

**REPORT AND RECOMMENDATION
OF THE
PRESIDENT
TO THE
BOARD OF DIRECTORS
ON
PROPOSED LOANS
TO THE
PEOPLE'S REPUBLIC OF BANGLADESH
FOR THE
DHAKA CLEAN FUEL PROJECT**

October 2002

CURRENCY EQUIVALENTS

(as of 24 October 2002)

Currency Unit	–	taka (Tk)
Tk1.00	=	\$0.0171
\$1.00	=	Tk 57.85

ABBREVIATIONS

ADB	–	Asian Development Bank
ADF	–	Asian Development Bank's Special Funds
AP	–	affected people
BRTA	–	Bangladesh Road Transport Authority
BRTC	–	Bangladesh Road and Transportation Corporation
CGS	–	city gate station
CIDA	–	Canadian International Development Agency
CNG	–	compressed natural gas
CO	–	carbon monoxide
DCC	–	Dhaka City Corporation
DOE	–	Department of Environment
EA	–	executing agency
EIRR	–	economic internal rate of return
FIRR	–	financial internal rate of return
GAIL	–	Gas Authority of India Limited
GTCL	–	Gas Transmission Company Limited
HC	–	Hydrocarbon
IDC	–	interest during construction
IEE	–	initial environmental examination
IPSA	–	initial poverty and social assessment
JBIC	–	Japan Bank for International Cooperation
LIBOR	–	London interbank offered rate

NOTES

- (i) The fiscal year (FY) of the Government ends on 30 June. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2000 ends on 30 June 2000.
- (ii) In this report, "\$" refers to US dollars.

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LPG	–	liquefied petroleum gas
NDF	–	Nordic Development Fund
NGV	–	natural gas vehicle
NO _x	–	oxides of nitrogen
OCR	–	ordinary capital resources
PAPR	–	Partnership Agreement on Poverty Reduction
PM	–	particulate matter
PPMS	–	project performance monitoring system
PSC	–	Production-sharing contracts
PSMP	–	power system master plan
RP	–	resettlement plan
RPGCL	–	Rupantarita Prakritik Gas Company, Limited
SASEC	–	South Asia Subregional Economic Cooperation
SDR	–	special drawing rights
SHL	–	S. H. Lucas & Associates
SPM	–	suspended particulate matter
TA	–	technical assistance
TGTDCL	–	Titas Gas Transmission and Distribution Company Limited
VG	–	vulnerable group
WACC	–	weighted average cost of capital
WB	–	World Bank
WHO	–	World Health Organization

WEIGHTS AND MEASURES

CF	–	cubic feet
CM	–	cubic meter
MMCFD	–	million cubic feet per day
MMCM	–	million cubic meter
PSIG	–	pounds per square inch
TCF	–	trillion cubic feet

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LOAN AND PROJECT SUMMARY

Borrower	The People's Republic of Bangladesh
Classification	Poverty: Others Thematic: Economic growth Environmental improvement
Environmental Assessment	Category B. An initial environment examination for the investment was undertaken and the summary is a core appendix.
Project Description	<p>The Project has six components:</p> <p>Part A: Construction of a 60-kilometer 20-inch natural gas transmission pipeline between Dhanua and Aminbazar, Savar; and two city gate stations (CGSs) at Ashulia and Savar</p> <p>Part B: Construction of 97 km of 16-inch extended natural gas distribution pipelines in Dhaka</p> <p>Part C: Establishment of 3 major compressed natural gas (CNG) filling stations just outside Dhaka, 3 major filling stations along the Dhaka-Chittagong highway for buses and trucks, and 20 minor filling stations in Dhaka for cars and auto rickshaws</p> <p>Part D: Purchase of 300 CNG-fueled buses, 2,000 CNG-fueled four-stroke auto rickshaws, and CNG conversion kits for 10,000 petrol cars owned by government, semigovernment, and private owners</p> <p>Part E: Establishment of three new workshops to increase the capacity to convert petrol-fueled to CNG-fueled cars, repairs, maintenance as well as to act as referral workshops for workshops to be established by the private sector</p> <p>Part F: Capacity building in the following areas: (i) technology development and training for the workshops; (ii) implementation of new safety codes, standards, and regulations related to conversion and the use of CNG equipment for the transport sector; (iii) public consultation and awareness campaign regarding public safety and benefits of using CNG; and (iv) environmental management</p>
Rationale	The Project will advance the use of domestic resources for the transport sector by creating the initial infrastructure for the supply of CNG fuel in Dhaka as well as establishing the initial critical number of CNG-fueled vehicles. It will also contribute to the improvement of Dhaka's air quality.

Objectives The Project will (i) develop the use of domestic natural gas resources as substitute for imported liquid fuels for the transport sector, thereby improving the foreign exchange position of the country; (ii) improve the ambient air quality in Dhaka; and (iii) establish the foundation for private sector participation in the future development of CNG-fueled transport.

Cost Estimates The Project is estimated to cost \$113.4 million equivalent, comprising \$81.9 million in foreign exchange cost and \$31.5 million equivalent in local currency.

Financing Plan

(\$ million)				
Source	Foreign Exchange	Local Currency	Total Cost	Percentage
ADB				
- OCR	30.2		30.2	26.6
- ADF	42.4		42.4	37.4
Cofinancing-NDF	9.3		9.3	8.2
Government/EAs		31.5	31.5	27.8
Total	81.9	31.5	113.4	100.00

ADB=Asian Development Bank, ADF=Asian Development Fund, EA=executing agency, NDF=Nordic Development Fund, OCR=ordinary capital resources.

Loan Amounts and Terms (i) A loan in various currencies equivalent to SDR 32.126 million (\$42.4 million equivalent) from the Asian Development Bank's (ADB's) Special Funds resources with a term of 32 years, including a grace period of 8 years, and with an interest charge at the rate of 1% per annum during the grace period and 1.5% thereafter for parts C, D, E, and F(iii) of the Project; and (ii) a loan of \$30.2 million from ADB's ordinary capital resources under ADB's London interbank offered rate (LIBOR)-based lending facility; a commitment charge of 0.75% per annum; a front-end fee of 1.0%; with a repayment period of 20 years and a grace period of 5 years for parts A, B, F(i), and F(ii).

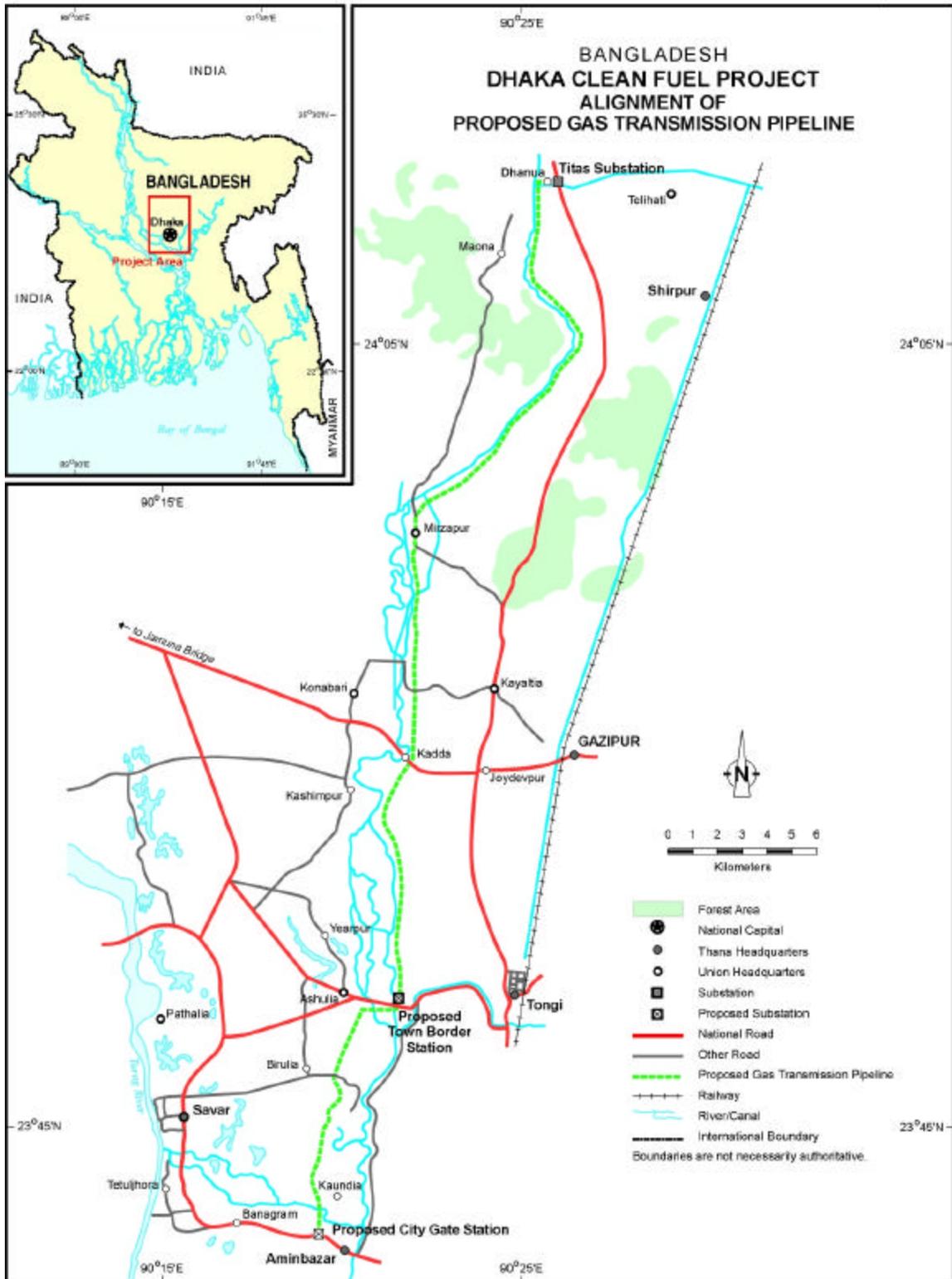
Allocation and Relending Terms

The Borrower will relend the proceeds as follows:

- (i) to the Gas Transmission Company Ltd. (GTCL), \$20.3 million for parts A and F(i) of the Project, with an interest rate of 5.5% per annum and a repayment period of 20 years including a grace period of 5 years;
- (ii) to the Titas Gas Transmission and Distribution Company Ltd. (TGTDC), \$9.9 million for parts B and F(ii), with an interest rate of 5.5% per annum; and a repayment period of 20 years including a grace period of 5 years; and
- (iii) to the Rupantarita Prakritik Gas Company Ltd. (RPGCL), \$42.4 million for parts C, D, E, and F(iii) with an interest rate of 7.5% per annum and a repayment period of 10 years including a grace period of 3 years.

Period of Utilization Until 30 June 2007

Estimated Project Completion Date	31 December 2006
Executing Agencies	Parts A and F(i) of the Project will be executed by GTCL; parts B and F(ii) by TGTDCCL; and parts C, D, E, and F(iii) by RPGCL.
Implementation Arrangements	The Project will be implemented by Petrobangla as a holding company through its three executing subsidiaries – GTCL, TGTDCCL, and RPGCL. Each EA will manage its own implementation headed by individual project directors.
Procurement	Goods and related services, and civil works financed by ADB will be procured following ADB's <i>Guidelines for Procurement</i> . To accelerate project implementation, the Executing Agencies have been allowed advance procurement action. Retroactive financing has not been permitted.
Consulting Services	<p>Consulting services will be required in part A</p> <ul style="list-style-type: none"> (i) engineering design and (ii) construction supervision <p>Consulting services will also be required in parts C, D, and E for</p> <ul style="list-style-type: none"> (i) building the capacity to implement new safety codes, standards, and regulations related to conversion and the use of CNG equipment for the transport sector; and (ii) building the capacity of EAs in public consultation and awareness campaigns and in addressing environment, safety, and health issues.
Project Benefits and Beneficiaries	<ul style="list-style-type: none"> (i) Reduce commercial risks from the ongoing production-sharing contracts by expanding the domestic gas market, (ii) Ease pressure on the foreign exchange reserves of Bangladesh, (iii) Improve ambient air quality in Dhaka by providing cleaner fuels, and (iv) Increase private sector participation in the sector. <p>The economic benefits associated with the reduced health problems will be reaped mostly by the urban poor such as street vendors, cyclists, rickshaw pullers, and passengers. Reduction in the pollution level (improved air quality) is expected to provide the qualitative benefit of reducing in the incidence of deaths and sicknesses reported and to save about \$48 million annually to the economy on account of improved human health in Dhaka. Since the poor are particularly vulnerable to air pollution, the Project has a high poverty reduction impact.</p>



I. THE PROPOSAL

1. I submit for your approval the following Report and Recommendation on proposed loans to the People's Republic of Bangladesh for the Dhaka Clean Fuel Project.

II. RATIONALE: SECTOR PERFORMANCE, PROBLEMS, AND OPPORTUNITIES

A. Performance Indicators and Analysis

2. A technical assistance (TA) study¹ with the principal objective of assisting the Government in formulating a strategy to improve air quality in Dhaka and other major cities was completed in August 2001. The TA concluded that, to achieve the objective, a two-pronged strategy needed to be adopted: (i) reduce traffic congestion by constructing flyovers at critical points and improving traffic management, and (ii) replace diesel-fueled buses and two-stroke auto rickshaws – the major causes of air pollution – with vehicles using clean fuel. Traffic management is now being improved with support from the World Bank (WB) through the Dhaka Urban Transport Plan. This Project addresses the latter part of the strategy and will reduce air pollution by promoting clean fuel and technologically cleaner automotive combustion processes. The Project framework is in Appendix 1.

3. Natural gas was discovered in Bangladesh (then East Pakistan) in 1955, in Sylhet District in the northeast. Since then over 22 gas fields have been discovered, all but one to the east of the Jamuna-Padma-Meghna river system that bisects the country. Two fields are offshore in Bay of Bengal. In 1993, as part of its efforts to improve efficiencies in the natural gas sector, the Government invited international oil companies to participate in exploration and production of gas through production sharing contracts (PSCs). The first PSCs were awarded in 1995 and since then, a total of about 5 trillion cubic feet (TCF) of recoverable reserves have been declared. Total gas in place is estimated at 20 - 28 TCF, of which 16 - 24 TCF is classified as remaining reserves². Of the average production of about 900 million cubic feet per day (MMCFD), about 80% is from fields owned by the Government, and the balance from fields operated by international oil companies under PSCs. At the present rate of consumption, the country has a reserve-to-production ratio of over 40 years. An analysis of the sector is presented in Appendix 2.

4. Gas transmission for commercial use began in the early 1960s in the Sylhet area. About 1,300 kilometers (km) of 4-inch through 30-inch transmission pipelines has been laid, covering all the major towns in eastern Bangladesh. Recently, with the construction of the Bangabandhu Bridge over the Jamuna River, the gas supply was extended to Serajgonj town and Baghabari Power Station in the west. Gas transmission is entirely in the public sector. The current transmission pipeline is in Map 1.

5. Gas distribution on a commercial scale began in 1968 and since then over 10,000 km of 1-inch through 20-inch pipelines has been laid, serving about 900,000 consumers. Gas distribution is entirely in the public sector.

¹ ADB. 1999. Technical Assistance to Bangladesh for the *Urban Transport and Environmental Improvement Project*. Manila.

² As of the *Bangladesh Petroleum Potential and Resource Assessment 2001* conducted by the Hydrocarbon Unit of Ministry of Power, Energy and Mineral Resources and Norwegian Petroleum Directorate.

6. ADB and other aid agencies have been in a continuous dialogue regarding improving aspects of governance in the sector, as well as using the sector as an engine for accelerating economic growth. The policy dialogue involves issues such as enactment of a new gas law to allow the establishment of an independent regulatory commission, private sector participation in gas exploration and production, planning for optimized development of the gas sector and use of natural gas resources, improvement in the corporate governance of the sector entities including reconstitution of the boards of directors, delegation of authority, and revision of the conditions of service of employees. External assistance to the gas sector over the last 10 years is summarized in Appendix 3.

7. A small pilot conversion program in 1982 – 1985 under World Bank funding introduced the use of CNG for the transport sector in Dhaka. The development was very slow and up to 1997, only 208 cars had been converted. Conversion peaked in 1998 with 678 cars converted, but since then it has slowed down to only 52 last year. At present, five CNG filling stations have been established in Dhaka and about 1,500 vehicles converted to CNG in the last 16 years. However, shortage in the supply of CNG and lack of maintenance and service capability in Dhaka have hindered the opportunities to expand the use of CNG in the transport sector. The obvious economic benefit of using CNG vehicles and the Government's strong campaign to combat air pollution have increased the public demand for CNG vehicles and for a steady supply of CNG. The use of CNG vehicles to combat air pollution is already very well accepted by the public. It is now time for the Government to provide a continued and adequate supply of CNG for the sector.

8. Although the total number of vehicles in Dhaka is not large relative to the human population, the main arterial roadways have high levels of ambient pollutants due to traffic density, poor traffic flow, and poor maintenance of vehicles. The most striking aspect of Dhaka's air pollution problem is the crowded, smoke-filled streets of the city. Trucks, buses, three-wheel two-stroke auto rickshaws, and cars create a dense smoke plume that exposes traffic police, roadside vendors and the public to extreme levels of air pollution. The number of two-stroke engine vehicles increased by 60% from 1990 to 1996 and are now increasing at an annual rate of 20%.

9. Air pollution has become a serious public health problem in urban Bangladesh. Air pollution by its nature is a cross-sector issue involving transport, energy, industry, commercial, and the domestic sector. In Dhaka, however, vehicles represent the dominant source of air pollution – there are no other significant sources of air pollution such as industrial emissions, power stations, or deserts causing dust pollution. The major pollutants are suspended particulate matter (SPM), carbon monoxide (CO), sulfur dioxide (SO₂) and airborne lead. The SPM levels range from 2 to 4 times the Bangladesh standards and about 12 times higher than the standards prescribed by the World Health Organization (WHO). Ambient SO₂ levels are nearly 10 times above WHO standards. In cities where the contribution of transport to the ambient concentrations of fine particle matter is deemed significant, replacing diesel with natural gas in transit buses could lead to a significant improvement in air quality. Reduction of pollution levels to the Bangladesh national air quality standards is expected to reduce in the incidence of deaths and sicknesses reported. Improved human health in Dhaka, in turn, is estimated to save the economy about \$48 million annually.

B. Analysis of Key Problems and Opportunities

1. Foreign Exchange Constraints

10. Nonavailability of foreign exchange has constrained economic development in Bangladesh. This is especially true for the private sector, which does not have access to foreign exchange credits. Hence, saving foreign exchange by substituting domestic goods and services for imported ones is a high priority in the country's economic policies. Both the Government and the private sector strongly supported substituting domestic natural gas for imported diesel and petrol as a measure that will release additional foreign exchange for domestic business.

2. Program to Improve Air Quality in Dhaka

11. Since 1992, significant studies and progress have been made to understand Dhaka's air quality problems. The studies provide a better picture of the contribution pattern of vehicle emissions. Two-stroke engine vehicles, cars/jeeps, and motorcycles are the major sources of CO emission, contributing about 37%, 30%, and 24%, respectively. It is also estimated that two-stroke auto rickshaws are the main sources of hydrocarbon emissions, with a share of about 56%. Trucks and buses are significant sources of SO₂ and SPM. The significant pollutants from diesel-fueled vehicles are SPM (including smoke) and nitrogen oxides. In 1996, the recorded concentration of lead in ambient air over Dhaka was 4.6 milligrams/cubic meter.

12. Considering the result of random monitoring of air quality in Dhaka as well as the health effect of those pollutants, the Government (i) banned the use of leaded gasoline, (ii) regulated the content of sulfur in diesel, (iii) banned the import of two-stroke three-wheelers, (iv) phased out auto rickshaws that are more than 10 years old, and (v) has promoted the use of CNG. Traffic management is being improved with support from the WB through Dhaka Urban Transport Plan. In addition, the WB is assisting the Government to strengthen its capacity to monitor air quality and to establish an air monitoring station in Dhaka through the Air Quality Management Project.

13. Efforts to promote the use of CNG started in 1982 through a WB pilot project under which Rupantarita Prakritik Gas Company Ltd. (RPGCL) established a workshop for converting vehicles to CNG. The local university – Bangladesh University of Engineering Technology – has undertaken research to reduce pollution and to achieve maximum economic costs for converting trucks and buses to CNG. A pilot model for converting two-stroke auto rickshaws is being carried out with support from Canadian International Development Agency (CIDA) under the Bangladesh Environmental Management Project. The United Nations Development Programme (UNDP) is involved in a pilot program for conversion of two-stroke auto rickshaws as well as some capacity building for stakeholder. However, conversion of two-stroke engines to CNG has had technical limitations.

14. Most of these previous efforts have had limited success due to the scarcity of CNG filling stations and conversion kits, and low pressure in the filling stations (inadequate supply of natural gas). The proposed Project will address these constraints covering the complete supply chain as well as building capacity and implementing equipment safety and emission standards.

3. Private Sector Participation

15. With this Project, the Government will be able to lay the first major foundation of infrastructure and vehicle fleet investments, assuring the market of a sustainable future. Being

the biggest operator, the current public bus operator, Bangladesh Road and Transportation Corporation (BRTC), will absorb the major portion of the initial supply of CNG buses to be provided by the Project. As Executing Agency (EA), RPGCL will procure the vehicles for BRTC through a leasing arrangement with an intermediate bank that will ensure lease payments to RPGCL. BRTC no longer operates its buses by itself, but is leasing them out on a daily basis to private bus operators. At least 100 of the 300 buses financed through the Project will initially be earmarked for private sector operators. The private bus operators will themselves handle procurement. Financing arrangements will be similar to those for the public sector through commercial banks and/or leasing companies.

16. The CNG filling stations will initially be implemented by RPGCL in existing diesel/gasoline filling stations owned by private operators and operated in cooperation with gasoline station operators to ensure sufficient training and safety measures based on the adopted international safety codes and standards and after an appropriate running-in period. The ownership of the CNG filling stations will gradually be transferred to the private operators. With confidence created through this Project, the Government will encourage private sector participation to further expand the CNG vehicle fleet in the country as well as increase the number of filling stations and workshops for conversion and maintenance.

17. To ensure future private sector development, there is a need to implement international standards, reliable pricing, and a rational tax structure. Organizationally, the public sector gas operations are already corporatized. However, the boards of these companies do not have adequate power to perform their functions in a commercial manner, and this inadequacy leads to delayed and bureaucratic decision making. The latter matter is addressed as one of the conditionalities for the Project.

18. Private workshops for conversion and maintenance are already in place, and a major interest is to set up many more CNG filling stations as well as convert cars and taxi fleets to CNG. As CNG, without any kind of subsidies, is offering a major price advantage compared with existing fuels, the private sector is only waiting for all the basic criteria and the foundation from this Project, such as regulations on standardized equipment and emission as well as the needed initial volumes of supply and demand (filling stations and number of vehicles) to ensure a sustainable takeoff.

4. Capacity Building and Training

19. Successful fuel switching requires that a number of additional conditions be met: (i) sufficient incentives for CNG bus fleet operators, (ii) regulatory and administrative arrangements in place to ensure the financial sustainability of operators who would use CNG, (iii) proper regulatory framework including enforcement of safety and performance standards, (iv) transparent enforcement of existing laws and regulations related to the environment and traffic pollution, (v) strong and long-term commitment and involvement of the fleet management, (vi) extensive training and education of mechanics and drivers, and (vii) regular preventive maintenance and prompt repairs. All these issues will be properly addressed in a supporting capacity building and training program for the involved agencies.

5. Lessons Learned

20. ADB has been involved in the natural gas sector intermittently over the last 23 years, with six loans totaling \$374 million. From its role as a provider of funds for individual projects in the 1970s, ADB became a provider of funds as well as technical advice for project preparation in the

1980s. In the late 1990s, ADB changed its stance to a more proactive one, providing policy advice to the Government in implementing sector reforms. With the significant discoveries made in the last few years, ADB realizes that natural gas is one of the few large-scale indigenous resources available in Bangladesh that, if developed properly, can dramatically improve the economy and the living standards of the people.

21. Overall macroeconomic/political issues of the country have a significant bearing on the sector's performance as well as its ability to reform. Political unrest, labor militancy, enforcement of law and order, speed and quality of the judicial processes, and ability of the education system to provide the staff required for efficiently operating the sector, all affect the sector's performance, and there is very little that the sector by itself can do to systematically redress these problems. Thus at any point in time, gas sector development can only proceed up to a point and no further. Forcing actions beyond this point without removing the constraints is futile and even jeopardizes the entire reform process.

22. Delegation of powers from the Government to the management of the sector entities, and from the management to the staff is very limited. Despite efforts by ADB and other sources delegation has not been sufficiently enhanced. The entities are also restricted by the Government's personnel and wage policies, which inhibit the recruitment and retention of competent staff and the retrenchment or dismissal of excess or nonperforming staff. Since the corporate structure of the sector entities permits such delegations, it is not necessary to create new sector entities. However, there is a need to instill an overall environment of commercialization in the sector, and to distance operations, ownership, regulations, and policy making from each other.

6. Performance Under ADB's Third Natural Gas Development Project

23. The only ongoing project of ADB in the sector is the Third Natural Gas Development Project³. The project comprises (i) drilling of seven appraisal-cum-development wells in Titas and Habiganj gas fields and workover of six wells in Titas and Bakhrabad gas fields; (ii) adding gas treatment facilities in Titas and Habiganj gas fields; (iii) expanding transmission lines; and (iv) expanding and upgrading distribution networks. The original completion date of 31 December 1999, was subsequently been extended to 31 December 2001. Procurement actions have all been completed, but with significant delays. The delays are attributed to the review by several layers of authorities in the Government as well as to the subjectivity of ADB's guidelines for selection of consultants, which leaves the selection process open to possible interference. There have been attempts to eliminate Government interference by providing autonomy to the boards of directors of the sector companies, and the subjectivity of ADB's consultant selection process has been minimized through the use of the newly introduced quality and cost-based selection (QCBS) method.

³ ADB. 1993. Report and Recommendation of the President to the Board of Directors on a Proposed Loan to Bangladesh for the *Third Natural Gas Development Project*. Manila.

III. THE PROPOSED PROJECT

A. Objectives

24. The objectives of the Project are to

- (i) increase the sustainable use and supply of domestic natural gas resources in place of imported liquid fuels for the transport sector and thus ease pressure on the foreign exchange reserves of Bangladesh;
- (ii) develop the use of CNG in the transport sector and improve ambient air quality in Dhaka. This will reduce respiratory diseases especially among the urban poor who are the most vulnerable;
- (iii) encourage private sector participation by (a) implementing transparent regulations based on international emission standards; (b) providing an initial foundation for further private sector development of the domestic downstream gas sector; and
- (iv) improve corporate governance in the gas sector companies by appointing independent boards of directors and management.

B. Components and Outputs

25. The Project comprises the following:

1. Extension of the Gas Transmission Pipeline (Part A)

26. To ensure a proper supply and balance in the gas distribution system, an additional transmission pipeline infrastructure is required for the Dhaka region. A 60 km 20-inch pipeline will be constructed between Dhanua and Aminbazar, Savar; and two city gate stations (CGSs) at Ashulia and Amanibazar, Savar. Alignment of the proposed pipeline is in Map 2.

2. Extension of the Gas Distribution Network in Dhaka (Part B)

27. Presently in Dhaka, there are four CNG stations established by RPGCL and one implemented through a joint venture between RPGCL and a Chinese company. These filling stations many times face a shortage of gas supply particularly during morning hours when gas pressure decreases due to high domestic use. To improve and secure a reliable supply of gas to 100 CNG filling stations in Dhaka without overstressing the supply network, a distribution pipeline infrastructure must be put in place before establishing any new CNG stations. The Project, therefore, includes the construction of 97 km of 16-inch, 150 pounds per square inch (psig) pipelines for this purpose.

3. Establishment of CNG Filling Stations (Part C)

28. Critical to the sustainable development of CNG for automotive use is a minimum number of CNG filling stations distributed all over Dhaka so that consumers are encouraged to convert their petrol-fueled vehicles. The Project addresses this aspect by establishing 3 major CNG

filling stations just outside Dhaka, 3 major filling stations along the Dhaka-Chittagong highway for buses, and 20 minor filling stations in Dhaka city for cars and auto rickshaws. The filling stations will also have capabilities for repairs and services. Along with other ongoing developments in the private sector, this Project will meet the demand in the next 4–5 years.

4. Purchase of CNG-Fueled Buses, Auto Rickshaws, and Conversion Kits for Petrol-Fueled Cars (Part D)

29. Just as a minimum number of filling stations is necessary to sustain the use of CNG as an automotive fuel, there must be a nucleus of CNG-fueled vehicles operating to provide a minimum level of business to the CNG filling stations, as well as to demonstrate the technical and commercial viability of operating CNG vehicles. The Project, therefore, supports the purchase of 300 CNG-fueled buses for the public-private sector for intracity and intercity transport to replace the same number of existing diesel-fueled buses in Dhaka, 2,000 CNG-fueled four-stroke auto rickshaws to replace the same number of existing two-stroke auto rickshaws, and conversion kits for 10,000 petrol cars owned by Government, semi-Government agencies, as well as private owners.

5. Workshop Facilities (Part E)

30. To implement the projected increase in the number of conversions and future maintenance, major need is to increase the capacity of workshops for conversion, repairs, and maintenance as well as to establish referral workshops. While the private sector will set up additional workshops, RPGCL will have to establish referral workshops to set standards and monitor compliance. Therefore, the Project includes the construction of two new workshops by RPGCL.

6. Capacity Building and Training (Part F)

31. This will involve capacity building and training of GTCL and TGTDC. In addition to make the Project a success, there will be consulting services to RPGCL for some major areas such as

- (i) development of technology for conversion of non-compressed natural gas-fueled vehicles, the repair and maintenance of compressed natural gas-fueled vehicles, and the conduct of training workshops
- (ii) building the capacity of RPGCL in implementing new safety codes and environmental management, such as emission standards and regulations related to conversion and the use of CNG equipment for the transport sector; and
- (iii) conduct awareness campaigns on the health benefits of using CNG.

C. Cost Estimates

32. The Project is estimated to cost \$113.4 million equivalent, comprising \$81.9 million in foreign exchange cost and \$31.5 million equivalent in local currency. A summary of the scope along with the cost estimates is in Table 1. Detailed cost estimates are given in Appendix 4.

Table 1: Cost Estimates
(\$ million)

Component	Foreign Currency	Local Currency	Total Cost
Base Cost			
Part A: Transmission Gas Pipeline Including Land Acquisition	16.0	2.1	18.1
Part B: Distribution Gas Pipeline Line Including Land Requisition	7.9	3.8	11.7
Part C: Filling Stations	8.4	2.6	11.0
Part D: Purchase of Vehicles	30.8	2.9	33.7
Part E: Workshop Facilities	0.7	1.3	2.0
Part F(i): Consulting Services and Training - GTCL	0.4	0.2	0.6
Part F(ii): Capacity Building and Training – TGDCL	0.1	0.1	0.2
Part F(iii): Consulting Services and Training – RPGCL	2.5	0.7	3.2
Taxes and Duties	0.0	8.0	8.0
Subtotal	66.8	21.7	88.5
Contingencies			
Physical	6.7	2.2	8.9
Price	5.3	1.9	7.3
Interest During Construction and Other Charges	3.1	5.7	8.8
Total	81.9	31.5	113.4

GTCL=Gas Transmission Company Ltd., RCGL=Rupantarita Praktik Gas Company Ltd., TGDCL=Titas Gas Transmission and Distribution Company Ltd.

D. Financing Plan

33. The Project financing plan is in Table 2. ADB and the parallel cofinancing agency, Nordic Development Fund (NDF), will be financing only foreign exchange costs associated with the Project⁴. The Government and the sector agencies will finance all local currency costs.

Table 2: Financing Plan
(\$ million)

Agency	Foreign Exchange	Local Currency	Total	Percentage
ADB				
- OCR	30.2		30.2	26.6
- ADF	42.4		42.4	37.4
Cofinancing-NDF	9.3		9.3	8.2
Government/ Eas		31.5	31.5	27.8
Total	81.9	31.5	113.4	100.0

ADB=Asian Development Bank, ADF=Asian Development Fund, EA=executing agency, NDF=Nordic Development Fund, OCR=ordinary capital resources.

34. It is proposed that ADB extend two loans to the People's Republic of Bangladesh in support of this Project. The first loan will be for SDR 32.126 million (\$42.4 million equivalent) from ADB's special funds resources and will fund parts C, D, E and F(iii) of the Project. The loan will have a repayment period of 32 years including a grace period of 8 years and an interest charge of 1.0% during the grace period and 1.5% thereafter. The Borrower will be the People's

⁴ Nordic Development Fund (NDF) has expressed interest in cofinancing an additional 100 CNG-fueled buses with E10.0 million (40 years maturity including 10 years grace period, no interest, 0.75% service charge, and 0.5% commitment fee, and parallel conditions). In the event that the NDF loan will not be approved, part D of the Project will be reduced by 100 CNG-fueled buses.

Republic of Bangladesh and the proceeds will be re-lent to RPGCL under subsidiary loan agreements with terms and conditions acceptable to ADB. Relending terms to RPGCL will include a repayment period of 10 years including a grace period of 3 years, and interest at the rate of 7.5% per annum. The Borrower will bear the foreign exchange risk.

35. RPGCL will procure the 200 buses being financed for BRTC⁵ and relend the money for their procurement to Janata Bank with an interest rate of 8% per annum and a term of 7 years. Janata Bank will relend this money to BRTC at an interest rate of 12% with a term of 7 years.

36. For the 100 buses and 2,000 auto rickshaws earmarked for the private sector, RPGCL will progressively relend money to private commercial banks and leasing companies with an interest rate of 8% and a term of 10 years, including a grace period of 2 years. These financing institutions will be allowed a maximum spread of 3–4% to recover their administration and possible default payments. Based on current commercial terms, the private commercial banks as well as the private leasing companies will be able to recycle financing to the private sector at least twice, which will increase the number of buses as well as boost general private sector development. The flow chart of the financing arrangement for vehicles is in Appendix 5.

37. The second loan will be for \$30.2 million from ADB's ordinary capital resources (OCR) to fund parts A, B, F(i) and F(ii) of the Project. The loan will have a 20-year term, including a grace period of 5 years; an interest rate determined in accordance with ADB's LIBOR-based variable lending facility; a commitment charge of 0.75% per annum; a front-end fee of 1.0%, and conversion options that may be exercised in accordance with the terms of the draft Loan Agreement, the loan regulations, and ADB's conversion guidelines; and such other terms and conditions set forth in the draft Loan Agreement. The Government has provided ADB with (i) the reasons for the People's Republic of Bangladesh's decision to borrow under ADB's LIBOR-based lending facility on the basis of these terms and conditions and (ii) an undertaking that the choices were the People's Republic of Bangladesh's own independent decision and not made in reliance on any communication or advice from ADB. The Borrower will be the People's Republic of Bangladesh. The loan proceeds will be re-lent to Gas and Transmission Company Ltd. (GTCL) and Titas Gas Transmission and Distribution Company Ltd. (TGTDC) under subsidiary loan agreements with terms and conditions acceptable to ADB. Relending terms will include a repayment period of 20 years including a grace period of 5 years, and interest at the rate of 5.5% per annum. The foreign exchange risk will be assumed by GTCL and TGTDC during the life of the respective subsidiary loans, and thereafter by the Borrower. GTCL and TGTDC have the capacity to manage the foreign exchange risk as their revenues are adjusted to foreign exchange variations.

E. Implementation Arrangements

1. Project Management

38. EAs will be GCTL for parts A and F(i); TGTDC for parts B and F(ii); and RPGCL for parts, C, D, E, and F(iii). As EA for the public sector under part D, RPGCL will procure buses and auto rickshaws and channel them to the public operator (BRTC). In financing the vehicles for the private sector, RPGCL will onlend funds to commercial banks and leasing companies that will secure the repayment and arrange leasing agreements with the private sector operators. This recycling of ADB's assistance will allow the purchase of more vehicles and accelerate the elimination of polluting vehicles from Dhaka.

⁵ Of these 200 buses, 100 buses will be funded and procured under the guidelines of the NDF.

2. Implementation Schedule and Performance Review

39. Implementation has commenced in August 2002 and be completed in December 2006. The EAs and the Government will be responsible for directly supervising subproject implementation and monitoring subproject operation performance. The agencies will submit to ADB quarterly progress reports on their respective responsibilities within 30 days from the end of each quarter. ADB will review the implementation and operation of the Project based on these reports and meet with the EAs and the Government semiannually to discuss project progress. ADB will also monitor the overall performance of the EAs. The implementation schedule is in Appendix 6.

3. Procurement

40. Goods and related services, and civil works financed by ADB will be procured in accordance with ADB's *Guidelines for Procurement*. Contracts estimated to cost in excess of \$500,000 for equipment and related services, and \$1,000,000 for civil works will be subjected to international competitive bidding (ICB) requirements, and supply contracts valued above \$500,000 will be procured under International Supply. To encourage local manufacturers, suppliers, and contractors to participate in ICB, ADB's domestic preference scheme may be utilized. Contract package are listed in Appendix 7.

4. Consulting Services

41. International consultants (consulting firms as well as individual consultants) to be engaged under part F of the Project will be recruited in accordance with ADB's *Guidelines on the Use of Consultants* and other arrangements satisfactory to ADB for engaging domestic consultants. In the case of consulting firms, the quality and cost-based selection method will be implemented. In addition, under ADB's regional TA: Identification and prioritization of projects in the South Asia Subregional Economic Cooperation (SASEC) subregion, the Gas Authority of India Limited (GAIL) will give RPGCL in advance of the Project initial basic inputs for designs, standards, layouts, specifications, and safety regulations and practices on the use of CNG. GAIL and its associate companies have successfully introduced CNG for automobiles in Mumbai and Delhi in India.

5. Advance Procurement Action

42. GTCL, TGTDC, and RPGCL (supported by Petrobangla) have sufficient expertise in procuring goods, materials and services for the works entrusted to them under the Project and will be allowed to initiate advance procurement action for the ADB-financed goods and consulting services. The Government has been advised that ADB's approval of such advance procurement action will not in any way commit ADB to subsequently approve the Project. All such advance procurement actions will be in accordance with ADB's *Guidelines for Procurement* and *Guidelines on the Use of Consultants*.

6. Disbursement Arrangements

43. Since disbursement under the Project will be mainly for supply of goods and consulting services, ADB's commitment letter and direct payment procedures will be used for the purpose. Imprest account procedures will be used for the procurement of 100 of the buses and 2,000 of the auto rickshaws under Part D of the Project earmarked for private sector operators. An

imprest account of \$2.0 million equivalent in Taka will be established by the Borrower at the Bangladesh Bank (the Central Bank) and operated in accordance with ADB's Loan Disbursement Handbook and ADB's Interim Guidelines for Disbursement Operations, LIBOR-Based Loan Products, dated July 2002. RPGCL may avail of the funds in the imprest account and will place part of the proceeds of the account to commercial banks or leasing companies for onlending to private sector operators for purchase of buses and auto rickshaws. Subsequent withdrawals from the imprest account will be conditioned upon the production of satisfactory documentary evidence furnished by participating commercial banks to RPGCL and ADB that the funds have been utilized for the procurement of the buses and auto rickshaws.

7. Accounting, Auditing, and Reporting

44. The EAs will maintain separate accounts for the Project, and submit audited project accounts and audited financial statements within at least 9 months after the end of the fiscal year. They will prepare separate progress reports for their respective components and submit them to ADB quarterly. The reports will give a narrative description of progress made during the period, changes in the implementation schedule, problems or difficulties encountered, the performance of the project implementation consultants, and the work to be carried out in the next period. The reports will include a summary financial account for the Project, consisting of project expenditures during the period year to date, and total expenditure to date. Project completion reports will be submitted to ADB within 3 months of the physical completion of the Project.

8. Project Performance Monitoring System (PPMS)

45. The specific objectives of PPMS are to identify the key criteria and indicators for macro level monitoring of project inputs, outputs, and impacts. PPMS will enable the EAs and ADB to determine the efficiency and effectiveness of project implementation, identify constraints, and measure the performance and impact of the project. PPMS will be established to assess progress and implementation of the project and to measure impacts and outcomes. The information gained will be used directly to improve development planning and implementation by adjusting delivery mechanisms and identifying more appropriate strategies. In the context of Dhaka air quality, routine air quality monitoring by the Department of Environment (DOE) will be used to indicate improvement in air quality, particularly for oxides of carbon (CO_x), nitrogen oxide (NO), oxides of sulfur (SO_x), and suspended particulate matter (SPM).

IV. PROJECT BENEFITS, IMPACTS, AND RISKS

A. Technical Aspects

46. Transmission and distribution pipelines and CGSs will be built as per provisions of Bangladesh Mineral Safety Rules that are based on American Standards (ANSI B31.8) and other international standards. Implementation of the pipeline project will not cause any technical problem as both GTCL and TGTDCCL have already done similar projects under WB and ADB funding. Safety codes for the filling stations, conversion kits, CNG cylinders, and vehicles will be based on already existing international standards. Emission standards will be based on existing European standards. To ensure successful implementation, internationally proven technology will be used in the Project.

47. Many natural gas vehicles (NGVs) in commercial production already meet future particulate emission specifications to be imposed in North America and the European Union during the latter part of this decade. Therefore, replacing heavy-duty diesel vehicles with natural gas equivalents is one option for reducing vehicular gaseous and particulate emissions dramatically. Urban transit buses are high-usage vehicles that operate in heavily congested areas where air quality improvements and reductions in public exposure to harmful air contaminants are critical. Therefore, such vehicles are good candidates for achieving both near-term and long-term emission reductions. That many transit buses are centrally kept and fueled makes the introduction of new technologies and alternative fuels more efficient. In fact NGVs are ideal for fleet operations, and the natural gas industry is concentrating on high fuel-use commercial vehicles such as transit buses, taxis, airport shuttles, refuse haulers, and trucks in its market strategy. Emission standards for vehicles purchased under the Project will be specified as Euro II and III.

48. The disadvantages of natural gas include the following: (i) greater difficulty in distribution and storage, which makes an existing gas distribution network a prerequisite, (ii) shorter driving range, (iii) greater weight of the fuel tank (gas cylinder), and (iv) higher degree of safety compliance as it is a pressurized fuel. All these aspects have been carefully considered while designing the Project and adequate training, regulation, and monitoring of enforcement have been incorporated.

B. Policy Aspects

49. Anticipating further air pollution, since the early 1990s the Government has adopted policies to strategically address the emerging problem in the transport sector.⁶ However, these policies have not been systematically implemented due to lack of commitment from concerned agencies and shortage of funds. The emission standards for motor vehicles are not yet in place, traffic regulation is not well enforced, improvements on the road network have not taken into account air pollution in the city, and the incentive to use clean fuel has not been implemented for lack of a sustainable supply of clean fuel. All these aspects have discouraged the effective implementation of a national policy on the environment and energy. By overcoming the barriers to a sustainable supply of clean fuel, this Project is expected to encourage that other stakeholders to do their part in the action against air pollution from the transport sector.

50. As a part of this Project, the Government has taken the following actions:

- (i) Based on the right of first refusal, the Government will offer to the private sector operators, through a transparent financial arrangement similar to that of the public operator, a financing mechanism to purchase at least 100 buses. Furthermore, the Government has assured that the filling stations will be leased out to, and operated by, existing private sector gasoline station owners and eventually be transferred to them after a running-in period. Draft agreement was conveyed to ADB on 14 October 2002.
- (ii) An intermediate financing arrangement between RPGCL and the public and private bus operators as well as auto rickshaw operators. Draft agreement was conveyed to ADB on 14 October 2002.

⁶ National Environmental Policy, 1992, Section 3.4 on energy and fuel sector further emphasized by National Energy Policy, 1995.

- (iii) For Janata Bank to be able to provide intermediate financing, the Government has arranged for BRTC, the public sector bus operator, to settle its current debts to the bank – Tk84 million through an acceptable repayment plan. Letter covering the Board of Directors of the Janata Bank decision to reschedule BRTC's outstanding loan repayment was conveyed to ADB on 14 October 2002.
- (iv) Boards and management of the corporations concerned – GTCL, TGTDCCL, and RPGCL – will be reconstituted to include private sector professionals of standing, and provided complete autonomy in operations according to the Companies Act 1994. The Government has conveyed a letter on 20 October 2002 confirming its time schedule, before loan effectiveness, for the reconstitution of the Boards of Directors.
- (v) The Ashuganj–Elenga, Bakhrabad–Demra–and Bakhrabad–Chittagong transmission pipelines will, based on a firm action plan, be transferred from the gas distribution companies to GTCL. Vendor's agreement has been signed on 20 October 2002 for transfer of Ashuganj-Elenga pipeline from TGTDCCL to GTCL confirming physical transfer of all assets by 31 March 2003. Government has confirmed on 20 October 2002 that vendors' agreement for transfer of Bakhrabad-Demra and Bakhrabad-Chittagong pipelines by BGSL to GTCL will be signed by 31 December 2002 specifying physical transfer of all assets by 31 March 2003.
- (vi) The Government has ensured that customs, duties and taxes on gas transmission and distribution components financed by the project, which are currently between 50% and 70%, will be made uniform and substantially reduced. Government's notification was conveyed to ADB on 20 October 2002.
- (vii) The Government and its EAs have announced the public disclosure of the resettlement plan in the project office and made it available as a reference to affected persons.

C. Institutional Aspects

1. Regulatory and Institutional Framework for Promoting CNG use in the Transport Sector

51. For the vehicles and equipment to be used in the CNG transport sector, European standards and regulations will be implemented. However, efforts to promote the use of CNG need to go hand in hand with efforts to ensure its safe use in this sector. Therefore, the Government must have a regulatory and institutional framework to address the issue of safety, by at least establishing a certification system for safe conversion of vehicles to CNG, safe operation of conversion and maintenance workshops for CNG vehicles, and safe use of equipment (especially CNG cylinder tanks), and operation of filling stations to internationally acceptable norms and standards.

2. Downstream Private Sector Projects

52. With the Project establishing the foundation for more widespread distribution of CNG for the transport sector in the country, further expansion preferably can be undertaken by the private sector. The requirements in capital and skills of the transport sector are huge. Only the private sector can provide such resources on a long-term basis. The Project is an excellent

opportunity for public–private partnership. The public sector project components will serve to facilitate private sector participation by supplying inputs, mitigating risks, and developing opportunities. The Project lays a solid foundation that will be in place to convince both consumers and private investors of the reliability and sustainability of the new CNG market, which is a prerequisite for future private development of the sector. The private sector has appropriately responded showing interest in financing, marketing, and use of CNG for the transport sector.

D. Social Aspects

1. Poverty Reduction

53. Although the Project is not classified as a poverty intervention project, it will indirectly contribute to poverty reduction by reducing household expenditures on health, especially for the urban poor who are highly vulnerable. Through improved air quality, the Project will benefit approximately 10 million people in Dhaka, 36.6%⁷ of whom live below the poverty line. Since the poor are more susceptible to air pollution due to the average physical exposure, it is anticipated that the poor will reap most of the economic benefits associated with reduced health problems. Reducing SPM concentrations in Dhaka to the national air quality standard will likely result in about 3,580 fewer premature deaths, 10 million fewer restricted-activity days, and 87 million fewer days of respiratory symptoms per year.

54. The Project will generate about 3,000 person-months of work over the construction period. Men and women will have equal opportunities for employment. The vast majority of the jobs to be created, both temporary and permanent, will go to the poor, as most of the work will be labor-intensive and low-skill.

2. Social Aspects

55. The social dimensions of the Project – i.e., stakeholder participation, contract specifications on equal pay for men and women, and prevention of child labor – are designed to facilitate more pro-poor benefits and equitable distribution. The Project will adopt the participatory approach in implementing an awareness campaign on safety issues and the benefits of using CNG. The initial poverty and social assessment (IPSA) did not identify any communities of indigenous people and ethnic minorities that would be adversely affected by the Project. Therefore, there is no need to prepare an indigenous people’s development plan.

56. The demand for gas has considerably increased in over FY1999/2000 when 47,986 connections were commissioned: 117 industrial, 239 commercial, and 47,630 domestic customers. With the gradual expansion of the urban areas, demand from new customers will also increase. Although the Project is primarily targeting supply to CNG filling stations, gas will also be distributed to general users. By increasing the supply of gas to domestic customers, women and children will benefit from improved indoor air quality. The detailed social assessment is presented in Appendix 9.

⁷ The data shows a lower poverty line, which incorporates a minimal allowance for nonfood spending for those who could afford just the food requirement. Poverty lines constructed using the cost-of-basic needs (CBN) method represent the level of per capita expenditures at which the members of a household can be expected to meet their basic needs of food caloric requirement (2,122 kcal per day and person) and also nonfood consumption.

3. Land Acquisition and Resettlement

57. Part A will not require relocation of any households. Land comprising 63 hectares (ha) will be acquired for the Project. Another 90 ha will be requisitioned for temporary use as working space. A maximum of 2,103 households will be affected due to partial loss of land, houses, crops, and trees. The estimated cost for compensation including implementation and monitoring is \$2.59 million equivalent. A resettlement plan based on the 100% census in accordance with ADB's policy on involuntary resettlement was prepared by the Government and EAs in Appendix 8.

58. The Government confirmed that parts B and C will not require any land acquisition and resettlement. For part B, TGTDCCL will construct pipelines along existing highways and major roads. Compensation amounting to \$0.99 million equivalent will be paid to Dhaka City Corporation for restoring the roadside damaged during construction. For part C – construction of 6 major filling stations, 20 minor filling stations, and 2 workshops – existing sites belonging to private filling stations and RPGCL will be used.

E. Financial Aspects

59. Parts A, B, F(i) and F(ii), which are proposed for OCR financing sources, show robust financial internal rates of return (FIRRs). The remaining portions of the Project – parts C, D, E and F(iii) – that are proposed for financing from ADB's special funds resources, also have robust FIRRs. Although the new CNG-fueled buses are going to replace the existing diesel-fueled buses, the FIRR was computed based on new diesel buses being procured as alternate to the CNG buses. The existing buses that are to be replaced are already in such a condition that they should have been phased out and replaced in any case. Based on the considerable economic benefits, but not enough attractive financial incentives for the bus operators, this component has to be combined with a gradual ban of diesel-fueled buses for urban transport, which is one of the conditionalities for the Project. The FIRR for the overall Project is 21%. In the most extreme case – a 10% increase in capital costs and operation and maintenance costs as well as a 10% decrease in volumes and a one-year delay – the Project will still have a FIRR of 16%, which is adequate. The detailed financial analyses for the three EAs are in Appendix 10, and those for the Project in Appendix 11.

F. Economic Aspects

60. Aside from the significantly lower exhaust emissions, especially of particulate matter (PM), one more major reason for switching to natural gas is to diversify energy sources, since worldwide natural gas reserves are more abundant than oil reserves. In 2000, the ratio of proven reserves to production of natural gas was estimated to be 62 years, and that of oil 38 years. A country that imports oil, but has an abundant supply of natural gas, may find it particularly attractive to consider natural gas as a transport fuel so as to reduce its oil import bills.

61. The Project has two discrete categories of beneficiaries. The first is the users of Dhaka's roads and the second is the nontransport consumers such as household consumers, industries, and the commercial sector in the Greater Dhaka area. The latter consumers derive benefit from the additional capacity created from the investments in the transmission and distribution gas pipelines. Estimating the monetary value of the environmental and health benefits is difficult and involves subjective value judgments. However, the use of the projected supply instead of other fuels and the resultant reduction in pollution level (improvement in air quality) are expected to

provide a qualitative benefit-reduced incidence of deaths and sickness cases reported and is expected to save about \$48 million annually to the economy on account of improved human health in Dhaka. Some studies⁸ have shown that a general loss in productivity due to air pollution has an estimated 2% impact on the gross domestic product (GDP). These benefits have not been included in the economic internal rate of return, which is nevertheless high at 41.9%. The details of the economic analysis are in Appendix 12.

G. Environmental Aspects

62. Overall, the Project is expected to contribute in providing a conducive environment for promoting the use of CNG vehicles. The Project is also expected to contribute in improving air quality in Dhaka by reducing CO, NO_x, SO_x, and PM. Replacing 300 diesel-fueled buses with 300 CNG-fueled buses in Dhaka will reduce bus emissions, particularly PM, by 20% and CO by 6%.⁹ Close coordination with the Ministry of Forest and Environment, particularly DOE, to monitor air quality in Dhaka will be part of the PPMS. The summary initial environmental examination (IEE) is in Appendix 13.

63. Natural gas as a transport fuel has a number of advantages over diesel: (i) very low particulate emissions; (ii) low emission of airborne toxins; (iii) negligible SO₂ emissions; and (iv) less noisy operation, with less vibration and less odors than the equivalent diesel engines. All these benefits make NGVs especially suitable for urban areas. In addition, life cycle analysis suggests that NGVs emit less of the major greenhouse gases than gasoline-fueled vehicles do still less than diesel vehicles.

64. Establishing new transmission pipelines to transport natural gas from Dhanua to Aminbazar, Savar (60 km); expanding and upgrading the distribution system within Dhaka (97 km); as well as establishing 6 major filling stations and 20 filling stations for distribution will create some environmental disturbances and impacts during their construction and operation, but the impacts can easily be mitigated. The IEE recommendations for mitigating the environmental impacts are incorporated into the project design and operating procedures.

65. The Project will assist the Government in strengthening its capacity to formulate and adopt environmental and safety standards for distribution of CNG, establish and operate CNG filling stations, as well as CNG in the transport sector. This effort will lead to the establishment of the regulatory and institutional framework for using CNG in the transport sector. The framework will create a conducive environment for private sector involvement in providing services for safe conversion to CNG vehicles, managing filling stations, as well as maintaining CNG cars.

H. Risks

66. Based on lessons learned from similar projects and a separate assessment this specific Project, the risks are mainly on (i) supply of natural gas, (ii) regulation, and (iii) long-term sustainability based on private sector participation.

67. Domestic resources of natural gas as well as an established infrastructure for distributing the gas are essential for successful implementation of a CNG program. Such a supply and the infrastructure facilities already exist in Bangladesh. However, to secure sufficient pressure even

⁸ United States-Asia Environmental Partnership.

⁹ At present about 1,500 buses operate in Dhaka.

during peak hours to supply a major increase in CNG filling stations, parts A and B will fund additional transmission and distribution gas pipelines.

68. Standards for the CNG transport sector will be in place well in advance of implementation of the CNG filling stations and the purchase of vehicles under parts C and D of the Project, since the Government has already decided to follow existing international/European standards for its regulations on safety and emission control. The Government and the EAs will receive initial basic inputs for designs, CNG filling station layouts, specifications, and safety regulations and practices including mandatory inspection programs, in advance of this Project. This support will be implemented under an ADB's regional TA¹⁰ through the Gas Authority of India (GAIL) and its associate companies, which successfully have introduced CNG for automobiles in Mumbai and Delhi cities in India, based on European regulations and standards.

69. Private sector participation is essential for the future expansion of the CNG transport sector, but not for the success of this specific Project, which is primarily an economic growth and environmental and health improvement project. However, private sector participation from the start of the Project has already been secured through (i) a strictly commercial-based intermediate financing arrangement through commercial banks and leasing companies, and (ii) purchase and operation of vehicles by the private sector.

70. Private sector financing institutions, bus operators, taxicab and other car owners, and present and prospective owners of gasoline filling stations and workshops have expressed a keen interest in the implementation of CNG for the transport sector. The private sector is just waiting for the basic foundation covered by this Project, such as (i) a secure supply of natural gas, (ii) initial critical number of CNG filling stations, (iii) initial critical number of vehicles to prove sustainability, and (iv) regulations and standards on equipment and the use of CNG.

V. ASSURANCES

A. Specific Assurances

71. In addition to the standard assurances, the Government and the EAs have given the following assurances, which have been incorporated in the legal documents.

- (i) During the first year of project implementation, the Government will set and approve (a) international standard safety codes related to the CNG filling stations, installation of CNG conversion kits; and (b) the use of CNG including emission standards for different kinds of fuels. By 31 December 2003, the Government will have instituted a mandatory vehicle inspection program to ensure the enforcement of safety and emission standards.
- (ii) The Government will ensure that during project implementation and 10 years thereafter, there is at all times at least a 50% price differential between the pump price for CNG and for other fuels.

¹⁰ ADB. 2000. *Regional Technical Assistance for Identification and Prioritization of Subregional Projects in South Asia*. Manila.

- (iii) The Government will ensure that each bus or auto rickshaw to be provided under the Project replaces an old diesel-fueled bus or two-stroke auto rickshaw for transportation in Dhaka. In each case, the old diesel-fueled buses or two-stroke auto rickshaws will be sent out of Dhaka city or scrapped.
- (iv) By July 2003, the Government will have begun a program to phase out all two-stroke baby taxis from Dhaka and to replace two-stroke vehicles with four-stroke CNG vehicles. The Government will have completed the phase out of two-stroke baby taxis by 31 December 2007.
- (v) The Government will phase out diesel-fueled buses in Dhaka as follows: (a) 25% by 2005, (b) 50% by 2008, (c) 100% and a total ban of diesel-fueled buses for urban transportation within Dhaka by 2010.
- (vi) The Government, through GTCL and TGTDC, will ensure that land acquisition activities are implemented in accordance with all applicable laws and regulations and ADB's policy on involuntary resettlement, as set out in the agreed upon resettlement plan, including (a) acquisition of land and rights-of-way in a proper and timely manner; (b) provision of compensation and entitlements as stipulated in the plan and ADB policy to prevail in the case of difference with the Borrower's laws and regulations, and compensation to be at replacement cost; (c) timely provision of counterpart funds and disbursements to AP; (d) guarantee to meet unforeseen obligations in excess of the budget estimate; (e) adequate supervision, monitoring, and reporting by the EA; (f) external monitoring and evaluation by an independent agency; (g) dissemination of adequate information and consultation with AP; and (h) regular reporting of progress to ADB.
- (vii) The Government, through GTCL, TGTDC, and RPGCL, will ensure that all environmental mitigation measures and the environmental management plan described in the IEE and the summary IEE, both conducted for the Project, are followed during Project implemented in consultation with the Department of Environment and in accordance with ADB's environmental requirements as set forth in Section 20 of ADB's Operational Manual, and ADB's environmental assessment requirements as set forth in *Environmental Assessment Requirements of the Asian Development Bank (Environmental Division Office of Environment and Social Development, March 1998)*.
- (viii) The Government, through GTCL, TGTDC, and RPGCL will ensure that all of the civil works contracts under this Project expressly provide for the contractor to be responsible for, and to carry out, information and education campaigns on sexually transmitted diseases and human immunodeficiency virus/ acquired immunodeficiency syndrome for construction workers as part of their health and safety program at construction campsites during the construction period.
- (ix) The Government, through GTCL, TGTDC, and RPGCL will ensure that civil works contractors comply with all applicable labor laws, do not employ child labor for construction and maintenance activities, and provide appropriate facilities for children in construction campsites. The Government will set employment targets for women, acceptable to ADB, for pipeline construction activities, and will ensure that the bidding documents and construction contracts expressly require contractors to provide equal wages between men and women for work of equal value.

- (x) With the active participation of qualified representatives of civil society and as agreed upon with ADB, the Government will develop and implement an adequate number of public awareness campaigns on safety aspects and benefits of using CNG.
- (xi) The Government will ensure that RPGCL selects the private sector participants under the Project in accordance with procedures and criteria agreed upon with ADB. The Government will submit the procedures and criteria for ADB's approval prior to selection of any private sector participants under the Project.
- (xii) Prior to any onlending by RPGCL under the Project, the Government will ensure that RPGCL submits to ADB for its review and approval, draft onlending agreements in form and substance acceptable to ADB.
- (xiii) The Government will ensure that the agreement for financing arrangements for the private sector participation for at least 100 CNG buses between RPGCL and the intermediate financing institutions shall be signed, as acceptable to ADB, within not more than one month of the Effective Date.
- (xiv) The Government will ensure that agreements for purposes of setting up the CNG filling stations, between RPGCL and such number of private owners of gasoline stations as acceptable to ADB, shall be signed, as acceptable to ADB within not more than six months of the Effective Date.
- (xv) In order to ensure intermediate financing of at least 200 CNG buses by Janata Bank, the Government will ensure that the agreement between BRTC and Janata Bank with regard to the settlement of current debt to of BRTC to Janata Bank for an amount of not less that Taka. Eighty Four million shall be signed between BRTC and Janata Bank, as acceptable to ADB, within not more than one month of Effective Date.

B. Conditions for Loan Effectiveness

72. The Ordinary Operations Loan agreement shall have been duly executed and delivered on behalf of the Government, and all conditions precedent to its effectiveness shall have been fulfilled.

73. The subsidiary loan agreements between the Government and GTCL, TGTDCCL, and RPGCL in form and substance acceptable to ADB (i) will have been delivered to ADB and (ii) will have become effective subject only to the effectiveness of ADB Loan Agreement.

74. To avoid subsidies, the Government will have increased the natural gas price charged by TGTDCCL to the CNG filling stations to Tk0.070 per cubic feet.

75. The Government will have notified to ADB that, the legal and physical transfer of the gas transmission pipelines (the Ashuganj-Elanga, Bakhrabad-Dema and Bakhrabad-Chittagong pipelines currently owned and managed by TGTDCCL and Bakhrabad Gas Systems Limited, BGSLL) to GTCL, has been completed.

76. The Government will have notified to ADB that the Boards of Directors of GTCL, TGTDCCL and RPGCL have been reconstituted with inclusion of private sector professionals in each board.

77. The Government will have caused GTCL, TGTDCCL and RPGCL to have the full financial and administrative powers under the provisions of the Companies' Act 1994 to be incorporated in their respective charters.

78. The Government will have recruited the management (the Managing Director, General Manager (Finance) and General Manager (Operations)) of the GTCL, TGTDCCL, and RPGCL on competitive basis through open advertisements in the press, as acceptable to ADB.

VI. RECOMMENDATION

79. I am satisfied that the proposed loan would comply with the Articles of Agreement of ADB and acting in the absence of the President, under the provisions of Article 35.1 of the Articles of Agreement of ADB, I recommend that the Board approve

- (i) the loan in various currencies equivalent to Special Drawing Rights 32,126,000 to the People's Republic of Bangladesh for the Dhaka Clean Fuel Project, from ADB's Special Fund Resources with an interest charge at the rate of 1% per annum during the grace period and 1.5% per annum thereafter; a term of 32 years, including a grace period of 8 years; and such other terms and conditions as are substantially in accordance with those set forth in the draft Loan and Project Agreements presented to the Board; and
- (ii) the loan of \$30,200,000 to the People's Republic of Bangladesh for the Dhaka Clean Fuel Project, from ADB's ordinary capital resources with interest to be determined in accordance with ADB's LIBOR-based lending facility; a term of 20 years, including a grace period of 5 years; and such other terms and conditions as are substantially in accordance with those set forth in the draft Loan and Project Agreements presented to the Board.

Myoung-Ho Shin
Vice President

30 October 2002

LOGICAL FRAMEWORK

Design Summary	Performance Indicators/Targets	Monitoring Mechanisms	Assumptions and Risks
<p>1. Goal Improve urban environment and health through widespread utilization of compressed natural gas (CNG) as an automotive fuel in Bangladesh</p>	<ul style="list-style-type: none"> • By 2012 at least 80% of the public transportation vehicles using CNG and 20% of the petrol cars in metropolitan areas of Dhaka • Long-term reduction in incidence of respiratory death and sickness cases reported 	<ul style="list-style-type: none"> • Annual transport sector surveys • Public health statistics 	
<p>2. Purpose Reduce urban vehicle pollution problems in Dhaka and other metropolitan areas</p>	<ul style="list-style-type: none"> • Significant reduction in roadside suspended particulate matter (SPM) concentrations compared with current status: 1,000–2,000 $\mu\text{g}/\text{m}^3$ by 2010 • Significant reduction in SPM10 concentration in the metropolitan area of Dhaka by 2010 	<ul style="list-style-type: none"> • Public daily/monthly reports from enforced roadside monitoring systems performed by Government authorities • Public reports from enforced rooftop measurement systems 	<ul style="list-style-type: none"> • Government's continued commitment to reduce air pollution
<p>3. Outputs Transmission and distribution gas pipelines New CNG filling stations and 2 workshops Replacement of buses, and auto rickshaws, and conversion of petrol cars Improved capacity among executive agencies (EAs) staff</p>	<ul style="list-style-type: none"> • The complete expansion of 60 km transmission pipeline and 97 km distribution pipeline installed and implemented with full capacity by June and December 2005, respectively • 26 new filling stations implemented by June 2005 • Operation of 300 CNG buses, 2,000 auto rickshaws, and 10,000 converted petrol cars by October 2005 • Price and tax structure, safety and emission standards in place by December 2003. 	<ul style="list-style-type: none"> • Project implementation progress reports • Operation monitoring reports 	<ul style="list-style-type: none"> • Long-term reliable price and tax policy in relation to competitive fuels that will support public acceptance of CNG transportation • Enforcement and control of new and already existing laws and regulations related to vehicle registration, environmental conditions, and other environmental issues related to the transport sector

Design Summary	Performance Indicators/Targets	Monitoring Mechanisms	Assumptions and Risks
<p>4. Activities Expansion of transmission and distribution gas pipelines Procurement Construction Operation</p> <p>Establishment of new filling stations Procurement Construction Operation</p> <p>Purchase of CNG-fueled buses, auto rickshaws, and conversion kits for petrol cars Procurement Training Operation</p> <p>Consulting Services and Training Procurement Training Operation</p>	<p>Start: January 2002 Complete: December 2005 Responsible: Gas Transmission Co. Ltd. (GTCL) and Titas Gas Transmission and Distribution Co, Ltd (TGTDCL)</p> <p>Start: January 2002 Complete: October 2005 Responsible: Rupantarita Praktirik Gas Co., Ltd. (RPGCL)</p> <p>Start: April 2004 Complete: June 2006 Responsible: RPGCL</p> <p>Start: September 2002 Complete: December 2006 Responsible: RPGCL</p>	<ul style="list-style-type: none"> • Project progress reports and review mission reports • Project progress reports and review mission reports • Project progress reports and review mission reports • Project progress reports and review mission reports 	<ul style="list-style-type: none"> • Timely procurement and supply of needed equipment and efficient training of personnel concerned • Timely supply of needed equipment and trained personnel • Vehicle and conversion kit standards in place • Transparent tender and procurement processing • Efficient regulating authority timely in place
<p>5. Inputs Consultants Civil works Equipment and supplies Training Counterpart and project management support Awareness and beneficiary program</p>	<p>International/domestic – 140/115 person-months \$11.5 million \$54.5 million International 200 person-months \$20.2 million \$1.0 million</p>	<ul style="list-style-type: none"> • Project Implementation progress reports • Project accounts 	<ul style="list-style-type: none"> • Counterpart budget is available on a timely basis. • Counterpart staffs are available.

SECTOR AND SUBSECTOR ANALYSIS

A. General Energy Sector Overview

1. Bangladesh has a per capita consumption of 200 kilograms of oil equivalent (kgoe)¹ of energy, which is the third lowest in Asia, after Cambodia and Nepal. Most of it is noncommercial energy comprising biomass. Commercial energy is available to about 20% of the population as electricity and to about 8% of the population as hydrocarbons, liquid fuels, natural gas, or liquefied petroleum gas.

2. Bangladesh has limited hydropower potential because the terrain is flat. The Jamuna-Padma-Meghna river system, which runs north to south and then to the southeast, divides the country into two parts. The country's proven recoverable reserves of oil (including condensate), is estimated at about 51 million barrels, and total natural gas in place is estimated at 20 - 28 trillion cubic feet (TCF), of which about 16 - 24 TCF is classified as remaining reserves. The annual consumption of natural gas in the year 2001 was about 0.372 TCF. The consumption of natural gas in the transport sector, particularly as automotive fuel, is negligible at present and is at an initial level. However, there is a good demand for conversion of buses, cars, and baby taxis to CNG vehicles, but a sufficient number of CNG filling stations must be available. In terms of generated electricity, about 88% of the total in FY2001 was from gas-fired power plants.

B. Gas Sector Description

3. The natural gas sector is organized under the Ministry of Energy and Mineral Resources. The Government, through the ministry, wholly owns and supervises the Bangladesh Oil, Gas, Mineral Company (Petrobangla), as well as the various companies that deal with specific aspects of the natural gas business. Petrobangla acts as the holding company for all the other companies in the sector. As of now, the Government-owned companies operating in the sector include Petrobangla as holding company; Gas Transmission Company Limited (GTCL), which is the sole gas transmission company; the Bangladesh Petroleum Exploration Company Limited (BAPEX), the sole drilling and exploration company; four gas distribution and marketing companies – the Titas Gas Transmission and Distribution Company Limited (TGTDC), the Bakhrabad Gas Systems Limited (BGSL), the Jalalabad Gas Transmission and Distribution System Limited (JGTDSL), and the recently established Paschimanchal Gas Company Limited (WESGAS); and two gas production companies – Sylhet Gas Fields Company Limited (SGFL) and the Bakhrabad Gas Fields Company Limited (BGFCL). The Government has also promoted companies for the conversion of and use of gas. One is Rupantarita Prakritik Gas Company Limited (RPGCL), which deals in compressed natural gas (CNG) and conversion of natural gas liquids to other usable hydrocarbons. Since 1995, after the award of the production-sharing contracts (PSCs) to international oil companies, four private sector companies have been engaged in gas exploration and production: Unocal (through acquisition of 100% interest of Occidental); Shell (through acquisition of 100% interest of Cairn Energy Plc); joint venture of Tullow Oil, Rexwood and Oakland (current operator is Tullow through acquisition of 80% interest from Rexwood and Oakland); and United Meridien Company. Recently the Government initiated and signed five PSCs with seven more international oil companies. About 20 TCF of recoverable reserves was declared,² of which about 4.3 TCF has already been extracted over the last 30 years.

¹ Extrapolated from the World Bank's *World Development Report* for 1999-2000, which indicates a figure of 197 kgoe for 1996, with an average growth rate of 0.9 % per annum, over 1980-1996.

² As of the *Bangladesh Petroleum Potential and Resource Assessment 2001* conducted by the Hydrocarbon Unit of Ministry of Power, Energy and Mineral Resources and Norwegian Petroleum Directorate.

4. This increase in gas resources is both an opportunity as well as a threat to Bangladesh's economy. The capital required for investments in downstream activities is presently limited; thus, the benefits that could be derived from this additional gas find are restricted. Under current and prospective gas purchase and sales agreements Bangladesh is required to purchase a minimum quantity of gas in foreign exchange. This requirement puts pressure on Bangladesh's fragile foreign exchange reserves. Therefore, if this additional gas were not put to productive use, it would represent an unsustainable burden in costs as well as foreign exchange outflow.
5. Of the average production of about 900 million cubic feet per day (MMCFD), about 80% is from fields owned by the Government and the balance from fields operated by international oil companies under PSCs. At the present rate of consumption, the country has a reserve-to-production ratio of over 40 years.
6. Gas transmission for commercial use began in the early 1960s in the Sylhet area and about 1,300 kilometers (km) of 4-inch through 30-inch transmission pipelines has been laid, covering all the major towns in eastern Bangladesh. Recently, with the construction of the Bangabandhu Bridge over the Jamuna River, gas supply was extended to Serajgonj town and Baghabari Power Station in the west. Gas transmission is entirely in the public sector.
7. Distribution of gas began on a commercial scale in 1968. Since then, over 10,000 km of 1-inch through 20-inch pipelines has been laid, covering about 900,000 consumers. Gas distribution is entirely in the public sector.
8. CNG was introduced in Dhaka for use in cars early in 1980. In 1994, four filling stations were established to serve 1,200 vehicles. The obvious economic benefit of using CNG vehicles and the Government's strong campaign on combating air pollution have increased public demand for CNG vehicles, which leads to increased demand for CNG supply. The Government's program promoting the use of CNG vehicles as one of the efforts to combat air pollution is already very well accepted by the public. It is now time for the Government to provide a continued and adequate supply of CNG for the transport sector.
9. The Ministry of Communications is the ministerial-level agency that is responsible for transportation issues in the country.
10. The Bangladesh Road Transport Authority (BRTA) is responsible for planning the transit system and approving routes, approving transit contracts for private operations, and registering vehicles including testing for physical and environmental fitness. The Bangladesh Road Transport Corporation (BRTC) is the government-subsidized transit company running buses on approved routes. BRTC essentially competes with private bus companies approved by BRTA, since there appears to be little coordinated privatization.
11. Although the total number of vehicles in the city of Dhaka is not large relative to the human population, visual observation of the main arterial roadways suggests high levels of ambient pollutants due to the density of traffic, poor traffic flow and poor maintenance of vehicles. The estimated number of vehicles in Dhaka is in Table A2.

Table A2: Estimated Number of Vehicles in Dhaka in 2000

Vehicle Types	Estimate
Passenger Cars including Jeep/Station Wagons and Pickups	83,611
Taxis	800
Big Buses	1,500
Minibuses	6,627
Trucks	15,600
Auto Rickshaw (Baby Taxis)	66,360
Motorcycles	121,156
Others	2,382
All Vehicles	298,035

12. The data are based on registration records up to 1999, and that for 2000 is estimated by adding the average increase between 1998 and 1999. There is a widespread belief within the Government that the registered vehicle numbers are low by 25-50%, and that limited enforcement of registration regulations allows a large number of unregistered vehicles to ply the roadways. In addition to the motorized fleet of vehicles, there is a significant number (estimated at over 100,000) of bicycle rickshaws within the city. Although they are not a direct source of emission, the congestion aggravated by such an abundance of nonmotorized transport is a relevant component of the transportation and air quality problem. The most striking aspect of Dhaka's air pollution problem is the crowded, smoke-filled streets of the city. Trucks, buses, three-wheel two-stroke baby taxis, and cars create a dense smoke plume that exposes traffic police, roadside vendors, and the public to extreme levels of air pollution. The number of two-stroke engine vehicles increased by 60% from 1990 to 1996.

C. Government Policies and Plans

13. The Government policies in the gas sector are summarized below:

- (i) New exploration and production of gas will predominantly be by the private sector through PSCs.
- (ii) Gas transmission will be a monopoly of GTCL. However, private sector participation will be encouraged through (a) construction of pipelines through build own operate transfer contracts, with operations controlled by GTCL; (b) minority equity participation in GTCL; and (c) participation in the overall supervision of GTCL's activities.
- (iii) Gas marketing and distribution will be commercialized and gradually privatized.
- (iv) An independent regulatory authority will be established for licensing, tariff setting, and regulating of gas transmission and distribution activities. The Government will shortly submit a new law for Parliament's consideration.
- (v) Exports of gas and gas-based value-added products will be permitted after the Government is satisfied that the future domestic requirements of gas can be fully met. According to recent discussions and public-made statements, the Government is inclined to make a decision soon on gas exports purely on financial and economic considerations.

- (vi) Tariffs for nontransport sector use will gradually be rationalized to reflect the costs of service. The Government may subsidize certain consumer categories, but the subsidies will be direct, quantified, explicit, and subject to periodic review.
- (vii) Traffic flows will be improved by drafting out a plan for phasing out auto rickshaws and replace them with larger more efficient vehicles as well as banning rickshaws initially on 4-5 major roads so that alternate modes of transport could be arranged to ease public suffering.
- (viii) The Government has already issued notification to phase out all two-stroke baby taxis by July 2003, but implementation has not started. According to the current Motor Vehicles Act, the life of 2-3 wheelers is 9 years. In 1998 import of two-stroke vehicles was discontinued; therefore their gradual phaseout may be completed by the year 2007.
- (ix) The Department of Environment has plans for introducing the catalytic converter in Bangladesh. This will definitely help in reducing emissions and support the change in fuel quality, i.e., removal of lead and sulfur from gasoline, but it is unlikely that the change will occur in the near future. Catalytic converters were supposed to be mandatory for all vehicles in Bangladesh since May 2001.

14. The Government strategy is to use natural gas (an indigenous resource) to reduce imports of other fuels, reduce pollution, and improve efficiencies. Over the next 10 years, the Government plans to increase the population's access to gas – piped gas, liquefied petroleum gas (LPG), or CNG from the present 9% to about 20%. The Government also plans to replace about 20% of the liquid fuel-based transportation in Dhaka and other major cities with vehicles fueled by CNG, thereby reducing imports of petrol and diesel, and also reducing pollution. All major power stations except the proposed Barapukhuria coal-based power station, will utilize natural gas as their primary fuel, thus reducing imports of diesel and heavy fuel oil. After ensuring availability of natural gas for meeting present and future domestic needs, the Government plans to use exports of natural gas and gas-based products for the macro foreign exchange stability of the economy.

15. The new Government of Bangladesh has expressed urgent interest in a fast conversion of all public sector vehicles into CNG systems, for proper use of natural gas and to curb environmental pollution. Recently the new Government also stressed the need to phase out two-stroke engines so as to reduce air pollution in the city, increase the number of CNG refueling stations and encourage the private sector to participate in this transition. Furthermore, the CNG refueling facility should be made obligatory when giving permission to set up new petrol pumps. The Government has already directed the authorities concerned to complete CNG conversion of all two-stroke auto rickshaws in the city within the next 2 years. The Government is in favor of providing auto rickshaw owners with loans for CNG conversion under arrangements with leasing companies or banks.

D. Sector Issues

16. The Asian Development Bank (ADB) has been involved in the natural gas sector intermittently over the last 23 years, with six loans totaling \$374 million. From its role as a provider of funds for individual projects in the 1970s, ADB became a provider of funds as well as technical advice for project preparation in the 1980s. In the late 1990s, ADB changed its stance to a more proactive one, providing policy advice to the Government in implementing sector reforms.

With the significant discoveries made in the last few years, ADB realizes that natural gas is one of the few large-scale indigenous resources available in Bangladesh that can, if appropriately developed, dramatically improve the economy and the living standards of the people.

17. ADB's strategy for developing the gas sector, formulated in consultation with the other major aid agencies in the sector,³ comprises the following:

- (i) The natural gas industry is a commercial one. Hence all activities and decision making in the sector must aim to improve commercialization. Critical to this effort is the autonomy of the operations of the sector from the social obligations of the Government. Hence, independent setting of tariffs and regulation, private sector participation, and distancing of the managements of the public sector companies from the Government are supported.
- (ii) Nonavailability of energy is a major constraint to the development of the economy. Hence, efforts to increase energy coverage for the population must be accelerated. Poverty reduction being ADB's overarching development goal, implies support for improving the poor's access to natural gas, and cottage industries through carefully targeted interventions.
- (iii) Natural gas is the only commercially viable mineral resource of importance in Bangladesh and is, therefore, to be utilized carefully to ensure that long-term benefits are recognized and accrue to the majority of the population. Hence, optimization of use and appropriate tariffs to ensure distribution of the benefits of development are supported. Optimization of use implies (a) a cautious approach to exports of available gas reserves to stabilize the economy; and (b) decreasing waste of gas in all segments of the sector.
- (iv) Improved governance is another key issue in the sector since it cuts across all other aspects. Good governance improves commercialization, improves the distributive aspects of development, and reduces waste. Hence, transparency, predictability, and accountability in the sector's transactions are supported.

18. ADB and other aid agencies in the sector have been in continuous dialogue regarding improving the aspects of governance in the sector, as well as using the sector as an engine for accelerating economic growth. The policy dialogue involves issues such as enactment of a new gas law to allow establishment of an independent regulatory commission; private sector participation in gas exploration and production; planning for optimized development of the gas sector and use of natural gas resources; and improving corporate governance in the sector entities, e.g., reconstituting boards of directors, delegating authority, and revising the conditions of service for the employees. ADB has given technical assistance for improving operational efficiencies,⁴ preparing a gas master plan,⁵ drafting a gas law,⁶ developing a policy on private sector participation in gas pipelines and evaluating of options for private sector participation in

³ The consultative group for the energy sector comprises ADB, World Bank, Government of Germany/ Kreditanstalt fuer Wiederaufbau (KfW), Government of Japan/Japan Bank for International Cooperation (JBIC), Department for International Development of UK (DFID), Canadian International Development Agency (CIDA), and United States Agency for International Development (USAID). ADB is the aid agency coordinator in the sector.

⁴ ADB. 1993. Technical Assistance to Bangladesh for *Safety and Efficiency Improvement in the Gas Sector*. Manila.

⁵ ADB. 1993. Technical Assistance to Bangladesh for *Preparation of a Gas Master Plan*. Manila.

⁶ ADB. 1997. Technical Assistance to Bangladesh for *Gas Regulatory Authority*. Manila.

the Rashidpur-Ashuganj gas pipeline,⁷ and examination of personnel-related issues in the sector.⁸ In addition to ADB, Japan International Cooperation Authority (JICA) and USTDA have supported studies on optimization of gas use; the Norwegian Agency for Development is assisting in establishing and supporting the hydrocarbon unit, a think tank for policy advice within the Ministry of Energy and Mineral Resources (MEMR); and Canadian International Development Agency (CIDA) has supported introduction of CNG-fueled vehicles.

E. Performance Under ADB's Third Natural Gas Development Project

19. The only ongoing ADB project⁹ of in the sector involves (i) drilling of seven appraisal-cum-development wells in Titas and Habiganj gas fields and work over of six wells in Titas and Bakhrabad gas fields; (ii) adding gas treatment facilities in Titas and Habiganj gas fields; (iii) expanding transmission lines; and (iv) expanding and upgrading of distribution networks. The original completion date of 31 December 1999 was subsequently moved to 31 December 2002. Procurement actions have all been completed, but with significant delays. The delays are attributed to the review by several layers of authorities in the Government and ADB, as well as to the subjectivity of ADB's then applicable guidelines for selecting consultants, which leaves the selection process open to possible interference.

20. Many of the covenants agreed upon in the loan have not been implemented. On closer examination, however, it is seen that some of the covenants, such as the one to offload 5 percent of the shares in each sector company, are irrelevant to the current reform process since they will not lead to any change in the governance of the sector or of the companies, or to an improvement of sector efficiencies. Similarly, the appointment of one nongovernment director on the board of each sector company will not significantly improve the commercialization of the company if its board of directors is not granted sufficient autonomy in operation. On the other hand, in some areas not covenanted, such as private sector development of gas production, the Government has progressed far beyond that envisaged by ADB. The important covenant that has not been fulfilled relates to reduction of systems losses in TGTDC. Action is under way to make structural changes in the company, fragment it into governable entities, and accord significant managerial autonomy to the board of directors. These developments necessitate a shift in ADB's line of support. A comprehensive set of revised agreements is being prepared as part of the policy dialogue under the proposed Gas Sector Development Program scheduled for processing in late 2002.

⁷ ADB. 1998. Technical Assistance to Bangladesh for *Developing a Policy for Private Sector Participation in Gas Transmission*. Manila.

⁸ ADB. 1998. Technical Assistance to Bangladesh for *Institutional Reforms in Gas Sector*. Manila

⁹ ADB. 1993. Report and Recommendation of the President to the Board of Directors on a Proposed Loan to Bangladesh for the Third Natural Gas Development Project. Manila.

EXTERNAL ASSISTANCE TO THE GAS SECTOR, 1993-2002

Source	Project	Amount (million)			Year of Approval
		USD	Yen	GBP	
ADB	• Third Natural Gas Development Project	107.00			1993
	• Evaluation of Private Sector Investment Proposals for Oil and Gas Exploration and Development	0.10			1993
	• Preparation of a Gas System Development Plan and the Strengthening of the Organizational and Regulatory Framework for the Oil and Gas Sector	0.57			1993
	• Safety and Efficiency Improvements in the Gas Sector	0.48			1993
	• Gas Regulatory Authority	0.60			1997
	• Fourth Natural Gas Development	0.60			1997
	• Developing a Policy on Private Sector Participation in Gas Transmission	0.15			1998
	• Institutional Reforms in the Gas Sectors	0.15			1998
World Bank	• Narsingdi-Demra Pipeline Gas Infrastructure Development (Ashuganj-Bakhrabad Pipeline, SCADA, and Development of Rashidpur Gas Field)	120.80			1995
Japan	• Third Natural Gas Development Project (Cofinancing)		1,050.00		1995
	• Narsingdi-Demra Pipeline Gas Infrastructure Development (Ashuganj-Bakhrabad Pipeline, SCADA, and Development of Rashidpur Gas Field)		946.00		1995
	• Construction of Meghna-Bakhrabad Pipeline		342.00		1997
United Kingdom	• Narsingdi-Demra Pipeline Gas Infrastructure Development (Ashuganj-Bakhrabad Pipeline, SCADA, and Development of Rashidpur Gas Field)			19.00	1995
TOTAL		230.45	2,338.00	19.00	

ADB=Asian Development Bank, GBP=Great Britain Pound, USD=United States Dollar, SCADA=Supervisory Control and Data Acquisition System.

COST ESTIMATES

Table A4.1: GTCL Component (Part A)
(\$ million)

Cost Component	Foreign Exchange	Local Currency	Total Cost
A. Preconstruction Expenditure (Route Survey, Land Acquisition/Requisition, Resettlement, Environment Management) Site Development, etc.)	-	0.59	0.59
Subtotal (A)	-	0.59	0.59
B. Equipment			
1. Line Pipe	4.00	-	4.00
2. Coating and Wrapping Materials	1.00	-	1.00
3. Miscellaneous Fittings	1.00	-	1.00
4. Cathodic Protection Materials	0.53	-	0.53
Subtotal (B)	6.53		6.53
C. Pipeline Construction (Civil works)			
1. Concrete Coating of Line Pipe	0.50	0.14	0.64
2. Internal Transportation	-	0.06	0.06
3. Pipeline Construction	5.85	0.08	5.93
4. River Crossing	1.00	0.10	1.10
Subtotal (C)	7.35	0.38	7.73
D. Regulating and Metering Stations (Turnkey)	2.00	0.47	2.47
E. Telecom Facility (Turnkey)	0.15	0.03	0.18
Subtotal (E)	2.15	0.50	2.65
F. Consulting Services	0.30	0.15	0.45
G. Overhead	-	0.62	0.62
H. Capacity Building and Training	0.13	0.06	0.19
Subtotal (F, G, H)	0.43	0.83	1.26
I. Custom Duty and Value-Added Tax	-	1.96	1.96
Total Base Cost	16.46	4.26	20.72
Physical Contingency	1.65	0.43	2.08
Price Contingency	0.65	0.48	1.13
Front-End fee and IDC	1.56	1.86	3.42
Grand Total	20.32	7.03	27.35

GTCL=Gas Transmission Company Ltd., IDC=interest during construction.

Table A4.2: TGTDCCL Component (Part B)
(\$ million)

Cost Component	Foreign Exchange	Local Currency	Total Cost
A. Preconstruction Expenditure (Route Survey, Road Restoration, Environment Management, Site Development)	-	0.99	0.99
B. Equipment			
1. Line Pipe	5.00	-	5.00
2. Coating and Wrapping Materials	0.50	-	0.50
3. Miscellaneous Fittings	0.50	-	0.50
4. Cathodic Protection Materials	0.30	-	0.30
5. TBS/DRS	0.57	-	0.57
C. Internal Transportation	-	0.06	0.06
D. Pipeline Construction	-	1.85	1.85
E. River Crossing (Civil Works)	1.00	0.10	1.10
F. Construction of TBS/DRS	-	0.15	0.15
G. Overhead	-	0.62	0.62
H. Capacity Building and Training	0.13	0.06	0.19
Subtotal (A-H)	8.00	3.83	11.83
I. Custom Duty and Value Added Tax	-	2.06	2.06
Total Base Cost	8.00	5.89	13.89
Physical Contingency	0.80	0.59	1.39
Price Contingency	0.43	0.40	0.83
Front-End fee and IDC	0.62	0.90	1.52
Grand Total	9.85	7.78	17.63

DRS=district regulating system, IDC=interest during construction, TBS=town border station, TGTDCCL=Titas Gas Transmission and Distribution Company Ltd.

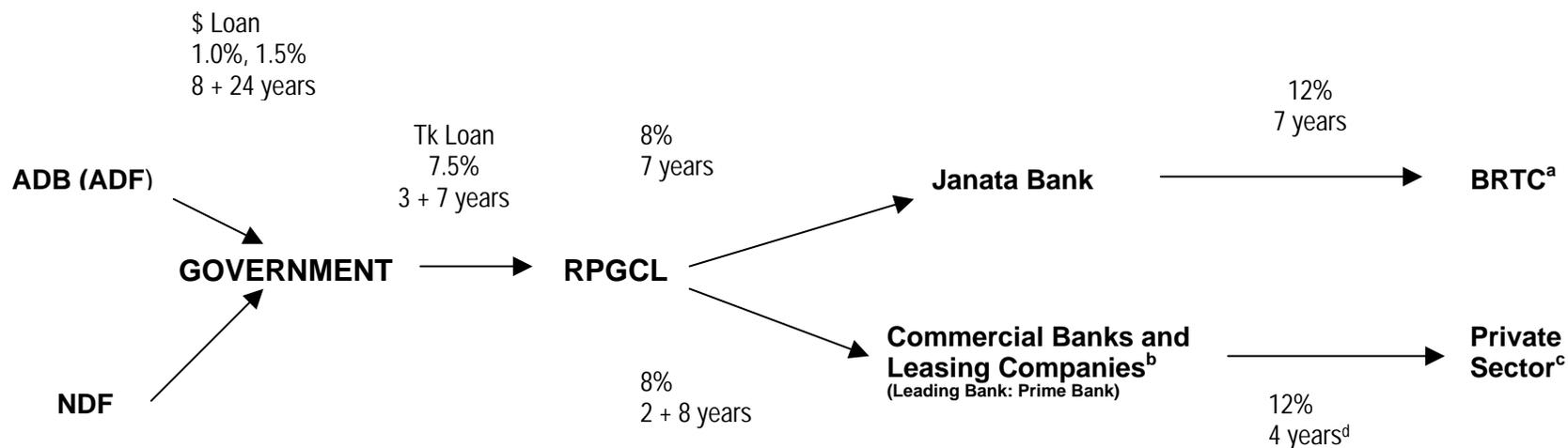
Table A4.3: RPGCL Component (Part C)
(\$ million)

Item		Foreign Currency	Local Currency	Total Cost
A. Preconstruction Expenditure (Route Survey, Land Acquisition/Requisition, Resettlement, Environment Management, Site Development, etc)		-	2.00	2.00
B. Equipment				
1. Conversion Kits for Petrol Cars (unit)	10,000	2.50	0.25	2.75
2. 40-90 liters cylinders (no.)	10,000	3.00	0.30	3.30
3. 4-Stroke Three Wheeled Vehicles (no.)	2,000	6.00	0.50	6.50
4. CNG Operated Buses (with recommended spares) (no.)	300 ^a	19.27	1.86	21.13
C. Turnkey Contract				
1. CNG Filling Station Compressors	10X160 cm/hr	1.60	0.13	1.73
	10X300 cm/hr	2.25	0.18	2.43
	6X700 cm/hr	4.50	0.30	4.80
2. 2 Workshops for Conversion with Diagnostic Equipment		0.50	1.30	1.80
3. Vehicle Maintenance Workshop		0.20	0.05	0.25
Subtotal (A-C)		39.82	6.87	46.69
D. Consulting Services		2.00	0.50	2.5
E. Capacity Building and Training		0.50	0.20	0.70
F. Duties and Taxes (@10%)		-	3.94	3.94
Total Base Cost		42.32	11.51	53.83
Physical Contingency		4.24	1.15	5.39
Price Contingency		4.24	1.07	5.31
Service Charge and IDC		0.90	3.00	3.90
Grand Total		51.70	16.73	68.43

CNG=compressed natural gas, IDC=interest during construction, RPGCL=Rupantarita, Prakritik Gas Company Ltd.

^a 100 buses to be cofinanced by Nordic Development Fund.

FINANCING ARRANGEMENT FOR VEHICLES



ADB=Asian Development Bank, ADF=Asian Development Fund, BRTC=Bangladesh Road and Transportation Company, NDF=Nordic Development Fund, RPGCL=Rupantarita Prakritik Gas Company Ltd.

^a Vehicles to be procured through RPGCL.

^b Possible banks and financing institutions identified by the Mission: Dutch-Bangla, Islami Bank, and United Leasing Company.

^c Possible private sector operators: Bangladesh Metro Bus Company, Nirapad, Navana, GL Super, and others.

^d To be recycled at least two times and based on private sectors own procurement.

IMPLEMENTATION SCHEDULE

Task Name	2002				2003				2004				2005				2006			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Transmission and Distribution Gas Pipeline																				
Route Survey																				
Consultant Selection RAP and IEE																				
Design and Bidding Documents																				
Land Acquisition																				
Procurement																				
Local Contractor Selection																				
- for Pipeline Construction																				
- for TBS/DRS																				
Construction of Pipeline																				
- for Pipeline																				
- for TBS/DRS																				
Route Survey																				
- for Pipeline																				
- TBS/DRS																				
CNG Transportation																				
Selection of Sites for Filling Stations																				
Engagement of Consultants																				
- for IEE and RAP																				
- for Engineering and Supervision																				
Design and Documentation																				
Agreement with Commercial Banks																				
Procurement of Filling Stations																				
Procurement of Conversion Kits																				
Installation of Compressors																				
Procurement of Workshop Equipment																				
Conversion of Vehicles																				
Procurement of Buses																				
Procurement of Auto Rickshaws																				

CNG=compressed natural gas, DRS=district regulating station, IEE=initial environmental examination, RP=resettlement plan, TBS=town border station

CONTRACT PACKAGE LIST
Table A7.1: Gas Transmission Line and CGS (Part A)

Contract No.	Description	Contract Type	Procurement Method	Estimated Contract Value (\$ million)
1	Line Pipe	Supply	ICB	4.00
2	Coating and Wrapping materials	Supply	ICB	1.00
3	Cathodic Protection Materials	Supply	ICB	0.53
4	Valves	Supply	IS	0.50
5	Miscellaneous Fittings	Supply	IS	0.50
6	Pipeline Construction/River Crossing	Civil Works	ICB	7.35
7	Telecom Facility	Turnkey	IS	0.15
8	CGS at Ashulia, Savar, and Metering Unit at Dhanua	Turnkey	ICB	2.00
Total				16.03

CGS=city gate station, ICB=international competitive bidding, IS=international supply.

Table A7.2: Gas Distribution Facilities (Part B)

Contract No.	Description	Contract Type	Procurement Method	Estimated Contract Value (\$ million)
1	Line Pipe	Supply	ICB	5.00
2	Coating and Wrapping materials	Supply	IS	0.50
3	Cathodic Protection Materials	Supply	IS	0.30
4	Valves	Supply	IS	0.35
5	Miscellaneous Fittings	Supply	IS	0.15
6	Materials for TBS/DRS	Supply	ICB	0.57
7	Directionally Drilled River Crossing	Civil Works	ICB	1.13
Total				8.00

DRS=district regulating station, ICB=international competitive bidding, IS=international supply, TBS= town border station.

Table A5.3: CNG Facilities (Part C)

Contract No.	Description	Contract Type	Procurement Method	Estimated Contract Value (\$ million)
1	CNG Filling Stations	Turnkey	ICB	8.35
2	Conversion Kits for Cars	Supply	ICB	2.50
3	Cylinders for Cars	Supply	ICB	3.00
4	CNG Buses	Supply	ICB	19.27
5	4-Stroke 3-Wheel CNG Vehicles	Supply	ICB	6.00
6	Worskhop Facilities/ Vehicle Maintenance Workshop	Turnkey	ICB	0.70
Total				39.82

CNG - Compressed Natural Gas, ICB=international competitive bidding.

SUMMARY POVERTY REDUCTION AND SOCIAL STRATEGY

A. Linkages to the Country Poverty Analysis

Sector Identified as a National Priority in Country Poverty Analysis? Yes	Sector identified as a National Priority in Country Poverty Partnership Agreement? Yes
<p>Contribution of the sector/subsector to reduce poverty in Bangladesh:</p> <p>Air pollution in Dhaka is a serious public health problem that is growing worse as the population of the city increased from 9 million in 1996 and is projected to be 15.5 million by 2015. Some researches report that suspended particulate matter (SPM) levels in Dhaka are about two times higher than the national standard. Urban air pollution in Dhaka has worsened due to population growth, industrialization, and increased vehicle use. The health consequences of exposure to dirty air are considerable. The increasing use of diesel in urban transport is environmentally costly because of the higher levels of toxic emissions emitted by diesel engines and the consequent health damage. The health effects of exposure to SPM include additional cases of premature mortality from respiratory illnesses and cardiovascular diseases, increased prevalence of chronic bronchitis, and upper and lower respiratory tract infections.¹</p> <p>The poor usually suffer most from air pollution since they have few choices in where they live and work. The poor such as streetside vendors, rickshaw pullers, pedestrians, etc. are exposed to very high pollutant concentrations. Furthermore, poor people generally suffer from nutritional deficiencies, and from infectious diseases due to poor sanitation and overcrowding. They tend to receive medical care of poor quality. Each of the factors may render the poor more susceptible to the effects of air pollution. Women and children are particularly affected.</p> <p>The Project will benefit approximately 10 million people through improved air quality in the project cities. At least 15% or 1.5 million beneficiaries turning below the poverty line in the project area will benefit. Improving quality of urban air enhances poor people's well-being, protects their health and capacity to work, and reduces their vulnerability to environmental risks. The Project will benefit the poor through several channels. Reducing SPM concentrations in Dhaka to the Bangladeshi national air quality standard will likely result in 3,580 fewer premature deaths, 10 million fewer restricted-activity days, and 87 million fewer respiratory-symptoms days per year. The economic benefits associated with these reduced health problems may have a value over \$48 million. These estimates do not account for public safety and traffic-related costs, soiling, or aesthetic degradation. The total public health, material damage, and aesthetic cost of air pollution in Dhaka is likely to be much greater.</p> <p>The Project will also create construction job opportunities for both skilled and unskilled labor during the implementation stage. The Project will utilize about 3,000 workers over the construction of pipelines and CNG stations. Men and women will be provided the equal opportunity for employment positions.</p>	

B. Poverty Analysis

Proposed Classification

<p>Thematic: Economic growth Environmental improvement</p> <p>The household income and expenditure survey (HIES) conducted by the Bangladesh Bureau of Statistics gives estimates of both the income and human dimensions of poverty. The latest survey (FY1996) estimated poverty for 47% of the population. Subsequent estimates, based on the poverty monitoring surveys, indicate that poverty incidence has since declined somewhat to about 45%. Although the country has achieved significant progress in social development indicators over recent years, Bangladesh's human development index (HDI) continues to be lower than that of most South Asian</p>	
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¹ Khaliquzzaman M, Biswas SK, Tarafder Sa, Islam A.: *Nature and Extent of Airborne Particulate Matter Pollution in Urban and Rural Areas of Bangladesh during 1993-1998*. Bangladesh Atomic Energy Commission, Dhaka. 2000.

countries.

Bangladesh has one of the highest paces of urbanization among developing countries. The urban population in Dhaka and in other metropolitan cities have virtually doubled from around 12% in 1993/94 to 22% in 1995/96. Urban poverty in Bangladesh is due to massive migration from rural areas. The lack of employment opportunities in the rural areas and other push-and-pull factors are the causes of rural-to-urban migration. Although the growth in urban per capita income was much higher than that of rural income, urban income still cannot keep up with the pace of urbanization due to rural-urban migration. As a result, although the proportion of the urban poor declined in relative terms, their absolute number continued to grow at a faster rate. The proportion of urban poor to the total poor increased from 9.8% in 1983/84 to 12.9% in 1995/96, and is expected to grow higher in the future. According to one estimate, the urban population will rise up to 40% by 2020.² At the present rate of rural and urban poverty reduction, the proportion of urban poor in total poor will be about 25–30%.

However, urbanization should not be seen in a negative light. Urbanization has contributed in recent years to the decline in national poverty. During the period between 1983/84 and 1991/92, for instance, there was a 5% reduction in the national head-count index. The drop in the rural index was in the order of only 1.7%; in contrast, the urban head-count declined by as high as 17.8% during the period.³ Between 1991/92 and 1995/96, the same trends occurred: the rate of reduction of urban poverty was much higher than that of rural poverty (21.7% as against 5%).

C. Participation Process

Stakeholder analysis was prepared as part of the social assessment. Participation strategy: Consultation with stakeholders such as bus and baby taxi passengers, owners of baby taxis and private buses, owners of filling stations; nongovernment organizations (NGOs) on microfinance; private sector and government organizations; and international aid communities were conducted to find out about demand, affordability, needs, and impact of the Project in reducing air pollution and traffic congestion in Dhaka city. Health and safety awareness campaign on the benefit of using compressed natural gas (CNG) will be implemented during project implementation. The Department of Environment in association with civil society, public health, mass media, and other government agencies will conduct a public awareness campaign on the reduction of air pollution and the use of CNG.

D. Potential Issues⁴

	Significant/ Nonsignificant/ Uncertain/ None	Strategy to Address Issues	Output Prepared
Resettlement	Significant	Land acquisition for right of way (ROW) of 60 km pipelines is required. However, no relocation is envisaged. A full land acquisition plan has been prepared and submitted to the Asian Development Bank (ADB) for approval. Construction of a 97 km 16-00nch extended distribution gas pipelines in Dhaka will be done along the existing city road. Approval from Dhaka City Corporation to use ROW for construction of pipelines will be submitted to ADB prior to loan appraisal. Land belonging to Rupantarita Prakritik Gas Company Limited (RPGCL) and Bangladesh Road	Full

² Hossain, Mahabub.1996. "Income, Employment and Poverty", Quoted in Hossain Zillur Rahman, Mahabub Hossain, and Binayak Sen (eds.) 1987-1994: *Dynamics of Rural Poverty in Bangladesh, BIDS, Dhaka*, 1996 (mimeo), 5-50.

³ Sen, Binayak. 2000. *Bangladesh Poverty Analysis: Trends, Policies and Institutions*. Asian Development Bank.

⁴ If not known, contingencies should be included in the TA budget to predict the need of a plan.

	Significant/ Nonsignificant /Uncertain/ None	Strategy to Address Issues	Output Prepared
		and Transportation Company (BRTC) will be used in establishing 6 major CNG filling stations and 2 new workshops. Establishment of 20 minor filling stations will be done in the existing gas stations in Dhaka city. A summary of the resettlement plan is in Appendix 9. A detailed inventory of losses and socioeconomic survey of actual affected persons have been conducted, and a full resettlement plan was submitted to ADB for approval.	
Gender	Non-significant	The gender aspect will be addressed through employment targets for women for pipeline construction activities. A specific clause to address equal wages for men and women for work of equal value will be included in the bid documents, and compliance will be strictly monitored during project implementation.	No
Affordability	Non-significant	The Project will provide cheaper and cleaner fuel for the public and private transport system in Dhaka city.	No
Labor	Non-significant	The Project will create temporary employment opportunities during the construction of gas pipelines and filling stations as well as permanent employment for bus and auto rickshaw drivers and workers at the filling stations.	No
Indigenous Peoples	No	The initial poverty and social assessment (IPSA) did not find any communities belonging to indigenous people and ethnic minorities. Therefore, preparing an indigenous people's development plan (IPDP) a requirement of ADB, is not warranted.	No
Other Risks/ Vulnerabilities	Significant	Lack of capacity of Implementing Agencies and other stakeholders in addressing a social safeguard policy, particularly land acquisition issue, and allowing public discussions on important social issues could be a potential social risk. Building the capacity of the staff of Implementing Agencies staff in facilitating public consultation and awareness campaigns on addressing health issues related to air pollution is included in the project design.	No

SUMMARY RESETTLEMENT PLAN

A. Background

1. The proposed Project will create the initial infrastructure for the supply of compressed natural gas (CNG) fuel in Dhaka city and establish the initial critical number of CNG-fueled vehicles. It will also contribute to the improvement of Dhaka's air quality. The Project has six components: (i) construction of a 60 kilometer (km) natural gas transmission pipeline between Dhanua and Savar; (ii) construction of extended natural gas distribution pipelines in Dhaka; (iii) establishment of CNG filling stations; (iv) purchase of CNG-fueled vehicles; (v) establishment of CNG workshops; and (vi) capacity building on CNG technology.

B. Scope of Land Acquisition and Resettlement

2. Under the Project, land will be acquired for construction of the Dhanua–Savar gas pipeline. The proposed land, which is primarily open fields, belongs to private individuals. A socioeconomic survey and full census of affected households was carried out for construction of the transmission gas pipeline from Dhanua to Savar; and for two associated city gate stations at Ashulia and Savar. The resettlement plan (RP) was prepared based on this social assessment, the full census and the inventory of losses. Some 63 hectares of land to be acquired for the Project will affect 2,103 households. Some damage will occur to crops and trees during the construction of the pipeline. No households will need to be relocated.

3. Construction of 97 km 16 inch extended distribution gas pipelines in Dhaka will be constructed along the existing city road. There will be no land acquisition for this component. However, temporary disturbance will be expected. TGTDCCL will provide compensation to Dhaka City Corporation (DCC) and approval from DCC will be submitted to ADB prior to construction of the civil works. Land belonging to RPGCL and BRTC has been identified and will be used for the establishment of 6 major filling stations and 2 CNG workshops. Establishment of 20 minor filling stations will be undertaken in the existing gasoline stations in Dhaka city. There are no illegal occupants or squatters that might be displaced in these sites.

C. Policy Framework and Entitlements

4. The policy framework and entitlements for the Project are built on the national law (1982 Acquisition and Requisition of Property Act) and ADB's *Policy on Involuntary Resettlement* (1995). The entitlement matrix for the Project is summarized in the table.

Type of Loss/Impacts	Definition of Entitled Person/Unit	Definition of Entitlement	Application Guidelines
A. Agricultural Land 1. Loss of income from agricultural activities 2. Loss of water bodies for natural and cultured fisheries	<u>Landowner</u> : a person with an original certificate, or a transfer certificate of title in case of registered property; and tax declaration for unregistered land <u>Agricultural Lessee/Tenant</u> : a person who cultivates land furnished either by the owner or the legal possessor of the property and covered by the agrarian laws of the country	1. Replacement value in cash; replacement cost is equal to the market value of the land 1 year before publication of the notice plus 50% premium. 2. Disturbance compensation to agricultural lessee is equivalent to the value of 5 years' gross harvest from the area being acquired.	Based on the 100% census, there will be no landowners and residences losing more than 25% of their land. Therefore all will be compensated in cash at replacement cost. The affected people (AP) are to be exempted from the capital gains tax against this payment. All fees and property transfer costs will be paid by Gas Transmission Company Ltd. (GTCL).
3. Loss of standing and perennial crops	<u>Informal Tenant</u> : A person cultivating land under informal or short-duration lease, not covered by the agrarian laws of the land	4. Financial assistance to informal tenant, equal to gross harvest for one year not less than Tk10,000 or any extended period as maybe necessary.	Compensation for perennial crops and trees and fish calculated as annual produce value for last 3 years Agricultural lessee/share-tenant entitled to value of the gross harvest calculated on the basis of the average of gross harvest during the last 5 years
B. Residential Land and Structures 1. Loss of housing by owners, tenants, and informally sheltered, ultra poor/uthuli 2. Loss of plot or frontage of structures	<u>Owner</u> : a person with certificate of title (title holder) or tax declaration for the residential land <u>Renting Occupant</u> : a person or family occupying a structure on payment basis	Owners: Replacement value in cash without depreciation Assistance to owner/occupant to transport all material from previous residence to new location, and dislocation allowance to owners equivalent to 3 months' average income	Proportion of cash compensation when only partial acquisition is made and the AP is not displaced Transition allowance for three months to owners; rental allowance for 3 months for tenants
C. Commercial Structures/ Establishment 1. Loss of permanent or temporary units 2. Loss of structure or frontage of small industries	AP running a business establishment on property to be acquired. This includes owners and tenants of structure as well as encroachers and squatters on the right of way (ROW).	Alternative location in the vicinity with equivalent land area to rehabilitate the business Replacement value for structure and transportation cost as for other displaced households Compensation for loss of income during the transition period, but not less than 3 months income	Transitional allowance for actual time lost for 3 months' income
D. Social Infrastructure Loss of social infrastructure	The local community in general	Replacement of the properties	Reconstruction of the social infrastructure within easy reach of all users
E. Assistance for Vulnerable Groups (VGs)	<u>Uthuli</u> : extremely poor people, informally sheltered free of cost within the structure of an owner.	Financial assistance or one-time grant in the amount of Tk10,000 for VGs who occupy land prior to the census of AP.	

D. Resettlement Strategy

5. None of the households will be displaced for the entire project pipeline routes. Landless households, non-title holders and ultra poor will be entitled to resettlement and income restoration assistance of not less than Tk10,000, if they have been occupying the affected land prior to the census of APs. After all compensation and other entitlements have been delivered, land titles will be transferred from AP to GTCL. Loss of structures including temporary loss will be compensated at replacement cost in cash.

E. Consultation, Participation, and Grievance Mechanism

6. The feasibility study involved consultations with stakeholders and AP. The Project will ensure that AP and other stakeholders are informed, consulted and encouraged to participate actively during project implementation. The contents of the RP and entitlement matrix will be disclosed to AP and communities, before implementation. A grievance mechanism will be established for the Project. A minimum of 60 days will be given from the initial notification of intent to acquire land to the notification to acquire land to enable AP to file objections. The RP has been placed in the project office for the reference of AP.

F. Institutional Arrangements and Monitoring

7. A land acquisition and resettlement support team will be established within the project implementing unit (PIU), assisted by a domestic social development specialist (18 person-months). The team will be responsible for preparing, implementing, and monitoring the RP; stakeholder participation; and information dissemination and liaison with other government agencies.

8. The district commissioner, together with a GTCL representative and a representative of APs will conduct joint verification of properties on the affected land based on the land acquisition plan that will be submitted by GTCL to the deputy commissioner. Construction activities will not begin and land will not be possessed until the APs have been properly compensated.

9. A nongovernment organization (NGO) will be appointed to assist the Implementing Agencies to deliver supplementary direct and indirect payments to reach replacement cost, and other assistance such as one-time cash grant to vulnerable groups. To ensure that AP receive full compensation, a public consultative committee (PCC), which includes a representative of AP, will supervise payments of compensation. The PCC will visit points geographically close to the AP for payments.

10. Internally, GTCL will conduct monthly internal monitoring of the progress of the planned land acquisition and resettlement activities. The land acquisition officer, in the Office of the deputy commissioner, will assist GTCL in monitoring the progress of land acquisition. The external monitoring and evaluation agency will be commissioned for annual, midterm, and end-term monitoring and evaluation of these activities.

G. Cost Estimates and Implementation Schedule

10. The estimated costs for RP implementation and management amount to Tk144.0 million (\$2.59 million equivalent). A budget amounting to approximately \$0.9 million will be paid to DCC for constructing 97 km of the extended distribution gas pipeline along the existing city road. The

total budget for resettlement and land requisition will be \$3.58 million equivalent. All resettlement activities will be coordinated with the civil works.

FINANCIAL PERFORMANCE AND PROJECTIONS

1. Gas Transmission Company Limited (GTCL) and Titas Gas Transmission and Distribution Company Limited (TGTDCCL) will be the Executing Agencies (EAs) for parts A and F(i), and B and F(ii), respectively. Rupantarita Prakritik Gas Company Limited (RPGCL) will be the executing agency for the remaining parts—C, D, E, and F(iii). RPGCL will procure the buses in part D – procurement and distribution of vehicles—and channel them to the public operator (BRTC) through Janata Bank under long-term lease arrangements. The private sector bus operators will procure their own buses, which will be financed with onlending funds provided by RPGCL under similar leasing arrangements through commercial banks and leasing companies. RPGCL will procure the auto rickshaws and then distribute them to the private sector through commercial financing institutions.

2. Projections were made based on the actual audited accounts statements for the initial years as provided by the EAs. The revenues were projected with an average increase of 9.75% a year for GTCL and TGTDCCL, and 5-6% for RPGCL based on the current sales plus the additional revenues assumed in the respective financial internal rates of return (FIRRs). Sales and expenses were based on the existing pattern of each company. The proposed loans with the proposed interest rates and repayment terms as well as loan outstanding as per the audited accounts were considered for repayment as per the indicated schedules. The account receivables were adjusted assuming a reasonably effective recovery management compared with the current one so that the accounts receivable is reduced to about 2-3 months revenue.

A. Gas Transmission Company Limited

1. Organizational Structure and Responsibilities

3. GTCL was incorporated as a public limited company on 14 December 1993 under Companies Act 1913. The company was formed with the objective of establishing a balanced and reliable national gas transmission network with effective and unified control to ensure the transportation of gas required for meeting the increased gas demand in the country. Gas is being produced from nationalized gas fields operated by international oil companies (IOCs). Production was about 1,272 million cubic feet per day (MMCFD) in 1999–2000. GTCL has transported about 3,500 million cubic meter (MMCM) of gas through the transmission pipelines and ancillary facilities in that period. GTCL estimates that the average daily gas demand will reach a peak of 1,700 MMCFD during 2004–2005.

2. Financial Performance

4. GTCL revenue from gas transportation was Tk982.5 million with a net profit of Tk97.4 million after tax during FY2000–2001 as per company's audited financial account. The debt-equity ratio was 69:31 during FY2000-2001. For the purposes of the financial analysis of the Project, a debt- equity ratio of 70:30 was considered.

5. The cost of sale and services including depreciation and holding company service charges works out to about 48% of sales, while financial cost accounts for 42% of the sales revenue, leaving a margin of 10% for the project.

6. The total fixed assets net of depreciation stood at Tk10.39 billion and capital works in progress at Tk2.40 billion. The account recoverable as of 30 June 2001 was Tk516.9 million, which is about 5 months average revenue. Long-term debts as of 30 June 2001 was Tk7.93

billion including foreign sources and local source borrowings in the ratio of about 2:1, respectively.

7. The rate of wheeling charges was revised on 1 January 2002 from Tk0.22 per cubic meter (CM) to Tk0.25 per CM, and was considered in the projections. Furthermore, the projection took into account the proposed investment as per implementation period, interest rate to the EA, and its repayment period. GTCL has been making profits during the past several years and expects this trend to continue as well as create adequate cash flows and meet the repayment schedules as per the proposed loan condition.

8. A summary of GTCL's projected financial performance is presented in Table A10.1. The complete income statement, balance sheet and cash flow statement including the proposed Project are in Supplementary Appendixes A, B, and C.

**Table A10.1: Summary of GTCL's Projected Financial Performance
FY2000–FY2007 (Tk million)**

Item	Audited			Projected				
	2000	2001	2002	2003	2004	2005	2006	2007
Total Revenue	815.3	982.5	1,100.0	1,182.5	1,271.2	1,522.9	1,625.4	1,970.1
Net Profit	35.9	97.4	53.0	60.7	49.9	231.4	265.1	541.0
Current Asset	1,580.5	1,449.8	1,661.8	1,552.6	2,025.0	2,238.7	2,525.8	2,942.2
Fixed Asset	11,619.8	12,981.0	13,246.1	13,801.7	14,028.9	13,927.5	13,786.8	13,694.8
Total Assets	13,200.3	14,430.8	14,907.9	15,354.3	16,053.9	16,166.2	16,312.6	16,637.0
Current Liabilities	1,499.3	1,975.9	2,000.0	2,030.0	2,060.45	2,091.4	2,122.7	2,154.6
Long-Term Liabilities	7,294.7	7,927.1	8,296.3	8,590.4	9,178.8	9,028.8	8,878.8	8,630.4
Equity	4,406.3	4,527.8	4,611.6	4,733.9	4,814.6	5,046.0	5,311.1	5,852.0
Total Liabilities	13,200.3	14,430.8	14,907.9	15,354.3	16,053.9	16,166.2	16,312.6	16,637.0
Operating Margin (%)	53.0	51.4	50.9	51.1	51.2	56.2	55.9	60.6
Rate of Return on Fixed Assets (%)		0.8	0.4	0.5	0.4	1.7	2.0	4.1
Rate of Return on Average Equity (%)		1.2	1.3	1.0	4.7	5.1	9.7	9.5
Current Ratio	1.1	0.7	0.8	0.8	1.0	1.1	1.2	1.4
Long-Term Debt-to- Equity Ratio	1.66:1	1.75:1	1.80:1	1.81:1	1.91:1	1.79:1	1.67:1	1.47:1
Equity Ratio (%)	37.7	36.4	35.7	35.5	34.4	35.9	37.4	40.4
Debt-Service Coverage Ratio (times)		2.2	2.2	2.2	2.1	2.5	2.8	3.5

9. The financial projection for GTCL was based on the principles discussed in paras. 2 and 7, and investments derived from this Project. The projection indicates sound financial performance over the period of the loan. Being a heavy infrastructure company with long-term depreciation on investments but with manageable operational risks, GTCL is operating under a fairly high initial capital expenditure, which is compensated by also high and fairly secure operating profit. The return on fixed assets and on average equity is reduced in the subsequent years after the investment and thereafter increases steadily due to the interest burden of new loans with revenue flowing only after the completion of the Project. The equity ratio is well above

30% during the entire projected period, and the cash flows are reasonably sufficient to meet all operating costs and debt and equity service requirements.

B. Titas Gas Transmission and Distribution Company Limited (TGTDCCL)

1. Organizational Structure and Responsibilities

10. TGTDCCL was incorporated under the Company Act 1913 on 20 November 1964, with the objective of transmitting natural gas from gas fields to different areas and distributing it to consumers in power, fertilizer, industrial, commercial, seasonal, and domestic categories of its franchise areas, viz. B. Baria, greater Dhaka, and Mymensingh districts. After the liberation of the country, the company was nationalized under the public holding company Petrobangla. At present TGTDCCL supplies gas to about 700,000 customers including eight government power stations, two private power stations, and four fertilizer factories.

2. Financial Performance

11. The published annual report is available up to the year ending 30 June 2000. The account for FY2000-2001 is under audit and is yet to be finalized. The turnover for FY1999-2000 was Tk14.64 billion. Net profit after tax was Tk539.1 million. The projected turnover for FY2000-2001 is Tk15.71 billion and a net profit of Tk1.02 billion is expected. The company has been making profits during the past several years, and this trend is expected to continue as well as to create adequate cash flows and meet repayment schedules as per the proposed loan condition.

12. Long-term borrowing as of 30 June 2000 stood at Tk5.52 billion, which included Tk3.95 billion in foreign sources.

13. The accounts receivable amounted to Tk6.60 billion against annual sales revenue of Tk14.64 billion, accounting for almost 5.4 months sale. The debts from the power and industry sector are maximum with 30% and 38%, respectively, of the total amount due. A more cash flow-focused management is expected and the accounts receivable are expected to gradually improve in the area of 3 months of sales value.

14. Sales to various sectors during 1999-2000 follow (Table 10.2):

Table A10.2: Gas Sales of TGTDCCL in 1999-2000

Sector	Quantity (MMCM)	Percentage
Power	3,182.54	52
Fertilizer	1,259.01	21
Industrial	961.31	16
Commercial	69.21	1
Domestic	610.44	10
Seasonal	8.65	0.1
	6,091.16	100

MMCM=million cubic meter

15. During the discussion, it was noted that the sale price of natural gas (NG) of Tk1.52 per cubic meter (CM) to RPGCL is not adequate and does not cover the cost. Based on this, the

Project has conditioned a tariff increase on the portion of gas sold to the compressed natural gas (CNG) filling stations, which is included in the computations. Aside from this specific assumption, the projection took into account the general assumptions from the proposed investment as per implementation period, interest rate to the EA, and the repayment period.

16. A summary of TGTDCCL's projected financial performance is presented in Table A10.3. The complete income statement, balance sheet and cash flow statement including the proposed project are in Supplementary Appendixes D, E, and F.

Table A10:3 Summary of Titas Gas Transmission Co. Ltd's Projected Financial Performance FY2001-FY2007 (Tk million)

Item	Audited		Budgeted		Projected			
	2000	2001	2002	2003	2004	2005	2006	2007
Total Revenue	14,635.2	15,707.1	17,238.5	18,919.3	20,763.9	23,850.0	26,533.8	29,436.4
Net Profit	539.1	1,021.7	1,292.4	1,429.6	1,581.0	1,814.6	2,042.2	2,304.3
Current Asset	2,848.8	3,004.0	4,414.5	5,011.7	5,733.7	6,493.4	7,064.0	8,098.4
Fixed Asset	9,838.3	10,475.7	11,061.4	11,637.2	12,203.6	12,954.3	13,727.3	14,225.2
Total Assets	12,687.1	13,479.7	15,475.9	16,648.9	17,937.3	19,447.7	20,801.3	22,323.6
Current Liabilities	1,101.6	1,500.0	2,564.2	2,692.4	2,800.1	2,912.1	3,028.6	3,149.8
Long-Term Liabilities	5,520.1	5,520.1	5,838.6	6,159.3	6,482.4	6,807.9	6,787.2	6,707.5
Other Long-Term Liabilities	2,511.7	2,634.2	2,721.2	2,801.6	2,884.6	2,970.3	3,059.0	3,150.6
Equity	3,553.7	3,825.4	4,351.9	4,995.6	5,770.2	6,757.4	7,916.5	9,315.7
Total Liabilities	12,687.1	13,479.7	15,475.9	16,648.9	17,937.3	19,447.7	20,791.3	22,323.6
Operating Margin (%)	7.62	12.8	15.0	15.0	15.0	14.8	14.8	14.8
Rate of Return on Fixed Assets (%)		12.1	14.2	14.8	15.5	16.8	17.7	18.9
Rate of Return on Avg. Equity (%)		27.7	31.6	30.6	29.4	29.0	27.8	26.7
Current Ratio	8.8	5.3	3.7	3.7	3.8	4.0	4.0	4.1
Long-Term Debt-to-Equity Ratio	2.26:1	2.13:1	1.97:1	1.79:1	1.62:1	1.45:1	1.24:1	1.06:1
Equity Ratio (%)	30.7	31.9	33.7	35.8	38.1	40.9	44.6	48.6
Debt-Service Coverage Ratio (times)	6.3	5.7	5.9	6.2	6.7	7.1	7.2	8.0

17. The financial projection for TGTDCCL is based on the principles discussed in paras. 2, 7, 14, 15, and 16 and investments derived from this Project. The projection indicates a sound financial performance over the term of the loan. The equity ratio is well above 30% during the entire projected period, and the cash flows are reasonably sufficient to meet all operating costs and debt and equity service requirements.

C. Rupantarita Prakritik Gas Company Limited (RPGCL)

1. Organizational Structure and Responsibilities

18. RPGCL was incorporated as a public limited company under Company Act 1913 on 1 January 1987 under the public holding company Petrobangla. A study of the technical, financial, and economic feasibility of converting gasoline and diesel auto engines to use CNG was carried out and a small pilot conversion program under World Bank funding was undertaken in 1982–1985. As a result of that study, RPGCL was established to undertake the business as

manufacturers/producer and dealer of natural gas liquids (NGL), CNG and other related products.

2. Financial Performance

19. The company's annual reports show that it has been in the business of converting vehicles since 1983/84. During FY1997/98, RPGCL converted a maximum of 678 vehicles. Thereafter the number converted each year declined steadily to 52 vehicles only in FY2000/01. Converted vehicles totaled 1,500 as of 30 June 2001.

20. During FY2000-2001, RPGCL made a net profit after tax of Tk24.0 million as against the loss of Tk18.8 million in FY1999-2000. The company had been incurring losses in the previous years and FY2000-2001 was the first year when it turned the corner. After 2 years of implementation and increased financial expenditures, it is expected that the company will continue to make a profit.

21. As of 30 June 2001, long-term borrowing of Tk380.2 million was outstanding. It included amounts borrowed from the development project fund of the Government of Bangladesh to the extent of Tk296.9 million and a foreign source loan of Tk83.3 million. The fixed assets at cost less depreciation stood at Tk333.5 million and capital work in progress at Tk116.6 million.

22. Accounts receivable amounted to Tk393.1 million as of 30 July 2001. It represents a year's income, which is considered very high. Such a huge outstanding was attributed to large amounts receivable from Government agencies. Out of the total sales income of Tk381.8 million during the year FY2000-2001, income from the sale of CNG was Tk15.5 million, amounting to about 4% only. With this Project, sales are expected to gradually increase to the amount of Tk800 million. It is assumed that greater efforts in cash management will gradually reduce accounts receivable.

23. The gas sold for CNG from TGTDCCL to RPGCL's filling stations has so far been subsidized. The Project has imposed as condition a tariff increase on the portion of gas sold to the filling stations, which is included in the computations. Besides from this specific assumption, the projection takes into account the general assumptions from the proposed investment as per implementation period, interest rate to the EA, and repayment period.

24. A summary of RPGCL's projected financial performance is in Table A10.4. The complete income statement, balance sheet, and cash flow statement including the proposed Project are in Supplementary Appendix G, H, I.

**Table A10.4 Summary of Rupantarita Prakritik Gas Company, Ltd's
Projected Financial Performance
FY 2001-FY2007 (Tk million)**

Item	Audited		Projected					
	2000	2001	2002	2003	2004	2005	2006	2007
Total Revenue	167.5	381.8	410.6	431.5	453.4	902.8	1,149.4	1,285.5
Net Profit	-18.8	24.0	19.8	11.5	1.4	69.0	109.4	133.3
Current Asset	279.3	573.7	664.1	801.0	1,269.0	2,183.0	2,496.5	2,187.8
Fixed Asset	461.9	455.5	480.0	718.6	1,180.6	1,418.4	1,526.1	1,662.8
Total Assets	741.2	1,029.2	1,144.1	1,519.6	2,449.6	3,601.4	4,022.6	3,850.6
Current Liabilities	145.3	421.8	400.7	394.7	388.8	426.3	442.8	448.2
Long-Term Liabilities	378.7	380.2	475.8	797.5	1,649.0	2,622.5	2,891.1	2,579.8
Other Long-Term Liabilities	24.3	25.6	26.0	26.5	27.0	27.5	28.0	28.6
Equity	192.9	201.6	241.6	300.9	384.8	525.1	660.7	794.0
Total Liabilities and Equity	741.2	1,029.2	1,144.1	1,519.6	2,449.6	3,601.4	4,022.6	3,850.6
Rate of Return on								
Fixed Assets (%)		5.3	4.3	1.9	0.0	5.4	7.5	8.4
Operating Margin (%)		14.4	15.5	15.6	15.6	21.7	22.9	23.2
Rate of Return on								
Average Equity (%)		12.15	18.8	7.4	0.0	15.2	18.5	18.3
Current Ratio	2.2	1.5	1.2	2.1	3.4	5.2	5.7	4.9
Long-Term Debt-to-								
Equity Ratio	2.09:1	2.01:1	52.59:1	2.74:1	4.36:1	5.05:1	4.42:1	3.28:1
Equity Ratio (%)	32.4	33.2	1.9	26.8	18.7	16.5	18.5	23.3
Debt-Service Coverage Ratio (times)	10.5	3.2	1.9	1.3	2.1	-3.4	0.9	0.9

25. The financial projection for RPGCL was based on the principles discussed in para.2, 23 and 24, and investments derived from this Project. The projection indicates sound financial performance over the term of the loan. After a short decline during the initial phase of the project implementation, the equity ratio will recover to a healthy level of 30% and above. The cash flows are reasonably sufficient to meet all operating costs and debt and equity service requirements.

FINANCIAL ANALYSIS

1. The financial evaluation of the Project was carried out in real terms and on an incremental basis by comparing with-project and without-project scenarios. The project cost estimates and financial projections in nominal terms were converted to real terms by adjusting for the effects of fluctuating foreign and domestic inflation.

A. Financial Internal Rate of Return

2. For estimating the financial internal rates of return (FIRRs), the total project was divided into four segments: (i) gas transmission pipelines; (ii) gas distribution pipelines; (iii) vehicles including compressed natural gas (CNG) buses, auto rickshaws, and conversion kits for petrol cars; and (iv) filling stations and workshops. The assumptions for the different segments are discussed in the following paragraphs. The rate of exchange was assumed as \$1.00 = Tk58.50.

1. Gas Transmission Pipeline

- (i) The revenue was calculated at a rate of Tk250 per million cubic meter (MMCM) as per the rates in force on 1 January 2002.
- (ii) The pipeline is of 20-inch diameter with inlet pressure of 800 psig, outlet pressure of 350 psig, and annual gas output increasing gradually from 625 MMCM in 2005–2006 to 2,085 MMCM in 2017–2020 as per estimation given by Gas Transmission Company Limited (GTCL) in its project report.
- (iii) No transmission losses were considered.
- (iv) The operating cost was assumed as Tk6.55 million, from GTCL's project report.
- (v) Income tax at 40% was assumed after providing for depreciation at 3.3% based on GTCL's account.
- (vi) The calculated FIRR is 12%.

2. Gas Distribution Pipelines

- (i) A gradual increase in annual gas sales was assumed from initially 270 MMCM in FY2005 to its maximum capacity of 1,030 MMCM (2.85 MMCMD for 360 days), from FY2012 onward in total of which 90% was for general use and 10% was for vehicular use under the Project.
- (ii) The charges for general gas use were assumed at an average of Tk4.34 per CM as per current rates for domestic and commercial customer groups. The charges used for vehicular use were assumed at Tk2.45 per MMCM to achieve a minor margin on this portion as well.
- (iii) The wheeling charges payable to GTCL at 250 MMCM was considered along with operating and other costs.
- (iv) Cost of gas procured was considered at current rate, Tk3.146 per cubic meter (CM) calculated while taking the weighted average of domestic, commercial, and vehicular tariffs at present.
- (v) The calculated FIRR is 23%.

3. Filling Stations and Workshops

- (i) The workshops are added as additional investment without any additional revenues.
- (ii) Cost of gas purchased was assumed at Tk2.45 per CM.
- (iii) The operating cost including electricity consumption and dealer commission of 0.36 per CM of CNG was assumed totally as Tk2.86 per CM of CNG. This includes electricity consumption of Tk1.00 and dealer commission of Tk0.36 per CM.
- (iv) Sales price was based on the current average price of Tk7.45 per CM.
- (v) The quantity of gas shown in the statement in respect of distribution line project was considered.
- (vi) The calculated FIRR comes out at 14%.

4. Vehicles

3. Since the 300 CNG buses will replace existing operating diesel buses, it was assumed that the revenue and general operating and other expenses would remain the same except for savings in the cost of fuel and some minor savings in maintenance costs. The cost benefits were assumed as projected in the S. H. Lucas & Associates (SHL) report based on Japan Bank for International Cooperation (JBIC's) study of CNG for vehicular use (January 2000). Hence incremental savings in cost were considered. A similar treatment was given to autos and conversion of petrol-driven vehicles using the cost savings as taken in the SHL report. The assumptions are as follows:

a. For Buses

- (i) Retail cost of diesel equivalent to that for 1 CM of CNG, Tk15.95
- (ii) Retail price of CNG per CM, Tk7.45
- (iii) Total km per day, 270
- (iv) Range per CM CNG or per liter diesel, 2 km
- (v) Cost-benefit per km $(15.95 - 7.45) / 2$, Tk4.25
- (vi) Operating days per year, 324
- (vii) In addition to fuel savings, a customer preference benefit of Tk371,790 per bus and year is expected, as per SHL report, but was not considered in this case.

b. For Auto Rickshaws

- (i) Retail price of petrol, Tk28 per liter
- (ii) Retail price of CNG, Tk7.45 per CM
- (iii) km per day, 20 for petrol cars and 25 for CNG cars
- (iv) Cost of oil per km for petrol vehicle, Tk0.19
- (v) Cost of oil per km for CNG vehicle, Tk0.04
- (vi) Savings in oil per km, Tk0.15
- (vii) Fuel cost-benefit per km, Tk1.102
- (viii) km per day, 126
- (ix) Operating days, 350
- (x) Annual savings including savings in oil and maintenance per vehicle, Tk59,920

c. For Conversion Kits

- (i) Conversion cost including kit and conversion per unit, Tk40,000
- (ii) km per day, 80
- (iii) km per liter of petrol, 8
- (iv) km per CM of CNG, 10
- (v) Operating days per year, 350
- (vi) Cost of petrol per km 28/8, Tk3.50
- (vii) Cost CNG per km 7.45/10, Tk0.745
- (viii) Fuel cost-benefit per km, Tk2.755

4. The different kinds of vehicles, buses, auto rickshaws, and conversion of petrol cars were analyzed individually as well. As expected, replacing diesel for buses is financially a bigger challenge, as diesel is an already favorable low-taxed fuel because of its use in the transport and agriculture sectors. However, computing with the marginal cost for the more expensive CNG buses without computing any revenues from the transport operation itself aside from savings in fuel and slightly lower maintenance costs, the buses still have a fairly robust FIRR of 19%. Auto rickshaws, conservatively computed as full investment with minor scrap value for the replaced vehicles, have a FIRR of 15%. Petrol cars, with the conversion kits and conversion cost as sole investment and a major fuel savings, reach a high FIRR of 77%. The average FIRR for vehicles is 44%.

5. Consolidated Project

5. Besides the analyses of the four segments, a consolidated FIRR was also computed for the entire Project. The overall FIRR is 21%.

A. Weighted Average Cost of Capital

6. The weighted average cost of capital (WACC) was calculated in real terms based on the actual expected capital composition for each segment of the Project. The relending rate for the Asian Development Bank (ADB) loans and for the cofinancing by Nordic Development Fund (NDF) were calculated at 7.5% and adjusted for taxes of 40%. The loans in local currency were calculated at 9.25% and adjusted for taxes as well as for domestic inflation of 4.5%. The equity portion (30%) of the domestic funds was calculated at 15% and adjusted for domestic inflation as well. Where applicable, the minimum rate test was used according to the new ADB guidelines. Based on these assumptions, the WACC for the different segments was computed:

- (i) Transmission gas pipeline – 4.47%
- (ii) Distribution gas pipeline – 4.80%
- (iii) Filling stations and workshops – 4.62%
- (iv) Vehicles – 5.16%, if computing with higher onlending rate through intermediate commercial banks
- (v) Consolidated Project – 4.51%

B. Sensitivity Analysis

7. Table A11 gives the results of the sensitivity analyses of the FIRRs under various following scenarios.

Table A11: Sensitivity Analyses

Scenario	Financial Internal Rate of Return (%)				
	Transmission	Distribution	Filling Stations	Vehicles	Total
Base Case	12	23	14	44	21
1. 10% Increase in Capital Cost	11	21	13	39	19
2. 10% Increase in O&M Costs	12	22	12	44	21
3. 10% Decrease in volume	11	20	14	44	20
4. Delay in Project by 1 year	11	20	11	35	18
5. 1+ 2 above	11	20	11	39	20
6. 1 +2 + 3 above	10	18	11	39	19
7. 1 + 2 + 3 +4 above	9	15	7	32	16

O&M=operation and maintenance.

8. Except for the transmission gas pipeline and the filling station segments, the sensitivity test found a comfortable switching value for a 10% increase in capital cost, 10% increase in operation and maintenance (O&M) cost, 10% decrease in volume as well as a 10% decrease in tariffs for all segments. The filling stations were a little bit more affected by the combination of all four occurrences, from a FIRR of 14% in the base case to 7%, still above the WACC for this component of the Project. To make the filling stations financially more attractive to the private sector, the Government is considering an increased margin for this part of the CNG value-added chain. This is an extreme case and the probability of its occurring is very remote.

D. Conclusion

9. The FIRR is expected to comfortably exceed the WACC for each project component as well as for the consolidated Project (both computed on an after-tax basis). Given the overall objectives of the Project, the financial performance is deemed acceptable.

ECONOMIC ANALYSIS

1. The economic benefits from the proposed Project were considered under two broad categories: transport and nontransport components. Analysis was carried out in line with the standard cost-benefit analysis framework. Besides direct benefits accruing to the economy, other benefits such as savings in foreign exchange, health benefits, etc, were also considered for qualitative appraisal of the Project.

A. Economic Internal Rate of Return

2. As the proposed grid expansion is only in the area of Greater Dhaka, the potential consumers of the projected gas supply may be grouped in two discrete categories: (i) the transport vehicles that will run on compressed natural gas (CNG), and (ii) the nontransport consumers such as the commercial sector and household consumers in the Greater Dhaka area. The economic analysis will identify the benefits for each category and assess the overall economic internal rate of return (EIRR).

3. The projected capacity of the distribution pipelines is estimated at 100 million cubic feet per day (MMCFD) of natural gas. As the number of vehicles to be procured by the Project will utilize only 4.15 MMCFD of 10 MMCFD gas available for the transport sector, benefits in terms of full resource cost savings from this portion are included in the analysis. Benefits from the remaining transport portion, 5.85 MMCFD, are included less net cost of additional conversion to CNG by private bus and auto rickshaw operators as well as private car owners. All these economic benefits are nonincremental in nature.

4. The remaining capacity arising from the Project, i.e., 90 MMCFD of natural gas for the nontransport component, was assumed to be supplied to only households and commercial consumers in the Greater Dhaka area. Discussions with the Executive Agencies (EAs) revealed that the proposed Project would help improve the supply pressure during peak hours, which in turn will create an incremental demand for about 15 MMCFD of gas by the existing consumers. Economic benefits from the nontransport component were considered nonincremental benefits, as new customers as well as existing customers will replace existing fuels with natural gas.

5. The economic as well as financial viability of the Project depends mainly on the demand for gas by new consumers. The demand for gas was projected keeping in view the existing consumption level per household plus annual growth in terms of new connections, as communicated by the EAs. Growth in the number of new connections was taken as 10% per annum during the period 2005–2010 and as 6% thereafter. The demand projections with these input parameters indicate that the full projected supply of gas will be consumed in the year 2012 and beyond.

6. Nonincremental benefits for commercial and household consumers were valued in terms of resource cost savings. The fuels replaced by gas were assumed to be diesel and kerosene, respectively, and the savings in resource cost comprised the differential in economic cost of diesel and kerosene used by commercial and household consumers respectively and the economic cost of gas that would replace those fuels. As the current supply of gas is inadequate and pressure is low during peak hours, the benefits for existing customers were also valued in terms of resource savings in replacing diesel and kerosene, which are still used as emergency fuels. Therefore, no major incremental benefits are expected from the Project.

7. The economic cost of the Project components was based on the total project cost estimates, less taxes, duties, price contingency, and interest during construction (IDC).

8. The annual maintenance costs of vehicles used were based on Barwood Cab Fleet Study conducted by the US Department of Energy. The cost of operating and maintaining the transmission and distribution pipelines was based on actual and budgeted figures from Gas Transmission Company Limited (GTCL) and Titas Gas Transmission and Distributing Company Limited (TGTDCCL).

9. The economic costs of the various categories of fuels are given in Table A12.1. The economic cost of CNG was based on the report of the resettlement plan (RP) Gas Company Limited, Dhaka, and that for other fuels was based on border prices plus transportation cost. No depletion premium was considered for CNG, as the available gas resources of the country are large and at the current rates of consumption are expected to last far beyond the life of the Project. Even if computed, the depletion premium will be a very small and insignificant cost.

Table A12.1: Retail Prices and Economic Cost of Fuels

Fuel	(Tk)	
	Retail Price	Economic Cost
Natural gas (per CM)	4.04 and 7.25 ^a	1.97
CNG (per CM)	7.45	3.35
Petrol (per liter)	30.00	27.00
Diesel (per liter)	17.00	15.30
Kerosene (per liter)	20.00	18.00

CM=cubic meter, CNG=compressed natural gas

^a Retail price of natural gas is Tk4.04 for household consumers and Tk7.25 for commercial consumers. The economic cost of natural gas for the two categories of consumers was calculated by taking the weighted average of the economic cost of gas to these consumers, with the proportionate share in the supply of gas being weights.

10. Assumptions regarding consumption, distances covered per day, number of operating days were based on a study of Dhaka city by S.H. Lucas & Associates, with minor adjustments.

11. Table A12.2 gives the results of economic analysis.

Table A12.2: EIRR Calculation

Year	Total Costs	Benefits		Total Benefits	Net Benefits
		Transport	Nontransport		
2002	527.21	0.00	0.00	0.00	-527.21
2003	1,094.81	0.00	0.00	0.00	-1,094.81
2004	1,803.41	76.52	0.00	76.52	-1,726.89
2005	2,209.40	204.01	1,304.99	1,509.00	-700.40
2006	1,152.77	345.97	1,856.29	2,202.26	1,049.49
2007	717.13	546.21	2,462.73	3,008.94	2,291.81
2008	717.13	638.39	3,129.81	3,768.20	3,051.07
2009	743.19	638.39	3,863.60	4,501.99	3,758.80
2010	743.19	638.39	4,670.76	5,309.15	4,565.96
2011	769.25	638.39	5,203.49	5,841.88	5,072.63
2012	769.25	638.39	5,768.19	6,406.58	5,637.33
2013	795.31	638.39	5,684.13	6,322.52	5,527.21

Year	Total Costs	Benefits		Total Benefits	Net Benefits
		Transport	Nontransport		
2014	795.31	638.39	5,684.13	6,322.52	5,527.21
2015	821.37	638.39	5,684.13	6,322.52	5,501.15
2016	821.37	638.39	5,684.13	6,322.52	5,501.15
2017	847.43	638.39	5,684.13	6,322.52	5,475.09
2018	847.43	638.39	5,684.13	6,322.52	5,475.09
2019	847.43	638.39	5,684.13	6,322.52	5,475.09
2020	847.43	638.39	5,684.13	6,322.52	5,475.09
2021	847.43	638.39	5,684.13	6,322.52	5,475.09
				EIRR	41.90%

EIRR=economic internal rate of return.

12. Sensitivity analysis was carried out under the various scenarios. The results are in Table A12.3. Even in a worst-case scenario (combination of 2 + 4 + 6), the Project is economically sound.

Table A12.3: Sensitivity Analysis

Scenario	EIRR (%)
1. 10% Increased in Capital Cost	38.32
2. 20% Increased in Capital Cost	35.12
3. 10% Increased in Gas Input Price	41.40
4. 20% Increased in Gas Input Price	39.16
5. Delay in Project Completion	34.24
6. Delay in Project Completion	29.23
7. Combination of 1 + 3 + 5	32.30
8. Combination of 1 + 3 + 6	27.12
9. Combination of 2 + 4 + 6	26.34

EIRR=economic internal rate of return.

B. Other Project Benefits

13. Projections by the power system master plan (PSMP) put the likely growth in demand for energy at 10% per annum. Assuming the same rate for petrol and diesel, calculations reveal that demand for these energy products is going to be five times after 15 years. Keeping in view the current import bill of the country for these fuels,¹ and limited available reserves of petroleum and exploration activities, domestic production is not going to meet this increasing demand. To meet this demand, the Government has two options: (i) increase imports, or (ii) replace the use of these fuels by domestically produced natural gas. The first option is not affordable to the country. In 1995/96, 1.01 million metric tons (t) of diesel valued at \$183 million was imported. Assuming that the ratio between imported fuels and domestic production remains the same as at present, and demand growth is as predicted by PSMP, the likely quantum of import of diesel alone will be about 6.70 million t in 2015. Considering the existing level of imports of these products and limited opportunities in increasing exports, Bangladesh cannot afford to depend on imported energy fuels to meet the increasing demand. The international reserves of Bangladesh have been declining in recent years.²

¹ The payment on account of import of crude petroleum and petroleum, oil, and lubricants (POL) was \$273.0 million and \$44.0 million respectively, for the period July 2000 to June 2001 (source: Bangladesh Bank).

² In 1994/95, these reserves were \$3,069.6 million, but came down to \$1,602.1 million in 1999-2000 and further fell to \$1,085.4 million in October 2001.

14. The other viable option is to replace petrol and diesel with natural gas as a fuel in industry and transport. Since the replacement of diesel with gas is a gradual process and will take a few years to fully materialize, the savings in foreign exchange will be smaller in the initial years. But after 4-5 years, such savings will pick up. Thus, import substitution will save the country foreign exchange of about \$90 million in 2005, which will increase to about \$330 million in 2010.

15. Any development in the gas system has a significant bearing on the environment of the area. Environmental impacts may be in terms of land acquisition, natural hazards, surface water disturbances, etc. In practice, it is very difficult to estimate and quantify the environmental impacts of any human activity; however, these environmental impacts can be managed through an appropriate environmental management plan (EMP).

16. The major positive impact of the Project on the environment will be reduced air pollution, which in turn will result in improved human health. The human health effects include both mortality and morbidity impacts. The current air pollution level in Dhaka is striking. For example, the level of suspended particulate material (SPM) in Dhaka ranges from 600 to 2,000 $\mu\text{g}/\text{m}^3$, while the standard value for commercial and mixed areas is 400 $\mu\text{g}/\text{m}^3$ and developed countries standard is 240 $\mu\text{g}/\text{m}^3$. If the current levels of pollution in the country's four principal cities were to be hypothetically reduced to those of the developed countries level, as many as 15,000 deaths, a million cases of sickness requiring medical treatment, and 850 million cases of minor illness could possibly be avoided annually.³ But the Project neither aims to nor is expected to improve pollution levels to the standards in force in developed countries. However, the Project is likely to bring about some major improvement in the quality of air in Dhaka because the main cause of air pollution is traffic. Gas-based vehicles are comparatively less polluting. Simple calculations show that projected vehicle conversions to CNG (under the Project as well as outside it) may replace more than about 11% of the existing fleet of various categories of vehicles and thus can reduce the pollution level in Dhaka by about the same proportion. Thus the projected use of gas in place of other fuels and the resultant reduction in pollution level (improvement in air quality) are expected to provide the qualitative benefit of reduced incidence of deaths and sickness cases reported. In turn, this reduction is expected to give savings of about \$48 million annually to the economy on account of improved human health in Dhaka. It is relevant to mention that benefits from human health were estimated but not considered in calculating of the EIRR. The estimation is only for the qualitative appraisal of the Project.

C. Conclusion

17. Although it is difficult to exactly calculate the benefits (contribution in output of the economy) due to investment in the Project, the estimates are encouraging. Besides the direct benefits from the Project, other benefits – as savings in foreign exchange due to replacement of imported fuels with domestically produced natural gas, and health benefits due to reduced air pollution – are significant. Thus, keeping in view the objectives of the Project, i.e. economic growth and environmental and health improvement, the Project is economically robust.

³ Shah, Jitendra. 2001. The Times of India: India. Quoted in Ershadul Huq, *Air Pollution Kills 15,000 a Year in Bangladesh* (Based on a World Bank Report).

SUMMARY INITIAL ENVIRONMENTAL EXAMINATION

A. Introduction

1. The proposed Dhaka Clean Fuel Project is categorized as a B Project in accordance with ADB's *Guideline on Environmental Assessment*. An initial environmental examination (IEE) was prepared. This appendix is based on information in the IEE reports prepared by the Government.

B. Description of the Project

2. The proposed Project will involve (i) the construction of 60 kilometer (km) of 20-inch gas transmission pipelines from Dhanua to Aminbazar, Savar; (ii) 97 km expansion of the existing 16-inch gas distribution network within the Dhaka area; (iii) establishment of 6 major compressed natural gas (CNG) filling stations (3 stations in the suburbs of Dhaka and 3 along the Dhaka-Chittagong highway) and 20 minor CNG filling stations within Dhaka city; (iv) purchase of 300 CNG buses, 2,000 CNG baby taxis (auto rickshaws), and 10,000 conversion kits to convert Government vehicles to CNG vehicles; (v) capacity building, which includes establishing a regulatory framework and its infrastructures to implement safety in CNG use in the transport sector; and (vi) establishment of referral workshops for converting and maintaining CNG vehicles

C. Description of the Environment

3. The Project is located mostly in Dhaka; however, the gas transmission pipeline and six major CNG filling stations are located outside and in the suburbs of Dhaka. The environmental conditions of the area involved in the Project are briefly described.

1. Area Affected by Establishment of Filling Stations, Distribution Networks, Procurement of CNG Vehicles, and Establishment of Maintenance Conversion Workshops

4. Dhaka city is the main area affected by the project activities. The area is topographically flat delta. Four major rivers cross the city: Sitalakhya, Buriganga, Meghna, and Jamuna. Most of the city is flood-prone. The total land area is about 360 square kilometers (km²). The population in 2000 was estimated to be about 8 million; the population density was about 220 people per km².

5. Transportation in the city is mainly road-based. The major road is about 310 km long and minor roads measure about 2,690 km. The number of motor vehicles increased significantly from about 80,000 in 1992 to 110,000 in 1996. Besides the pressure from rising traffic levels, separated road junctions are few and traffic congestion at many key junctions cannot be avoided.

6. The inhabitants of Dhaka suffer from air pollution associated with the transport system, particularly due to the high Sulfur content of diesel and lead in gasoline. The ambient concentration of SO₂ ranges from 130 to 180 micrograms per cubic meter μg/m³, NO_x ranges from 50 to 150 μg/m³, and the suspended particulate matter (SPM) level ranges from 600 to 2,000 μg/m³. Buses and trucks are significant sources of sulfur dioxide (SO₂) and suspended particulate matter (SPM), while auto rickshaws are the main source of hydrocarbon (HC) emission.

2. Area Affected by Gas Transmission Pipelines

7. The project area is mostly located in Dhaka and Gazipur District. The gas will be transported from Dhanua gas station in Gazipur District. The pipeline will cross one river and one canal, one main road connecting Joydebpur to Jamuna Bridge, and three other rural roads. Areas that will be affected by the gas transmission alignment are agricultural land, vacant land, and settlement area. Sites for the temporary storage of construction equipment and used pipelines are in four small towns (Mirzapur, Kadda, and Birulia). The alignment of the transmission pipelines will affect no environmentally sensitive areas.

D. Screening of Potential Environmental Impacts and Mitigation Measures

1. Impacts of the Introduction of CNG Vehicles

8. About 1,500 buses, mostly diesel-fueled, are operated by public and private operators to serve Dhaka city. Replacing of one diesel bus with one CNG bus for a total of about 300 buses will reduce approximately 20% of SO₂ and SPM emissions from buses. Replacing auto rickshaws with CNG baby taxis and converting of 10,000 vehicles to CNG are expected to reduce emissions of HC, oxides of nitrogen (NO_x), SO₂, and SPM. The results are improved air quality and reduced threat to public health. Similar projects will subsequently be implemented in other major cities of Bangladesh to improve the environment.

2. Impacts of the Establishment of Gas Transmission Pipelines

9. No significant impact is expected due to the location of the pipeline, since there is no environmentally sensitive area along the alignment of the transmission line. However, environmental impacts associated with the construction stage will occur: (i) increased air pollution due to increasing dust, (ii) increased noise, (iii) disturbance of the surface water system due to cut and filling and other earthworks, and (iv) potentially more increase traffic accidents. The mitigation measures to minimize these impacts have already been detailed in the land acquisition and resettlement plan (LARP): (i) establish clear traffic signs to inform road users about the construction works; (ii) maintain optimum moisture content during handling of soil, spray water to minimize dust; (iii) strictly control the construction works that create noise by prohibiting night work in the residential areas; (iv) have provisions for pumping stagnant water; and (v) provide an adequate drainage system. These mitigation measures will be included in the contract document for the contractor. Clearly, all these impacts are temporary and manageable. The operation of the gas transmission pipeline will have no significant environmental impact. While the operation of city gate stations (CGS), particularly regulators to reduce gas pressures, will create insignificant noise, ranging from 40 to 60 decibels, no mitigation measure is required. If needed, an appropriate silencing mechanism will be built into the regulating streams of CGSs.

3. Impacts Due to the Expansion of Gas Distribution Network and the Establishment of CNG Filling Stations and Workshops

10. Traffic disturbance could be the main impact when the distribution pipes are laid. Other impacts will be increased air pollution due to increasing dust during the construction stage, and disruption of drainage and some parts of the water system. The proposed mitigation measures will include rerouting traffic, providing clear information to road users about the construction works, and similar measures for minimizing impacts from the laying of the gas transmission line.

11. The operation of CNG filling stations, particularly with compressors to increase gas pressure, will generate noise of about 30-50 decibels for about 5-8 hours per day. No mitigation measure is required.

E. Institutional Requirement and Environmental Monitoring Program

1. Institutional Framework and Responsibility

12. The contractor will be responsible for implementing mitigation measures during the construction stage. The construction supervisors from Gas Transmission Company Limited (GTCL), Rupantarita Prakritik Gas Company Limited (RPGCL), and Titas Gas Transmission and Distribution Company Limited (TGTDCCL) will be responsible for preparing contract documentation so that the bidding documents, bills of quantity, and other contractual obligations of the contractor clearly identify environmental responsibilities and describe penalties for noncompliance. The three companies will ensure the implementation of overall mitigation measures and the monitoring plan, which includes collaboration with other agencies (e.g., office of the chief inspector of explosives for approval of layout and materials needed for nondestructive testing of pipe welds; district and municipal traffic enforcer for rerouting traffic during the construction stage; Bangladesh Road and Transport Agency for monitoring the movement of buses and auto rickshaws outside Dhaka) as well as the Department of Environment for environmental management.

2. Environmental Monitoring and Management Plan

13. The IEE has identified the generic monitoring and management program, which will be part of the mitigation of adverse impacts, which will be mostly the responsibility of GTCL, TGTDCCL, and RPGCL. The DOE will carry out ambient air quality monitoring, while the Department of Explosives will handle explosive materials.

F. Finding and Recommendations

14. The IEE report shows that environmental impacts associated with the proposed Project are manageable and can be mitigated. The positive impact, particularly, improved air quality, will reduce threats to the public health. Environmentally sensitive areas will not be disrupted. Therefore, a full environmental impact assessment (EIA) to assess further impacts of the gas transmission pipelines is not required. However, the Project is categorized as a red category project in accordance with Bangladesh Environmental Preservation Rules 1997. Therefore, any works for this Project can begin only after the DOE issues an environmental clearance.

G. Conclusion

15. The Project will improve air quality in Dhaka. The overall IEE finding is that the Project will not cause a significant environmental problem and the potential adverse impacts are manageable. However, continued monitoring should be carried out.