Construction	3.8	0.0	3.8
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Total Financing Required	<u>25.1</u>	<u>69.1</u>	<u>94.2</u>
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NOTE: Total Project cost net of duties and taxes (US\$13.9 million) is US\$80.3 million.

Financing Plan:

	<u>Local</u>	<u>Foreign</u>	<u>Total</u>
	[-----	US\$ million	-----]
IDA Credit	-	67.2	67.2
RPGCL	5.6	-	5.6
LPGL	19.5	-	19.5
Bilateral Grant Cofinancing	-	1.9	1.9
TOTAL	25.1	69.1	94.2

Estimated Disbursements (US\$ million):

(IDA Fiscal Year)	<u>FY92</u>	<u>FY93</u>	<u>FY94</u>	<u>FY95</u>	<u>FY96</u>
Annual	5.6	21.1	23.9	10.3	6.3
Cumulative	5.6	26.7	50.6	60.9	67.2

Economic Rate of Return: 20%

Based on the following conservative assumptions: (i) pre-Gulf crisis prices for crude oil (US\$18/bbl base price) and petroleum products; (ii) no price pressures on refining margins for middle distillates and a low kerosene-to-crude margin; (iii) a factor of 1.3 to derive the kerosene equivalent of LPG; and (iv) no high-value commercial fuelwood substitution.

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LIQUEFIED PETROLEUM GAS (LPG) TRANSPORT AND DISTRIBUTION PROJECT

STAFF APPRAISAL REPORT

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This report is based on the findings of an appraisal mission in July 1990. Mission members included Mr. F. Manibog (Mission Leader) and Ms. M. Tumaliwan (Operations Assistant)--AS1IE; Messrs. M. Sergio (Sr. Financial Analyst), J. Thomas (Sr. Geologist) and L. Wijetilleke (Sr. Chemical Engineer)--ASTEG; and Messrs. J. Davis (Financial Analyst), R. DeLucia (Economist) and B. Mink (Environmental and Process Engineer)--Consultants. The report has been endorsed by Messrs. S. Asanuma (Director, AS1DR) and F. Temple (Chief, AS1IE). Peer reviewers included Messrs. P. Nore (IENGU), E. Moore (IENED) and M. Shirazi (EMTIE), who reviewed economic and pricing, institutional and technical aspects, respectively. Secretarial support was provided by Mmes. I. Christy and A. Thornton.

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### LIQUEFIED PETROLEUM GAS (LPG) TRANSPORT AND DISTRIBUTION PROJECT

#### STAFF APPRAISAL REPORT

##### I. THE ENERGY SECTOR

###### A. Sectoral Importance

1.01 An efficient energy sector is essential to promote economic growth in Bangladesh. Given its severe resource limitations and persistent balance of payments constraints, the country needs to substitute for energy imports and mobilize resources for sector entities and the Government budget. To reduce the foreign exchange outlays on imported petroleum, a major objective of the Government of Bangladesh (GOB) is to develop the country's large reserves of natural gas and natural gas liquids (NGL), which include liquefied petroleum gas (LPG). GOB's FY86-90 3rd Five Year Plan (FYP) recognized the need to accelerate energy sector development, for which about 16% of total public allocations was earmarked. The 4th FYP (FY91-95) retains a high allocation for energy, with the gas subsector diversifying from mainly supplying gas to power and fertilizer consumers during the 1980s, to direct substitution of NGL for petroleum imports during the 1990s.

###### B. Energy Resources and Supply

1.02 Bangladesh imports all of its petroleum supplies. Its main commercial energy resources consist of substantial reserves of relatively low-cost natural gas and limited hydropower potential. The potential for oil and coal resources has yet to be determined. About 40% of total energy supply is from commercial resources, and the remainder is from traditional biomass fuels, namely, fuelwood, crop residues and animal wastes. In FY87, domestic sources (natural gas and hydropower) accounted for about 60% and imported sources (oil and coal) for about 40% of commercial energy supplies.

1.03 Natural Gas and Oil. GOB accords high priority to the development of natural gas and NGL resources. Natural gas output increased from 45 billion cubic feet (BCF) in FY80 to about 147 BCF in FY89, a 14% annual growth rate. It is now the main commercial energy source, accounting for about 59% of supply compared to 36% in FY80. The small oil find in Sylhet is being evaluated.

1.04 The appraisal drilling program under the Second Gas Development Project (SGDP/Cr.1586-BD) has been completed successfully in 1990, increasing the known gas reserves from 10 trillion cubic feet (TCF) to 15 TCF. The nine appraisal and two work-over wells were completed as gas producers, and the reservoir study results indicate that the northeastern gas fields not yet in production are larger than originally estimated. Upon completion of SGDP, significant new production capacity of around 300 million cubic feet per day (MMCFD) will be added to the gas network, enabling supplies from the northern fields to reach the east bank of the Jamuna River. Under the Petroleum Exploration Promotion Project (Cr. 1402-BD), GOB held a promotion campaign aimed at attracting international oil companies (IOCs) to undertake petroleum exploration. The June/July 1989 promotion meetings resulted in 20 companies purchasing exploration data packages, and Petrobangla is discussing possible production-sharing agreements with several interested IOCs. Future development

plans focus on (a) bringing surplus gas from the northeastern gas fields to the south to avoid impending deficits in the Chittagong area where new major consumers are planned and (b) further NGL recovery and distribution. These efforts are expected to further reduce petroleum imports.

1.05 Coal. Several thick coal seams at depths of less than 200 meters have been located recently in the Barapukuria area of Dinajpur District in the west zone. Potential resources are estimated at 265 million tons. A full feasibility study funded by the Overseas Development Administration (ODA, UK) was completed in November 1990 and is under review.

1.06 Hydropower. Bangladesh's hydropower potential is around 1,500 gigawatt-hours/year, of which 1,050 gigawatt-hours/year have been developed at a 330-megawatt plant at Kaptai near Chittagong. No detailed engineering studies have been undertaken for two other hydro sites, since their development would require the relocation of about 30,000 people.

1.07 Traditional Fuels. Per capita biomass supplies are diminishing continuously due to deforestation and rapid population growth. Extensive fuelwood planting is a not viable option to meet the supply gap due to the high population density and pressure for agricultural land. In addition to providing LPG as a substitute fuel, it is essential to improve biomass recovery and conversion efficiency (e.g., in cooking stoves), which is a technical assistance component under this LPG Project.

### C. Energy Consumption

1.08 Bangladesh's per capita commercial energy consumption of about 56 kilograms of oil equivalent per annum is among the lowest in the world (about one-ninth of the average for low-income countries). In FY87, gross commercial energy consumption was about 4.6 million tons of oil equivalent, of which natural gas accounted for 54%, petroleum 38%, hydropower 5% and coal 3%. With the accelerated development of gas supplies, however, the consumption of commercial energy increased rapidly at 10.8% a year during FY83-87, compared with the annual growth rate of about 4.1% for real GDP. The bulk of gas consumption in FY88 was in power generation (44%) and fertilizer production (36%); however, other industrial, commercial and domestic uses are expanding steadily. The GDP/commercial energy elasticity of about 2.6 was high, compared to the average of about 1.1 for developing countries. There is considerable inefficiency in commercial energy use and hence substantial scope for improvement, particularly in industry, petroleum refining and electric power transmission and distribution. This issue is being addressed through various IDA-financed projects, including the Industrial Energy Efficiency Project (Cr. 1942-BD), Power Distribution Project (Cr. 2016-BD) and the completed Energy Efficiency & Refinery Rehabilitation Project (Cr. 1357-BD).

1.09 With increased gas availability and GOB's policy of substituting gas for imported petroleum products, the country's dependence on imported crude oil and petroleum products was reduced significantly during FY80-87 from about 60% to 40% of total commercial energy needs. Despite this decline, petroleum imports continue to be substantial, claiming about 9% of the country's limited foreign exchange earnings in FY89. Further, the residential/commercial (37%) and transport (29%) sectoral shares of total petroleum products consumption remain high (Annex 1.1). Demand for petroleum products is heavily skewed

toward middle distillates. Of total petroleum products consumption (Annex 1.2), kerosene accounts for 29% and diesel for 54%, with 90% of kerosene supplies used in the residential/commercial sector and 65% of diesel supplies in the transport sector alone.

#### D. Energy Sector Organization and Planning

1.10 The institutions responsible for energy sector policy are: (a) the Planning Commission, responsible for macroeconomic planning, including Five-Year Plans and Annual Development Plans, and for approving capital investments costing more than Tk 5.0 million (about US\$140,000); and (b) the Ministry of Energy and Mineral Resources (MEMR), responsible for overseeing operations of the four publicly-owned energy sector entities that produce, transport and deliver Bangladesh's commercial energy. The entities are the Bangladesh Power Development Board (BPDB), the Rural Electrification Board (REB), the Bangladesh Oil, Gas and Minerals Corporation (Petrobangla) and the Bangladesh Petroleum Corporation (BPC)<sup>1/</sup>. BPDB is responsible for electricity generation, transmission and distribution, except in areas served by REB. REB is responsible for rural electrification schemes and organizing consumers into semi-autonomous cooperatives. Petrobangla is responsible for the exploration, production and delivery of natural gas and NGL, and the exploration and development of oil and solid minerals, including coal. In July 1989, GOB reorganized Petrobangla as a holding company, holding equity in a new set of independent companies operating along functional lines for exploration and drilling, production, transmission and distribution of gas. BPC is responsible for purchasing and refining crude oil and marketing petroleum products. Refining is carried out at Bangladesh's only refinery, the Eastern Refinery Limited (ERL), a BPC subsidiary. LPG is bottled and sold to private distributors by LPG Limited (LPGL), another BPC subsidiary. Three other BPC subsidiaries (Jamuna, Meghna and Padma oil companies) market petroleum products. The organization charts of Petrobangla and BPC are presented in Annex 1.3.

1.11 The exceptions to public sector ownership are in the distribution of commercial biomass fuels and petroleum products, which rely primarily on privately-owned road and river tankers for transport and on private dealers for local retailing. Although the petroleum distribution system is operating satisfactorily, the expected future growth in commercial energy requirements may stretch the system's capability to meet demand efficiently. Consequently, there is further scope for increasing private sector participation, which IDA is encouraging in new areas of the petroleum subsector. Private sector involvement in LPG distribution is being promoted on a pilot basis in Khulna under the Refinery Modification and LPG Recovery & Distribution Project (Cr. 1749-BD) and would be expanded under the proposed Project. Further, GOB is seeking to increase private oil exploration through a promotional campaign under Cr. 1402-BD (para. 1.04).

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<sup>1/</sup> A fifth entity, the Dhaka Electricity Supply Authority (DESA), which will be responsible for distribution in the greater Dhaka area, has been legally established and is expected to begin commercial operations in 1991.

### E. Energy Pricing

1.12 GOB's key energy pricing policy objectives include economic efficiency, resource mobilization and equity. GOB has increased energy prices to reflect the costs to Bangladesh of meeting consumers' energy requirements, while minimizing the adverse effects on low-income consumers.

1.13 Electricity Tariffs. BPDB's tariff rates for each consumer class are uniform throughout Bangladesh, while each rural electrification cooperative sets its own tariff rates with REB's approval. Electricity tariffs have been raised frequently in recent years. During FY80-90, BPDB's average tariff rates were increased by about 28% in real terms. Following the FY90 tariff increases, BPDB's overall average tariff rate is about 70% of LRMC, and that for cooperatives is about 56% of LRMC.

1.14 Natural Gas and Petroleum Products. Gas prices have been increased by an average of 18% annually during FY86-90. In FY90, the weighted average gas price is about Tk 43.5 per thousand cubic feet (MCF), which is slightly above the estimated long-run marginal cost of supply and depletion premium (Tk 40.0/MCF). Further, in line with its economic efficiency and resource mobilization objectives, until mid-FY90 GOB maintained (a) petroleum product prices at FY87 levels, which significantly exceeded border prices, and (b) a weighted average transfer price, including excise duty, that is always at least 15% above the border price. In February 1990, the average transfer price was 35% above the border price. In FY91, responding to the events in the Gulf, GOB increased product prices by about 60% during September and October 1990 alone.

1.15 Liquefied Petroleum Gas (LPG). Under the Project, the LPG transfer and retail prices would be set according to principles intended to achieve both economic and financial objectives (Annex 1.4). On strictly economic grounds, the build-up of LPG prices would be based on the economic costs involved and provide flexibility to adjust prices when upstream and/or downstream costs change. The minimum economic pricing benchmark would be the economic ex-recovery transfer price plus full economic cost recovery for downstream investments. The upper-bound economic benchmark would correspond to the border price of the substitute fuel, adjusted for transport and useful energy equivalency. Under certain conditions, financial considerations may warrant higher LPG prices to ensure that margins fully cover operating costs, taxes and duties, debt service, a reasonable return on investments and an adequate contribution to capital expenditures. Further, higher LPG prices would: (a) encourage natural gas use; (b) discourage LPG leakage into the transport sector; (c) cover payment of import and excise duties levied on LPG operations; (d) encourage private sector participation; and (e) capture consumers' willingness to pay a convenience premium for LPG use.

1.16 To comply with these objectives, GOB agreed that: (a) LPG transfer and retail prices will be reviewed annually and adjusted to comply with financial viability objectives, or economic efficiency criteria, whichever is higher; (b) the applicable prices will be fully put into effect by the time the incremental LPG supplies come on stream; and (c) the transfer price from LPG producers to LPG bottlers will be uniform throughout Bangladesh (paras. 4.17 and para. 6 of Annex 1.4).

1.17 As regards retail prices, GOB agreed under the ongoing Refinery Modification Project (Cr. 1749-BD) to remove all price controls on the distribution and sale of LPG by June 30, 1989. In line with this agreement, GOB increased the price of LPG per 12.5 kilogram cylinder from Tk 131 in July 1990 to Tk 180 in September 1990 and subsequently to Tk 200 in October 1990. This represents a 53% increase, as part of a series of adjustments that has nearly doubled the weighted average retail price of all petroleum products since February 1990 (Annex 1.5). The Tk 200 per cylinder LPG retail price (around US\$460/mt) would about equal the upper-bound economic benchmark, based on a long-term crude oil price assumption of US\$ 25/barrel, a kerosene-to-crude margin of US\$50/mt, a factor of 1.3 to convert the LPG to its kerosene equivalent (para. 5.07) and adjustment for domestic transport and distribution costs. At present, the relevant LPG retail pricing benchmark would be derived from financial criteria, based on the current kerosene retail price of Tk 14/liter, or US\$660/mt after adjustment for LPG equivalency. Further, at the minimum, the LPG retail price should be in line with the kerosene equivalent retail price, to ensure economically efficient LPG use and mobilize resources for GOB. Financial viability of the Project beneficiaries and other entities involved in LPG transport and distribution is achieved at this price level.

1.18 GOB has increased LPG prices significantly since appraisal. In view of the wide fluctuations during FY91 and uncertainties in international petroleum prices, the levels and monitoring of the LPG price increases were reviewed during negotiations and GOB confirmed that the LPG retail price will be increased to reach adequate levels in accord with the agreed pricing principles, before the incremental LPG supplies come on stream. The calculation of the eventual LPG retail prices would be based on the prevailing exchange rate and would take resource mobilization objectives as well as inflation into account.

#### F. GOB's Energy Sector Strategy

1.19 Recognizing the importance of improving energy supplies to meet forecast demand, GOB accorded high priority to the energy sector in the 3rd FYP. The 3rd FYP's principal energy objectives are to: (a) accelerate the development of natural gas resources to reduce dependence on imported oil; (b) improve power supply reliability and quality and reduce system losses; (c) improve energy use efficiency through conservation measures and appropriate pricing policies; (d) meet energy demand at least cost to the economy; (e) improve sector entities' performance; and (f) encourage private participation in the sector, particularly in oil and gas exploration and petroleum distribution. To underscore its commitment to the sector's development, GOB allocated Tk 61 billion (about US\$1.9 billion) at FY85 prices for energy investments under the 3rd FYP. Energy accounts for 16% of the total public sector allocation, compared with about 12% under the 2nd FYP, and is exceeded only by the allocation to agriculture sector.

#### G. Bank Group Involvement in the Energy Sector

1.20 Lending in the power and gas subsectors has been designed to: (a) strengthen investment planning to meet forecast demand for gas and electricity at least cost; (b) improve sector institutions' performance and provide training; (c) optimize the use of energy resources through appropriate energy pricing and conservation measures; (d) appraise gas discoveries and optimize

field development; and (e) attract private capital for exploration. Since 1973 IDA has supported GOB's energy strategy through 13 credits of US\$858 million equivalent, representing about 19% of IDA resources committed to Bangladesh. Seven of the credits (US\$390 million) were for power projects, and six were for petroleum projects and the Energy Sector Adjustment Credit (ESAC/Cr. 1999-BD).

1.21 Both the ongoing Second Gas Development Project (SGDP/Cr. 1586-BD) and the Bakhrabad Gas Development Project (Cr. 1091-BD), which closed on December 31, 1985, encompassed all activities from production to delivery to final users. The Bakhrabad project was implemented with only a slight delay from the appraisal schedule (Project Performance Audit Report, October 22, 1987). The SGDP was delayed for almost three years with virtually no activity except technical assistance, due primarily to the delay in mobilizing the bilaterally financed drilling rig and petroleum technical services. In the absence of drilling results establishing sufficient gas reserves, the design of infrastructure and procurement of major items could not proceed. Since the project finally started in 1988, however, the disbursement performance has been on track with appraisal estimates.

1.22 Although considerable progress was achieved through the above projects, they did not provide an effective means to rationalize the entire energy investment program and address issues affecting the overall organization of the power and petroleum subsectors. Thus, during FY87, GOB and IDA developed a comprehensive energy sector reform program, including investment planning, institutional development, and energy pricing and resource mobilization, to be implemented under the ESAC. The ESAC became effective in June 1989, and the first and second tranches were disbursed by December 31, 1989 and June 30, 1990, respectively.

1.23 Cofinancing and Donor Coordination. The two IDA-financed gas subsector projects to date have featured substantial cofinancing from several bilateral sources, including the Canadian International Development Agency, the Directoraat Generaal Voor Internationale Samenwerking (the Netherlands), the Overseas Development Administration (UK), the Overseas Economic Cooperation Fund (Japan), the OPEC Fund for International Development, and the United Nations Development Programme. The joint supervision missions provide a semi-annual forum for coordinating donor assistance to the gas subsector. Further, a Gas Sector Investment Planning Review under preparation would provide a framework for further donor coordination. Cofinancing for the Project was sought vigorously but was not forthcoming due to the cofinanciers' programming constraints and diversification of areas for assistance.

1.24 Lessons Learned. Several lessons are evident from the two lending operations in the gas subsector. First, gas projects should be formulated within the context of a long-term development plan. Second, training components should be clearly defined and closely monitored. Third, in cofinanced projects, items to be financed by different cofinanciers should be selected carefully, to ensure that procurement guidelines applicable to parallel credits do not seriously affect overall procurement efficiency. Fourth, sector policy issues should be addressed within the context of policy-based lending.

1.25 The foregoing lessons were made part of the Project's design. Under the ESAC, it has been agreed that new capital investments would be focused on

priority projects under an agreed Priority Investment Program (PIP). The Project is part of the PIP and long-term development plan agreed and reviewed annually with GOB, Petrobangla and BPC. The Project's training components include the provision of a management and operations assistance team, beyond the normal training provided with the equipment contract and monitored by the supplier. No equipment will be cofinanced under the Project (para 1.23). Finally, ESAC sectoral reforms would be reinforced in the Project.

## II. THE BENEFICIARIES

2.01 The two Project beneficiaries are the Rupantarita Prakritik Gas Company Limited (RPGCL) and the Limited Petroleum Gas Limited (LPGL), which are subsidiaries of Petrobangla and BPC, respectively (para. 1.10). Under the Project, RPGCL will be the beneficiary for the Ashuganj storage facilities and the LPG pipeline from Ashuganj to Elenga. LPGL will be the beneficiary for the LPG bottling plants, cylinders and storage. The two entities are also the beneficiaries for the Project's implementation supervision and other technical assistance (TA) components, as appropriate.

### A. Rupantarita Prakritik Gas Company Limited (RPGCL)

2.02 The appraisal mission reviewed the long-term institutional arrangements to handle the recovery, fractionation, transport, bottling and distribution of LPG as supplies from natural gas production at the northeastern gas fields expand during the 1990s. The review concluded that, given the relatively small amount of incremental LPG involved, the existing downstream institutional setup was adequate, with LPGL responsible for bottling and the private sector for transport and distribution.

2.03 For upstream functions, Sylhet Gas Fields Limited (SGFL) will own and operate the NGL recovery facilities, as part of its responsibility to produce pipeline quality gas. Ex-SGFL, however, Petrobangla decided that one Petrobangla operating company (OC) should assume responsibility for transporting and fractionating NGLs, which otherwise would be divided between three different OCs, i.e., SGFL, the Titas Gas Transmission and Distribution Company (TGTD) and the Bangladesh Gas Fields Company Limited (BGFCL). A single OC responsible for NGLs is essential since Petrobangla could be producing up to 100,000 mtpy of LPG and a higher quantity of condensates as more gas is produced. Centralized accountability, quality control and monitoring of operational and environmental safety would be facilitated. Further, only one transfer price within Petrobangla would be required (i.e., ex-SGFL), compared to three internal transfer prices if NGL operations were spread over the existing OCs (i.e., ex-SGFL at Kailashtila, ex-TGTD at Ashuganj and ex-BGFCL at Elenga). This approach supports the ESAC institutional reform objective of organizing the operations of the various Petrobangla OCs along functional lines.

2.04 In order to avoid creating an additional OC and duplicating boards and directors, in November 1990 Petrobangla amended the Articles of Association of the existing Compressed Natural Gas Company Limited (CNGCL) to add NGL transport and processing operations to its CNG activities. The transformed CNGCL was named the Rupantarita Prakritik Gas (or Converted Natural Gas)

Company Limited (RPGCL). The RPGCL General Manager has been appointed. RPGCL's organization chart and staffing plan were agreed during negotiations (Annex 2.1).

B. Liquefied Petroleum Gas Limited (LPGL)

2.05 LPGL was incorporated in 1983 as a fully-owned BPC subsidiary responsible mainly for bottling LPG produced at the Chittagong refinery. Under the Project, LPGL's activities will be expanded to include bottling plants at Kailashtila and Elenga, which will make LPG cylinders available to private sector distributors at the plant gates. LPGL's completion of an LPG market development plan for IDA's review and concurrence is a dated covenant under the Project. TA is being provided under the LPG pilot component of the ongoing Refinery Modification Project for the establishment of a set of operating codes and safety standards. This LPG Project provides for an expanded TA/training package to assist LPGL in rehabilitating its Chittagong operations, as well in managing and operating its new LPG bottling plants (para. 2.08).

C. Organization, Management and Staffing

2.06 RPGCL. RPGCL will have two separate divisions: (a) the Compressed Natural Gas Division (CNGD), to which CNGCL's current staff of five and existing facilities will be transferred; and (b) the NGL Division (NGLD), which will be responsible for all NGL-related functions, including the Ashuganj-Elenga pipeline, the north-south condensate pipeline and the Ashuganj fractionation, jetty, storage and ancillary facilities to be transferred to RPGCL when completed under SGDP. Each division would be expected to be financially self-sufficient. RPGCL will employ new staff for its NGL operations, some of whom will be transferred from other Petrobangla companies. TGTDC is responsible for maintaining the entire pipeline and surface facilities network of the Titas Franchise Area, which accounts for close to 70% of natural gas sales in Bangladesh. To avoid duplication of staff and minimize maintenance costs, RPGCL agreed that the Titas Gas Transmission and Distribution Company will be responsible for supervising the maintenance of RPGCL's pipelines.

2.07 RPGCL's new staff of about 70 people would include a General Manager, assisted by two Managers for CNGD and NGLD. In the first two years of operation, an expatriate team with adequate experience will be retained to provide assistance and training to ensure proper management and operations of the NGL facilities.

2.08 LPGL. LPGL's organization and staffing of about 60 employees is scaled to its present operations of handling about 9,000 metric tons per year in Chittagong. The staff consists of a General Manager, foreman, shift supervisors and labor. While present staffing is adequate, LPGL's current setup would be insufficient to handle the Elenga and Kailashtila plants under the Project. To ensure adequate staffing for its future operations, LPGL agreed on a staffing plan for its expansion and strengthening, which would include separate plant managers and technical staff for each of the three bottling plants. The staffing at each center should be geared to the LPG volumes being handled, and the operating policies should incorporate the maintenance procedures and safety measures of the Chittagong rehabilitation

plan. As in RPGCL, LPGL would also be provided a management and operations assistance and training team for the first two years of operation.

#### D. Accounts and Audit

2.09 RPGCL and LPGL are required by law to prepare full commercial accounts. Existing accounting and internal control systems are adequate for their current operations. With expanded operations, however, cost center accounting needs to be introduced to monitor the financial performance of each of LPGL's bottling plants and of RPGCL's LPG and CNG operations separately. Such cost center accounting would also provide useful information for pricing decisions and ensure that RPGCL's NGL operations do not subsidize its CNG operations. RPGCL and LPGL have agreed to maintain separate accounts for RPGCL's CNG and NGL divisions, for LPGL's Elenga, Kailashtila and Chittagong operations, and for the IDA-financed Project.

2.10 Companies in Bangladesh, such as RPGCL and LPGL, are subject to two types of external audit. The first audit is by a firm of Chartered Accountants, after which each enterprise's balance sheet and profit and loss statement are submitted to the annual general meeting of its stockholders. Accounts are required to be ready for external audit within six months following the end of the financial year and are audited within three months after submission. The second audit is the Government's commercial audit, the report of which is submitted to the Ministry of Energy and Mineral Resources. These audit arrangements are adequate, except for the timeframes for the preparation of statements and their audit.

2.11 RPGCL and LPGL have agreed to: (a) appoint independent auditors satisfactory to IDA; (b) submit to IDA copies of their unaudited financial statements (balance sheets, income statements and funds flow statements), as well as Project accounts and analytical accounts for each cost center, not less than three months after the end of each fiscal year, and copies of the audited statements with the report and comments of the Commercial Auditor not later than six months after the end of the fiscal year. GOB has agreed to submit to IDA the report of the Comptroller and Auditor General within nine months after the end of each fiscal year. The Auditor's report should include an opinion on controls and procedures on the use of a Special Account and an audit report on the Statement of Expenditures under the Project (para. 3.17).

#### E. Training Requirements

2.12 RPGCL would need to develop the capability to implement the Project and operate the Ashuganj facilities upon completion, which would require RPGCL to acquire the necessary expertise in process plants and LPG pipeline operations. Training of RPGCL staff would be made part of the supply contract for the SGDP facilities and augmented under the Project through: (a) a management and operations assistance contract; (b) TGTDC advice and secondments (para. 3.09); and (c) external training for the plant team. LPGL's technical capabilities to handle larger bottling operations would also need to be enhanced, primarily through a management and operations assistance contract. Twinning arrangements for LPGL to provide on-the-job training would be required to take full advantage of extensive experience within the region in LPG operations. RPGCL's and LPGL's respective training programs and implementation schedules were discussed and agreed during negotiations.

### III. THE PROJECT

#### A. Project Background

3.01 Bangladesh's only indigenous commercial energy resources are natural gas, the liquids in the gas (NGL), dwindling supplies of biomass fuels, and possibly coal. The country imports all of its petroleum supplies, and kerosene alone accounts for almost 30% of total petroleum consumption. The majority of the population depends on biomass fuels, of which a large proportion is sold at market prices almost quadruple the price of kerosene on a useful energy equivalent basis. LPG (or bottled gas) recovered from natural gas production could substitute for kerosene and commercial fuelwood used in cooking.

#### B. Project Objectives

3.02 The main Project objective is to assist Bangladesh in carrying out an economic and least-cost household and commercial energy supply strategy through the substitution of LPG for imported kerosene and commercial fuelwood. The Project would assist in: (a) reducing the foreign exchange drain from oil imports; (b) alleviating biomass energy shortages and promoting social equity between the country's eastern region and the less-developed western zone; (c) establishing LPG prices in accord with economic efficiency and financial viability principles; (d) developing a suitable institutional framework for efficient LPG development and operations; (e) promoting an environmentally and operationally safe petroleum industry; and (f) facilitating private sector involvement in LPG transport and distribution.

#### C. Project Description

3.03 In addition to the north-south pipeline and the drilling of nine gas wells, the Second Gas Development Project (SGDP) is also financing upstream facilities for (a) gas dehydration and hence recovery of LPG and condensate by-products, and (b) pipeline transport and fractionation of these liquids at the Ashuganj central products terminal, as well as on-site at Kailashtila on a small scale. The Project would assist in the downstream transport, bottling and cylinder distribution of LPG derived from gas production at the northern gas fields, from which up to 100,000 metric tons per year (mtpy) of LPG could be recovered when the fields are further developed during the 1990s in line with the PIPs of Petrobangla and BPC (para. 1.25). The linkage between SGDP and the Project is discussed in Annex 3.1. The combined facilities are presented in the Project map. As from the mid-1990s, the Ashuganj fractionation plant is expected to annually produce around 135,700 metric tons of liquids, composed of the following products (in mtpy): LPG (34,200); kerosene (20,100); motor spirit (60,700); high speed diesel (16,600); and propane (4,100). Around 5,000 mtpy of LPG would also be available at Kailashtila.

3.04 Project Components. The Project would consist of the following components:

RPGCL:

- (a) construction of storage facilities for LPG and condensates, and acquisition of related equipment and spare parts, at the Ashuganj NGL fractionation plant;
- (b) construction of an LPG-dedicated pipeline from Ashuganj to Elenga (about 165 km);
- (c) directional drilling works for about four river crossings for the LPG pipeline;

LPGL:

- (d) construction of LPG bottling plants and storage facilities at Elenga and Kailashtila;
- (e) acquisition of cylinders, valves and regulators for the Elenga and Kailashtila bottling plants;
- (f) rehabilitation of the LPG bottling plant at Chittagong; and
- (g) acquisition of related equipment with spare parts for (d) and (f).

3.05 The Project's technical assistance (TA) components include construction implementation supervision for both RPGCL and LPGL, as well as Project support, capacity building and policy development. Project support and capacity-building TA includes: (a) intensive management and operations assistance and training for RPGCL and LPGL; (b) for RPGCL, the following studies: (i) feasibility study for incremental NGL processing and distribution; and (ii) a technical, economic and financial assessment of compressed natural gas development options and preparation of a commercialization strategy; and (c) for LPGL, the following activities: (i) preparation of a detailed LPG market development plan; (ii) establishment of a program to enhance the role of Bangladeshi women in the retail distribution of LPG cylinders and stoves, and to train commercialization agents in the development and promotion of energy-efficient cooking stoves; and (iii) a technical assessment of cracking surplus naphtha to produce LPG. For the policy development TA, RPGCL and LPGL would prepare a full assessment of petroleum sector environmental and operational safety standards and practices, with a view to identifying urgently required equipment as well as regulatory and institutional reform.

3.06 During negotiations, agreement was reached with RPGCL and LPGL on (a) the terms of reference for the TA/training components and (b) dated covenants to review the recommendations of the studies and agree on an implementation plan.

#### D. Project Implementation

3.07 The LPG transport portion would be implemented by RPGCL. LPGL would implement the LPG bottling portion. GOB has agreed that RPGCL and LPGL would each be assisted for infrastructure design and construction supervision under IDA financing. Contract award for the infrastructure design and implementation supervision consultancy services is a condition of Credit effectiveness. The joint implementation schedule for SGDP and the Project, which should be adequately coordinated to avoid delays, is provided in Annex 3.2.

3.08 During appraisal, Petrobangla and the Titas Gas Transmission and Distribution Company (TGTDC) agreed that: (a) the 165-kilometer, 4-inch diameter LPG pipeline from Ashuganj to Elenga would follow the route of the Brahmaputra Basin gas transmission pipeline financed by the Asian Development Bank, for which the land (20-foot strip) and right-of-way have already been acquired; and (b) the LPG bottling plant will be located at the TGTDC site already acquired at Elenga, which is about 3 km from the proposed Jamuna Bridge site. Until a bridge is built, the LPG cylinders would be ferried across to west zone destinations from Bhuapur, which is about 15 km from Elenga. When a bridge is commissioned, the LPG pipeline could be extended across to a west zone bottling plant site, or the Elenga LPG bottling plant can continue supplying northwest Bengal from Rangpur and Bogra to south of Baghabari.

3.09 RPGCL will be assisted through technical advice and staff secondments by TGTDC, which already has the in-house expertise in pipeline-laying and knowledge of any coordination requirements with the Brahmaputra Basin gas pipeline. Further training of RPGCL staff would be made part of the supply contracts under SGDP and augmented under the Project, including an operation and management contract for the first 24 months of operation, as well as external training for the plant team. LPGL's capabilities to handle larger bottling operations would be enhanced through a management and operation contract, as well as external twinning arrangements. The latter would take full advantage of the extensive experience within the region in the management, operation, market development and safety aspects of LPG downstream operations. The national oil companies of the Philippines and Thailand have expressed preliminary interest in such twinning arrangements.

#### E. Project Cost

3.10 The Project's estimated cost, including physical and price contingencies, is US\$90.4 million, of which duties and taxes are US\$13.9 million. The total financing required is estimated at US\$94.2 million, including US\$69.1 million in foreign exchange. The estimates are based on early-FY91 prices. Physical contingencies are included at 10% of base costs, on the basis of experience with similar projects in Bangladesh. Price contingencies for foreign costs are 3.6% a year for FY91-96 and for local costs are 9% for FY91, 8% for FY92, and 7% for FY93 and 6% a year thereafter. Purchasing power parity is assumed for exchange rate changes over the life of the Project, starting from a base of Tk 34.9/US\$1.0 at the time of appraisal. Total price contingencies amount to 15% of the base cost including physical contingencies. Depending on whether the site is classified as less- or least-developed, and the equipment as either industrial or commercial, the duties and taxes are at 10.5%, 15.5% or 88.8% of the foreign exchange cost of materials and equipment. The summary cost estimate is given in Table 3.1.

**Table 3.1: PROJECT COST ESTIMATE SUMMARY**

	<u>Local</u> [----- Take million -----]	<u>Foreign</u> [----- US\$ million -----]	<u>Total</u> [-----]	<u>Local</u> [----- US\$ million -----]	<u>Foreign</u> [----- US\$ million -----]	<u>Total</u> [-----]
<b>RP Gas Co. Ltd. (RPGCL)</b>						
A. Storage for LPG and Condensates	88.8	227.8	286.6	1.0	5.9	6.9
B. Ashuganj-Elenga LPG pipeline	58.4	362.0	420.4	1.5	9.4	10.9
C. Directional Drilling	11.5	73.0	84.5	0.8	1.9	2.2
D. Implementation Supervision		80.4	80.4		2.0	2.0
E. Management & Operations Assistance/Training and Studies		89.8	89.8		2.2	2.2
F. Technical Assistance		31.0	31.0		0.8	0.8
<b>SUBTOTAL, RPGCL</b>	<b>108.7</b>	<b>863.4</b>	<b>972.1</b>	<b>2.8</b>	<b>22.2</b>	<b>25.0</b>
<b>LP Gas Co. Ltd. (LPGL)</b>						
G. LPG Bottling Plants	63.0	325.5	388.5	1.6	8.4	10.0
H. Cylinders, Valves, Regulators	442.7	487.5	930.2	10.9	12.0	22.9
I. Storage	46.8	321.8	368.6	1.2	8.8	9.5
J. Implementation Supervision		39.9	39.9		1.0	1.0
K. Management and Operations Assistance/Training and Studies		93.2	93.2		2.8	2.8
L. Technical Assistance		27.3	27.3		0.7	0.7
<b>SUBTOTAL, LPGL</b>	<b>552.5</b>	<b>1,295.2</b>	<b>1,847.7</b>	<b>13.7</b>	<b>32.7</b>	<b>46.4</b>
<b>Base Cost Estimate</b>	<b>661.2</b>	<b>2,158.6</b>	<b>2,819.8</b>	<b>16.5</b>	<b>54.9</b>	<b>71.4</b>
Physical Contingencies (10%)	66.1	215.9	282.0	1.7	5.5	7.2
Price Contingencies	125.5	347.2	472.7	3.1	8.7	11.8
<b>Total Project Cost</b>	<b>852.8</b>	<b>2,721.7</b>	<b>3,574.5</b>	<b>21.3</b>	<b>69.1</b>	<b>90.4</b>
Interest During Construction	148.8	0.0	148.8	3.8	0.0	3.8
<b>Total Financing Required</b>	<b>1,001.6</b>	<b>2,721.7</b>	<b>3,723.3</b>	<b>25.1</b>	<b>69.1</b>	<b>94.2</b>

NOTE: Total Project cost net of duties and taxes (US\$13.9 million) is US\$80.3 million.

**F. Project Financing Plan**

3.11 The proposed Credit would finance 100% of the Project's foreign cost, excluding US\$1.9 million in bilaterally grant-financed technical assistance. The accounting policies of Petrobangla and BPC provide for capitalization of interest during construction (IDC), which is estimated to be US\$3.8 million. RPGCL and LPGL would finance US\$25.1 million from their internally generated cash, and GOB's share of around US\$1.9 million for the technical assistance component would be contributed as equity. GOB would bear the cost overrun risks. The proposed financing plan is in Table 3.2.

**Table 3.2: PROPOSED FINANCING PLAN**

	<u>Local</u> [-----]	<u>Foreign</u> US\$ million	<u>Total</u> [-----]
IDA Credit	-	67.2	67.2
RPGCL	5.6	-	5.6
LPGL	19.5	-	19.5
Bilateral Grant Cofinancing	<u>-</u>	<u>1.9</u>	<u>1.9</u>
<b>TOTAL</b>	<b><u>25.1</u></b>	<b><u>69.1</u></b>	<b><u>94.2</u></b>

The Credit would be provided to GOB on standard IDA terms and onlent to RPGCL and LPGL under Subsidiary Loan Agreements satisfactory to IDA. The proceeds would be onlent at 10% per annum, for a period of 15 years including a 5-year grace period, with the Beneficiaries bearing the foreign exchange risk in line with previous IDA Credits in the petroleum sector. The exchange rates for the US Dollar and the Taka used in the financial forecasts assume purchasing power parity based on the projections for local and foreign inflation in accord with Bank forecasts. On this basis, the effective Taka onlending rate for FY92 would be 15.4%, which is comparable to the current local Taka lending rates for industrial projects of 13.5% to 16.5%. The execution of the Subsidiary Loan Agreements on terms and conditions acceptable to IDA is a condition of Credit effectiveness.

**3.12 Private Sector Participation.** In line with GOB policy to maximize private involvement in LPG distribution, the distribution of LPG cylinders and stoves will be handled by the private sector. Private retailers are expected to use inland barges, trucks and/or other small transport means to obtain LPG at the bottling plant gates, in the same manner as the entirely private distribution of liquid products from BPC depots. During negotiations, RPGCL confirmed that the surplus propane at Ashuganj (around 5,000 mtpy) will be offered for sale to private sector companies. The bottling plant and cylinders would be fully owned and operated by LPGL to avoid any risk in delaying LPG distribution, which has to start in time for the availability of natural gas and NGLs under SGDP in FY94. Private sector interest has been expressed through the submission of bids for the pilot LPG component under the Refinery Modification Project, but the formation of joint venture/s, such as the joint venture between BPC and Bangladesh Oxygen Limited (BOL), have involved long lead times. Further, the private sector parties have required firm LPG supply contracts before committing downstream investments. In 1988, for example, Shell withdrew its interest when uncertainty arose regarding the source, volume and timing of LPG supplies. The scope for private sector involvement in LPG bottling can be assessed as Petrobangla firms up its drilling and infrastructure development plans for the remainder of the 4th FYP.

### G. Status of Project Preparation

3.13 The design for the LPG recovery facilities has been prepared by the SDGP infrastructure design and implementation supervision consultants. Procurement is also at an advanced stage with their assistance, and the bids are under evaluation. The construction team for the north-south gas and condensate pipelines has been mobilized, and laying of the lines started in mid-CY90. The July 1989 LPG Feasibility Study (LFS) financed by the Canadian International Development Agency evaluated the viability of extracting LPG from various gas fields and concluded that LPG development at the northeastern gas fields has the highest economic and technical merit. Further technical issues (e.g., reservoir fluids analyses, LPG specifications, operational safety measures) were addressed and detailed cost estimates were prepared by subsequent IDA missions. The route for the LPG pipeline is already known, and no land acquisition is involved in the Project (para. 3.08).

### H. Procurement

3.14 Procurement of goods and services for this Project will be carried out as follows:

- (a) storage for LPG and condensates, the Ashuganj-Elenga LPG pipeline and the LPG bottling plants at Elenga and Kailashtila will be awarded under turnkey contracts in accordance with international competitive bidding (ICB) procedures; bidders for the Ashuganj-Elenga pipeline will be prequalified;
- (b) cylinders, valves and regulators will be awarded under ICB procedures;
- (c) contracts for procurement of goods and services each costing US\$1 million or less, for which there are a limited number of suppliers, may be procured under limited international bidding (LIB) procedures, up to an aggregate value of US\$3 million;
- (d) contracts for procurement of goods and services each costing less than US\$200,000 may be procured under international or local shopping, not exceeding an aggregate value of US\$1 million;
- (e) items of a proprietary nature may be procured directly from the suppliers with prior approval by the Association of the list of items to be procured;
- (f) other goods costing US\$200,000 or more not listed above will be procured following ICB procedures; and
- (g) consultancy services will be procured under the Bank's Guidelines for the Use of Consultants.

Studies and technical assistance services not financed by IDA would be obtained under the bilateral cofinanciers' procurement procedures.

3.15 A margin of preference of 15% of the CIF cost of imported items or the applicable customs duty, whichever is less, will be granted to domestic suppliers competing under ICB. A 7.5% price preference will be granted to

domestic contractors bidding for the Ashuganj-Elenga LPG pipeline contract. All procurement documents relating to bids valued over US\$0.5 million and all LIB contracts will be subject to IDA prior review; smaller bids will be submitted for post-award review. It is estimated that the Project procurement requirements will be covered by about sixteen procurement packages. Of these, about ten are estimated to have a value in excess of US\$0.5 million each and a total value of US\$55 million, or 82% of the procurement financed under the Credit.

**Table 3.3: SUMMARY OF PROCUREMENT ARRANGEMENTS**  
(US\$ Million)

	<u>ICB</u>	<u>LCB</u>	<u>Other</u> <sup>a/</sup>	<u>N/A</u> <sup>b/</sup>	<u>Total</u>
Storage for LPG and Condensates at Ashuganj	7.5 (7.5)	-	-	1.8 (-)	8.8 (7.5)
Ashuganj-Elenga Pipeline	11.9 (11.9)	-	-	1.9 (-)	13.8 (11.9)
Directional Drilling	-	-	2.4 (2.4)	0.4 (-)	2.8 (2.4)
LPG Bottling Plants at Elenga and Kailashtila	10.1 (10.1)	-	-	1.8 (-)	11.9 (10.1)
Rehabilitation of the Chittagong LPG Plant	-	-	0.5 (0.5)	0.3	0.8 (0.5)
Cylinders, Valves and Regulators	14.8 (14.8)	-	-	14.1 (-)	28.9 (14.8)
Storage at Elenga and Kailashtila	10.5 (10.5)	-	-	1.5 (-)	12.0 (10.5)
Consultants/Training	-	-	11.4 (9.5)	-	11.4 (9.5)
<b>TOTAL</b>	<b>54.8</b> <b>(54.8)</b>	<b>-</b>	<b>14.8</b> <b>(12.4)</b>	<b>21.3</b> <b>(-)</b>	<b>90.4</b> <b>(87.2)</b>

<sup>a/</sup> "Other" includes Limited International Bidding, local or international shopping, Consultancy Services under IDA guidelines, and Consultancy Services under bilateral cofinancing guidelines.

<sup>b/</sup> "Not Applicable" includes customs duties, equipment and services financed out of RPGCL and LPGCL's own resources.

**NOTE:** Figures in parentheses are the respective amounts financed by IDA.

### I. Disbursement

3.16 Disbursements under the Credit would be made as follows:

- (a) 100% of foreign expenditure for materials and equipment, including installation; 100% of ex-factory expenditure for goods manufactured locally and procured under ICB or LIB procedures; and 75% of the expenditure for other goods procured locally;
- (b) 100% of foreign expenditure and 75% of local expenditure for civil works and transport, erection and commissioning of equipment; and
- (c) 100% of total expenditure for consulting services and training.

Retroactive financing of up to US\$5 million for expenditures incurred on or after January 1, 1991 would be allowed to cover payments expected to be made for services and equipment procured in accord with IDA's Procurement Guidelines. This retroactive financing is necessary to carry out urgent work (e.g., the repair and rehabilitation of the Chittagong LPG plant to prevent further deterioration) and Project engineering (e.g., infrastructure design consultancy services).

3.17 To facilitate disbursement, a Special Account would be established in the Bangladesh Bank on terms and conditions satisfactory to IDA. The Special Account would be used only for actual Project expenditures and there would be no second-generation Special Account/s. The initial deposit in the Account would be US\$3.0 million equivalent, estimated on the basis of four months' average expenditures, net of large contracts not expected to be paid from the Special Account. All disbursements would be made following standard IDA documentation requirements, except for contracts valued at less than US\$200,000 equivalent per contract, for which Statement of Expenditures (SOEs) procedures could be used. RPGCL and LPGL will retain for IDA inspection the detailed documentation supporting SOEs. The operation and audit of the Special Account were agreed with GOB during negotiations.

3.18 The disbursement schedule shown in Annex 3.3 is based on a Credit Closing Date of June 30, 1996. The total disbursement period for the Project is expected to be 5 years, compared with the 6-year Bank profile for Asia region gas pipeline projects. The proposed implementation and disbursement schedules are considered realistic based on the experience with the Bakhrabad Gas Development Project (Cr. 1091-BD), which was completed with only a slight delay from the five-year implementation period and to date is the most rapidly disbursed energy project in Bangladesh. The disbursement profile for Bangladesh power projects would not apply, since no major land acquisition or civil works are involved in the Project. Land and right-of-way for the LPG pipeline and bottling plant have already been acquired under the Brahmaputra Basin gas project and the equipment are to be procured mostly off-the-shelf (e.g., skid-mounted LPG bottling plant, standard LPG cylinders).

#### J. Environmental Impact and Operational Safety

3.19 The Project's environmental and operational safety assessment was prepared under the LPG Feasibility Study and through consultancy services during IDA preparation missions. TA is being provided under the LPG component of the Refinery Modification Project to ensure that safety norms are being applied. For example, based on internationally accepted safety standards and practices, BPC has adopted the specification of limiting the propane content in LPG for household use to a maximum of 50%. Further, the Chittagong facilities have been allowed to deteriorate into serious disrepair. BPC recognizes this problem and has requested IDA to include in the Project the urgent implementation of a rehabilitation plan for the Chittagong plant, including regulations to ensure that the plant facilities and LPG cylinders are handled and used safely. The plan builds on the operational TA being provided under the Refinery Modification Project and would be fully implemented before the Elenga and Kailashtila operations commence.

3.20 The appraisal mission also reviewed the draft LPG Safety Rules and found them to be broadly satisfactory, with some improvements required in terms of explicit references to detailed procedures applied in other LPG-using countries. Further, to ensure the application of environmental and safety measures for the petroleum sector as a whole, it was agreed that an assessment of necessary standards and practices would be part of the Project's TA component. This assessment would include the preparation of detailed operational procedures for all the entities that will be involved when LPG comes on stream in FY94. The environmental and operational safety assessment should be completed by June 30, 1992, at which time IDA will seek agreement with GOB, Petrobangla and BPC, by December 31, 1992, on the action plan for implementing the assessment's recommendations by the time the LPG under the Project comes on stream.

3.21 The LPG plant sites will be located within the restricted and secure premises of the concerned Petrobangla and BPC operating companies. There will be no groundwater contamination from the LPG recovery plants, which do not produce liquid effluents. The LPG pipeline and bottling plant will be constructed following already acquired land and right-of-way (para. 3.08).

3.22 Care is required in the handling of LPG, as in any other petroleum product. LPG, however, has been used extensively and safely for several decades in densely populated developing countries. The Project design and installation will ensure that equipment designs are strictly in accord with international safety codes. A preventive maintenance and safety inspection program will be instituted in the plants as part of the management and operations TA. At the point of end-use, LPG (like natural gas) is an extremely clean fuel, which does not yield poisonous and sulphur- or dust-containing flue gases. LPG substitution for kerosene would alleviate the negative environmental effects and safety risks related to kerosene and fuelwood use (e.g., emission of particulates and carbon dioxide).

#### K. Development Impact

3.23 Women in Development (WID). BPC's three marketing companies are limited to transport and storage of bulk petroleum products up to main depots. As LPG supplies increase, however, an intricate network of retail distribution channels needs to be established to reach a large number of households. Bangladeshi women, operating through small-scale private enterprises and/or with non-governmental organizations, could play an increasingly important role in large-scale LPG marketing and distribution. The Project includes measures to involve Bangladeshi women as agents of technology transfer and commercialization, as follows:

- (a) marketing: promotion of LPG use by demonstrating to housewives the financial cost, time savings and health benefits of LPG use;
- (b) retail distribution: provision of training and extension to ensure safety in the sale and use of LPG cylinders and stoves; and
- (c) management: identification of opportunities to foster leadership roles in which women may have comparative advantage (e.g., management of credit schemes, direct promotional activities with housewives, networking with non-governmental organizations).

The WID component would require a pilot phase (FY92) followed by full implementation (FY93/94), for which the scale and strategies would be tailored to the pilot results. This component would set the stage for distributing larger amounts of LPG during the 1990s.

3.24 Poverty Alleviation. A primary Project benefit would be the creation of employment and income-generation opportunities through small-scale private retail outlets for LPG cylinders and stoves. Time savings from fuelwood and other biomass fuel procurement on a non-commercial basis would also accrue, for which the opportunity value is additional time available for child care, education, and possibly income-generating activities. Through the WID component, an added social benefit would be the specific targeting of a relatively disadvantaged social group, namely, Bangladeshi women, to transfer and commercialize a new household cooking fuel. Finally, there would also be cash savings where substitution for commercial fuelwood occurs.

#### L. Project Monitoring and Reporting

3.25 Project implementation would be monitored by RPGCL and LPGL with the assistance of implementation supervision consultants. RPGCL and LPGL would submit quarterly reports and other pertinent information to IDA. Following Project completion (i.e., not later than six months after the Credit Closing Date or a later date agreed for this purpose), RPGCL and LPGL would each provide to IDA a Project Completion Report on the Project's execution and initial operation, costs and benefits, their performance and the accomplishment of the Credit's objectives. Accounts and audit monitoring and reporting are discussed in paras 2.09 to 2.11.

#### M. Risks

3.26 The main Project risk is possible delays in implementation. Since SGDP will be the first source of LPG from a sequence of NGL-related investments in Petrobangla's PIP, a condition of Credit effectiveness will be the contract award for the SGDP LPG recovery facilities. Implementation delays could result both during procurement and construction. The main potential source of delay would be procurement of long-delivery items. A schedule of key procurement steps was agreed with RPGCL and LPGL during negotiations. In line with this timetable, contract award for consultancy services to prepare detailed design specifications, as well as prequalification and tender documents for the major works, equipment and materials, would be a condition of Credit effectiveness. Based on past experience in Bangladesh, construction delays could result from inadequate project management, which would be addressed by providing for effective implementation supervision by RPGCL and LPGL (para 3.07). Risk of delays due to domestic resource constraints would be minimized by suitable conditionalities to ensure adequate financial performance (paras 4.09 and 4.14).

#### IV. FINANCES

4.01 Under the Project, the Rupantarita Prakritik Gas Company Limited (RPGCL) would be formed out of the existing Compressed Natural Gas Company Limited (CNGCL) and assume responsibility for natural gas liquids processing and LPG fractionation and transport (paras. 2.02 to 2.04), in addition to current CNG operations. The Liquefied Petroleum Gas Limited (LPGL) would be responsible for LPG bottling; marketing will be handled by the private sector and BPC's regional marketing companies. CNGCL and LPGL have accumulated excessive long-term debt due to GOB's past financing policies. Financial restructuring and the adoption of sounder financial policies are therefore required to correct capital imbalances and to protect the financial viability of future operations. CNG activities are intended to be experimental without commercial intent, commercialization being the role of the private sector. Hence, in the future, GOB should finance all CNG pilot activities on a 100% grant basis, until operations are commercially viable. On this basis, no losses or charges would accrue to RPGCL for CNG operations. As regards NGL and LPG operations, the financial forecasts indicate that once the Project has been implemented, both operations should yield satisfactory profits, with annual after-tax rates of return being in the 10% to 21% range. The Project's financial objectives are to restructure the Beneficiaries to make them financially viable (paras. 4.06 and 4.12), and to ensure the future financial viability of operations through adequate pricing arrangements (paras. 1.15-1.18) and improved monitoring of financial performance (paras. 2.09-2.11).

##### A. Rupantarita Prakritik Gas Company Limited (RPGCL)

4.02 RPGCL took over all the assets and liabilities of CNGCL when it assumed responsibility in early-1991 for all CNG activities and NGL transport and processing operations. The financial statements (Balance Sheets, Income and Funds Flow Statements) for CNG and NGL operations during FY87-97 are given in Annex 4.1. The financial statements up to FY91 relate entirely to CNGCL's past CNG operations, while those for FY92-97 show the combined results of CNG and the fully commercial NGL operations of RPGCL. The FY92-97 consolidated figures essentially reflect the results of NGL operations, given the 100% GOB grant financing arrangements for future small-scale CNG development (para. 4.07).

4.03 Past CNG Finances. Prior to January 1, 1987 when CNGCL was created, all CNG project as well as current management and administrative expenditures, were financed by loan advances from the Annual Development Plan (ADP) and onlent IDA funds from GOB. CNGCL took over all the assets and liabilities of CNG operations on incorporation. There has been little consumer interest in converting vehicles to CNG use due to high conversion costs, the small number of filling stations, and insufficient differential between the prices of CNG and gasoline to encourage conversion. Consequently, CNGCL's operations have been consistently in deficit.

4.04 All current expense deficits prior to January 1, 1987 were accumulated and capitalized as deferred charges in CNGCL's books on incorporation. Further losses in FY88 were also capitalized. Losses of Tk 2.4 million and Tk 1.5 million in FY89 and FY90, respectively, were carried forward in the accounts of those years. This unsatisfactory situation has been further exacerbated by the capitalization of exchange losses (Tk 8.4 million) which appear related to the

onlent IDA Cr. 1091-BD and which, in accord with the Development Credit Agreement, should have been taken up by GOB.

4.05 Present Financial Position. CNGCL's financial position is unsatisfactory. The capitalization of past operating losses and exchange fluctuations has resulted in deferred charges equivalent to 60% of net assets, which should be written-off since they have no value. GOB's practice of financing CNGCL's operations and development schemes through annual ADP loan advances and onlent IDA Credits has resulted in excessive long-term debt. CNGCL's current total debt/equity ratio of 70/30 is unacceptable for a non-commercial operation. GOB's original equity contribution to CNGCL of Tk 25.4 million was itself a converted ADP advance. As of June 30, 1990, CNGCL had a cash balance of Tk 24.7 million consisting of unused funds.

4.06 Financial Restructuring. During negotiations, agreement was reached with RPGCL on a financial restructuring program for its CNG-related operations by FY92. GOB also agreed that it will take all actions necessary to facilitate RPGCL's financial restructuring action plan. Using figures taken from CNGCL's FY91 audited account, this financial restructuring is expected to include the following steps: (a) long-term debt under IDA Cr. 1586-BD to be converted to equity, in accordance with the agreement under Cr. 1586-BD; (b) GOB to provide additional equity contribution to RPGCL, to be used as a prepayment of long-term debt under IDA Cr. 1091-BD; (c) long-term ADP debt to be converted to equity; (d) all deferred charges to be written off against equity; and (e) balance due to Head Office to be converted to equity. These measures would be reflected in RPGCL's balance sheet of June 30, 1992. The capitalization of CNG operations before and after financial restructuring is given in Table 4.1 below.

Table 4.1: RESULTS OF FINANCIAL RESTRUCTURING OF CNG OPERATIONS <sup>1/</sup>

	<u>CNGCL</u>		<u>RPGCL</u>	
	<u>Closing Balance Sheet</u>		<u>Opening Balance Sheet</u>	
	<u>-----Tk million-----</u>			
Net Fixed Assets		10.3		10.8
Deferred Charges		48.5		
Current Assets: Cash	24.7		24.7	
Other	<u>1.3</u>		<u>1.3</u>	
	28.0		26.0	
Less Current Liabilities	2.0	24.0	2.0	24.0
Total Net Assets		<u>77.8</u>		<u>34.8</u>
<u>Financed By:</u>				
Equity		22.6		34.8
Long-Term Debt - IDA	34.2			
- ADB	<u>17.2</u>	51.4		-
Head Office		<u>3.8</u>		-
		<u>77.8</u>		<u>34.8</u>

<sup>1/</sup> Based on CNGCL's FY90 audited accounts.

4.07 CNG operations are intended to be experimental, with the private sector responsible for commercialization, and therefore should not be encumbered with debt. During negotiations, GOB agreed that as from the date of transfer of CNG operations to RPGCL, GOB will finance on a 100% grant basis all future CNG feasibility and pilot projects.

4.08 Future Finances. Annex 4.1 gives the assumptions used in RPGCL's FY92-97 financial forecasts for NGL transfer pricing and planned CNG schemes. RPGCL's new NGL operations would become profitable in FY94, the first year of production, and the profits would progressively increase from Tk 9 million in that FY to Tk 103 million in FY97. After-tax rates of return on net fixed assets would increase from 10% in FY94 to 15% in FY97. Considering the income tax rate of 50%, these rates of return would be satisfactory. Once NGL production commences, RPGCL's financial position is expected to be good. The high debt/equity ratios forecast for FY92-94, which relate to the high level of debt financing for the new facilities, would decline rapidly to acceptable levels once the Project is fully operative and are expected to improve to about 62/38 in FY97. The current ratio after FY93 is forecast to be in the 2.8 to 4.0 range, which would be fully satisfactory. Liquidity would be good, and after FY94 funds could be made available from the large cash balances for expansion or prepayment of debt, thereby further improving RPGCL's debt/equity ratio. Debt service coverage is expected to be more than adequate. The salient features of RPGCL's FY91-97 consolidated accounts are provided in Table 4.2 below.

Table 4.2: RPGCL'S CONSOLIDATED ACCOUNTS (FY91-97)  
(Tk Million)

<u>FY</u>	<u>91</u>	<u>92</u>	<u>93</u>	<u>94</u>	<u>95</u>	<u>96</u>	<u>97</u>
Gross Sales Revenue	0.1	0.1	0.1	686.0	1454.1	1541.8	1638.9
Less: Raw Materials	<u>0.1</u>	<u>0.1</u>	<u>0.1</u>	<u>399.2</u>	<u>846.8</u>	<u>897.0</u>	<u>950.9</u>
Net Sales Revenue	-	-	-	<u>286.8</u>	<u>607.8</u>	<u>644.8</u>	<u>688.0</u>
Operating Expenses	<u>3.2</u>	<u>3.4</u>	<u>3.6</u>	<u>166.2</u>	<u>308.0</u>	<u>321.6</u>	<u>331.8</u>
Net Operating Income	<u>(8.2)</u>	<u>(8.4)</u>	<u>(8.6)</u>	<u>120.6</u>	<u>299.9</u>	<u>322.8</u>	<u>351.7</u>
Interest Charged	-	-	-	(94.1)	(207.4)	(208.3)	(187.5)
Interest Received	2.7	2.7	2.7	7.5	28.3	49.2	67.0
Exchange Losses	-	-	-	(15.1)	(24.8)	(26.0)	(24.0)
Income Tax	-	-	-	<u>(10.0)</u>	<u>(48.2)</u>	<u>(72.0)</u>	<u>(104.4)</u>
Net Profit (Loss)	<u>(0.5)</u>	<u>(0.7)</u>	<u>(0.9)</u>	<u>9.9</u>	<u>44.9</u>	<u>70.4</u>	<u>102.7</u>
Rate of Return on Net Fixed Assets:							
After Tax	-	-	-	10%	12%	13%	15%
Current Ratio	13.0	12.1	10.9	2.8	2.9	3.8	4.0
Debt/Equity Ratio	-	70/30	77/23	71/29	70/30	68/32	62/38
Debt Service Coverage	n/a	n/a	n/a	2.5	1.8	2.0	1.6

4.09 To protect RPGCL's financial viability, GOB agreed that in pricing NGL products, RPGCL will be allowed margins that would enable NGL revenues to cover operating expenses, debt service, additional working capital requirements, and a minimum of 35% contribution to investment. RPGCL also agreed on the following financial performance targets: (a) RPGCL's debt/equity ratio would not exceed 65/35 after FY94; (b) RPGCL would not incur debt in any FY without prior consultation with IDA, if the projected debt service coverage in that or any future year would be less than 1.5 times; (c) surplus cash resources from NGL operations would first be used to meet the requirements of those operations, and RPGCL would not declare a dividend or transfer profits to GOB or Petrobangla in any FY unless RPGCL's own financial requirements have been adequately met; and (d) RPGCL would review with IDA by March 31 each year its capital expenditure program for the following FY and the related financing requirements to ensure that required funds are available to implement the program.

**B. Liquefied Petroleum Gas Limited (LPGL)**

4.10 LPGL's financial statements in Annex 4.2 give the results for FY86-90 and forecasts for FY91-97. The FY86-90 figures relate entirely to Chittagong LPG operations, while those for FY91-97 are a consolidation of forecast investment and operational results for all three centers (Chittagong, Elenga and Kailashtila).

4.11 Past Finances. In recent years, LPGL has achieved annual after-tax rates of return on historically valued net fixed assets of between -2% and 19% on its Chittagong operations; however, net operating income has been insufficient to cover interest charges. The high annual interest charges have resulted from excessive debt. LPGL's audited FY89 accounts show an unacceptable debt/equity ratio of 81/19; the latest figures for FY90 indicate a ratio of 74/26. The excessive debt level can also be seen in the failure of LPGL's internal cash generation to cover debt service payments in three of the last five fiscal years. LPGL has only been able to show a net profit because of the interest received from large cash deposits accumulated since incorporation; the provisional accounts for FY90 indicate cash balances to be equivalent to twice the net value of LPGL's plant. Thus, it would seem that in the past LPGL has chosen to borrow from ADP and thereby increase its debt/equity ratio, rather than use its increasing cash balances for investment or prepayment of debt. This practice may have been facilitated by GOB's use of budgetary-based procedures for making ADP loans, rather than the normal appraisal processes. In its present financial situation and to put its finances on a sound commercial basis, LPGL needs to restructure its capital to achieve both a satisfactory balance between equity and debt and a debt service level sustainable by its Chittagong operations. Depreciation rates on plant and buildings appear excessive, having exceeded 16% per year in the past. Hence, LPGL also needs to review and adopt more appropriate depreciation rates for each class of plant in use. The salient features of LPGL's past finances are presented in Annex 4.2.

4.12 Financial Restructuring. LPGL should be required to maintain a debt/equity ratio not exceeding 65/35 on its operations. While due to the proposed financing arrangements for the Project, a debt/equity ratio of 65/35 cannot be expected on its consolidated operations before the end of FY94 when the Elenga and Kailashtila plants are commissioned, LPGL should take corrective measures in FY91 to bring down the present high debt/equity ratio (74/26) on its ongoing Chittagong operations. Such a reduction would contribute to the longer term processes of lowering the debt/equity ratio on consolidated operations and strengthening the company's overall finances. While the required improvement could be achieved by a simple debt conversion, a satisfactory debt/equity ratio could also be achieved through appropriate financing arrangements for the Chittagong investment program (estimated at appraisal to be about Tk 50 million for FY91). Financing such a program by LPGL (61%), GOB equity contribution (25%) and loan (14%) would achieve the desired objective. During negotiations, LPGL agreed on a capital restructuring plan to reduce the debt/equity ratio of its Chittagong operations to not more than 65/35. GOB also agreed that it will take all actions necessary to facilitate LPGL's action plan for financial restructuring. Agreements were also reached with LPGL that: (a) from FY95 and thereafter, it will maintain a debt/equity ratio not exceeding 65/35 on its consolidated operations; (b) as from FY92 it will periodically review with IDA the annual depreciation rates and adjust

these in line with those commonly practiced within the industry; and (c) each year by March 31, it would review with IDA its capital expenditure program for the following FY and the related financial requirements to ensure that required funds are available to implement the program.

4.13 Future Finances. LPGL's FY91-97 consolidated financial forecasts indicate a considerable improvement compared to the company's past earnings pattern. Taking into account price increases of 20% in each of FY92 and FY93 which may be required to bring prices in line with the current energy equivalent retail price of kerosene, net profit should increase from Tk 12.4 million in FY91 to Tk 43.9 million in FY93. Given LPGL's very low rate base, after tax rates of return are forecast to reach 53% in FY93. In FY94, the new operations at Elenga and Kailashtila are expected to bring about a further radical transformation in LPGL's earnings and overall financial performance. Net profits are forecast to increase from Tk 148 million in FY94 to Tk 206 million in FY97. With the commissioning of the new facilities, LPGL's net fixed assets will increase from Tk 70 million in FY93 to Tk 1,440 million in FY94, and to Tk 1,665 million in FY97; consequently after-tax rates of return are likely to fall to within the 15% to 20% range which, given the high level of taxation, would be satisfactory. Current ratios would be good; the cash position would be sufficient to provide funds for further expansion or the prepayment of debt, after making increasing dividend payments to GOB. The debt/equity ratio would improve to 61/39 in FY97. Debt service coverage, at 2.2 times when full debt service becomes due in FY97, would be adequate. LPGL's expected sales volumes, the assumptions used in the financial forecasts, and overall financial requirements during the construction and full commissioning period of the Project (FY92-96) are presented in Annex 4.2. The salient features of LPGL's FY91-97 consolidated financial forecasts are given in Table 4.3 below.

Table 4.3: LPGL'S CONSOLIDATED ACCOUNTS (FY91-97)  
(In Tk Million)

<u>FY</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Gross Sales Revenue	148.0	192.0	230.4	785.3	1,348.4	1,429.8	1,515.1
Less: Raw Materials	89.0	100.0	102.8	255.3	449.8	478.9	505.4
Excise Duties	9.9	11.9	14.3	51.7	91.0	93.5	102.3
Net Sales Revenue	<u>49.1</u>	<u>80.1</u>	<u>113.3</u>	<u>468.4</u>	<u>807.6</u>	<u>856.0</u>	<u>907.4</u>
Operating Expenses	<u>21.0</u>	<u>28.0</u>	<u>31.8</u>	<u>150.3</u>	<u>325.0</u>	<u>383.2</u>	<u>411.6</u>
Net Operating Income	<u>28.2</u>	<u>52.1</u>	<u>81.6</u>	<u>308.0</u>	<u>482.6</u>	<u>472.8</u>	<u>495.8</u>
Interest Charged	(5.9)	(8.2)	(8.5)	(44.9)	(129.9)	(159.0)	(184.9)
Interest Received	2.8	6.7	13.0	41.5	81.6	108.1	117.3
Exchange Losses	-	-	(0.3)	(8.3)	(26.4)	(34.2)	(38.5)
Income Tax	<u>(12.4)</u>	<u>(28.3)</u>	<u>(43.9)</u>	<u>(148.1)</u>	<u>(203.9)</u>	<u>(192.9)</u>	<u>(205.8)</u>
Net Profit	<u>12.4</u>	<u>28.3</u>	<u>43.9</u>	<u>148.1</u>	<u>203.9</u>	<u>192.9</u>	<u>205.8</u>
Return on Net Fixed Assets (%)							
After Tax	26.9	34.2	52.7	21.2	17.6	15.5	16.3
Current Ratio	3.3	3.4	3.8	3.1	4.1	5.3	5.6
Debt/Equity Ratio	56/44	61/39	72/28	67/33	64/36	63/37	61/39
Debt Service Coverage Times	3.7	6.0	8.4	7.1	4.9	4.4	2.2

4.14 To ensure LPGL's overall financial viability, agreements were reached with GOB and LPGL that: (a) GOB's pricing policies for LPG should enable LPG revenues to cover LPGL's operating expenses, debt service, additional working capital requirements and a contribution to LPGL's investment of not less than

35%; (b) LPGL would not incur any debt in any fiscal year without prior consultation with IDA, if the projected debt service coverage in that or any future year would be less than 1.5 times; (c) surplus cash resources from LPG operations would first be used to meet the requirements of those operations; and (d) LPGL would not declare any dividend or transfer profits to GOB or BPC in any FY unless LPGL's own financial requirements have been adequately met.

C. Financial Internal Rate of Return (FIRR)

4.15 The FIRR was calculated on the same incremental basis as for the economic internal rate of return (para. 5.08), based on the financial projections and assumptions described in Annexes 4.1 and 4.2. Depreciation and interest have been excluded and income taxes included. All cash streams have been deflated by the projected inflation in Bangladesh to reflect 1991 purchasing power. The Project's FIRR is 35% for the NGL portion and 19% for the bottling and distribution portion (Annex 4.3). A sensitivity analysis shows that under a combination of adverse circumstances (i.e., capital and operating expenditures up 10% and revenues down 10%), the FIRR in real terms would be 28% for the NGL operations and 13% for the bottling and distribution. In addition to the annual income tax payments made by LPGL and RPGCL, after FY93 LPGL should be able to make substantial contributions to GOB from the company's large profits.

D. Resource Mobilization

4.16 The Project's timely implementation and operation should result in substantial financial benefits to GOB. GOB's receipts from customs duties and taxes, excise duties, income tax payments, distributed profits, and debt service on the onlent IDA Credit will far exceed GOB's contribution to the Project and interest payments to IDA. Table 4.4 estimates the net resources accruing to GOB over the FY92-97 period, when the Project would have been in full operation for only 3.5 years (mid-FY94 to FY97). Annex 4.4 provides the annual resource mobilization estimates, disaggregated between RPGCL and LPGL.

Table 4.4: ESTIMATE OF THE PROJECT'S RESOURCE MOBILIZATION IMPACT (FY92-97)

	<u>Tk Million</u>	<u>US\$ Million</u>
Income Tax	1053	80.2
Distributed Profits	682	19.6
Excise Duties	368	10.5
Debt Service		
Principal Repayments	599	17.2
Interest	1204	34.6
Customs Duties and Other Taxes	722	20.7
	<u>4628</u>	<u>132.6</u>
Less:		
GOB Contribution to the Project	1410	40.4
Interest on IDA Credit	76	2.2
Net Benefits: FY92-97	<u>3142</u>	<u>80.0</u>

4.17 Transfer prices of LPG ex-RPGCL and ex-ERL are to be the same. However, since ERL's LPG production costs would be lower than those costs from natural gas, ERL would be expected to have higher profits. Thus, GOB should be

able to capture these additional benefits through ERL's income tax and profit distribution. Furthermore, any increase in the retail price for LPG and other petroleum products under the Project would provide a margin for increased fiscal benefits for GOB. The financial forecasts indicate that both RPGCL and LPGL would have substantial cash balances after the facilities commence to operate. If these resources are not used for expansion, they could be used for the prepayment of debt and thereby made available to the economy.

## V. PROJECT JUSTIFICATION

### A. Demand Forecasts and Market Development

5.01 Natural Gas Demand. The supply of LPG is linked to the demand for natural gas, from which LPG is recovered. At present, the relevant incremental gas demand forecast is for the Titas Franchise Area (TFA), which will be driven mainly by the consumers to be linked to the north-south gas transmission pipeline and the Brahmaputra Basin gas transmission and distribution network. When the proposed Ashuganj-Bakhrabad interconnecting gas transmission pipeline becomes operational around 1995/96, the incremental gas demand forecast would be increased by the addition of the Bakhrabad Franchise Area (BFA). These large TFA and BFA gas consumers in the power and fertilizer sectors are already under construction or committed in the 4th FYP, and the gas infrastructure requirements are in turn reflected in the sequence of priority investments for the oil and gas sector agreed under the ESAC (para. 1.25). By the mid-1990s, the TFA's incremental gas demand is estimated at 150 million cubic feet per day (MMCFD). Since the ten Titas wells are already at full production, the northeastern gas fields would serve as the incremental gas supply source. The 40,000 mtpy of LPG to be distributed under the Project would be recovered from existing and committed gas wells. Up to 100,000 mtpy of LPG could be recovered as further gas appraisal and development becomes necessary during the 1990s to meet forecast long-term gas demand.

5.02 LPG Demand. There is a substantial suppressed demand for LPG, particularly in the west zone where kerosene supplies are limited and irregular and fuelwood shortages are most acute. Kerosene alone accounts for about 30% of Bangladesh's petroleum product consumption (Annex 1.2), and the bulk of kerosene supplies stays in the east zone (Annex 5. .). Only about 20% reaches the energy-short northwest region, mostly in Baghabari, which is accessible only for part of the year due to draft restrictions during the dry season. Rangpur receives almost no kerosene supplies. Consequently, IDA consultant studies during Project preparation concluded that LPG will remain supply-constrained even at the estimated level of 100,000 mtpy by 2000, taking into account (a) the unevenly distributed kerosene supply and consumption of around 500,000 mtpy growing at an average annual rate of about 6% (Annex 5.2), and (b) the shortages and high prices of commercial fuelwood.

5.03 LPG Market Development. The LPG Feasibility Study prepared a market development plan on the basis of full gas development throughout Bangladesh and hence maximum LPG supplies. Subsequent IDA missions reviewed these plans with GOB, Petrobangla and BPC, focussing on the initial LPG volumes under the Project, which would be marketed mainly in the northwest. Until the proposed Jamuna Bridge is built, the LPG cylinders would be ferried from Bhuapur (about

15 km from Elenga) to Sirajganj, Rangpur, Bogra and Baghabari. Onward cylinder distribution to dealers will be by trucks, using the road transport network being improved under the IDA-financed Road Rehabilitation and Maintenance Project (Cr. 1827-BD). Transport from dealers to retailers would also be facilitated by the network of access roads in the northwest supported by the Rural Roads and Markets Improvement Project (Cr. 1940-BD). A deposit system will be established for the LPG cylinders, as currently practiced for the 5,000 mtpy of LPG produced at the refinery in Chittagong. A key component of the distribution system for cylinders and stoves will be the involvement of the private sector and Bangladeshi women entrepreneurs (paras. 3.12 and 3.23). A dated covenant under the Project is the preparation and implementation of a detailed LPG market development plan, which would incorporate the pilot results of the Women in Development TA component.

5.04 The condensate products would be marketed by the BPC marketing companies and distributed by the private sector under existing arrangements or exported by BPC. The local markets for the motor spirit and kerosene would be served initially from the BPC depots at Ashuganj, Fatullah and Chandpur. Using ERL vessels, the small amounts of diesel would be transported to the Eastern Refinery Limited (ERL) in Chittagong for blending to specifications. The surplus propane would be sold to the private sector, which will be responsible for retail distribution (para. 3.12).

#### B. Least-Cost Alternatives

5.05 Domestic LPG recovery is the least-cost option compared to LPG and kerosene imports (Annex 5.3). A cost-effectiveness analysis was also conducted to compare the alternatives of barging the LPG from Ashuganj to Baghabari and Khulna, or transporting the entire LPG supply by pipeline to the Jamuna Bridge site. It was determined that LPG transport by pipeline is the least-cost option, since the land and right-of-way has already been obtained under the Brahmaputra Basin gas project (para. 3.08). Pipeline transport would also provide greater security of supply and assurance of environmental and operational safety. During Project preparation, an important objective for technical design was to minimize downstream costs by: (a) making full use of existing or committed infrastructure; (b) maximizing involvement of existing and experienced institutions, e.g., by drawing on the competitive local private sector for transport and women in small commercial enterprises for retail distribution; and (c) identifying least-cost options for capital items.

#### C. Economic Internal Rate of Return (EIRR)

5.06 The EIRR for the Project (Annex 5.4) was calculated on an incremental basis, i.e., capturing the additional costs and benefits resulting from the change in technology choice for drying gas recommended by studies under SGDP. Gas dehydration is a necessary process to deliver pipeline quality gas. The dehydration systems considered during SGDP appraisal were based on silica gel units, which would yield only condensates. An alternative option would be molecular sieve-turboexpander (MSTE) dehydration systems, which would permit

the recovery of LPG as well and a marginally higher amount of condensates.<sup>2/</sup> The MSTE systems, however, are more costly and will require the downstream transport and distribution investments to be financed under the Project. The incremental EIRR approach would be applicable in this case since the economic justification for SGDP as originally designed, i.e., as a producer of natural gas and condensates but not LPG, remains valid.<sup>3/</sup>

5.07 Project benefits were valued in terms of the CIF border price of the kerosene equivalent, i.e., adjusted by a factor of 1.3 to reflect the higher combustion efficiency of LPG and the mechanical losses inherent in the retail marketing of kerosene. This may be a conservative figure, as field studies under the TA component of the Project are expected to yield a range of 1.5 to 1.6, which would further enhance the Project's economic justification and provide an empirical basis for future derivation of LPG transfer and retail prices (para. 1.16). The small amounts of surplus propane were also similarly valued, although the private sector has expressed interest in marketing propane for higher-value industrial processes. Marginal increases in motor spirit were valued at the FOB price of gasoline, to be exported after upgrading in the surplus reformer capacity at the refinery. Savings in domestic kerosene transport from ERL to northwest depots were also counted as benefits.

5.08 The Project's EIRR is 20%, based on the following highly conservative assumptions. First, international product prices based on Bank forecasts at Project appraisal in July 1990 were used, as well as a crude oil price of about US\$18/barrel (bbl), or around US\$130/mt, increasing in real terms by around 2% per year to almost US\$20/barrel by the year 2000. Crude oil price levels, however, peaked at US\$40/bbl (or about US\$290/mt) in early 1991. Second, it was also assumed that there would be no pressures in product-to-crude margins, and a low kerosene-to-crude margin (US\$50/mt) was used in the EIRR calculation. However, it is expected that these margins would increase due to the demand for kerosene outpacing the capacity of the worldwide refining industry to increase the production of middle distillates, especially kerosene. Middle distillate demand is spiralling in rapidly developing Asian economies in particular. Third, no commercial fuelwood substitution was assumed, although this may be expected to occur in urban and peri-urban areas in the west zone. The economic value of fuelwood is considerably higher than its financial price, which is almost quadruple the price of kerosene on a useful energy basis.

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<sup>2/</sup> The MSTE option was reviewed in December 1989 by SGDP's infrastructure design consultants, taking into account the results of the reservoir studies and fluids analyses conducted in 1988 and 1989.

<sup>3/</sup> The EIRR for SGDP is 90% based on the economic value of the substitute fuel mix and 60% based on the long-run marginal cost of gas and a depletion premium. The almost three-year delay in implementation meant that there were no major capital expenditures until 1988, which is effectively the SGDP start-up date. With respect to the key parameters for the economic analysis of SGDP, there have been no significant cost overruns to date, and gas demand is expected to exceed appraisal forecasts due to the lower reserves at the Bakhrabad field.

#### D. Sensitivity Analysis

5.09 An overrun of 10% in capital and operating costs would decrease the EIRR to 16%, although this is not expected due to the standard, off-the-shelf nature of the key equipment involved. A slow market penetration at 50% of projected rates for the first five years would decrease the EIRR to 12%, which is unlikely due to the high suppressed demand for LPG, particularly in the west zone (para. 5.02), and the prior preparation of a detailed LPG market development plan (para. 5.03). A 2-year delay in the LPG coming on stream would result in an EIRR of 14%. Delays in LPG supplies, however, are unlikely since investments on the LPG-related facilities would not be undertaken unless SGDP facilities are nearing completion, thus ensuring LPG availability. Consequently, processing of the LPG Project is closely linked to progress in SGDP implementation (para. 3.26).

5.10 Project economics are robust, considering the conservative assumptions used and the sensitivity analysis showing the unlikely negative events would not reduce the EIRR below 12%. However, more realistic assumptions on the valuation of Project benefits (e.g., higher coefficient for the kerosene equivalent of LPG, commercial fuelwood substitution, upward pressures on international kerosene prices), would increase significantly the Project's EIRR. In view of the recent events in the Gulf and two previous oil shocks, the development of the gas subsector and recovery of natural gas liquids to substitute for imported oil is of critical importance to Bangladesh.

#### E. Justification for Bank Group Involvement

5.11 IDA's involvement in the Project would build on the pilot LPG component of the Refinery Modification Project by assisting GOB, Petrobangla and BPC in the least-cost development of LPG supplies and the strengthening of their capabilities in LPG operations. IDA would pursue LPG pricing reforms initiated under the refinery project by assisting GOB in establishing economically and financially sound LPG pricing policies. In support of GOB's policy, IDA would play a catalytic role in encouraging private sector involvement, building on the private LPG joint venture under the refinery project. The Project would complement SGDP and facilitate the optimization of future petroleum sector investments by establishing a joint Petrobangla/BPC planning perspective, since LPG/NGL recovery and distribution need to be coordinated with gas production. IDA would also play a pioneering role in TA related to promoting environmental and operational safety, more efficient cooking devices, and the role of Bangladeshi women in the retail distribution of LPG cylinders and stoves. The Project is consistent with the ESAC's investment planning, institutional and pricing policy reform framework. The Project is part of the FY90-92 Priority Investment Program agreed under the ESAC for Petrobangla and BPC.

**VI. SUMMARY OF AGREEMENTS REACHED AND RECOMMENDATION**

**6.01 During negotiations, the following agreements were reached with GOB:**

- (a) GOB will: (i) review transfer and retail prices annually and adjust these to comply with financial viability objectives, or economic efficiency criteria, whichever is higher; (ii) fully put into effect the applicable prices by the time the incremental LPG supplies come on stream; and (iii) establish a uniform transfer price from LPG producers to LPG bottlers throughout Bangladesh (paras. 1.16 and 1.18);
- (b) GOB will submit to IDA the report of the Comptroller and Auditor General within nine months after the end of each fiscal year (para. 2.11);
- (c) GOB will adhere to the procedures for the operation and audit of the Special Account (para. 3.17);
- (d) GOB will take all actions necessary to facilitate the RPGCL and LPGL financial restructuring action programs (paras. 4.06 and 4.12);
- (e) GOB will finance all future CNG feasibility and pilot projects as a 100% GOB equity contribution as from the date of transfer of CNG operations to RPGCL (para. 4.07); and
- (f) GOB will price NGL products and LPG so as to enable RPGCL and LPGL to earn NGL and LPG revenues, respectively, sufficient to cover their respective operating expenses, debt service, additional working capital requirements and a minimum 35% contribution to expansion (paras. 4.09 and 4.14);

**6.02 During negotiations, the following agreements were reached with RPGCL:**

- (a) RPGCL's staffing plan (para. 2.04), training programs and implementation schedules (para. 2.12);
- (b) RPGCL will enter into an agreement with the Titas Gas Transmission and Distribution Company for supervising the maintenance of RPGCL's pipelines (para. 2.06);
- (c) RPGCL will: (i) maintain separate accounts for its CNG and NGL divisions, and the IDA-financed Project (para. 2.09); (ii) appoint independent auditors satisfactory to IDA; and (iii) submit to IDA copies of the unaudited financial statements, including Project accounts and analytical accounts for each cost center, not less than three months after the end of each fiscal year, and copies of the audited statements with the report and comments of the Commercial Auditor, not later than six months after the end of the fiscal year (para. 2.11);
- (d) RPGCL's TA/training terms of reference and dated covenants to review the recommendations of the studies and agree on an implementation plan (para. 3.06);

- (e) RPGCL will offer for sale to the private sector the propane at Ashuganj (para. 3.12);
- (f) RPGCL will undertake a financial restructuring action program for its CNG-related operations by FY92 to be reflected in its opening balance sheet of June 30, 1992 (para. 4.06); and
- (g) RPGCL will adhere to the following financial performance targets:
  - (i) RPGCL's debt/equity ratio will at all times not exceed 65/35 after FY94; (ii) RPGCL will not incur debt in any FY without prior consultation with IDA, if the debt service coverage in that year and in any future year will be less than 1.5 times; (iii) surplus cash resources from NGL operations will first be used to meet the requirements of those operations, and RPGCL will not declare a dividend or make any transfer of profits to GOB or Petrobangla in any FY unless RPGCL's own financial requirements have been adequately met; and (iv) RPGCL will review with IDA by March 31 each year its annual capital expenditure for the following FY and the related financing requirements, and the related financing requirements (para. 4.09).

6.03 During negotiations, the following agreements were reached with LPGL:

- (a) LPGL's staffing plan (para 2.08), training programs and implementation schedules (para 2.12);
- (b) LPGL will: (i) maintain separate accounts for its Elenga, Kailashtila and Chittagong operations, and the IDA-financed Project (para. 2.09); (ii) appoint independent auditors satisfactory to IDA; and (iii) submit to IDA copies of the unaudited financial statements, including Project accounts and analytical accounts for each cost center, not less than three months after the end of each fiscal year, and copies of the audited statements with the report and comments of the Commercial Auditor, not later than six months after the end of the fiscal year (para. 2.11);
- (c) LPGL's TA/training terms of reference and dated covenants to review the recommendations of the studies and agree on an implementation plan (para. 3.06);
- (d) LPGL will undertake a capital restructuring plan to reduce the debt/equity ratio of its Chittagong operations to not more than 65/35 (para. 4.12);
- (e) LPGL will: (i) maintain as from FY95 a debt/equity ratio not exceeding 65/35 on its consolidated operations; (ii) periodically review with IDA, as from FY92, its annual depreciation rates and adjust these in line with those commonly practiced within the industry; and (iii) review with IDA, each year by March 31, its capital expenditure program for the following FY and the related financial requirements (para. 4.12); and
- (f) LPGL will adhere to the following financial performance targets: (i) LPGL will not incur any debt in any fiscal year without prior consultation with IDA, if the debt service coverage in that year or any

future year is less than 1.5 times; and (ii) surplus cash resources from LPG operations will first be used to meet the requirements of those operations, and LPGL will not declare any dividend or make any transfer of profits to GOB or BPC in any fiscal year, unless LPGL's own financial requirements have been adequately met (para. 4.14).

6.04 Before Credit effectiveness, the following actions should be completed:

- (a) contract award by RPGCL and LPGL for the infrastructure design and implementation supervision consultancy services (para 3.07);
- (b) conclusion of respective Subsidiary Loan Agreements between GOB and RPGCL, and between GOB and LPGL (para. 3.11); and
- (c) contract award for the LPG recovery facilities under the Second Gas Development Project (para. 3.26); and
- (d) GOB approval of the Project Proforma.

6.05 With the above agreements and assurances, the proposed Project constitutes a suitable basis for an IDA Credit of SDR 49.8 million (US\$67.2 million equivalent) on standard IDA terms with 40 years maturity to the People's Republic of Bangladesh.

## BANGLADESH: LPG TRANSPORT AND DISTRIBUTION PROJECT

### SECTORAL SHARES IN PETROLEUM PRODUCTS CONSUMPTION, 1984/85-1988/89 in thousand metric tons and %

Fiscal Year	1984/85		1985/86		1986/87		1987/88		1988/89	
	Value	%								
Transport	570	37%	610	37%	620	38%	650	38%	675	37%
Residential/Commercial	315	21%	325	20%	309	19%	447	26%	529	29%
Power	286	19%	310	19%	305	19%	261	15%	200	11%
Industry	210	14%	235	14%	213	13%	148	9%	161	9%
Agriculture	150	10%	170	10%	180	11%	186	11%	250	14%
<b>Total</b>	<b>1531</b>	<b>100%</b>	<b>1650</b>	<b>100%</b>	<b>1627</b>	<b>100%</b>	<b>1692</b>	<b>100%</b>	<b>1815</b>	<b>100%</b>

Source: Bangladesh Petroleum Corporation

## BANGLADESH: LPG TRANSPORT AND DISTRIBUTION PROJECT

### FUEL SHARES IN PETROLEUM PRODUCTS CONSUMPTION, 1984/85-1991/92 in thousand metric tons and %

	1984/85		1985/86		1986/87		1987/88		1988/89		AVERAGE GROWTH RATE (%) 1984/85 - 1988/89
High Octane Blending Component	7.40	0.5%	8.40	0.5%	9.40	0.6%	9.75	0.6%	11.10	0.6%	10.75
Motor Spirit	52.00	3.5%	56.20	3.6%	59.00	3.9%	61.65	3.8%	68.73	4.0%	7.26
Jet Petrol	74.20	5.0%	71.50	4.6%	77.70	5.1%	78.93	4.9%	79.79	4.7%	1.93
Superior Kerosene Oil	363.20	24.3%	396.40	25.3%	402.10	26.4%	419.62	26.1%	476.12	27.8%	7.10
High Speed Diesel Oil	608.60	40.7%	653.50	41.7%	692.10	45.4%	708.35	44.0%	847.44	49.5%	8.82
Light Diesel Oil	17.90	1.2%	13.70	0.9%	12.90	0.8%	11.94	0.7%	8.67	0.5%	-16.03
High Sulphur Furnace Oil	365.20	24.4%	358.90	22.9%	262.50	17.2%	309.73	19.2%	209.52	12.2%	-10.74
Liquefied Petroleum Gas (LPG)	8.30	0.6%	8.60	0.5%	8.80	0.6%	9.16	0.6%	9.21	0.5%	2.64
<b>Total</b>	<b>1496.8</b>	<b>100%</b>	<b>1567.2</b>	<b>100%</b>	<b>1524.5</b>	<b>100%</b>	<b>1609.1</b>	<b>100%</b>	<b>1710.6</b>	<b>100%</b>	

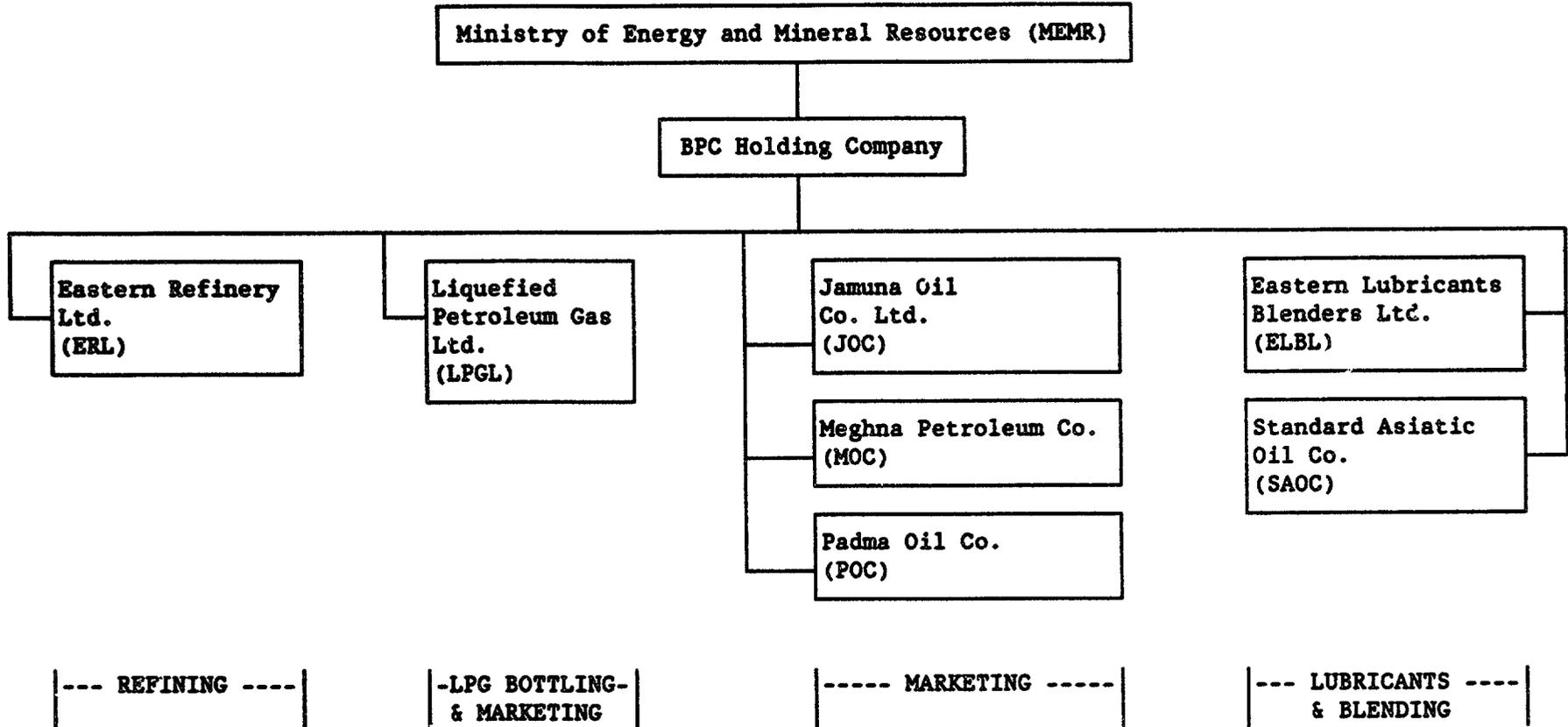
	EST. 1989/90		PROJECTIONS			
			1990/91		1991/92	
High Octane Blending Component	12.29	0.7%	13.61	0.7%	15.08	0.7%
Motor Spirit	73.72	4.1%	79.07	4.1%	84.81	4.2%
Jet Petrol	81.33	4.5%	82.89	4.3%	84.49	4.2%
Superior Kerosene Oil	509.93	28.3%	546.13	28.6%	584.91	28.9%
High Speed Diesel Oil	922.16	51.1%	1003.47	52.6%	1091.94	53.9%
Light Diesel Oil	7.28	0.4%	6.11	0.3%	5.13	0.3%
High Sulphur Furnace Oil	187.02	10.4%	166.94	8.8%	149.02	7.4%
Liquefied Petroleum Gas (LPG)	9.45	0.5%	9.70	0.5%	9.96	0.5%
<b>Total</b>	<b>1803.2</b>	<b>100%</b>	<b>1907.9</b>	<b>100%</b>	<b>2025.3</b>	<b>100%</b>

Source: Bangladesh Petroleum Corporation



BANGLADESH PETROLEUM CORPORATION (BPC)

Organization Chart of the Holding Company and Operating Companies



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**Note:** The BPC holding company comprises the Chairman, Board of Directors, a Secretariat and Directors for Finance, Marketing and Planning & Operations. A Joint Secretary of MEMR and a Joint Secretary of the Finance Division are represented in the BPC Board of Directors. Each of the seven operating companies (OCs) has its own Board of Directors and General Manager. The OCs' Board of Directors include BPC holding company representatives but no Government representatives, as Government control is exercised through the holding company.

BANGLADESH

LIQUEFIED PETROLEUM GAS (LPG) TRANSPORT AND DISTRIBUTION PROJECT

LPG Transfer and Retail Pricing

1. The build-up of transfer and retail prices for LPG should comply with economic efficiency criteria as well as ensure financial viability of the entities involved in extraction/fractionation, transport, bottling, marketing and retail distribution. In Bangladesh, conditions may arise when financial viability objectives would dictate the LPG price build-up, i.e., the price levels based on financial criteria would be higher than the economic price benchmarks. This note provides the basic principles for deriving applicable transfer and retail prices for LPG in Bangladesh.

Economic Efficiency Criteria

2. In principle, the estimation of the economic price of LPG is straightforward. If LPG were to be imported, its economic transfer price as an internationally traded commodity should be set at the imported LPG price (CIF Chittagong), adjusted for: (i) adequate storage to guarantee a level of continuous supply that is comparable to the domestic LPG recovery option; and (ii) the scarcity value of foreign exchange, if applicable. In Bangladesh, where domestic LPG recovery is the least-cost supply option compared to LPG or kerosene imports, the transfer price between Petrobangla and BPC should cover the economic costs of the capital plant, natural gas use and shrinkage and non-energy operating costs. The economic transfer price so defined is a minimum level. However, as LPG and kerosene (the imported substitute fuel) are tradeable commodities, there may be reasons for adjusting this LPG transfer price toward the border price of the kerosene equivalent. This difference (an economic rent) likely would need to be allocated to cover financial costs, which as indicated above would be higher than economic benchmarks. If the difference is great enough (as may be the case in future Kailashtila LPG development), some of this rent may be captured through a special excise tax or some other mechanism. Once the transfer price is determined, the economic retail price for the final user could be estimated by adding to this transfer price the economic costs of storage, transport, bottling, marketing and distribution. Retail pricing of LPG should provide flexibility to adjust prices when upstream and/or downstream costs change.

3. The economic pricing benchmarks could be further fine-tuned to take into account factors such as: (i) consumer surpluses due to the superior end-use characteristics of LPG as compared to kerosene and fuelwood; (ii) level and allocation of economic rents, i.e., the difference between LPG production costs and its economic value; and (iii) the need to prevent uneconomic end-uses (e.g., in the transport sector).

Financial Transfer Prices and Margins

4. The transfer prices and margins for each company participating in the production, transport and distribution of LPG should be set, and maintained over time, at levels that (i) ensure coverage of operating costs, debt service and applicable taxes and duties, and (ii) provide a reasonable return on equity for their LPG investments under efficient operations. To apply this pricing principle, a number of issues need to be addressed and decisions taken, as discussed below.
5. Definition of the Institutional Set-up. The organization for production is fairly straightforward, involving the refinery and other Petrobangla operating company(ies) as other gas field sources are developed. On the downstream side, however, LPG transportation and distribution are expected to involve a combination of LPGL, joint venture(s) with the private sector, full private sector ownership and operation, and/or subcontracted private transport companies. A decision on the organization of downstream LPG activities is required in order to define the transfer prices and margins for participating companies.
6. Uniform Transfer Price. Petrobangla's production cost for LPG is likely to be higher than that of the refinery. Since the same downstream company(ies) may take LPG from both sources, it would be practical to have one nationwide transfer price between upstream and downstream operations, irregardless of where LPG is produced. This would require a decision to increase ERL's current ex-refinery price for LPG, as well as the mechanisms for allocating the accruing economic rent.
7. Operating Costs (OC). OCs would cover gas used in the LPG production process, utilities, maintenance (spares, etc.), labor, plant depreciation, etc. Further, OC estimates per metric ton of LPG would be based on normal inputs and outputs, under efficient operations, for the type of LPG plant selected.
8. Debt Service. Interest estimates for IDA funds would be based on the onlending rate plus the expected cost of covering the foreign exchange risk. Amortization of debt should be covered by plant depreciation, but the cash flows should be studied, as the depreciation and amortization schedules are likely to differ.
9. Taxes and Duties. These include income taxes, customs duties for imported equipment and materials, and excise duties on process gas, condensates and LPG.
10. Return on Equity. This return is normally expected to exceed the cost of borrowed funds (e.g., at least 12% plus the foreign exchange risk). The private sector is likely to require over 20%. Thus, it is necessary to define the form and extent of private sector participation and expectations for return on equity.

11. Efficient Operations. The gas compositions and plant design would be the basis for establishing standards on inputs and outputs (e.g., quantity of process gas, spares, down time for service, number of staff employed and metric tons of LPG and condensates produced). To encourage efficient operations, the LPG producer would benefit if production exceeds standards and/or if costs are lower.

12. Adjustment and Maintenance of Prices and Margins. The physical standards (para. 11) could change if proved inadequate (e.g., changes in plant configuration). Further, cost increases may occur (e.g., for labor, spares, utilities, taxes and duties, debt service) due to general inflation, GOB decisions and/or currency devaluation. In case of major unit cost increases that are not due to lower productivity, the transfer prices and margins would have to be recalculated. As long as domestic LPG recovery remains the least-cost supply option compared to LPG and kerosene imports, the transfer prices and margins should be reviewed once a year and adjusted if this review indicates an increase of at least 10%.

July 1990  
Dhaka, Bangladesh

## BANGLADESH: LPG TRANSPORT AND DISTRIBUTION PROJECT

### PETROLEUM PRODUCT RETAIL PRICES (February to October 1990)

Product	FY90 Est. Sales (10 <sup>6</sup> lit)	Retail Prices (Tk/liter) <sup>b/</sup>				Total Sales Value (Tk MM)			
		Feb 90	Apr 90	Sep 90	Oct 90	Feb 90	Apr 90	Sep 90	Oct 90
LPG	9,000.0 <sup>a/</sup>	131.00	131.00	180.00	200.00				
HOBC <sup>a/</sup>	16.8	8.18	8.58	10.20	14.95	137.4	144.1	171.4	251.2
Motor Spirit	104.9	7.80	8.20	9.20	14.90	818.2	860.2	965.1	1,563.0
Kerosene	646.6	6.87	7.37	9.20	14.00	4,442.1	4,765.4	5,948.7	9,052.4
Diesel	1,093.7	6.90	7.30	9.20	14.00	7,546.5	7,984.0	10,062.0	15,311.8
Fuel Oil	202.4	4.70	5.10	5.60	7.41	951.3	1,032.2	1,133.4	1,499.8
Total, excl LPG	<u>2,064.4</u>					<u>13,895.6</u>	<u>14,786.0</u>	<u>18,280.6</u>	<u>27,678.2</u>

Weighted Average Prices (Tk/liter): <sup>c/</sup>

Increase from Previous Date (%):

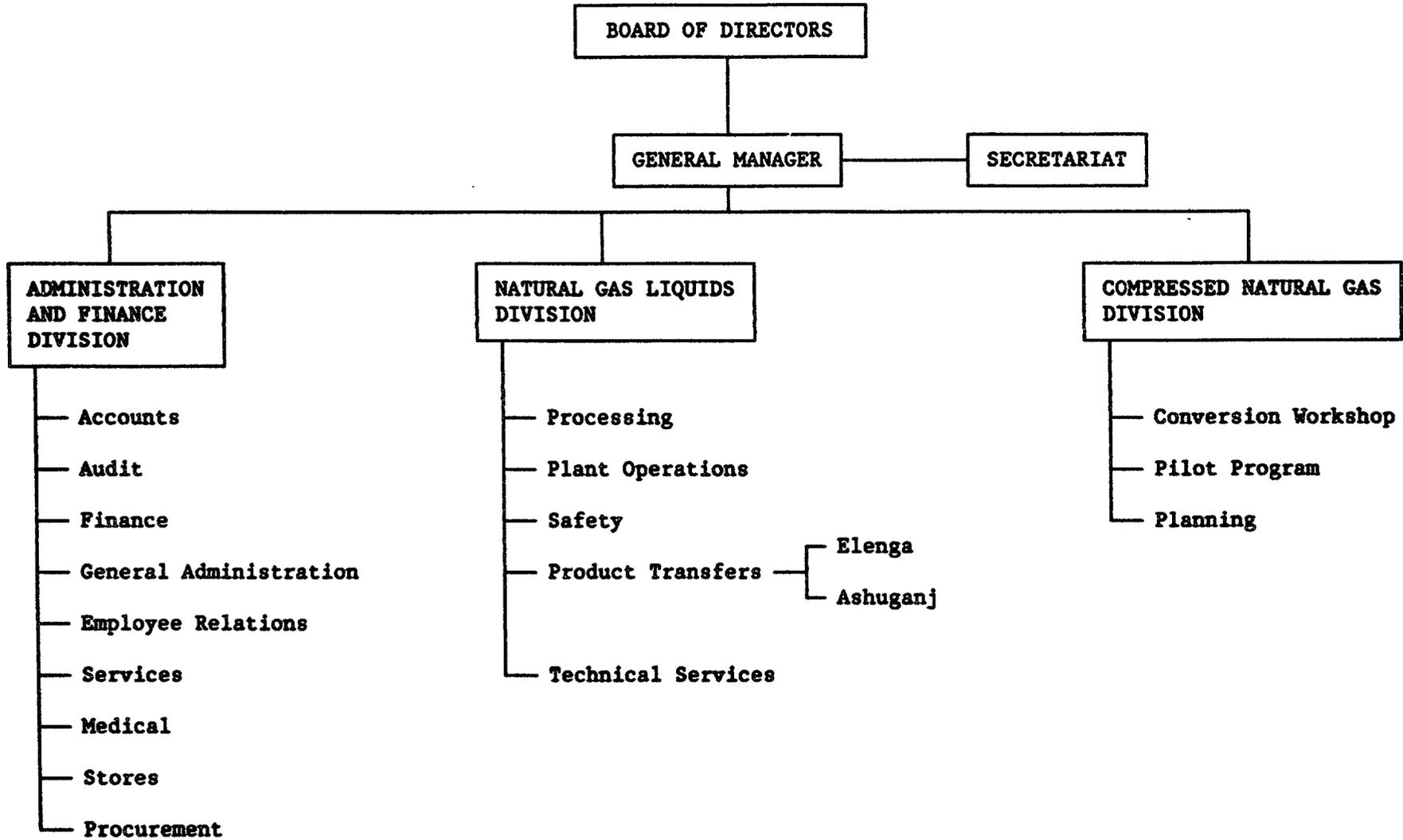
Feb 90	6.7	
Apr 90	7.2	7.5
Sep 90	8.9	23.6
Oct 90	13.4	51.4

- Notes:
- a/ High-octane blending component
  - b/ Metric tons
  - c/ For LPG, in Tk per 12.5 kilogram cylinder
  - d/ Excluding the small amount of LPG

Source: Bangladesh Petroleum Corporation

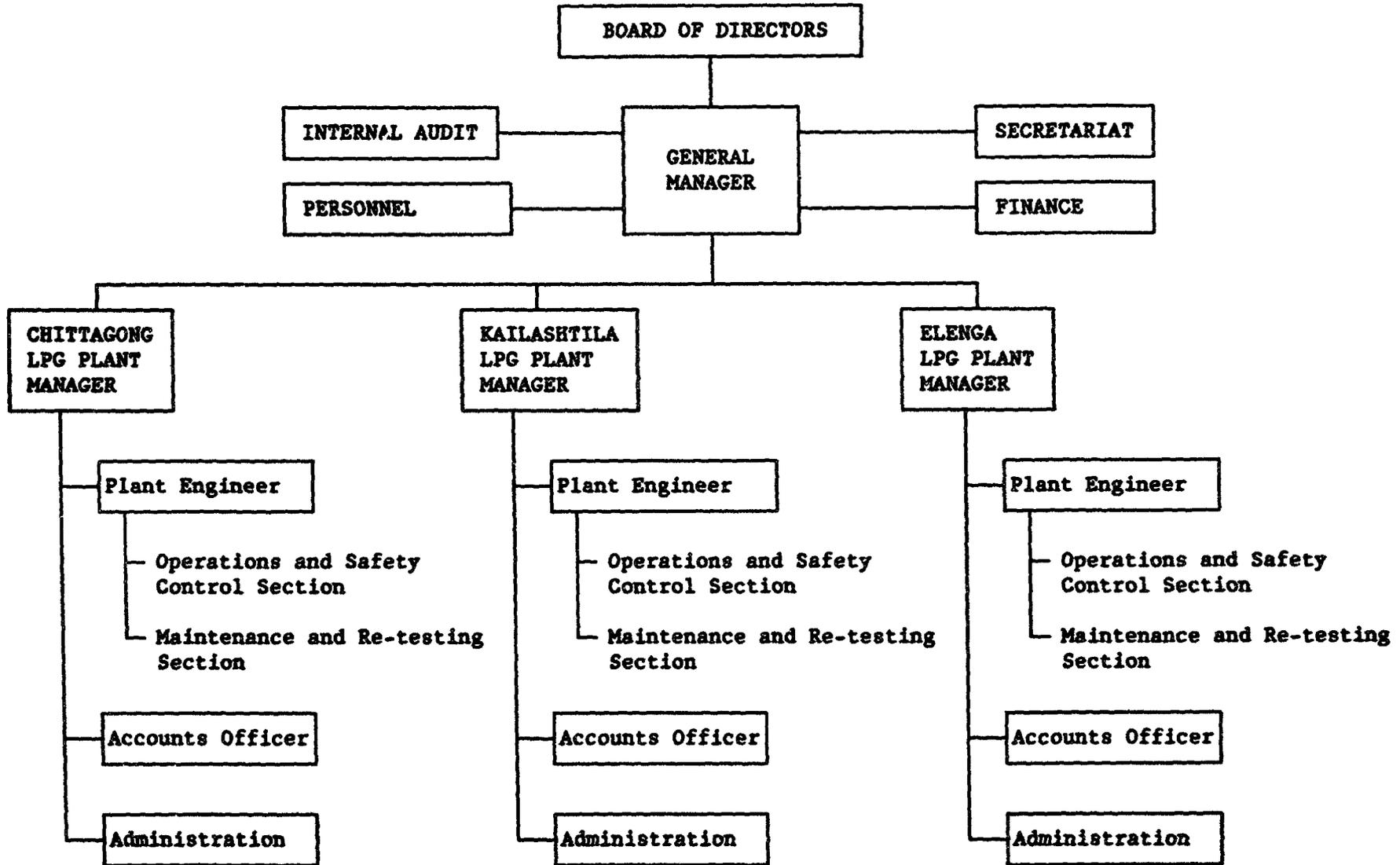
RUPANTARITA PRAKRITIK GAS COMPANY LIMITED (RPGCL)

Proposed Organization Chart



LIQUEFIED PETROLEUM GAS LIMITED (LPGL)

Proposed Organization Chart



BANGLADESH

LPG TRANSPORT AND DISTRIBUTION PROJECT

LINKAGE OF THE LPG PROJECT WITH THE SECOND GAS DEVELOPMENT PROJECT (SGDP)

1. During the appraisal of SGDP (Cr. 1586-BD), reservoir data from the limited number of wells drilled indicated LPG recovery potential. However, further drilling and reservoir analyses were required to assess whether gas reserves and compositions were adequate to justify LPG development. Of the various gas fields in Bangladesh, the reservoir studies cofinanced by the Canadian International Development Agency under SGDP indicated the northeastern and the Bakhrabad (BKD) gas fields as having LPG development potential. GOB's initial emphasis was on BKD, which was already producing gas, pending completion of the reservoir studies in October 1989. The subsequent BKD reservoir study, however, indicated remaining recoverable BKD gas reserves of about 0.7 trillion cubic feet (TCF), or around half of earlier estimates. Thus, long-term LPG investments at BKD are not justified unless more reserves are proven from a new round of appraisal drilling.

2. In addition to inadequate BKD gas reserves, two new findings under SGDP in 1989 directed GOB's priorities to LPG development at the northern gas fields. First, the reservoir studies indicated much higher reserves (about 4 TCF) than originally assumed (almost 2 TCF). Second, the reservoir fluids analyses also indicated sufficient LPG fractions. As a result, in order to maximize the economic value of the natural gas, GOB and Petrobangla opted for gas process facilities at the northern gas fields that would permit the extraction of LPG (i.e., molecular sieve-turboexpander units), which otherwise would not be possible with the silica gel units originally contemplated.

3. Thereafter, GOB and the petroleum entities decided to give priority to investments for distributing the LPG that would become available during the 1990s from natural gas production at the northern gas fields. The SGDP, the LPG Project, and future appraisal/development drilling and expansion of gas process facilities at the northern gas fields are time slices of the oil and gas sector's Priority Investment Program agreed under the Energy Sector Adjustment Credit (Cr. 1999-BD) to maximize the benefits to the economy of developing Bangladesh's hydrocarbon resources.

**LPG TRANSPORT AND DISTRIBUTION PROJECT  
IMPLEMENTATION SCHEDULE  
(April 1991)**

PROJECT COMPONENTS	1988			1989			1990			1991			1992			1993			1994																										
	J	F	M	J	A	S	O	N	D	J	F	M	J	A	S	O	N	D	J	F	M	J	A	S	O	N	D	J	F	M	J	A	S	O	N	D	J	F	M	J	A	S	O	N	D
<b>I. Second Gas Development Project</b>																																													
<b>DRILLING</b>	BB-2			KTL-2 KTL-3			WO R3 R4			PG			T11 BKD9 BKD10																																
<b>PIPELINE CONSTRUCTION</b>	[Tendering-Prequalification]			[TB]			[CS]			[AC]			[Construction]						[C]																										
<b>TELECOMMUNICATIONS</b>																																													
<b>TELECOMMUNICATIONS</b>							[Tendering]			[TB]			[CS]			[Supply and I]						[C]																							
<b>NGL PLANTS</b>																																													
<b>ASHUGANU FRACTIONATION PLANT</b>										[Tendering]			[AC]			[D]			[F]			[I]			[C]																				
<b>RASHIDPUR DEHYDRATION PLANT</b>										[TB]			[AC]			[F]																													
<b>ASHUGANU GAS MANIFOLD</b>										[Tendering]			[AC]			[I]																													
<b>II. LPG Project</b>																																													
<b>ASHUGANU STORAGE</b>										[Tendering]			[AC]			[D]			[F]			[I]			[C]																				
<b>LPG PIPELINE &amp; DIRECTIONAL DRILLING</b>										[Tendering]			[AC]			[D]			[F]			[I]			[C]																				
<b>LPG BOTTLING ELENGA &amp; STORAGE</b>										[Tendering]			[D]			[F]			[I]			[C]																							
<b>CYLINDERS, VALVES &amp; REGULATORS</b>																																													
<b>TECHNICAL ASSISTANCE</b>																																													
<small>           hatched box: March to November            solid black box: Other months            PG = Prequalification, TB = Technical BM, CS = Commercial BM, AC = Award of Contract, D = Design, F = Fabrication, I = Installation, C = Commissioning         </small>																																													

**BANGLADESH – LPG TRANSPORT AND DISTRIBUTION PROJECT**

***Disbursement Schedule***

<b><i>IDA Fiscal Year and Semester</i></b>	<b><i>Semester Disbursement (US\$ million)</i></b>	<b><i>Cumulative Disbursement (US\$ million) (%)</i></b>		<b><i>Bank Profile (Asla - Pipeline) (%)</i></b>
<b><u>1992</u></b>				
December 31, 1991	3.9	3.9	6%	3%
June 30, 1992	1.7	5.6	8%	10%
<b><u>1993</u></b>				
December 31, 1992	12.7	18.3	27%	22%
June 30, 1993	8.4	26.7	40%	38%
<b><u>1994</u></b>				
December 31, 1993	14.3	41.0	61%	46%
June 30, 1994	9.6	50.6	75%	54%
<b><u>1995</u></b>				
December 31, 1994	6.2	56.8	84%	72%
June 30, 1995	4.1	60.9	91%	90%
<b><u>1996</u></b>				
December 31, 1995	6.3	67.2	100%	95%
June 30, 1996	-----	DISBURSED	-----	100%

III. Combined CNG and NGL Divisions

**BANGLADESH**  
**RUPANTARITA PRAKRITIK GAS COMPANY LTD (RPGCL)**  
**INCOME STATEMENTS**  
(In Tk million)

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	1/ Audited	2/ Audited		Provi- sional							
	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
<b>Sales Revenue</b>											
Gross Sales Revenue	0.0	0.0	0.1	0.2	0.1	0.1	0.1	686.0	1454.1	1541.3	1633.8
Add: Conversion Charges	0.0	0.1	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Less: Raw Materials Purchases	0.0	0.0	0.1	0.1	0.1	0.1	0.1	399.2	845.3	897.0	950.9
<b>Net Sales Revenue</b>	<b>0.0</b>	<b>0.1</b>	<b>0.3</b>	<b>0.2</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>286.7</b>	<b>607.8</b>	<b>644.3</b>	<b>683.0</b>
<b>Operating Expenses</b>											
Salaries and Expenses	0.7	0.6	1.3	1.7	1.7	1.8	1.9	15.6	19.1	20.3	21.5
Management Service Charge	0.0	1.2	0.1	0.1	0.1	0.1	0.1	1.8	2.2	2.4	2.5
Repairs and Maintenance	0.2	0.1	0.2	0.3	0.2	0.2	0.3	21.8	27.2	28.9	30.6
Administration	0.4	0.3	0.7	0.4	0.4	0.5	0.5	3.9	4.3	5.1	5.4
Other Expenses	0.1	0.1	0.0	1.0	0.4	0.4	0.4	4.6	5.6	5.9	6.2
Depreciation	0.6	0.2	0.4	0.4	0.4	0.4	0.4	113.7	233.6	233.6	233.6
Amortization	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	15.4	25.8	31.6
<b>Total Operating Expenses</b>	<b>2.0</b>	<b>2.6</b>	<b>2.7</b>	<b>3.9</b>	<b>3.2</b>	<b>3.4</b>	<b>3.6</b>	<b>166.2</b>	<b>308.0</b>	<b>321.8</b>	<b>331.3</b>
<b>Net Operating Income</b>	<b>-2.0</b>	<b>-2.4</b>	<b>-2.4</b>	<b>-3.7</b>	<b>-3.2</b>	<b>-3.4</b>	<b>-3.6</b>	<b>120.5</b>	<b>299.9</b>	<b>322.5</b>	<b>351.7</b>
Interest Charged	0.6	1.2	2.9	0.4	0.0	0.0	0.0	94.1	207.4	203.3	187.5
Interest Received	1.9	0.9	2.9	2.6	2.7	2.7	2.7	7.5	23.3	49.2	67.0
Exchange Losses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.1	24.8	26.0	24.0
<b>Net Income Before Tax</b>	<b>-0.7</b>	<b>-2.7</b>	<b>-2.4</b>	<b>-1.5</b>	<b>-0.5</b>	<b>-0.7</b>	<b>-0.9</b>	<b>18.8</b>	<b>91.0</b>	<b>142.4</b>	<b>207.1</b>
Provision for Tax 50.0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	46.2	72.0	104.4
<b>Net Income After Tax</b>	<b>-0.7</b>	<b>-2.7</b>	<b>-2.4</b>	<b>-1.5</b>	<b>-0.5</b>	<b>-0.7</b>	<b>-0.9</b>	<b>8.8</b>	<b>44.8</b>	<b>70.4</b>	<b>102.7</b>
<b>Return on Ave. Net Fixed Assets</b>											
After Tax	-39%	-24%	-25%	-37%	-32%	-35%	-39%	10%	12%	13%	15%

Notes:

1/ For 12 month period ending December 31, 1987.

2/ For 12 month period ending June 30, 1988.

19-Apr-91

**BANGLADESH  
RUPANTARITA PRAKRITIK GAS COMPANY LTD (RPGL)  
BALANCE SHEETS  
(In Tk million)**

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	1/ Audited		2/ 1989	Provi- sional 1990	After Restruc 1990	1991	1992	1993	1994	1995	1996	1997					
	1987	1988															
<b>ASSETS</b>																	
<b>Fixed Assets</b>																	
Gross Fixed Assets	12.9	13.0	13.0	13.9	13.9	13.9	13.9	13.9	2279.0	2345.3	2345.3	2345.3					
Less: Accumulated Depreciation	2.7	2.9	3.3	3.6	3.6	4.0	4.4	4.8	118.5	352.1	585.6	819.2					
<b>Net Fixed Assets</b>	<b>10.2</b>	<b>10.1</b>	<b>9.7</b>	<b>10.3</b>	<b>10.3</b>	<b>9.9</b>	<b>9.5</b>	<b>9.1</b>	<b>2160.5</b>	<b>1993.2</b>	<b>1759.7</b>	<b>1526.1</b>					
<b>Pilot Scheme</b>						122.7	122.7	122.7	122.7	122.7	122.7	122.7					
<b>Less: GOB Grant</b>						122.7	122.7	122.7	122.7	122.7	122.7	122.7					
<b>Net</b>						<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>					
<b>Work in Progress</b>						0.0	0.0	0.0	0.0	0.0	0.0	0.0					
<b>Deferred Charges</b>						40.8	43.4	43.4	43.4	0.0	0.0	4.8	24.4	72.3	108.5	111.9	80.3
<b>Current Assets</b>																	
Cash and Bank Balances	19.3	21.7	22.6	24.7	24.7	24.7	24.7	24.7	146.9	385.0	665.9	877.9					
Accounts Receivable - Trade	0.0	0.0	0.0	0.0		0.0	0.0	0.0	85.7	181.8	192.7	204.2					
Accounts Receivable - Interest	0.0	0.0	0.0	0.0		0.0	0.0	0.0	1.2	5.1	11.8	16.1					
Stocks and Stores	2.9	2.9	2.9	1.0	1.0	1.0	1.2	1.2	23.7	24.3	24.3	24.3					
Others	0.2	0.2	0.2	0.3	0.3	0.3	0.8	1.3	1.3	1.3	1.3	1.3					
<b>Total Current Assets</b>	<b>22.4</b>	<b>24.8</b>	<b>25.7</b>	<b>26.0</b>	<b>26.0</b>	<b>26.0</b>	<b>26.7</b>	<b>27.2</b>	<b>258.7</b>	<b>597.5</b>	<b>895.8</b>	<b>1123.8</b>					
<b>TOTAL ASSETS</b>	<b>73.4</b>	<b>78.3</b>	<b>78.8</b>	<b>79.7</b>	<b>80.3</b>	<b>85.9</b>	<b>204.7</b>	<b>747.4</b>	<b>2491.5</b>	<b>2690.2</b>	<b>2767.4</b>	<b>2730.2</b>					

**BANGLADESH  
RUPANTARITA PRAKRITIK GAS COMPANY LTD (RPGCL)  
BALANCE SHEETS  
(In Tk million)**

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	1/ Audited		2/ 1989	Provi- sional 1990	After Restruc 1990	1991	1992	1993	1994	1995	1996	1997
	1987	1988	1989	1990	1990	1991	1992	1993	1994	1995	1996	1997
<b>EQUITY &amp; LIABILITIES</b>												
<b>Equity</b>												
Capital	25.4	25.4	25.4	25.4	34.3	33.9	60.6	173.3	691.7	691.3	690.9	690.5
Retained Earnings	0.0	0.0	-2.4	-2.8	0.0	0.0	0.0	0.0	10.0	66.1	126.1	232.5
<b>Total Equity</b>	<b>25.4</b>	<b>25.4</b>	<b>23.0</b>	<b>22.6</b>	<b>34.3</b>	<b>33.9</b>	<b>60.6</b>	<b>173.3</b>	<b>701.7</b>	<b>747.5</b>	<b>819.0</b>	<b>923.0</b>
<b>Long Term Debt</b>												
IDA	34.1	34.1	34.1	34.2	0.0	0.0	141.9	571.7	952.1	1094.7	1149.9	1060.2
ADP	10.3	14.0	16.0	17.2	0.0	0.0	0.0	0.0	748.9	653.6	560.2	468.8
<b>Total Long Term Debt</b>	<b>44.4</b>	<b>48.1</b>	<b>50.1</b>	<b>51.4</b>	<b>0.0</b>	<b>0.0</b>	<b>141.9</b>	<b>571.7</b>	<b>1699.0</b>	<b>1748.3</b>	<b>1710.1</b>	<b>1527.0</b>
<b>Current Liabilities</b>												
Accounts Payable	0.0	0.0	0.0	0.0		0.0	0.0	0.0	73.9	150.3	159.3	169.8
Income Tax Payable	0.0	0.0	0.0	0.0		0.0	0.0	0.0	10.0	46.2	72.0	104.4
Others	3.6	4.8	5.7	5.7	2.0	2.0	2.2	2.5	7.0	7.0	7.0	7.0
<b>Total Current Liabilities</b>	<b>3.6</b>	<b>4.8</b>	<b>5.7</b>	<b>5.7</b>	<b>2.0</b>	<b>2.0</b>	<b>2.2</b>	<b>2.5</b>	<b>90.9</b>	<b>203.4</b>	<b>238.2</b>	<b>280.2</b>
<b>TOTAL EQUITY &amp; LIABILITIES</b>	<b>73.4</b>	<b>78.3</b>	<b>78.8</b>	<b>79.7</b>	<b>36.3</b>	<b>35.9</b>	<b>204.7</b>	<b>747.4</b>	<b>2491.6</b>	<b>2699.2</b>	<b>2767.4</b>	<b>2730.2</b>
<b>Ratios:</b>												
Current Ratio	6.2	5.2	4.5	4.6	13.0	13.0	12.1	10.9	2.8	2.9	3.8	4.0
LT Debt/Debt + Equity	63.6%	65.4%	68.5%	69.4%	0.0%	0.0%	70.1%	78.7%	70.8%	70.1%	67.6%	62.3%

**BANGLADESH**  
**RUPANTARITA PRAKRITIK GAS COMPANY LTD (RPGCL)**  
**FUNDS FLOW STATEMENTS**  
(In Tk million)

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	1/ 1987	2/ 1988	1989	Provi- sional 1990	Restruc- -turing 1990	1991	1992	1993	1994	1995	1996	1997	TOTAL FY92-95
<b>SOURCES</b>													
Net Operating Income	0.0	0.0	-2.4	-3.7		-3.2	-3.4	-3.6	120.5	299.9	322.5	351.7	413.4
Add Non-Cash Items:													
Depreciation	2.7	0.2	0.4	0.4		0.4	0.4	0.4	113.7	233.6	233.6	233.6	348.1
Amortization	0.0	0.0	0.0	0.0		0.0	0.0	0.0	4.9	15.4	25.8	31.6	20.3
Internal Cash Generation	2.7	0.2	-2.0	-3.3		-2.8	-3.0	-3.2	239.0	548.9	581.8	616.8	781.8
Interest Received	0.0	0.0	2.9	2.6		2.7	2.7	2.7	7.5	23.3	49.2	67.0	36.2
New Long-Term Borrowings	44.4	3.7	2.0	2.5		0.0	135.0	406.7	1097.1	117.9	29.1	0.0	1756.8
Exchange Losses	0.0	0.0	0.0	0.0		0.0	6.9	23.1	30.1	24.8	26.0	24.0	84.9
Equity Contribution	25.4	0.0	0.0	0.0		0.1	27.3	113.5	519.5	0.9	1.1	1.3	661.4
Conversion of Debt to Equity				0.0	17.2								0.0
Conversion of Current A/C to Equity					3.7								0.0
Deferred Charges Written Off					-43.4								0.0
GOB Grant - Pilot Scheme						122.7							0.0
<b>Total Sources</b>	<b>72.5</b>	<b>3.9</b>	<b>2.9</b>	<b>1.8</b>	<b>-22.5</b>	<b>122.7</b>	<b>199.0</b>	<b>542.8</b>	<b>1893.4</b>	<b>715.8</b>	<b>687.3</b>	<b>709.1</b>	<b>3321.0</b>
<b>USES</b>													
Capital Expenditures	12.9	0.1	0.0	1.1		0.0	149.7	464.3	1525.1	66.3	0.0	0.0	2205.4
Interest During Construction	0.0	0.0	0.0	0.0		0.0	7.1	35.7	38.1	0.0	0.0	0.0	80.8
Exchange Losses	8.4	0.0	0.0	0.0	-8.4	0.0	6.9	23.1	30.1	24.8	26.0	24.0	84.9
Deferred Charges	32.4	2.6	0.0	0.0	-35.0	0.0	4.8	19.6	52.8	51.6	29.1	0.0	128.8
Pilot Scheme	0.0	0.0	0.0	0.0		122.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Debt Service													
Amortization	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	93.4	93.4	207.1	93.4
Interest Charged to Income	0.0	0.0	2.9	0.4		0.0	0.0	0.0	94.1	207.4	203.3	187.5	301.5
<b>Total Debt Service</b>	<b>0.0</b>	<b>0.0</b>	<b>2.9</b>	<b>0.4</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>94.1</b>	<b>300.7</b>	<b>296.8</b>	<b>394.6</b>	<b>394.9</b>
Conversion of Debt to Equity	0.0	0.0	0.0	0.0	17.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Provision for Income Tax	0.0	0.0	0.0	0.0		0.0	0.0	0.0	10.0	46.2	72.0	104.4	56.1
Provision for Contribution to GOB	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Increase (Decrease) in W.C.	18.8	1.2	0.0	0.3	3.7	0.0	0.5	0.2	143.2	226.2	263.6	186.0	370.0
<b>TOTAL USES</b>	<b>72.5</b>	<b>3.9</b>	<b>2.9</b>	<b>1.8</b>	<b>-22.5</b>	<b>122.7</b>	<b>199.0</b>	<b>542.8</b>	<b>1893.4</b>	<b>715.8</b>	<b>687.3</b>	<b>709.1</b>	<b>3321.0</b>
Debt Service Coverage	n/a	n/a	-0.7	-8.2		n/a	n/a	n/a	2.5	1.8	2.0	1.6	2.0

BANGLADESH

LIQUEFIED PETROLEUM GAS (LPG) TRANSPORT AND DISTRIBUTION PROJECT

RPGCL - Notes and Assumptions on Financial Statements

<u>FY</u>	<u>91</u>	<u>92</u>	<u>93</u>	<u>94</u>	<u>95</u>	<u>96</u>	<u>97</u>
Local Inflation	6%	6%	7%	6%	6%	6%	6%
Escalation Factor	1.09	1.177	1.260	1.335	1.415	1.500	1.590
Exchange Rate(Tk/US\$)	24.9	26.8	28.4	29.7	40.7	41.6	42.6
Factor (Local-Foreign)		5.4%	4.4%	3.4%	2.4%	2.4%	2.4%
Cumulative	1.00	1.05	1.10	1.14	1.17	1.19	1.22

1. RPGCL will take over the assets and liabilities of CNGCL, and will then assume responsibility for both CNG and NGL operations. When operations are transferred to RPGCL, CNG finances will be restructured. IDA Credit 1091-BD will be repaid and all other long term debt, and balances due to Head Office, will be converted to equity. As from transfer date, all future CNG feasibility and pilot projects will be financed on a 100% grant basis. These conditions have been reflected in the RPGCL forecasts for FY91-97. Since CNG operations are only planned on a yearly basis, the forecasts only include schemes for FY91.

2. RPGCL's forecast financial requirements during FY92-95 (the construction period of RPGCL's component of the proposed project) and the sources from which they are expected to be met as follows:

<u>Requirements</u>	<u>Tk Million</u>	<u>Tk Million</u>	<u>US\$ Million</u> <sup>1/</sup>	<u>%</u>
Capital Expenditure	2,205.4			
Interest during Construction	80.9			
Exchange Losses Capitalized	<u>45.1</u>	2,331.4	59.9	
Technical Assistance		126.8	3.3	
Working Capital		<u>870.0</u>	<u>9.5</u>	
		<u>2,830.2</u>	<u>72.7</u>	<u>100</u>
<u>Sources</u>				
Internal Cash Generation	820.2			
Less: Debt Service/Exchange Losses	434.7			
Less: Income Tax	<u>55.1</u>	329.4	8.6	12
Borrowings		1,841.7	47.3	65
Equity Contributions		<u>659.1</u>	<u>16.9</u>	<u>23</u>
		<u>2,830.2</u>	<u>72.7</u>	<u>100</u>

<sup>1/</sup> Converted at an average rate of US\$1=Tk 28.9

3. Income Statements

A. Sales Revenue:

CNG sales volumes and revenues have been based on experience in recent years. Annual LPG and other sales volumes have been estimated as follows:

	<u>FY94</u>	<u>FY95-97</u>
	[----- metric tons -----]	
Liquids Received	71,054	142,107
Loss Factor	<u>704</u>	<u>1,407</u>
Output (Sales)	<u>70,350</u>	<u>140,700</u>
of which:		
LPG	19,600	39,200
Propane	2,050	4,100
Kerosene	10,050	20,100
Motor Spirit	30,350	60,700
High Speed Diesel	<u>8,300</u>	<u>16,600</u>
	<u>70,350</u>	<u>140,700</u>

The initial transfer price of LPG ex-RPGCL has been assumed at US\$214.2/mt. This price has been derived from the October 1990 kerosene retail price of 14.0 Tk/liter (US\$660/mt), after an adjustment of 1.3 for fuel equivalency, excise duties, LPGL's and dealers' costs and margins--in all totalling US\$445.8/mt. Ex-RPGCL transfer prices for other products have been assumed to be one half of the undermentioned ex-ERL transfer prices as of October 1990, except for propane which is priced at the same price as LPG.

Propane	-	US\$214.2/mt
Kerosene	-	US\$476/mt
Motor Spirit	-	US\$482/mt
High Speed Diesel	-	US\$442/mt

All revenue forecasts have been maintained in real terms.

B. Raw Materials:

The transfer price of the liquids received from SGFL has been based on prices in similar contracts between Petrobangla Production Companies and ERL, and translates into about US\$131.4/mt. This price compensates SGFL for the additional investment incurred in the installation of plant using turbo-expanders rather than silica-gel.

C. Operating Expenses:

CNG - maintained at current levels; depreciation has been calculated at 3% of average gross fixed assets.

NGL - calculated according to an engineering assessment of RPGCL's needs for operating the new project. Annual inflation has been taken into account. Depreciation of plant has been calculated at 10% per year, and amortization of deferred charges (technical assistance) at 20% per year.

- D. Interest Charged:  
Onlent IDA funds - 10% per year with RPGCL assuming exchange risk.  
ADP funds - 15% per year.
- E. Interest Received:  
11% per year on cash balances in excess of two months cash operating expenses.
- F. Exchange Losses:  
Capitalized during project construction period of the project and thereafter charged annually against net operating income.
- G. Income Tax:  
50% of net income after interest and exchange losses.
4. Balance Sheet
- A. Work in Progress:  
Debited annually with actual capital construction executed during year under the project together with interest during construction and exchange losses. The accumulated total has been transferred to gross fixed assets when assets are put into operation. In the case of plant constructed by PIU under IDA-financed Second Gas Development Project, the value of plant is taken directly to gross fixed assets when transferred from PIU to RPGCL in FY94.
- B. Pilot Scheme:  
CNG Pilot Scheme to be executed in FY91; under proposed Credit conditions this scheme would be financed by GOB grant.
- C. Deferred Charges:  
Technical assistance for RPGCL under the project, would be amortized over five years.
- D. Current Assets:
- (i) Cash and Bank Balances--Because of the high profitability of the proposed Project, and absence of further developments after FY94, cash and bank balances are likely to exceed normal cash requirements. It has been assumed that excess cash would be placed on deposit (see interest received 2(e)).
  - (ii) Accounts Receivable: Trade--Equivalent to 1.5 months gross revenue.
  - (iii) Accounts Receivable: Interest--Equivalent to 3 months interest receivable.
  - (iv) Stocks and Stores--Equivalent to 1% of gross fixed assets as from FY94.
  - (v) Others--Advances and miscellaneous current items.

E. Equity

- (i) Capital--GOB contributions to RPGCL's development.
- (ii) Retained Earnings--Accumulated earnings retained in RPGCL.

F. Long Term Debt: Includes:

- (i) Onlent IDA Credit at 15 years including 5 years grace at 10% per year, with RPGCL taking exchange risk;
- (ii) ADP loan for plant transferred from PIU at 13 years including 5 years at 15% per year.

G. Current Liabilities:

- (i) Accounts Payable--Equivalent to 2 months cash operating expenses
- (ii) Income Tax Payable--After tax due for fiscal year.
- (iii) Others--Miscellaneous receipts in advance.

5. Funds From Flow Statements

A. New Long Term Borrowings:

Annual drawdowns from IDA Credit and ADP loans.

B. Equity Contribution:

GOB's annual contribution to RPGCL's capital development program.

C. Interest During Construction:

Interest has been capitalised during the construction period of the project.

D. Exchange Losses:

Exchange losses have been capitalized during the construction period of the project and thereafter charged to net income.

E. Deferred Charges:

Annual expenditure on technical assistance.

F. Provisional Income Tax:

Annual income tax has been assumed to be paid in the year following year of assessment.

G. GOB Contribution:

Assumed paid in the related year.

FY Ending June 30:	Audited			Provi- sional		1991	1992	1993	1994	1995	1996	1997
	1986	1987	1988	1989	1990							
<b>Sales Revenue</b>												
Gross Sales Revenue	68.2	64.9	64.7	65.2	70.3	148.0	192.0	230.4	785.3	1348.4	1428.3	1515.1
Less: Raw Materials	41.9	39.0	36.3	36.0	36.0	89.0	100.0	102.8	255.3	449.8	478.8	505.4
Excise Duties	3.6	5.5	5.5	5.4	5.8	9.9	11.9	14.3	51.7	91.1	85.5	102.3
<b>Net Sales Revenue</b>	<b>22.7</b>	<b>23.4</b>	<b>22.9</b>	<b>23.8</b>	<b>28.5</b>	<b>49.1</b>	<b>80.1</b>	<b>113.3</b>	<b>458.4</b>	<b>807.8</b>	<b>868.0</b>	<b>907.4</b>
<b>Operating Expenses</b>												
Salaries & Wages including Benefits	2.9	3.1	3.4	3.3	3.6	4.9	6.7	8.8	68.1	122.0	119.3	127.2
Manufacturing Overhead (Excl: Depreciation)	2.9	1.2	1.4	1.4	1.5	1.5	1.8	1.7	8.1	8.7	10.1	10.8
Selling and Administrative Expenses	0.8	0.9	1.2	1.0	1.1	1.1	1.2	1.3	4.1	4.8	5.0	5.1
Other Expenses	0.0	0.3	1.1	1.5	1.5	1.5	1.8	1.7	3.3	3.6	3.8	3.8
Depreciation	9.4	9.6	10.4	10.3	14.5	12.0	17.0	19.3	46.7	172.2	214.5	234.0
Amortization	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.7	30.5	30.5
<b>Total Operating Expenses</b>	<b>15.9</b>	<b>15.1</b>	<b>17.5</b>	<b>17.5</b>	<b>22.2</b>	<b>21.0</b>	<b>28.0</b>	<b>31.8</b>	<b>150.3</b>	<b>325.0</b>	<b>363.2</b>	<b>411.6</b>
<b>Net Operating Income</b>	<b>6.8</b>	<b>8.3</b>	<b>5.4</b>	<b>6.3</b>	<b>6.3</b>	<b>28.2</b>	<b>52.1</b>	<b>81.8</b>	<b>308.0</b>	<b>482.6</b>	<b>472.8</b>	<b>495.8</b>
Interest Charged	8.8	9.7	10.3	14.6	11.5	5.9	6.2	6.5	44.9	129.9	169.0	194.9
Interest Received	5.5	7.7	14.0	14.8	11.8	2.6	6.7	13.0	41.5	81.9	108.1	117.3
Exchange Losses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	8.3	28.4	34.2	36.5
<b>Net Income Before Tax</b>	<b>3.6</b>	<b>6.3</b>	<b>9.1</b>	<b>6.5</b>	<b>6.6</b>	<b>24.9</b>	<b>52.7</b>	<b>87.9</b>	<b>296.3</b>	<b>407.9</b>	<b>365.7</b>	<b>411.7</b>
Provision for Tax		50.0%										
	1.8	3.2	6.1	4.6	3.2	12.4	29.3	43.9	148.1	203.9	162.9	205.8
<b>Net Income After Tax</b>	<b>1.8</b>	<b>3.2</b>	<b>3.0</b>	<b>1.9</b>	<b>3.4</b>	<b>12.4</b>	<b>26.3</b>	<b>43.9</b>	<b>148.1</b>	<b>203.9</b>	<b>162.9</b>	<b>205.8</b>
<b>Return on Ave. Net Fixed Assets After Tax</b>	<b>19.5%</b>	<b>10.8%</b>	<b>-1.8%</b>	<b>5.5%</b>	<b>9.6%</b>	<b>26.9%</b>	<b>34.2%</b>	<b>52.7%</b>	<b>21.2%</b>	<b>17.0%</b>	<b>15.5%</b>	<b>16.3%</b>

**BANGLADESH**  
**LP Gas Limited (LPGL)**  
**Balance Sheets**  
**(In Tk million)**

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FY Ending June 30:	Audited			Provi- sional		1991	1992	1993	1994	1995	1996	1997
	1986	1987	1988	1989	1990							
<b>Fixed Assets</b>												
Fixed Assets in Operation	87.3	88.4	91.4	91.7	119.7	169.7	182.6	197.2	1614.0	2069.8	2460.0	2460.0
Less: Accu. Depreciation	35.5	45.1	55.5	65.8	80.3	92.3	109.2	127.5	174.2	346.4	530.9	794.9
<b>Net Fixed Assets in Operation</b>	<b>51.8</b>	<b>43.3</b>	<b>35.9</b>	<b>25.9</b>	<b>39.4</b>	<b>77.4</b>	<b>73.3</b>	<b>69.7</b>	<b>1439.8</b>	<b>1723.4</b>	<b>1899.1</b>	<b>1665.0</b>
Work in Progress	0.0	0.0	0.0	0.0	0.0	0.0	66.4	528.3	-0.0	0.0	0.0	0.0
Other Assets	0.0	0.3	0.0	0.0	0.0	0.0	4.8	14.4	69.6	113.9	109.5	79.0
<b>Current Assets</b>												
Cash and Bank Balances	57.1	94.1	104.1	83.8	53.5	42.6	87.4	155.3	431.9	936.8	1220.3	1379.4
Accounts Receivable – Trade Debtors	2.0	3.1	3.2	4.8	5.0	12.3	16.0	19.2	63.8	112.4	119.1	126.3
Accounts Receivable – Interest	2.7	3.5	12.7	12.5	10.0	0.7	1.7	3.3	10.4	20.4	26.5	29.3
Stock, Stores and Spares	6.8	3.8	3.1	3.0	3.1	3.3	3.5	3.7	18.2	22.9	27.0	27.1
Advances, Deposits & Prepayments	4.3	0.2	1.6	4.2	4.0	4.0	4.2	4.3	9.5	10.7	11.8	13.0
<b>Total Current Assets</b>	<b>72.9</b>	<b>104.7</b>	<b>124.7</b>	<b>108.3</b>	<b>75.6</b>	<b>62.9</b>	<b>112.7</b>	<b>185.8</b>	<b>633.7</b>	<b>1103.2</b>	<b>1404.8</b>	<b>1575.1</b>
<b>TOTAL ASSETS</b>	<b>124.7</b>	<b>148.3</b>	<b>160.6</b>	<b>134.2</b>	<b>115.0</b>	<b>140.3</b>	<b>257.3</b>	<b>788.1</b>	<b>2093.1</b>	<b>2940.5</b>	<b>3413.3</b>	<b>3319.1</b>

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**BANGLADESH**  
**LP Gas Limited (LPGL)**  
**Balance Sheets**  
**(In Tk million)**

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FY Ending June 30:	Audited			Provi- sional								
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
<b>Equity</b>												
Paid-up Capital	10.0	10.0	10.0	10.0	10.0	22.5	34.1	112.2	447.7	680.4	843.6	843.6
Reserve and Retained Earnings	2.8	4.4	5.7	6.6	7.9	18.3	42.6	86.6	114.7	138.7	151.5	157.4
<b>Total Equity</b>	<b>12.8</b>	<b>14.4</b>	<b>15.7</b>	<b>16.6</b>	<b>17.9</b>	<b>40.8</b>	<b>76.8</b>	<b>198.8</b>	<b>562.4</b>	<b>799.1</b>	<b>995.1</b>	<b>1001.0</b>
<b>Long Term Debt</b>	<b>84.6</b>	<b>97.0</b>	<b>101.1</b>	<b>73.1</b>	<b>50.6</b>	<b>52.5</b>	<b>119.6</b>	<b>522.4</b>	<b>1133.6</b>	<b>1454.6</b>	<b>1716.5</b>	<b>1574.5</b>
<b>Other Liabilities</b>												
Deposits - Cylinders	9.8	24.9	27.1	37.4	28.0	28.0	28.0	28.0	210.4	414.8	438.0	462.6
<b>Current Liabilities</b>												
Accounts Payable: Goods Supplied	4.0	4.3	2.2	1.6	2.0	2.0	2.1	2.2	23.5	47.4	50.3	53.3
Accounts Payable: Expenses	1.6	2.1	2.0	1.7	2.0	2.0	2.0	2.2	13.3	19.1	18.7	19.9
Interest Payable	4.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Others	0.4	0.5	0.7	0.5	0.5	0.5	0.5	0.6	1.7	1.7	1.9	2.0
Dividend	3.0	2.5	3.5	4.0	4.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0
Income Tax	3.6	2.5	8.3	9.3	10.0	12.4	26.3	43.9	148.1	203.9	162.9	205.8
<b>Total Current Liabilities</b>	<b>17.5</b>	<b>12.0</b>	<b>16.7</b>	<b>17.1</b>	<b>18.5</b>	<b>18.9</b>	<b>32.9</b>	<b>48.9</b>	<b>166.7</b>	<b>272.1</b>	<b>263.7</b>	<b>281.1</b>
<b>TOTAL EQUITY AND LIABILITIES</b>	<b>124.7</b>	<b>148.3</b>	<b>160.6</b>	<b>134.2</b>	<b>115.0</b>	<b>140.3</b>	<b>257.3</b>	<b>798.1</b>	<b>2093.1</b>	<b>2940.5</b>	<b>3413.3</b>	<b>3319.1</b>
<b>Ratios:</b>												
Current Ratio	4.2	8.7	7.5	6.3	4.1	3.3	3.4	3.8	3.1	4.1	5.3	5.6
Accts Recble Equiv. in Months of Billing	0.4	0.6	0.6	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0
LT Debt / Debt + Equity	86.9%	87.1%	86.6%	81.5%	73.9%	56.3%	60.9%	72.4%	66.8%	64.5%	63.3%	61.1%

BANGLADESH  
LP Gas Limited (LPGL)  
Funds Flow Statements  
(in Tk million)

08:19 AM

Sources	Audited		Provi- sional		1991	1992	1993	1994	1995	1996	1997	TOTAL FY02-08	
	1986	1987	1988	1989									1990
Net Operating Income	6.8	8.3	5.4	6.3	6.3	28.2	52.1	81.6	308.0	482.6	472.8	485.8	1397.1
Add Non-cash Items:													
Depreciation	9.4	9.8	10.4	10.3	14.5	12.0	17.0	18.3	48.7	172.2	214.5	234.0	488.8
Amortization	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.7	30.5	30.5	43.2
Internal Cash Generation	16.3	17.9	15.8	16.6	20.8	40.1	69.1	99.8	354.7	667.5	717.8	730.4	1900.0
Interest Received	5.5	7.7	14.0	14.8	11.8	2.8	6.7	13.0	41.5	81.6	100.1	117.3	249.0
New Long-Term Borrowings	4.3	30.8	5.6	0.0	0.0	7.0	72.5	405.2	600.4	300.1	233.2	0.0	1611.3
Exchange Losses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	16.2	26.4	34.2	39.5	79.8
Equity Contribution	0.3	0.0	0.0	0.0	0.0	12.5	11.6	78.1	335.5	212.7	183.2	0.0	821.1
Adjustment of Fixed Assets	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prior Year's Adjustments	0.0	0.1	0.3	-0.4	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reduction of Other Investments	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Conversion of ADP Debt	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cylinder Deposits	9.8	15.1	2.2	0.3	0.6	0.0	0.0	0.0	182.4	204.3	23.2	24.8	410.0
<b>Total Sources</b>	<b>36.6</b>	<b>71.7</b>	<b>38.3</b>	<b>32.7</b>	<b>33.1</b>	<b>62.3</b>	<b>159.9</b>	<b>599.2</b>	<b>1530.7</b>	<b>1492.5</b>	<b>1297.7</b>	<b>938.8</b>	<b>5080.0</b>
<b>Uses</b>													
Capital Expenditures	22.4	1.4	3.1	0.3	28.0	50.0	78.1	447.4	842.2	455.8	300.1	0.0	2211.7
Interest During Construction	0.0	0.0	0.0	0.0	0.0	0.0	3.2	26.2	38.5	0.0	0.0	0.0	67.9
Exchange Losses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	16.2	26.4	34.2	36.5	79.8
Debt Service													
Amortization	0.6	18.4	1.5	26.6	22.5	5.1	5.4	5.4	5.4	5.4	5.4	173.8	27.1
Interest Charged to Income	8.8	9.7	10.3	14.8	11.5	5.9	6.2	6.5	44.8	129.9	159.0	164.9	346.5
<b>Total Debt Service</b>	<b>9.4</b>	<b>28.1</b>	<b>11.8</b>	<b>41.2</b>	<b>34.0</b>	<b>11.0</b>	<b>11.6</b>	<b>11.9</b>	<b>50.3</b>	<b>135.3</b>	<b>164.4</b>	<b>343.5</b>	<b>373.8</b>
Other Assets & Deferred Charges	0.0	0.3	0.0	0.0	0.0	0.0	4.8	9.6	55.2	58.9	29.2	0.0	152.7
Conversion of ADP Debt	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Provisions for Income Tax	1.8	3.1	6.1	4.6	3.2	12.4	26.3	43.9	148.1	203.9	192.9	205.8	615.2
Provisions for Dividend	2.0	1.5	2.0	2.0	2.0	2.0	2.0	0.0	0.0	0.0	0.0	0.0	2.0
Provisions for Contribution to GOB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120.0	180.0	180.0	200.0	480.0
Increase (Decrease) in WC	1.0	37.3	15.3	-16.8	-34.1	-13.2	35.9	57.0	280.2	434.1	309.9	152.0	1087.1
<b>Total Uses</b>	<b>36.6</b>	<b>71.7</b>	<b>38.3</b>	<b>32.7</b>	<b>33.1</b>	<b>62.3</b>	<b>159.9</b>	<b>599.2</b>	<b>1530.7</b>	<b>1492.5</b>	<b>1297.7</b>	<b>938.8</b>	<b>5080.0</b>
Debt Service Coverage	1.7	0.6	1.3	0.4	0.6	3.7	6.0	8.4	7.1	4.9	4.4	2.2	5.1

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ANNEX 4.2  
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BANGLADESH

LIQUEFIED PETROLEUM GAS (LPG) TRANSPORT AND DISTRIBUTION PROJECT

LPGL : Notes and Assumptions on Financial Statements

1. LPGL has an excessive debt level. It has therefore been assumed that, in line with the proposed conditions for the IDA Credit, LPGL will reduce its debt/equity ratio on its Chittagong operations to an acceptable level of 65/35.

2. The forecast financial requirements for LPGL's during FY92-96 (the construction period of LPGL's component of the proposed Project) and the sources from which they are expected to be met are as follows:

	<u>Tk Million</u>	<u>Tk Million</u>	<u>US\$ Million</u> <sup>a/</sup>	<u>%</u>
<u>Requirements</u>				
Capital Expenditure	2,184.8			
Interest during Construction	67.9			
Exchange Losses Capitalised	<u>10.6</u>	2,262.8	67.4	
Technical Assistance		162.7	8.9	
Working Capital		<u>988.8</u>	<u>25.4</u>	
		<u>8,414.8</u>	<u>88.7</u>	<u>100</u>
<u>Sources</u>				
Internal Cash Generation	1,556.7			
Less: Debt Service/Exchange Losses	388.7			
Less: Income Tax	361.4			
Less: Dividends/Contributions to GOB	<u>290.0</u>	521.4	18.8	15
Cylinder Deposits		410.0	10.4	12
Borrowings		1,670.5	42.4	49
Equity Contributions		<u>812.4</u>	<u>20.6</u>	<u>24</u>
		<u>8,414.8</u>	<u>88.7</u>	<u>100</u>

<sup>a/</sup> Converted at an average rate of US\$1 = Tk 89.4

3. Income Statements

A. Gross Sales Revenue:

LPGL's expected sales volumes during FY91-97 are estimated as follows (in metric tons):

<u>FY</u>	<u>91</u>	<u>92</u>	<u>93</u>	<u>94</u>	<u>95</u>	<u>96</u>	<u>97</u>
Chittagong	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Elenga and KTL	-	-	-	19,600	39,200	39,200	39,200
Total	<u>10,000</u>	<u>10,000</u>	<u>10,000</u>	<u>29,600</u>	<u>49,200</u>	<u>49,200</u>	<u>49,200</u>

Sales volumes at Chittagong are entirely dependent on the availability of LPG from the ERL Refinery, and, in the absence of further information, it has been assumed in the FY91-97 forecasts that the sales volumes at that center would continue at current levels (10,000 m/t per year). Furthermore, it has been assumed that once the Elenga and Kailashtila Plants become operational in FY94, ex-LPGL transfer prices would be established at the same level at all three centers. At the same time, the transfer prices for LPG ex-ERL and ex-RPGCL would also be fixed at the ex-RPGCL price. The initial ex-LPGL LPG transfer price has been calculated at US\$564/mt. This price has been derived from the retail kerosene price of 14.0 Tk/liter as of October 1990, after adjustment for fuel equivalency, retailer's costs, and margins. To bring prices in line with the current retail price of the kerosene equivalent, prices have been increased by 20% in FY92 and FY93. All revenue forecasts have been maintained in real terms.

**B. Raw Materials:**

The ex-RPGCL LPG price of US\$214.2/mt has been based on the October 1990 kerosene retail price after adjustment for fuel equivalency, LPGL's and retailers' costs and margins.

**C. Excise Duties:**

Tk 12.38 per cylinder to FY91; 6% of sale price from FY92.

**D. Operating Expenses:**

Chittagong have been based on current levels with allowance for annual inflation.

Elenga and KTL have been based on an engineering appraisal of the operating requirements for the new plant.

Depreciation has been assumed at 10% per year.

Amortization of technical assistance deferred charges has been assumed at 20% per year.

**E. Interest Charged:**

Onlent IDA funds - 10% per year with LPGL taking the exchange risk.

**F. Interest Received:**

11% per year on cash balances in excess of two months cash operating expenses.

**G. Exchange Losses:**

Exchange losses have been capitalized during construction period of the project and thereafter charged annually against net operating expenses.

**H. Income Tax:**

50% of net income after interest and exchange losses.

4. Balance Sheet

A. Fixed Assets in Operation:

Apart from an increase in fixed assets of Tk 50 million in FY91 in Chittagong, all additions to fixed assets relate to the proposed Project which will be put into operation in FY94.

B. Works in Progress:

Annually accumulated works on the construction of the Project until transferred into fixed assets in operation in FY94.

C. Other Assets:

Costs of technical assistance to LPGL, to be amortized over five years as from FY96.

D. Current Assets:

(i) Cash and Bank Balances--Because of the high profitability of the proposed project and absence of further development after FY94, cash and bank balances are likely to exceed normal cash requirements. It has been assumed that excess cash would be placed on deposit (See Interest Received - 6(f)).

(ii) Accounts Receivable: Trade Debtors--Equivalent to 1 month's gross revenue.

(iii) Accounts Receivable: Interest--Equivalent to 3 months interest.

(iv) Stocks, Stores and Sales--Equivalent to 1% gross fixed assets.

H. Equity:

(i) Capital--GOB contributions to LPGL's development.

(ii) Reserves and Retained Earnings--Accumulated earnings retained in LPGL.

I. Long Term Debt:

Onlent IDA Credit at 15 years including 5 years grace at 10% per year with LPGL taking exchange risks, and ADP Loan for 20 years at 15% per year.

J. Other Liabilities:

Deposits for cylinders from consumers - assumed equivalent to 36% of gross revenues (as per Chittagong ratio).

K. Current Liabilities:

(i) Accounts Payable: Goods Supplied--Equivalent 6 weeks of raw materials.

(ii) Accounts Payable: Expenses--Equivalent to 2 months cash operating expenses.

(iii) Interest Payable--Equivalent to 3 months interest.

(iv) Others--Advances - Small liabilities.

(v) Income Tax--Tax due for fiscal year.

5. Funds Flow Statement

A. New Long-term Borrowings:

Annual drawdowns from IDA Credit and ADP loans.

B. Equity Contribution:

GOB's or donors' annual contribution to LPGL's Capital Development Program.

C. Cylinder Deposits:

Annual receipts from cylinder deposits. These have been treated as an internal source.

D. Interest During Construction :

Interest has been capitalised during the construction period of the project.

E. Exchange Losses:

Exchange losses have been capitalised during the construction period of the project and thereafter charged to net income.

F. Other Assets and Deferred Charges:

Annual expenditure on technical assistance.

G. Provision for Income Tax:

Annual income tax has been assumed to be paid in the year following year of assessment.

H. Contribution to GOB:

Assumed to be paid in related fiscal year.

6. Ratios

Rates of Return--Net operating income after tax as a percentage of average net fixed assets in operation

Debt/Equity Ratio--Long term debt as a percentage of total capitalization

Current Ratio--Current assets divided by current liabilities

Debt Service Coverage--Internal cash generation divided by debt service

**BANGLADESH - LPG TRANSPORT AND DISTRIBUTION PROJECT**

**Financial Internal Rate of Return Calculation**

RPGCL, NGL Division

<u>YEAR</u>	<u>CAPITAL EXPENDITURES</u>	<u>OPERATING COSTS</u>	<u>REVENUES</u>	<u>INCOME TAX</u>	<u>NET BENEFITS</u>	<u>DEFLATOR</u>	<u>ADJUSTED NET BENEFITS</u>
1991					0.0	0.92	0.0
1992	154.5				(154.5)	0.86	(132.9)
1993	483.9				(483.9)	0.81	(392.0)
1994	428.8	44.2	286.7	10.0	(196.3)	0.76	(149.2)
1995	117.9	55.4	607.8	46.2	388.3	0.72	279.6
1996	29.1	58.7	644.3	72.0	484.5	0.68	329.5
1997		62.2	683.0	104.4	516.4	0.68	351.2
1998		62.2	683.0	104.4	516.4	0.68	351.2
1999		62.2	683.0	104.4	516.4	0.68	351.2
2000		62.2	683.0	104.4	516.4	0.68	351.2
2001		62.2	683.0	104.4	516.4	0.68	351.2
2002		62.2	683.0	104.4	516.4	0.68	351.2
2003		62.2	683.0	104.4	516.4	0.68	351.2
2004		62.2	683.0	104.4	516.4	0.68	351.2
2005		62.2	683.0	104.4	516.4	0.68	351.2
2006		62.2	683.0	104.4	516.4	0.68	351.2
2007		62.2	683.0	104.4	516.4	0.68	351.2
2008		62.2	683.0	104.4	516.4	0.68	351.2
2009		62.2	683.0	104.4	516.4	0.68	351.2
2010		62.2	683.0	104.4	516.4	0.68	351.2

**IRR 35.3%**

**SENSITIVITY ANALYSIS**

	<b>IRR</b>
(a) Capital Expenditures (+10%)	32.1%
(b) Operating Costs (+10%)	34.8%
(c) Revenues (-10%)	31.3%
(d) Combination of (a), (b) & (c)	28.1%

23-Apr-91

**BANGLADESH - LPG TRANSPORT AND DISTRIBUTION PROJECT**

**Financial Internal Rate of Return Calculation**

**LPGL, Elenga + KTL-1 Operations**

<u>YEAR</u>	<u>CAPITAL EXPENDITURES</u>	<u>OPERATING COSTS</u>	<u>REVENUES</u>	<u>INCOME TAX</u>	<u>NET BENEFITS</u>	<u>DEFLATOR</u>	<u>ADJUSTED NET BENEFITS</u>
1991						0.92	0.0
1992	68.1				(68.1)	0.86	(58.6)
1993	442.4				(442.4)	0.81	(358.3)
1994	897.4	66.0	303.5	91.7	(751.6)	0.76	(571.2)
1995	512.7	99.2	643.4	142.4	(110.9)	0.72	(79.8)
1996	416.3	95.1	682.0	127.5	43.1	0.68	29.3
1997		101.5	723.0	136.5	485.0	0.68	329.8
1998		101.5	723.0	136.5	485.0	0.68	329.8
1999		101.5	723.0	136.5	485.0	0.68	329.8
2000		101.5	723.0	136.5	485.0	0.68	329.8
2001		101.5	723.0	136.5	485.0	0.68	329.8
2002		101.5	723.0	136.5	485.0	0.68	329.8
2003		101.5	723.0	136.5	485.0	0.68	329.8
2004		101.5	723.0	136.5	485.0	0.68	329.8
2005		101.5	723.0	136.5	485.0	0.68	329.8
2006		101.5	723.0	136.5	485.0	0.68	329.8
2007		101.5	723.0	136.5	485.0	0.68	329.8
2008		101.5	723.0	136.5	485.0	0.68	329.8
2009		101.5	723.0	136.5	485.0	0.68	329.8
2010		101.5	723.0	136.5	485.0	0.68	329.8

**IRR 18.9%**

**SENSITIVITY ANALYSIS**

**IRR**

(a) Capital Expenditures (+10%)	16.7%
(b) Operating Costs (+10%)	18.3%
(c) Revenues (-10%)	15.9%
(d) Combination of (a), (b) & (c)	13.3%

**BANGLADESH - LPG TRANSPORT AND DISTRIBUTION PROJECT**

***Estimated Resource Mobilization Impact***

	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>TOTAL</u>
	<i>(In Current Tk million)</i>						
<b><u>LPGL</u></b>							
Income Tax	26.3	43.9	148.1	203.9	192.9	205.8	820.9
Contributions to GOB	2.0	-	120.0	180.0	180.0	207.0	682.0
Excise Duties	11.9	14.3	81.7	91.1	96.5	102.3	367.8
Interest	6.2	6.6	44.9	129.9	159.0	164.9	511.4
Principal	5.4	5.4	5.4	5.4	5.4	178.6	205.6
Customs Duties & Taxes	2.6	28.7	234.7	200.4	181.8	-	648.2
Subtotal	54.4	98.8	604.8	810.7	818.6	851.6	3235.9
Less:							
Contributions to Project	6.8	68.5	320.4	207.4	183.2	-	786.3
Interest on Credit	0.3	1.9	6.0	9.8	11.9	13.0	42.9
Total, LPGL	47.3	28.4	278.4	593.5	620.5	838.6	2406.7
<b><u>RPGCL</u></b>							
Income Tax			10.0	46.2	72.0	104.4	232.6
Contributions to GOB							
Excise Duties							
Interest			94.1	207.4	203.3	187.5	692.3
Principal				93.4	93.4	207.1	393.9
Customs Duties & Taxes	7.8	31.0	34.7	-	-	-	73.5
Subtotal	7.8	31.0	138.8	347.0	368.7	499.0	1392.3
Less:							
Contributions to Project	22.5	94.0	504.5	0.9	1.1	1.3	624.3
Interest on Credit	0.5	2.7	5.6	7.3	8.3	8.5	32.9
Total, LPGL	-15.2	-65.7	-371.3	338.8	359.3	489.2	735.1
<b><u>Combined LPGL &amp; RPGCL</u></b>							
Income Tax	26.3	43.9	158.1	250.1	264.9	310.2	1053.5
Contributions to GOB	2.0	0.0	120.0	180.0	180.0	200.0	682.0
Excise Duties	11.9	14.3	81.7	91.1	96.5	102.3	367.8
Interest	6.2	6.6	139.0	337.3	362.3	352.4	1203.7
Principal	5.4	5.4	5.4	98.8	98.8	385.7	599.5
Customs Duties & Taxes	10.4	59.7	269.4	200.4	181.8	0.0	721.7
Subtotal	62.2	129.8	743.6	1157.7	1184.3	1350.6	4828.2
Less:							
Contributions to Project	29.3	162.5	824.9	208.3	184.3	1.3	1410.6
Interest on Credit	0.8	4.6	11.6	17.1	20.2	21.5	75.8
Total, LPGL + RPGCL	32.1	-37.3	-62.9	932.3	979.8	1327.8	3141.8

## BANGLADESH: LPG TRANSPORT AND DISTRIBUTION PROJECT

### PETROLEUM PRODUCT SALES, BY DEPOT (1988/89)

(in Metric Tons)

DEPOT	100/130	JPL-1	OCTANE	PETROL	KEROSENE	DIESEL	LDO	F.O.	JBO	SBP	MTT	LUBE	GREASE	LPG	BITUMEN	TOTAL
ASHUGANJ	0	0	0	0	7347	7786	0	0	532	0	0	38	0	0	0	15703
BAGHABARI *	0	0	0	8416	91837	161659	0	3168	0	0	0	1084	4	2716	0	268884
BARISAL *	0	0	0	515	12707	37596	0	0	0	0	0	263	0	57	215	51353
BHAIRAB	0	0	0	0	24397	26755	0	0	0	0	0	16	0	0	0	51168
BRAHMANBARIA	0	0	0	1274	0	2957	0	0	0	0	0	0	0	0	0	4231
CHANDPUR	0	0	3	0	40099	28268	0	108	324	0	0	176	0	0	0	68978
CHILMARI	0	0	0	0	8	150	0	0	0	0	0	0	0	0	0	158
CHITTAGONG	0	9	2140	15079	70179	175093	8024	10862	5232	373	1434	20262	205	5690	20706	335288
CHITTAGONG AIRPORT	3	6119	0	0	0	0	0	0	0	0	0	0	0	0	0	6122
DAULATPUR *	0	922	276	5637	83161	155435	609	189813	8414	0	16	3479	68	510	9326	457666
DHAKA AIRPORT	0	3065	0	0	0	0	0	0	0	0	0	0	0	0	0	3065
FATULLA	0	0	3028	10359	30618	65906	0	2900	4048	0	0	2141	22	125	4599	123746
GODAINAL	0	56	4701	20295	71564	136090	40	3626	8541	0	312	2931	48	0	9439	257643
JHALAKATI *	0	0	0	391	19689	19598	0	0	0	0	0	35	0	0	0	39713
KGF	0	0	0	705	0	61	0	0	0	0	0	8	0	0	0	774
KURMITOLA AIRPORT	94	69155	0	0	0	32	0	0	0	0	0	4	0	0	0	69285
MMSC	0	0	1009	1305	415	0	0	0	0	0	0	51	0	0	0	2780
RANGPUR *	0	0	0	8	0	198	0	0	0	0	0	60	1	0	0	267
SDR	0	0	0	0	0	7429	0	0	0	0	0	0	0	0	0	7429
SRIMANGAL	0	0	25	931	8420	11294	161	655	0	0	0	212	1	0	0	21699
SYLHET	0	0	0	3663	14266	13671	0	0	0	0	0	298	2	0	0	31900
<b>TOTAL</b>	<b>97</b>	<b>79326</b>	<b>11182</b>	<b>68578</b>	<b>474707</b>	<b>849978</b>	<b>8834</b>	<b>211132</b>	<b>27091</b>	<b>373</b>	<b>1762</b>	<b>31058</b>	<b>351</b>	<b>9098</b>	<b>44285</b>	<b>1817852</b>

\* West zone depots

Percentage of Total Kerosene Supply Reaching West Zone

43.7%

Baghabari and Daulatpur's share of West Zone Supply

84.4%

Sources:

Jamuna Oil Company Limited / Meghna Petroleum Limited / Padma Oil Company Limited

**BANGLADESH: LPG TRANSPORT AND DISTRIBUTION PROJECT**

**Petroleum Products Demand Projections**  
(in Metric Tons)

	<i>Actual Sales</i>		<i>Forecasts</i>					
	1987	1988	1989	1990	1991	1992	1993	1994
JP-1	78,926	79,794	85,000	91,000	97,000	103,000	110,000	117,000
Octane	9,751	11,107	13,500	15,000	17,000	19,000	21,500	25,000
Petrol	61,653	68,729	80,000	90,000	101,000	113,000	125,000	137,000
Kerosene	419,615	476,118	500,000	530,000	562,000	595,000	625,000	660,000
Diesel	708,353	847,444	920,000	1,000,000	1,080,000	1,160,000	1,240,000	1,320,000
LDO	11,940	8,673	10,000	11,000	11,500	12,000	12,500	13,000
JBO	28,569	27,028	28,500	29,000	29,500	30,000	30,500	31,000
Furnace Oil	309,729	209,521	230,000	245,000	260,000	275,000	290,000	300,000
Lubricating Oil	25,557	31,060	34,000	37,000	40,000	43,000	46,000	49,000
LPG	9,163	9,214	10,000	11,000	12,000	14,000	16,000	18,000
Bitumin	27,215	44,179	34,000	35,000	36,000	37,000	38,000	39,000
SBP	316	375	400	400	450	450	500	500
STT	1,513	1,769	1,800	1,800	1,850	1,850	1,900	1,900
<b>TOTAL</b>	<b>1,692,300</b>	<b>1,815,011</b>	<b>1,947,200</b>	<b>2,096,200</b>	<b>2,246,300</b>	<b>2,403,300</b>	<b>2,556,900</b>	<b>2,711,400</b>
<b>Change</b>	<b>102,594</b>	<b>122,711</b>	<b>132,189</b>	<b>149,000</b>	<b>152,100</b>	<b>155,000</b>	<b>153,600</b>	<b>154,500</b>
<b>Change (%)</b>	<b>6.45%</b>	<b>7.25%</b>	<b>7.28%</b>	<b>7.65%</b>	<b>7.26%</b>	<b>6.89%</b>	<b>6.39%</b>	<b>6.04%</b>

BANGLADESH

LIQUEFIED PETROLEUM GAS (LPG) TRANSPORT AND DISTRIBUTION PROJECT

I. Least-Cost Analysis

1. The cost-effectiveness approach involves the comparison of economic costs for alternative supply options delivering equivalent benefit streams, with a view of identifying the least-cost option. For the LPG Project, the primary issue is to determine whether the cost of domestic LPG recovery is lower than that of importing LPG or the substitute kerosene equivalent. To ensure comparability, the cost-effectiveness analysis has been applied to bulk LPG supply points that would provide continuous and reliable LPG availability, namely, domestic LPG recovery at the northeastern gas fields, or deliveries to the Chittagong refinery of imported LPG or the kerosene equivalent. The downstream bulk transport and distribution costs were not included in the analysis due to the clear advantages and lower costs of the selected pipeline and small road/shallow draft transport option (para 5.05 of the Staff Appraisal Report), compared to the safety risks, high costs and unreliability of the dedicated LPG barges/tankers alternative.

2. As explained in para 5.06 of the Staff Appraisal Report, dehydration is a required process to deliver pipeline quality gas. Hence, this analysis, as in the economic evaluation of the LPG Project, takes into account the incremental costs of LPG recovery. The benefit stream would be an incremental LPG production of about 44,000 metric tons per year (mtpy). The incremental condensates resulting from domestic LPG recovery is relatively small (4,000 mtpy) and was not included in the benefit stream. For domestic LPG recovery, the incremental cost components are related to: (a) molecular sieve-turboexpander gas dehydration equipment to recover LPG; (b) debutanizer and depropanizer at the fractionation plant to separate LPG; and (c) storage. The cost components for LPG or kerosene imports include Arabian Gulf FOB prices, freight, as well as storage, jetty, and handling facilities at the Eastern Refinery Limited in Chittagong. This least-cost analysis was based on the Bank's crude oil price projections<sup>1/</sup> discussed in para 10 of this Annex.

Supply Alternatives

(a) Domestic Recovery of LPG

3. LPG would become available from natural gas production at the northeastern gas fields. As from the mid-1990s, the incremental LPG production is estimated at 44,000 mtpy, comprised of about 39,000 mt of a 50/50 propane/butane mix and 5,000 mt of pure propane. Construction of incremental storage for LPG from the northeastern gas fields is estimated at US\$8 million, compared to estimates for Chittagong LPG storage at US\$10 million. Storage at the production points is likely to cost less because of the continuous gas production, which permits smaller storage requirements. In Chittagong, however, substantial investment on storage is required to guarantee continuous LPG supply, as well as to benefit from lower prices by ordering larger

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<sup>1/</sup> World Bank, International Trade Division of the International Economics Department, Price Prospects for Major Primary Commodities (Report No. 814/90). Washington, D.C., December, 1990.

deliveries from the international market. The incremental costs of domestic LPG extraction includes surface facilities (US\$8 million), storage (US\$8 million), and fractionation (US\$0.5 million), or a total of about US\$ 16.5 million.

(b) LPG Imports

4. The growing demand for and limited availability of LPG have increased its prices considerably over the past five years. LPG is traded under posted price schemes which have fluctuated in the Arabian Gulf from US\$135/mt before August 1990 to US\$405/mt in late October 1990. Using a conservative FOB price of US\$135/mt, the CIF Chittagong price would be about US\$235/mt, including US\$100/mt of freight and insurance costs. However, unlike Japan and Korea that have the ability to obtain favorable prices due to bulk and long-term purchases in the LPG market, Bangladesh will likely need to pay higher FOB prices and freight costs for LPG.

5. Since Bangladesh has never imported LPG, appropriate facilities to unload and handle the LPG parcels need to be constructed at Chittagong. Tankers entering the Chittagong port would be limited to 5,000 mt of loading capacity. Manifolds and berths need to be improved and other infrastructure installed and/or upgraded. The estimated costs for renovation and construction of suitable facilities are US\$2 million. Adequate storage in bullets to guarantee a level of continuous supply is also required. The material and construction costs of an LPG bullet with a capacity to hold 500 mt of LPG is estimated at US\$1 million, which would involve a total cost of around US\$10 million to accommodate each shipment of 5,000 mt.

(c) Kerosene Imports

6. Another supply alternative to domestic LPG recovery is to import the kerosene equivalent. Global kerosene demand is increasing rapidly, while supplies are constrained, leading to higher prices. FOB kerosene prices at the Arabian Gulf have been volatile, ranging from US\$153/mt in June to US\$559/mt in October and US\$280/mt in January. The lower range of kerosene prices (or around US\$180/mt) have been used in this analysis.

7. Storage of kerosene is relatively inexpensive, because it does not require special facilities as for LPG. However, more kerosene (around 57,200 mt) is needed to have the same useful energy equivalent as LPG. Hence, storing additional kerosene supplies at Chittagong requires some investment, since existing storage is almost at full capacity. Considering the demand for kerosene, storage to hold 15,000 mt would be reasonable to construct at the port, at an estimated cost of US\$6 million.

8. Annual operating and maintenance costs were assumed to be 10% of total costs for the domestic LPG recovery option (including gas shrinkage) and 2% for the LPG or kerosene import alternatives. Plant life of 15 years and a discount rate of 12% have also been assumed.

9. Based on the above assumptions, the levelized incremental capital and operating costs per unit of domestic LPG recovery is about US\$94/mt, which is significantly lower than estimated comparative costs of US\$204/mt for

imports of the kerosene equivalent, or US\$283/mt for LPG imports, at today's CIF prices for these products, and taking into account the leveled incremental capital and operating costs of storage and handling at Chittagong.

## II. Petroleum Pricing Assumptions

10. Forecasting crude oil prices is an inexact exercise. Any disturbance in the global oil supply system will result in volatile petroleum prices. Such perturbations, although likely to be short-term phenomena, are highly unpredictable as shown by the wide price swings during the Gulf crisis. The onset of the Gulf crisis in August 1990 reduced daily crude oil production by 4 million barrels (bbl) per day, resulting in crude oil prices well over US\$30/bbl. Oil prices remained high despite increases in crude oil supplies from inventories and other oil-producing countries. When the Gulf war broke out in January 1991, however, oil prices dropped to US\$20/bbl.

### (a) Crude Oil Price Projections

11. Around mid-1991, Bank forecasts indicate crude oil prices of about US\$20/bbl. This price would continue into 1992 due to the expected resumption of some exports from Gulf facilities as well as the slowdown in the OECD economic growth by the middle of 1991. In the medium and long run, prices would increase to US\$21/bbl by 1995 and US\$31/bbl by 2000, representing a real annual average growth rate of about 4%. This increase in prices will be due to higher demand for oil from developing countries and only a moderate increase in oil production. The assumptions used for the LPG Project's economic evaluation are conservative, i.e., a base price of US\$18/bbl and a 2% annual price increase in real terms. Using the higher forecast would increase the LPG Project's economic rate of return and widen the gap between the economic costs of domestic LPG recovery vis-a-vis costlier imports of the energy equivalent.

### (b) Margins Between Kerosene and Crude Oil

12. Analysis of kerosene prices over the past five years indicates that the kerosene-to-crude margin has remained above US\$50/mt, frequently reaching as much as US\$70/mt. The lower margin of US\$50/mt has been added to the crude oil price projections to derive a conservative estimate of kerosene prices. This price is adjusted by a factor of 1.3 to arrive at the base LPG price, in order to reflect the higher combustion efficiency of LPG and the mechanical losses inherent in the retail marketing of kerosene (see para 5.07 of the Staff Appraisal Report). Based on the lower estimated margin of US\$50/mt and US\$18/bbl of crude oil, FOB prices of kerosene would be around US\$180/mt. Estimated CIF prices at Chittagong would be US\$190/mt, including freight and insurance costs of about US\$10/mt.

## BANGLADESH – LPG TRANSPORT AND DISTRIBUTION PROJECT

### Incremental Economic Rate of Return Calculation Comparing Two Gas Dehydration Systems

*SGDS: Silica Gel Dehydration System*

*MSTE: Molecular Sieve-Turboexpander System*

#### I. PRODUCT YIELDS (metric tons/year)

	<u>SGDS</u>	<u>MSTE</u>	<u>Incremental Yield</u>
Propane		4,100	4,100
LPG		39,200	39,200
Motor Spirit	56,700	60,700	4,000
Kerosene	20,100	20,100	0
Diesel	16,600	16,600	0

#### II. INCREMENTAL CAPITAL COSTS and PHASING OF EXPENDITURES (in 1990 US\$ million)

<u>Silica Gel Dehydration System</u>		<u>Molecular Sieve-Turboexpander System</u>		<u>Increm. Costs</u>	<u>Annual Expenditure</u>		<u>% Phasing</u>
<u>Components</u>	<u>Costs</u>	<u>Components</u>	<u>Costs</u>		<u>FY</u>	<u>US\$ milli</u>	
Silica Gel Units	20.8	Turboexpander Units	28.4	7.6	FY92	5.5	9
Storage at Kailashilla & Ashuganj	7.9	Storage at Kailashilla, Ashuganj & Elenga	16.4	8.5	FY93	20.7	34
Ashuganj Fractionation	4.4	Ashuganj Fractionation With Depropanizer	4.7	0.3	FY94	27.4	45
n.a.	-	LPG Pipeline and Directional Drilling	13.1	13.1	FY95	7.3	12
n.a.	-	Elenga LPG Boiling Plant	9.4	9.4			
n.a.	-	Cylinders, Valves and Regulators	12.0	12.0			100
n.a.	-	Truck Transport	3.4	3.4			
n.a.	-	Retail Depots & Filling Units	1.1	1.1			
n.a.	-			55.4			
n.a.	-	Physical Contingency (10%)		5.5			
				60.9		60.9	

NOTE: Common components with no cost change were not included, i.e., Ashuganj site preparation, north-south condensate pipeline and transport of condensates. Cost estimates include foreign and local components.



YEAR	Crude Prices (US\$/mt)	PRODUCT ECONOMIC VALUES (in US\$/mt)					INCREMENTAL PRODUCT QUANTITIES (in mt)					INCREMENTAL PRODUCT BENEFIT STREAMS (in US\$ million)					TOTAL PROJECT BENEFITS
		Kero. (Adj.)	Pro-pane	Motor Spirit	Diesel	Kero	LPG	Pro-pane	Motor Spirit	Diesel	Kero	LPG	Pro-pane	Motor Spirit	Diesel	Kero	
1	131	296.9	296.9	201.4													
2	134	300.3	300.3	204.0													
3	137	303.8	303.8	206.7		23,520	2,460	2,400			7.1	0.7	0.5				8.4
4	139	307.4	307.4	209.4		31,360	3,280	3,200			9.6	1.0	0.7				11.3
5	142	311.0	311.0	212.2		39,200	4,100	4,000			12.2	1.3	0.8				14.3
6	145	314.7	314.7	215.1		39,200	4,100	4,000			12.3	1.3	0.9				14.5
7	148	318.5	318.5	218.0		39,200	4,100	4,000			12.5	1.3	0.9				14.7
8	151	322.3	322.3	220.9		39,200	4,100	4,000			12.6	1.3	0.9				14.8
9	154	326.2	326.2	224.0		39,200	4,100	4,000			12.8	1.3	0.9				15.0
10	157	330.2	330.2	227.0		39,200	4,100	4,000			12.9	1.4	0.9				15.2
11	160	334.3	334.3	230.2		39,200	4,100	4,000			13.1	1.4	0.9				15.4
12	163	338.5	338.5	233.4		39,200	4,100	4,000			13.3	1.4	0.9				15.6
13	167	342.7	342.7	236.6		39,200	4,100	4,000			13.4	1.4	0.9				15.8
14	170	347.1	347.1	240.0		39,200	4,100	4,000			13.6	1.4	1.0				16.0
15	173	351.5	351.5	243.4		39,200	4,100	4,000			13.8	1.4	1.0				16.2

YEAR	PROJECT COSTS	PROJECT BENEFITS	PROJECT NET BENEFITS
1	5.5	0.0	-5.5
2	20.7	0.0	-20.7
3	28.0	8.4	-19.6
4	8.2	11.3	3.1
5	1.3	14.3	13.0
6	1.4	14.5	13.1
7	1.4	14.7	13.3
8	1.4	14.8	13.4
9	1.5	15.0	13.5
10	1.5	15.2	13.7
11	1.6	15.4	13.8
12	1.6	15.6	14.0
13	1.7	15.8	14.1
14	1.7	16.0	14.3
15	1.8	16.2	14.4

EIRR = 20%

**NOTES:**

Product values are determined by adding to the crude value the product margins and savings from domestic products transport.

Kerosene value is adjusted by a factor of 1.3 to reflect LPG equivalency.

BANGLADESH

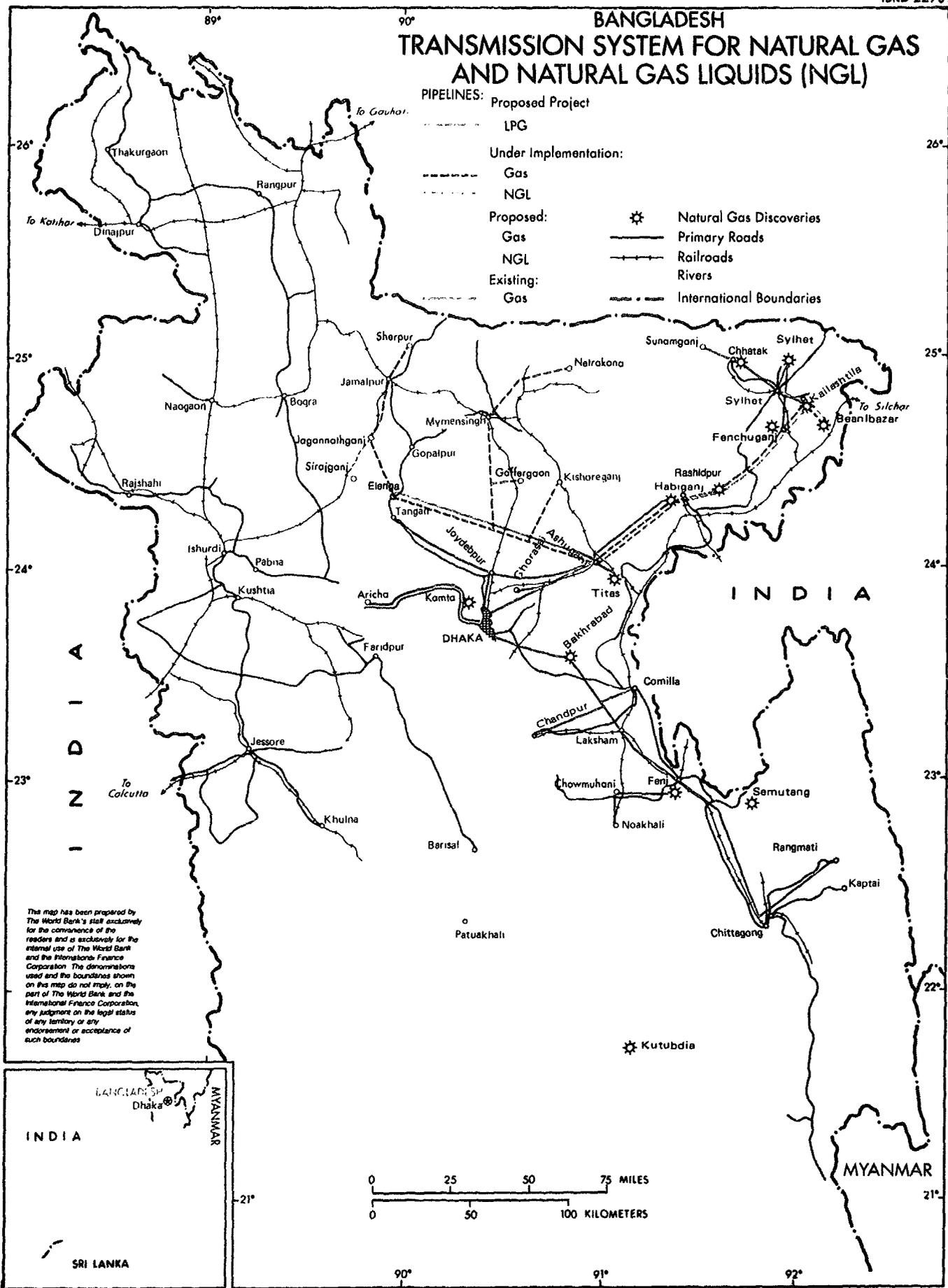
LPG TRANSPORT AND DISTRIBUTION PROJECT

Selected Documents Available in the Project File

1. Terms of reference for the technical assistance and training components.
2. DeLucia and Associates. LPG Pricing, Market Structure and Related Sector Issues in Bangladesh. Prepared for the Industry and Energy Division, Asia Country Department I, World Bank. October 1988.
3. DeLucia and Associates. Preparatory Notes on the Economic Viability of LPG in Bangladesh, LPG Demand and Markets, and LPG Pricing. Prepared for the Industry and Energy Division, Asia Country Department I, World Bank. July 1989.
4. RTM Engineering Ltd. Bangladesh - LPG Feasibility Study (Update). Prepared for the Canadian International Development Agency. July 1989.
5. Intercomp-Kanata Management Ltd. Reservoir Studies for the Northeastern Gas Fields. Prepared for the Canadian International Development Agency. October 1989.
6. Pencol Engineering Consultants. Review of the Second Gas Development Project Including Options for LPG Recovery. Prepared for the Bangladesh Oil, Gas and Minerals Corporation, Sponsored by the Overseas Development Administration (UK). December 1989.
7. Penspen Economics. Bangladesh - LPG Transportation Study. Prepared for the Industry and Energy Division, Asia Country Department I, World Bank. June 1990.
8. Background data on the gas compositions analyses, cost estimates, petroleum product prices, location maps, site visits and other technical, financial and economic analyses during project preparation and pre-appraisal.

# BANGLADESH TRANSMISSION SYSTEM FOR NATURAL GAS AND NATURAL GAS LIQUIDS (NGL)

- PIPELINES: Proposed Project
- - - - - LPG
  - - - - - Gas
  - - - - - NGL
- Under Implementation:
- - - - - Gas
  - - - - - NGL
- Proposed:
- ☼ Natural Gas Discoveries
  - Primary Roads
  - Railroads
  - Rivers
- Existing:
- Gas
  - International Boundaries



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