



Completion Report

Project Number: BAN 35466
Loan Numbers: 1942 and 1943
April 2011

Bangladesh: Dhaka Clean Fuel Project

Asian Development Bank

CURRENCY EQUIVALENTS

Currency Unit – taka (Tk)

| | | At Appraisal (24 October 2002) | At Project Completion (31 December 2009) |
|--------|---|--|--|
| Tk1.00 | = | \$0.0171 | \$0.0144 |
| \$1.00 | = | Tk57.85 | Tk69.26 |

ABBREVIATIONS

| | | |
|-------|---|--|
| ADB | – | Asian Development Bank |
| ADF | – | Asian Development Fund |
| BRTC | – | Bangladesh Road Transport Corporation |
| CGS | – | city gate station |
| CNG | – | compressed natural gas |
| DEPZ | – | Dhaka Export Processing Zone |
| DRS | – | district regulating station |
| EIRR | – | economic internal rate of return |
| FIRR | – | financial internal rate of return |
| GTCL | – | Gas Transmission Company |
| IEE | – | initial environmental examination |
| OCR | – | ordinary capital resources |
| PIO | – | project implementation officer |
| RPGCL | – | Rupantarita Prakritik Gas Company |
| SCADA | – | supervisory control and data acquisition |
| SDR | – | special drawing rights |
| SPM | – | suspended particulate matter |
| TA | – | technical assistance |
| TBS | – | town border station |

WEIGHTS AND MEASURES

| | | |
|-----------------|---|----------------------------|
| ft ³ | – | cubic feet |
| km | – | kilometer |
| m ³ | – | cubic meter |
| MMCFD | – | million cubic feet per day |
| MMCM | – | million cubic meter |
| PSI | – | pounds per square inch |
| TCF | – | trillion cubic feet |

NOTES

- (i) The fiscal year (FY) of the government and its agencies ends on 30 June. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2009 ends on 30 June 2009.
- (ii) In this report, "\$" refers to US dollars.

| | |
|-------------------------|---|
| Vice-President | X. Zhao, Operations 1 |
| Director General | S. H. Rahman, South Asia Department (SARD) |
| Director | T. Kandiah, Bangladesh Resident Mission (BRM), SARD |
| Team leader | A. K. M. Firoz, Sr. Procurement Officer, BRM |
| Team member | S. Khan, Assistant Project Analyst, BRM |

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

CONTENTS

| | Page |
|---|-------------|
| BASIC DATA | ii |
| I. PROJECT DESCRIPTION | 1 |
| II. EVALUATION OF DESIGN AND IMPLEMENTATION | 2 |
| A. Relevance of Design and Formulation | 2 |
| B. Project Outputs | 3 |
| C. Project Costs | 4 |
| D. Disbursements | 4 |
| E. Project Schedule | 5 |
| F. Implementation Arrangements | 6 |
| G. Conditions and Covenants | 6 |
| H. Consultant Recruitment and Procurement | 7 |
| I. Performance of Consultants, Contractors, and Suppliers | 7 |
| J. Performance of the Borrower and the Executing Agency | 10 |
| K. Performance of the Asian Development Bank | 10 |
| III. EVALUATION OF PERFORMANCE | 11 |
| A. Relevance | 11 |
| B. Effectiveness in Achieving Outcome | 11 |
| C. Efficiency in Achieving Outcome and Outputs | 12 |
| D. Preliminary Assessment of Sustainability | 13 |
| E. Impact | 13 |
| IV. OVERALL ASSESSMENT AND RECOMMENDATIONS | 14 |
| A. Overall Assessment | 14 |
| B. Lessons | 14 |
| C. Recommendations | 15 |
| APPENDIXES | |
| 1. Project Framework | 16 |
| 2. Capital Cost Estimates | 20 |
| 3. Disbursement by Category, Year and Executing Agency | 23 |
| 4. Project Implementation Schedule | 25 |
| 5. Status of Compliance with Loan Covenants | 27 |
| 6. Financial and Economic Analyses | 36 |

BASIC DATA

A. Loan Identification

| | | |
|----|----------------------------------|---|
| 1. | Country | Bangladesh |
| 2. | Loan Number | 1942-BAN (SF) and 1943-BAN |
| 3. | Project Title | Dhaka Clean Fuel Project |
| 4. | Borrower | People's Republic of Bangladesh |
| 5. | Executing Agencies | Rupantarita Prakritik Gas Company (RPGCL) Titas Gas Transmission & Distribution Company (Titas) Gas Transmission Company (GTCL) |
| 6. | Amount of Loan | \$72,600,000 in total |
| | L1942-BAN (SF) | SDR32,126,000 |
| | L1943 BAN | \$30,200,000 (OCR) |
| 7. | Project Completion Report Number | PCR: BAN 1238 |

B. Loan Data

| | | |
|----|----------------------------|--|
| 1. | Appraisal | |
| | – Date Started | N/R |
| | – Date Completed | N/R |
| 2. | Loan Negotiations | |
| | – Date Started | 21 October 2002 |
| | – Date Completed | 22 October 2002 |
| 3. | Date of Board Approval | 26 November 2002 |
| 4. | Date of Loan Agreement | 3 February 2003 |
| 5. | Date of Loan Effectiveness | |
| | – In Loan Agreement | 4 May 2003 |
| | – Actual | 17 December 2003 |
| | – Number of Extensions | 3 |
| 6. | Closing Date | |
| | – In Loan Agreement | 30 June 2007 |
| | – Actual | 21 June 2010 for L1942-BAN (SF) 14 June 2010 for L1943 |
| | – Number of Extensions | 2 for L1942-BAN (SF) 1 for L1943 |
| 7. | Terms of Loan | |
| | – Interest Rate | 1% during grace period, 1.5% thereafter for L1942-BAN (SF) Variable interest rate with lending spread of .60% (60 basis points) for L1943 |
| | – Maturity (years) | 32 for L1942-BAN (SF) 20 for L1943 |
| | – Grace Period (years) | 8 for L1942-BAN (SF) 5 for L1943 |
| 8. | Terms of Relending | |
| | – Service Charge | 7.5% per year, revised to 5% per year for L1942-BAN (SF) 5.5% per year for L1943 |
| | – Maturity (years) | 10 for L1942-BAN (SF) 20 for L1943 |
| | – Grace Period (years) | 3 for L1942-BAN (SF) 5 for L1943 |

9. Disbursements
a. Dates

| Initial Disbursement | Final Disbursement | Time Interval |
|---|--|-------------------------------------|
| L1942-BAN (SF): 28 July 2005 | 16 February 2010 | 54.5 months |
| L1943 BAN: 17 December 2003 | 15 August 2008 | 56.0 months |
| Effective Date 17 December 2003 | Original Closing Date 30 June 2007 | Time Interval 43.2 months |

| b1. | | Amount for L1942-BAN (SF) | 32.13 million (in SDR) | 48.87 million (in \$ equivalent) | | |
|------------|--------------------------------------|-------------------------------|-------------------------------------|-------------------------------------|----------------------------|--|
| No. (1) | Category (2) | Original Allocation (3) | Partial Cancellations (4=3-5) | Last Revised Allocation (5) | Amount Disbursed (6) | Undisbursed Balance ^a (7=5-6) |
| 1 | Equipment | 24.47 | | | | |
| 01A | Equipment– Vehicles | 17.58 | 12.31 | 5.27 | 5.00 | 0.27 |
| 01B | Equipment– Filling Stations | 6.37 | 1.52 | 4.85 | 4.14 | 0.70 |
| 01C | Equipment– Workshops | 0.53 | 0.15 | 0.38 | 0.37 | 0.01 |
| 2 | Training | 0.38 | 0.16 | 0.22 | 0.22 | 0.00 |
| 3 | Consulting Services | 1.52 | 0.71 | 0.81 | 0.46 | 0.35 |
| 4 | Interest Charge | 0.61 | 0 | 0.61 | 0.15 | 0.46 |
| 5 | Unallocated | 5.15 | 5.15 | 0.00 | 0.00 | 0.00 |
| 99 | Imprest Account | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Total (loan currency SDR) | 32.13 | 20 | 12.13 | 10.35 | 1.78 |
| | Total \$ equivalent | 48.87 | 30.42 | 18.45 | 15.74 | 2.70 |

^a An undisbursed loan balance of SDR1,784,560.91 was cancelled on the loan closing date of 21 June 2010. Previously, cancellations of SDR19,993,214 were made in five installments during 11 October 2006–12 January 2010. In all, SDR21,777,774.91 was cancelled from the loan.

b2. Amount for L1943-BAN: 30.20 million (in \$)

| No. (1) | Category (2) | Original Allocation (3) | Partial Cancellations (4=3-5) | Last Revised Allocation (5) | Amount Disbursed (6) | Undisbursed Balance ^a (7=5-6) |
|------------|--------------------------------------|-------------------------------|----------------------------------|-----------------------------------|----------------------------|--|
| 1 | Civil Works | 8.40 | 5.76 | 2.64 | 2.64 | 0.00 |
| 2 | Equipment | 15.50 | -9.24 | 24.74 | 24.72 | 0.02 |
| 3 | Training | 0.20 | 0.14 | 0.06 | 0.06 | - |
| 4 | Consulting Services | 0.30 | 0.24 | 0.06 | 0.06 | 0.00 |
| 5 | Interest and Commitment Charge | 2.20 | 0 | 2.20 | 2.20 | - |
| 6 | Front-End Fee | 0.30 | 0 | 0.30 | 0.30 | - |
| 7 | Unallocated | 3.30 | 3.3 | - | - | - |
| | Total | 30.20 | 0.2 | 30.00 | 29.98 | 0.02 |

^a An undisbursed loan balance of \$17,425.30 was cancelled on the loan closing date of 14 June 2010. A previous cancellation of \$200,000 was made on 8 December 2009. In all, \$217,425.30 was cancelled from the loan.

| | | |
|-----|------------------------|---|
| 10. | Local Costs (Financed) | |
| - | Amount (\$) | 0 |
| - | Percent of Local Costs | 0 |
| - | Percent of Total cost | 0 |

C. Project Data

1. Project Cost (\$ million)

| Cost | Appraisal Estimate | Actual |
|-----------------------|---------------------------|---------------|
| Foreign Exchange Cost | 81.9 | 45.8 |
| Local Currency Cost | 31.5 | 23.7 |
| Total | 113.4 | 69.5 |

2. Financing Plan (\$ million)

| Cost | Appraisal Estimate | | | Actual | | |
|---------------------------------------|---------------------------|--------------|---------------|---------------|--------------|--------------|
| | Foreign | Local | Total | Foreign | Local | Total |
| Implementation Costs | | | | | | |
| Borrower Financed | - | 25.74 | 25.74 | | 22.35 | 22.35 |
| ADB Financed | | | | | | |
| - OCR | 27.7 | - | 27.7 | 27.48 | - | 27.48 |
| - ADF | 41.5 | - | 41.5 | 15.58 | - | 15.58 |
| Other External Financing ^a | 9.3 | - | 9.3 | 0 | - | 0 |
| Total | 78.5 | 25.74 | 104.24 | 43.06 | 22.35 | 65.41 |
| IDC Costs | | | | | | |
| Borrower Financed | 0 | 5.76 | 5.76 | 0 | 1.37 | 1.37 |
| ADB Financed | 3.4 | 0 | 3.4 | 2.73 | 0 | 2.73 |
| Other External Financing | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 81.9 | 31.5 | 113.4 | 45.8 | 23.7 | 69.5 |

^a Cofinancing: Nordic Development Fund

ADB = Asian Development Bank, ADF = Asian Development Fund, OCR = ordinary capital resources

3. Cost Breakdown by Project Component (\$ million)

| Component | Appraisal Estimate | | | Actual | | |
|-------------------------|---------------------------|--------------|---------------|---------------|--------------|-------------|
| | Foreign | Local | Total | Foreign | Local | Total |
| Loan 1943-BAN | | | | | | |
| Part A: GTCL | 20.32 | 7.03 | 27.35 | 20.23 | 13.78 | 34.0 |
| Part B: Titas | 9.85 | 7.78 | 17.63 | 10.24 | 7.65 | 17.9 |
| Loan 1942-BAN | | | | | | |
| Parts C, D, E, F: RPGCL | 51.70 | 16.73 | 68.43 | 15.30 | 2.29 | 17.6 |
| Total | 81.87 | 31.54 | 113.41 | 45.8 | 23.72 | 69.5 |
| (%) | (72.2) | (37.8) | (100.0) | (65.9) | (34.1) | (100.0) |

4. Project Schedule

| Item | Appraisal Estimate | Actual |
|--|---------------------------|---------------|
| Date of Contract with Consultants | | |
| RPGCL | March 2003 | April 2005 |
| GTCL | June 2002 | February 2005 |
| Completion of Bidding | | |
| RPGCL | March 2006 | June 2006 |
| Titas | September 2004 | June 2006 |
| GTCL | September 2004 | July 2005 |
| Contract Award | | |
| RPGCL | March 2006 | June 2006 |
| Titas | September 2004 | June 2006 |
| GTCL | September 2004 | February 2007 |
| Completion of Engineering Designs | | |
| RPGCL | June 2003 | June 2006 |
| Titas | June 2003 | January 2004 |
| GTCL | June 2003 | December 2004 |
| Civil Works Contract (for Titas & GTCL) | | |
| Date of Award | September 2004 | June 2007 |
| Completion of Work | September 2005 | December 2009 |
| Equipment and Supplies Dates | | |
| First Procurement | January 2004 | April 2005 |
| Last Procurement | March 2005 | December 2009 |
| Completion of Tests and Commissioning | | |
| RPGCL | June 2006 | December 2009 |
| Titas | September 2005 | June 2008 |
| GTCL | September 2005 | June 2008 |

5. Project Performance Report Ratings

| Implementation Period | Ratings | |
|-------------------------------|-------------------------------|--------------------------------|
| | Development Objectives | Implementation Progress |
| From 17-12-2003 to 31-12-2003 | Satisfactory | Satisfactory |
| From 01-01-2004 to 31-12-2004 | Satisfactory | Satisfactory |
| From 01-01-2005 to 31-08-2005 | Satisfactory | Satisfactory |
| From 01-09-2006 to 31-12-2006 | Satisfactory | Highly Satisfactory |
| From 01-01-2007 to 28-02-2007 | Satisfactory | Highly Satisfactory |
| From 01-03-2007 to 31-12-2007 | Satisfactory | Satisfactory |
| From 01-01-2008 to 31-12-2008 | Satisfactory | Satisfactory |
| From 01-01-2009 to 31-12-2009 | Satisfactory | Satisfactory |
| From 01-01-2010 to 21-06-2010 | Satisfactory | Satisfactory |

D. Data on Asian Development Bank Missions

| Name of Mission | Date | No. of Persons | No. of Person-Days | Specialization of Members |
|--|---------------------------|---------------------------|-------------------------------|--------------------------------------|
| Fact-Finding Mission | 28–31 Jan 2002 | 7 | 28 | a,b,c,d,e,g,h |
| Fact-Finding Follow-up Mission | 6–9 May 2002 | 6 | 24 | a, c, d, e, g, h |
| Fact-Finding Follow-up Mission | 1–4 Jun 2002 | 3 | 12 | a, b, c |
| Consultation Mission (multipurpose) | 3–5 Sep 2002 | 2 | 6 | a, c |
| Contact Mission (multipurpose) | 5–8 May 2003 | 2 | 8 | a, c |
| Contact Mission (multipurpose) | 6–9 Jun 2003 | 3 | 12 | a, b, c |
| Inception Mission | 13-21 Jan 2004 | 4 | 36 | a, c, f, i |
| Review Mission 1 | 21 Dec 2004–2 Jan 2005 | 1 | 13 | c |
| Review Mission 2 | 7–23 May 2006 | 1 | 17 | f |
| Review Mission 3 | 23–30 May 2007 | 2 | 16 | f, i |
| Review Mission 4 | 2–11 Dec 2007 | 2 | 20 | f, i |
| Review Mission 5 | 27 May–8 Jun 2008 | 2 | 26 | f |
| Review Mission 6 | 24 Nov–1 Dec 2008 | 2 | 16 | f |
| Review Mission 7 | 24–30 Mar 2009 | 2 | 14 | f |
| Review Mission 8 | 25–29 Oct 2009 | 1 | 5 | f |

a = mission leader and energy specialist, b = senior or principal project engineer, c = senior project officer, d = social development specialist, e = environmental specialist, f = project implementation officer or procurement officer, g = economist, h = financial analyst, i = project analyst.

I. PROJECT DESCRIPTION

1. Natural gas contributes 70% of primary energy supply in Bangladesh. It has dominated the power sector, fueling 85% of power generation. Government policy in the gas sector since 1993 has been to attract private investments to upstream gas field development while improving the network coverage and operational efficiency of companies that produce and distribute natural gas. Bangladesh managed to attract significant investments from the private sector for gas exploration and boosted gas production by over 100% since 2000. The share of gas production by international oil companies grew to more than 50% of the total supply in 2010.

2. A technical assistance (TA) study¹ for 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 that use clean fuel. This project attended to the latter part of the strategy by promoting clean fuel and technologically cleaner automotive combustion processes, which helped reduce air pollution. The project framework is in Appendix 1.

3. The Dhaka Clean Fuel Project was prepared in line with the ADB country strategy and program². Its objectives were 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 compressed natural gas (CNG) in the transport sector and improve ambient air quality in Dhaka to reduce respiratory diseases, especially among the urban poor who are most vulnerable; (iii) encourage private sector participation by (a) implementing transparent regulations based on international emission standards, and (b) providing a foundation for further development of the domestic downstream gas sector; and (iv) improve corporate governance in gas sector companies by appointing independent boards of directors and management. ADB approved the project in November 2002³.

4. The project had six components. **Part A** (extension of the gas transmission pipeline) included (i) construction of a 20-inch pipeline of about 60 kilometers (km) between Dhanua and Aminbazar, and (ii) two city gate stations (CGSs) at Ashulia and Aminbazar. **Part B** (extension of the gas distribution network in Dhaka) consisted of (i) construction of about 97 km of 16-inch, 150 pounds per square inch (PSI) gas distribution pipelines, and (ii) construction of new town border stations (TBSs) and district regulating stations (DRSs), and upgrading and expansion of some existing TBSs and DRSs.

5. **Part C** (establishment of compressed natural gas filling stations) included (i) 3 major CNG filling stations with repair and service capabilities, just outside Dhaka; (ii) 3 major filling stations along the Dhaka–Chittagong highway for buses; and (iii) 20 minor filling stations in Dhaka city for cars and auto-rickshaws. **Part D** (purchase of CNG-fueled buses, auto-rickshaws

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

² ADB. 2002. *Country Strategy and Program Update: Bangladesh, 2003-2005*. Manila (circulated to the Board on 5 August 2002).

³ ADB. 2002. *Report and Recommendation of the President to the Board of Directors: Proposed Loans to the Peoples' Republic of Bangladesh for Dhaka Clean Fuel Project*. Manila

and conversion kits for petrol-fueled cars) included purchase of (i) about 200⁴ CNG-fueled buses for the public sector and about 100 CNG buses for the private sector, both to provide intracity and intercity transport; (ii) 2,000 CNG-fueled four-stroke auto-rickshaws to replace 2,000 two-stroke auto-rickshaws; and (iii) conversion kits for 10,000 petrol cars owned by the borrower's government and semi-government agencies, and private owners. **Part E** (workshop facilities) consisted of the establishment of two workshops for the conversion of non-CNG-fueled vehicles, and repair and maintenance of CNG-fueled vehicles. **Part F** (capacity building and training) included (i) capacity building and training of Gas Transmission Company (GTCL) under component F1, (ii) capacity building and training of Titas Gas Transmission & Distribution Company (Titas) under component F2, and (iii) provision of consulting services to Rupantarita Prakritik Gas Company (RPGCL) under component F3 to (a) develop technology for the conversion of non-CNG-fueled vehicles, repair and maintain CNG-fueled vehicles, and conduct training workshops; (b) build capacity to implement new safety codes and to manage environmental issues, such as emission standards and regulations related to conversion and use of CNG equipment for the transport sector; and (c) conduct awareness campaigns on the health benefits of using CNG.

6. The project was implemented by Petrobangla as a holding company through its three executing agencies: GTCL for Part A and F1, Titas for Part B and F2, and RPGCL for parts C, D, and E, and F3. Each appointed its individual project director for implementation of its part(s).

II. EVALUATION OF DESIGN AND IMPLEMENTATION

A. Relevance of Design and Formulation

7. The project design was in line with the country strategy⁵. The overarching goal of ADB's country strategy was to reduce poverty by (i) accelerating economic growth, (ii) providing direct assistance to the poor to improve their living conditions, and (iii) improving and protecting the environment. The project aimed at (i) developing the use of domestic natural gas resources as substitute for imported liquid fuels for the transport sector, (ii) improving the ambient air quality in Dhaka; and (iii) establishing the foundation for private sector participation in the future development of CNG-fueled transport. Thus, the project supported the government's efforts to accelerate economic growth, generate employment, and protect the environment for the overall goal of poverty reduction.

8. The government requested ADB to revise the project scope because: (i) Bangladesh Road Transport Corporation (BRTC) was reluctant to utilize loan funds for procurement of CNG-fueled buses; (ii) Dhaka's private sector had substantially developed CNG filling stations and conversion workshops; (iii) two-stroke petrol-fueled auto-rickshaws were replaced with four-stroke CNG auto-rickshaws after a ban on two-stroke three-wheelers in Dhaka; (iv) most government vehicles had already been converted to CNG vehicles; and (v) the government had reduced the bank rate. After the revision, Part C included the establishment of 26 CNG filling stations by the private sector along the highways leading to Dhaka. Part D entailed the purchase of about 100 CNG-fueled buses by the private sector, of 6,000 CNG cylinders for petrol vehicles, and of 5,000 CNG conversion kits for petrol cars. Part E included procurement of tools and equipment for the modernization of the CNG conversion workshop at Joarshahara,

⁴ Of these 200 buses, 100 were to be financed by the Nordic Development Fund (NDF). Later NDF decided to allocate funds directly to the Bangladesh Road Transport Corporation.

⁵ ADB.1993. *Country Operational Strategy for Bangladesh*. Manila

and construction of a new workshop at Dhania. Other revisions included reducing onlending terms—from government to RPGCL (from 7.5% to 5%), RPGCL to participating banks and/or leasing institutions (8% to 5.5%), and participating banks and/or leasing institutions to private operators (12% to 9%)—and raising the imprest account ceiling from \$2,000,000 to \$3,000,000. The changes in scope were relevant and timely for smooth completion of the project.

B. Project Outputs

9. As envisaged at appraisal for Part A of the project, GTCL completed 60 km of 20-inch nominal diameter gas transmission pipeline from Dhanua to Aminbazar via Ashulia, and installed two CGSs, at Ashulia and Aminbazar. This has improved gas supply to Dhaka city and Savar areas, including the Dhaka Export Processing Zone (DEPZ).

10. Under Part B, Titas installed 94.04 km (against 97 km envisaged at appraisal) of 16-inch nominal diameter gas distribution pipelines in Dhaka city to secure a reliable supply of gas to CNG filling stations without overstressing the existing gas supply network. In addition, it modified 5 and installed 4 new TBSs and DRSs. Equipment for another TBS at Agargaon was procured but could not be installed within the project period because the land acquisition was not completed. It has now been completed and the TBS is expected to be installed using government funds within June 2011. The river-crossing portion was completed using government funds after termination of an earlier contract because the contractor did not mobilize despite repeated requests by Titas. The training program was only partially completed because the quoted price was much higher than the allocated amount.

11. As requested by the government, the scope of the RPGCL components (Parts C, D, and E) was revised and the following was implemented: of 26 planned CNG filling stations under Part C, 23 stations with a minimum capacity of 500 cubic meter (m³) per hour were installed along the Dhaka–Chittagong, Dhaka–Sylhet, Dhaka–Mymensingh, Dhaka–Aricha, and Dhaka–Sirajganj–Bogra highways; this was done by private entrepreneurs, and the loan amount to fund them was channeled through two local commercial banks. One entrepreneur did not install its station and the bank in question cancelled the allocated fund. The other two planned CNG filling stations were not installed because gas was not available along the Dhaka–Mawa highway.

12. Under Part D, of 6,000 planned CNG cylinders (with capacities of 40, 50, 60, and 90 liters), 5,966 were procured. On preshipment inspection, 34 cylinders were rejected for not complying with specifications. As per revised scope, 5,000 conversion kits for petrol vehicles were purchased. These are being used for conversion of petrol vehicles to CNG fueled vehicles. The private sector purchased 149 buses/chassis (against a target of about 100 buses), and RPGCL channeled the loan amount through 2 commercial banks and 2 leasing companies. One other leasing company could not utilize the funds, which were withdrawn by ending the contract.

13. Under Part E, a new CNG workshop was established at Dhania and the existing workshop at Joarshahara was modernized, as envisaged in the revised scope.

14. RPGCL staff were trained, mostly for 2 months each, on various CNG-related topics. Consultancy services were provided to help prepare specifications for CNG kits and cylinders, and workshop equipment, and prepare safety codes, standards, rules and regulations for CNG activities. The safety codes are being examined by the Bangladesh Energy Regulatory Commission. After approval, the codes will be implemented through gazette notification.

C. Project Costs

15. The estimated project cost at appraisal was \$113.41 million equivalent. ADB's portion amounting to \$72.6 million (64%) was made available through two loans: Loan 1942-BAN (SF) for \$42.4 million equivalent from the Asian Development Fund (ADF) and Loan 1943-BAN for \$30.2 million from ordinary capital resources (OCR). The government's share amounted to \$31.5 million (27.8%) of the total project costs. The remaining \$9.3 million (8.2%) was planned to be funded by the Nordic Development Fund, but this did not materialize because BRTC was reluctant to use loan funds for procurement of buses. The loan was approved on 26 November 2002 and was effective from 17 December 2003. The loan closing dates for the ADF loan were 30 June 2007 (original) and 31 December 2009 (revised), and those for the OCR loan were 30 June 2007 (original) and 30 June 2008 (revised). ADB covered the foreign exchange cost for the project. The ADF loan was reduced to \$15.8 million after four cancellations due mainly to a major change in scope.

16. At completion, the actual cost of the project stood at \$69.58 million, much lower than envisaged at appraisal, mainly because RPGCL's scope had been narrowed. After cancellation of unutilized funds, ADB's amount stood at \$45.8 million, the government's at \$23.7 million. A summary of appraisal and actual project costs by component is in Appendix 2. A summary of project costs by component is in Table 1.

Table 1: Project Cost by Components (\$ million)

| Component | Appraisal Estimate | | | Actual | | |
|----------------------------|--------------------|--------------|---------------|-------------|--------------|-------------|
| | Foreign | Local | Total | Foreign | Local | Total |
| Loan 1943-BAN | | | | | | |
| Part A: GTCL | 20.32 | 7.03 | 27.35 | 20.23 | 13.78 | 34.0 |
| Part B: Titas | 9.85 | 7.78 | 17.63 | 10.24 | 7.65 | 17.9 |
| Loan 1942-BAN (SF) | | | | | | |
| Part C, D, E, and F: RPGCL | 51.70 | 16.73 | 68.43 | 15.30 | 2.29 | 17.6 |
| Total | 81.87 | 31.54 | 113.41 | 45.8 | 23.72 | 69.5 |
| (%) | (72.2) | (37.8) | (100.0) | (65.9) | (34.1) | (100.0) |

Source: Cost at appraisal was obtained from the report and recommendation of the President (footnote 3); actual cost at completion from the project completion reports of the executing agencies.

17. A cost underrun of about SDR1.8 million for L1942-BAN (the RPGCL component) was achieved mainly because prices for goods and services procured by RPGCL (equipment for the filling stations and consulting services) were lower than estimated. In contrast, there was a cost overrun of about \$6.55 million for the GTCL component (mainly in the local currency portion) as a result of global price increases for pipe materials, higher taxes and duties, higher land acquisition and requisition costs, and an increase in staffing and rental costs for equipment and appliances, etc.

D. Disbursements

18. Disbursements from both OCR and ADF loans by executing agency and category are shown in Appendix 3. After careful review, the ADF loan was downsized from SDR32.13 million to SDR12.13 million, canceling SDR19.99 million in four installments between October 2006 and January 2010. On the loan closing date in June 2010, loan funds of SDR1.78 million remained unutilized and were canceled on 21 June 2010. For the OCR loan, the amount

unutilized was substantially less, about \$0.22 million. This was cancelled in two installments—in December 2009 and in June 2010 after project completion.

19. The initial disbursement of the ADF loan started in July 2005, the final disbursement was in February 2010. The disbursement period was about 4 years 7 months, 1 year longer than appraised. The initial disbursement of the OCR loan started in December 2003, immediately after its effectiveness, while the final disbursement was made in August 2008; the disbursement period of 4 years 8 months was 1 year 1 month longer than appraised. Both loans were closed in June 2010, 3 years after the original closing date.

E. Project Schedule

20. Both loans were made effective on 17 December 2003, compared with a target date of 4 May 2003. The delay in loan effectiveness was due to late fulfillment of the effectiveness conditions stated in para. 21. The original date for loan closing, as per loan agreement, was 30 June 2007, which was extended twice up to 31 December 2009 for the ADF loan and once to 30 June 2008 for the OCR loan.

21. Project implementation was late for virtually all components. The GTCL component, to be completed by June 2007, was finished in June 2008, about 12 months late. This was mainly due to delayed loan effectiveness, late supply of line pipes and other materials, change of suppliers, and delay in land acquisition. The Titas component was also delayed by 12 months, from June 2007 to June 2008. The main reasons were late loan effectiveness and tardy permission to dig up some of the vital roads for installation of the pipelines. Besides the signing of subsidiary loan agreements between the borrower and the executing agencies, and requirement of legal opinion on loan agreements and subsidiary agreements, loan effectiveness conditions included: (i) increase in the natural gas price for CNG filling stations; (ii) reconstitution of the boards of directors of GTCL, Titas, and RPGCL to include private sector professionals; (iii) government approval of full financial and administrative powers for the three agencies; (iv) appointment of a managing director, a general manager or director of operations, and a general manager or director of finance at each agency; and (v) physical and legal transfer of gas transmission pipelines (Ashuganj–Elenga, Bakhrabad–Demra, and Bakhrabad–Chittagong) owned by Titas and Bakhrabad Gas Systems to GTCL. Delay in loan effectiveness was mainly due to late fulfillment of these conditions by the borrower. Of five new TBSs, one was not installed (government funding) due to non-availability of land at Agargaon during the project period, although the procurement of all necessary equipment with ADB financing had been completed.

22. The RPGCL component started in January 2003 and was scheduled to be finished by June 2007, but actual completion was in December 2009, 30 months late. Early on in project implementation it was observed that (i) the private sector was substantially developing CNG filling stations and conversion workshops, (ii) four-stroke CNG-fueled three-wheelers replaced two-stroke three-wheelers after the government banned the latter in Dhaka, and (iii) banks did not agree to onlend funds to BRTC. This led to a revision of the project scope. Accordingly, a revised development project proposal was submitted to the government in May 2005, which was approved in September 2006, taking 16 months. It is also worth noting here that replacement of the original team leader delayed the appointment of the consultants.

23. Appendix 4 compares appraisal estimates with the actual implementation schedule.

F. Implementation Arrangements

24. The implementation arrangements envisaged at appraisal were generally followed. Each executing agency (GTCL, Titas, and RPGCL) established a project implementation office (PIO) led by an officer with the rank of general manager or deputy general manager. The number of project staff varied from 13 to 28. The establishment of the PIOs and the availability of the requisite number of responsible officials helped smooth execution of the project. However, all three executing agencies frequently changed project directors (4 to 5 times).

G. Conditions and Covenants

25. The government and the executing agencies complied with most of the covenants in the loan agreement and the project agreement. However, some of the covenants were only partly complied with. The conditions under the loan and their compliance status are in Appendix 5.

26. Diesel-fueled buses have been converted into CNG-fueled buses well ahead of the target set by the loan covenant (December 2010). This covenant had a positive impact on the use of clean fuel in the transport sector and helped reduce air pollution in Dhaka city.

27. The government banned two-stroke baby taxis (three-wheelers) in 2003, which were replaced by four-stroke CNG-fueled baby taxis, well ahead of the target set by the loan covenant (31 December 2007). This covenant had a tremendous effect in reducing suspended particulate matter in the air of Dhaka city, since two-stroke baby taxis were the main contributors to such pollution.

28. During the first year of project implementation, the borrower was required to “set and approve (a) international standard safety codes for CNG filling stations, and the installation of CNG conversion kits; and (b) the use of CNG, including emission standards, for different kinds of fuels.” By 31 December 2003, the borrower was also to “have instituted a mandatory vehicle inspection program to ensure the enforcement of safety and emission standards.” These covenants were partly complied with. CNG rules are in place since 2002 and were revised in 2005. Safety codes prepared by the consultants are awaiting gazette notification after approval by the Bangladesh Energy Regulatory Commission.

29. The executing agencies prepared project completion reports within 6 months instead of the required 3 months, but this did not impair the performance of the project.

30. The borrower, through GTCL and Titas, was required to ensure that land acquisition activities were implemented in accordance with all applicable laws and regulations, ADB’s Involuntary Resettlement Policy (1995), and the agreed resettlement plan, including that “the borrower shall (a) acquire land and rights-of-way in a proper and timely manner; (b) provide compensation and entitlements as stipulated in the resettlement plan; (c) provide promptly counterpart funds and disbursements to affected persons; (d) finance unforeseen obligations in excess of budget estimates; (e) provide adequate supervision, monitoring, and reporting on resettlement issues through the relevant executing agencies; (f) provide external monitoring and evaluation by an independent agency on resettlement issues; (g) disseminate adequate information and consult with affected persons; and (report regularly on progress to ADB.” This covenant was mostly complied with except for (f), but this did not harm the implementation of the project.

31. The borrower was required to provide ADB with quarterly environmental reports detailing, among other things, the environmental mitigation measures taken by the borrower, which was not complied with. Since the project has a positive impact, particularly by improving air quality, and will reduce threats to public health, according to summary initial environmental examination, non-compliance with quarterly reporting requirements did not have much impact on project performance.

H. Consultant Recruitment and Procurement

1. Consultant Recruitment

32. International consultants were recruited in accordance with ADB's Guidelines on the Use of Consultants (2002, as amended from time to time). For the recruitment of consultancy firms, the quality- and cost-based selection method was followed.

33. GTCL signed a contract with a consultant on 8 February 2005. The consultant assisted GTCL during the design phase. Since the pipeline construction work was delayed, the consultant declined to mobilize for supervision and send supervising staff; as a result, GTCL terminated the contract on 19 September 2006. The implementation supervision was carried out by GTCL staff without recruiting another consultant.

34. RPGCL signed a consultancy contract on 16 April 2005. It included arranging a seminar on CNG safety codes and standards. The consultant assisted in preparing specifications for conversion kits and cylinders, workshop equipment, and design of workshop facilities, and prepared safety codes and standards, and rules and regulations for CNG activities. A 3-day training of trainers was arranged in March 2006 for RPGCL officials and private CNG workshop operators. The consultant developed (i) a public awareness program plan, (ii) regulatory process program plan, (iii) CNG training program plan, (iv) Bangladesh code of practice for CNG filling stations, and (v) Bangladesh code of practice for a CNG vehicle fuel system.

2. Procurement

35. Goods and services for the project were procured through international competitive bidding, following ADB's Guidelines for Procurement (1999, as amended from time to time), and ADB's standard bidding documents for procurement of goods and services. Civil construction works, under Government of Bangladesh financing, were procured through local competitive bidding following the executing agency's standard bidding procedures. No significant problems arose in packaging contracts, preparing bidding documents, and evaluating bids.

I. Performance of Consultants, Contractors and Suppliers

36. The performance of consultants and contractors was generally satisfactory for all the components of the project. An exception was the performance of the suppliers of anticorrosion-coated line pipe for the GTCL component (Part A), which delayed the Dhanua–Ashulia–Aminbazar transmission pipeline by about 2 years, as stated in para. 39. A brief discussion of performances by consultants, contractors, and suppliers follows.

37. **Gas Transmission Company component.** The GTCL component entailed (i) engagement of consultants, (ii) procurement of anticorrosion-coated line pipe and related materials for the transmission pipeline, (iii) engagement of a contractor to build the transmission

pipeline, (iv) a turnkey contract for construction of two CGSs, (iv) procurement of telecommunication facilities to link the two CGSs with the supervisory control and data acquisition (SCADA) system, and (vi) training of GTCL staff.

38. A consulting firm was recruited to assist GTCL in design and supervision of the pipeline construction work. The consultant declined to mobilize for supervision and to send supervising staff because the construction work was much delayed by late arrival of line pipes. GTCL later terminated the consultancy contract; its staff carried out the implementation supervision without recruiting another consultant.

39. The contract for supply of anticorrosion-coated line pipes was initially awarded in August 2004, but the firm did not furnish the performance guarantee and sign the contract because it deemed its quoted price unworkable. GTCL cancelled the notification of award by forfeiting the bid security. Rebidding was invited because the second-lowest bidder declined to extend the bid validity, and the price of the third-lowest bidder was too high. GTCL signed a contract with another supplier in July 2005, which also delayed shipment. As a result, the installation of the transmission pipelines was delayed by about 2 years. Liquidated damage was imposed for the late supply.

40. Suppliers of induction bends, fittings, pig launcher and receivers, and heat shrinkable sleeves, tape, and primer shipped goods within a permissible delivery period. The supplier of line valves failed to supply the full quantity in time, even after being granted 8 delivery extensions. However, GTCL arranged the required valves from its own stock, and the installation of the pipeline was completed. Liquidated damage was imposed for the late supply.

41. GTCL signed a contract with a pipeline construction contractor in December 2005. The contractor completed 48 km of pipe-laying work from Dhanua to Ashulia by June 2006, including three river crossings, which was commissioned in July 2006. However, owing to the rainy season, the 12 km of pipe-laying work from Ashulia to Aminbazar could not be continued; it was completed and commissioned in April 2007.

42. Two CGSs at Ashulia and Aminbazar were commissioned in June 2008. The contract price was about 183% higher than the estimate as a result of higher steel prices globally. Cathodic protection work of the pipeline was also completed in June 2008.

43. Procurement of telecommunication facilities to link the two CGSs with the SCADA system was not done due to shortage of funds. GTCL made temporary radio communication arrangements for the Dhanua–Ashulia–Aminbazar pipeline with available equipment. Installation of a regular telecommunication system using fibre-optic networks will be done under the Gas Transmission and Development Project financed by ADB⁶.

44. Because of a surge in global steel prices and higher dollar–euro exchange rates, the foreign currency costs of all imported materials increased. To meet this increase out of the loan proceeds, training was cancelled, but it did not greatly reduce the overall output and outcome of the project.

⁶ ADB. 2005. *Report and Recommendation of the President to the Board of Directors: Proposed Loans to the Peoples' Republic of Bangladesh for Gas Transmission and Development Project*. Manila

45. **Titas component.** This consisted of (i) procurement of line pipes and related materials for construction of 97 km of distribution line, modification of 5 and construction of 5 new TBSs and DRSs; (ii) engagement of a contractor for river-crossing work; and (iii) training of Titas staff.

46. Titas procured line pipes and related materials by June 2005. All pipelines were laid along existing roads of the Roads and Highways Department and the Dhaka City Corporation. Due to a summit of the South Asian Association for Regional Cooperation in Dhaka, the work could not be completed in time. About 94 km of pipeline was laid, tested and commissioned in stages between November 2006 and April 2007.

47. Two crossings of the Turag River (about 1 km) at Tongi and Aminbazar by horizontal directional drilling method were planned. Accordingly, a turnkey contract was signed in June 2005. The contractor, after supplying the materials, did not mobilize for installation work despite repeated requests from Titas, which eventually terminated the contract in April 2007. It seems the contractor lost interest after supplying the materials and receiving payment for the goods. As a result, Titas initially could not get the planned feed from Aminbazar via the newly built Dhanua–Ashulia–Aminbazar transmission pipeline. Temporary feeding arrangements were made from Joydevpur CGS via an existing 12-inch distribution pipeline. Titas completed the river crossing in December 2008, after project completion, with its own financing, and it is now fully operational.

48. All equipment for modification of 5 TBSs/DRSs and installation of 5 new TBSs/DRSs was procured and received by June 2005. Installation of all but one DRS, at Agargaon, was completed by June 2006 under government funding. The installation of the DRS at Agargaon, also government-financed, could not be completed because Titas was not allocated the land.

49. An overseas training program was conducted in June 2007 for eight officials (2 person-months) instead of the planned 18 officials (21.5 person-months), due to shortage of funds. The program ended in June 2007. As most of the project components were completed, the reduction in training had little negative effect on overall project output and outcome.

50. **Rupantarita Prakritik Gas Company component.** After being revised, the RPGCL component included (i) engaging a consultant; (ii) financing the procurement by the private sector of about 100 CNG buses; (iii) procuring 5,000 conversion kits and 6,000 CNG cylinders for petrol cars owned by the government, semi-government agencies, and the private sector; (iv) financing the installation by the private sector of 26 CNG filling stations in Dhaka city and/or along highways leading to Dhaka city; (v) RPGCL building one workshop and modifying an existing one; and (vi) training RPGCL staff.

51. A consultant was engaged in April 2005. The consultant assisted RPGCL in preparing specifications for conversion kits, specifications for workshop equipment, and design of workshop facilities. The consultant also surveyed CNG filling stations and conversion workshops. A seminar was arranged on CNG safety codes and standards in February 2006. In addition, a 3-day training of trainers was arranged in March 2006, which was attended by RPGCL officials and private CNG workshop operators. The draft report was discussed in a tripartite meeting and finalized in February 2007.

52. Agreements were signed with 2 banks and 3 leasing companies for onlending of funds for procurement of CNG buses by the private sector by July 2005. For non-utilization of funds, the agreement with one leasing company was terminated in December 2007. In all, 149 CNG

buses and/or chassis were procured against a target of about 100 buses. It was possible to procure more items within the allocated funds because procurement of chassis was permitted.

53. RPGCL signed contracts with 2 banks for onlending of funds for procurement of 26 CNG filling stations by the private sector. Of 26 stations, 23 stations were installed on highways leading to Dhaka. One entrepreneur did not install the station for which it had been allocated funds, which were subsequently canceled by the bank. The other two stations were not installed because of non-availability of gas along the Dhaka–Mawa highway.

54. RPGCL procured CNG kits and cylinders in two installments. The first, of 3000 CNG cylinders and 2,500 conversion kits, was received by February 2007. The second, in two separate contracts, was obtained by November 2009. Acceptance was made for 5,966 cylinders and 2,500 conversion kits.

55. Construction of a new conversion workshop building at Dhania under government financing was completed in August 2007. The installation of workshop equipment in the new building at Dhania and existing workshop at Joarshahara was completed in December 2009.

56. Local training was completed for 9 staff from RPGCL. Three persons pursued master's degrees from a university in Bangladesh and 6 persons completed a post-graduate diploma and a training program on development planning at Dhaka. Also, 54 RPGCL staff completed training in Australia on different topics within December 2009.

J. Performance of the Borrower and the Executing Agency

57. The borrower showed strong commitment to the project and reform measures. During 2005-06 representatives from the Implementation Monitoring and Evaluation Division of the Government of Bangladesh undertook 4 visits to the executing agencies. During project implementation, the borrower ensured that sufficient counterpart funds were available. Despite much difficulty, the borrowers and the executing agencies acquired all land (except for the Agargaon DRS) in timely manner, demonstrating the borrower's willingness to pursue the project. Commitment to a successful completion of the project was also evident when Titas completed river crossings with its own funds and when GTCL provided valves from its own resources to make up for a shortfall.

58. To implement the project, the executing agencies established their own PIOs with an adequate number of staff. They executed their respective components in accordance with the design, specifications, and construction methods envisaged at the outset, and as agreed with ADB during implementation. However, frequent changes of project directors for all components did somewhat hamper smooth implementation.

59. The performance of the borrower and the executing agencies were *satisfactory*.

K. Performance of the Asian Development Bank

60. ADB cooperated well with the borrower and the executing agencies in formulating the project, providing suggestions and processing the loan. During implementation, ADB's project staff actively monitored the project activities and advised executing agency staff to take action to ensure timely completion of the project, including necessary restructuring. The Bangladesh Resident Mission took over project administration after loan effectiveness, resulting in good interaction between ADB, borrower, executing agencies, consultants, and contractors. ADB's

timely approval of contract awards and disbursements, close monitoring of progress of works, and timely intervention to resolve implementation issues contributed greatly to project completion. ADB fielded 3 fact-finding missions and 8 review missions, and interacted regularly with the borrower and the executing agencies, which appreciated ADB's flexibility in changing the scope of the project and in extending the loan closing date to enable the borrower to complete the project. Overall, ADB's performance in project implementation was *satisfactory*.

III. EVALUATION OF PERFORMANCE

A. Relevance

61. Energy availability is essential for socioeconomic development. Demand for it increases with economic growth. Reliable and sufficient energy supply is a prerequisite for industrialization, commercial development, and poverty reduction. In Bangladesh, natural gas is virtually the only primary commercial energy, from which about 85% of its electricity is generated. Therefore, a project aiming at supplying the customers with sizable amounts of gas through transmission and distribution networks would definitely bring relief to energy-hungry customers and ensure socioeconomic development.

62. The project aimed to step up the use of domestic natural gas resources in place of imported liquid fuels in the transport sector, thereby improving the foreign exchange position of the country. It has boosted the quality of gas supply to new and existing customers in and around Dhaka city. The project was taken as an outcome of an ADB-funded study that recommended replacing diesel-fueled buses and two-stroke auto-rickshaws—the major causes of air pollution—with vehicles that use cleaner fuel. The project was to promote industrialization, commercial development, and poverty reduction. It also conformed to the government's energy sector strategy, which seeks to promote sustainable economic development. The project was in line with ADB's country strategy aimed at poverty reduction through sustainable economic development. The development objectives envisaged at appraisal were fully achieved at project completion. Therefore, the project is considered *highly relevant*.

63. The project design was highly relevant during appraisal, and its scope was determined by the sector's requirements and by the recommendations of the TA study (para. 2). Procurement of CNG-fueled, 4-stroke auto-rickshaws, CNG buses, and CNG kits was rightly included in the scope. The project scope covered almost all aspects of CNG use in transport, including transmission, distribution, and consumers' requirements. The project also successfully involved the private sector through private procurement of buses and installation of filling stations. The revision of the scope was highly relevant given the changed environment after a total ban of two-stroke auto-rickshaws and introduction of four-stroke CNG auto-rickshaws, and the substantial private development of CNG filling stations and conversion workshops in Dhaka.

B. Effectiveness in Achieving Outcome

64. The project is rated *highly effective* in achieving its outcomes. Large-scale use of cleaner fuel by vehicles has improved the air quality in Dhaka and reduced health problems related to air pollution. The completed project components achieved the principal project outcomes: (i) developing the use of domestic natural gas resources as a substitute for imported liquid fuels in the transport sector, thereby improving the foreign exchange position of the country; (ii) improving the ambient air quality in Dhaka; and (iii) establishing the foundation for private sector participation in the future development of CNG-fueled transport. These outcome were achieved by: construction of 60 km of transmission line from Dhanua to Aminbazar via Ashulia;

construction of 94 km of distribution line in different parts of Dhaka city; installation of 23 CNG filling stations; procurement of 149 CNG buses, 5000 CNG kits and 5966 cylinders of different sizes; and establishment and/or modification of workshops.

65. After implementing the 60 km gas transmission pipeline from Dhanua to Aminbazar via Ashulia, the gas supply in and around Dhaka city has increased by 65.7 billion cubic feet (ft³) in the 3 years from FY2007 to FY2009. This provided impetus to industrial development in Savar and DEPZ. The distribution pipeline laid by Titas in different parts of Dhaka city has supplied gas to about 200 CNG filling stations that the private sector established in Dhaka and Savar. This has been feeding about 200,000 CNG-converted vehicles, including about 26,000 auto-rickshaws and 5,000 buses and trucks. According to the estimates of Titas, about 25% of the gas supply obtained through this line is used by CNG filling stations. This has reduced the need to import liquid fuel and improved the country's balance of payments situation.

66. Establishing CNG filling stations on highways leading to Dhaka city and purchasing CNG buses for the private sector, procuring CNG conversion kits and cylinders, and setting up conversion workshops have promoted greater use of cleaner fuels in the transport sector and helped improve ambient air quality.

67. The completed transmission and distribution network, and other facilities established under the project are expected to have direct and indirect incremental effects on incomes and poverty. The project helped ease gas supply constraints in Dhaka city and surrounding areas, and maintain projected natural gas demand growth of 10% per year. It also supported rapid industrial growth in Dhaka city and Savar. Industrial growth is centered on readymade garments and backward-linked textile industries, which account for most industrial employment. Construction under the project created employment for skilled, semi-skilled, and unskilled labor. This has increased income and helped reduce poverty. In addition, widespread use of cleaner fuels for vehicles has improved the air quality in Dhaka and lessened health problems suffered predominantly by the poor.

68. Another outcome of the project was to promote the private sector, which was achieved by providing assistance to establish CNG filling stations and procure CNG buses. The project also supported capacity building of private CNG conversion workshops and operators of CNG filling stations by providing training.

C. Efficiency in Achieving Outcome and Outputs

69. Inadequate gas supply in and around Dhaka is a well-known problem. Gas is the main ingredient of electricity generation and fertilizer production. Insufficient supply of gas seriously hampers production in these and other sectors. As a result, there is frequent load shedding. Low gas pressure in the CNG filling stations created long queues of vehicles. This reduced effective working hours for taxis and three-wheelers. By adding a transmission and distribution network the project has clearly demonstrated the efficiency of the investment. Better quality and more reliable supply of gas have increased the importance of this energy source for consumers. Thus, the project has helped accelerate industrial development and poverty-reducing activities.

70. The project's financial and economic performances, as measured by the financial internal rate of return (FIRR) and the economic internal rate of return (EIRR) were assessed. Assumptions for the calculation of FIRR and EIRR, and the reasons for variance from calculations made at project preparation, are in Appendix 6. Table 2 shows the FIRR and EIRR at project preparation and project completion.

Table 2: Comparison of FIRR and EIRR (%)

| FIRR | | EIRR | |
|------------------------|---------------|------------------------|---------------|
| At Project Preparation | At Completion | At Project Preparation | At Completion |
| 21.0 | 46.0 | 41.9 | 61.9 |

FIRR = financial internal rate of return, EIRR = economic internal rate of return.

Source: Report and Recommendation of the President, and staff estimate

71. FIRR at project completion has been estimated at 46.0%, a little more than double the FIRR at project appraisal. The increase is mainly a result of higher gas prices and better earnings by Titas soon after commissioning. Similarly, EIRR at project completion has been calculated 61.9%, which is about 1.5 times higher than that at project appraisal. The higher EIRR is due to (i) higher supply of gas than estimated at appraisal through the newly built transmission line immediately after commissioning, and (ii) higher replacement cost saving (petroleum products by natural gas) at Project completion in respect to what was envisaged at appraisal.

72. The project components under the OCR loan were completed 1 year after the original loan closing date, and those under the ADF loan were delayed by 30 months. The major reasons for the delays were late loan effectiveness and a major change in scope of the RPGCL component.

73. Although the project may be considered financially and economically highly efficient, it is rated *efficient* because of the completion delays.

D. Preliminary Assessment of Sustainability

74. The ability of executing agencies to preserve or restore the assets created through proper maintenance determines the project's sustainability. The project helped the executing agencies boost their income, from which a given amount should be utilized to keep the assets in good condition. GTCL is a company that has taken over assets from parent organizations and created new assets under the project. Structured properly and staffed to do the job satisfactorily, it has proven its ability to minimize downtime through efficient maintenance of assets. GTCL has become a profitable organization with sufficient cash to maintain the system.

75. The executing agencies completed delayed work with own funds and demonstrated ownership, which enhances sustainability.

76. The sustainability of gas transmission and distribution, and its use depends on gas production in the field. At present, gas production is lagging demand, resulting in supply shortages in Dhaka city and other areas. Moreover, the gas supply network is being expanded in western and southwestern parts of the country, adding to gas supply demand. To make the system sustainable requires huge investment in exploration, development, and production of natural gas. The government is committed to improve gas supply and to make gas available to the consumers at the desired pressure. The project is therefore rated *sustainable*.

E. Impact

77. The project has had a positive impact on the environment by improving air quality in Dhaka city through reduction of carbon oxides, nitrogen oxides, sulfur oxides, and suspended particulate matter. Natural gas as a transport fuel has several advantages over diesel: (i) very

low particulate emissions; (ii) low emissions of airborne toxins; (iii) negligible sulfur dioxide emissions; (iv) and lower noise emissions with less vibration and less odors than the equivalent diesel engines.

78. No unanticipated issues, such as ones affecting the ethnic population, were encountered during project implementation. Acquisition and requisition of land affected some households, which were compensated adequately. The project, through more availability of gas, will enhance the standard of living in Dhaka and adjoining areas. In addition, benefits will accrue to both small and large commercial enterprises and the garment industries, increasing job opportunities for many people.

IV. OVERALL ASSESSMENT AND RECOMMENDATIONS

A. Overall Assessment

79. Reliable and adequate gas supply is a prerequisite for rapid economic development of a country like Bangladesh. ADB's involvement in the sector has helped increase gas supply across the country. The project aimed at removing bottlenecks in the transmission and distribution networks in and around Dhaka city to a great extent. The objectives were to (i) increase the sustainable use and supply of domestic natural gas resources in place of imported liquid fuels for the transport sector; (ii) develop the use of CNG in the transport sector and improve ambient air quality in Dhaka, which would reduce respiratory diseases especially among the urban poor; (iii) encourage private sector participation; and (iv) improve corporate governance by appointing independent boards of directors and management. These objectives were achieved by the end of the project. Incremental and reliable supply of natural gas, as a result of the project, has advanced economic development in Dhaka city and Savar areas. The project has helped increase job opportunities for many people.

80. The project is assessed as *highly relevant, highly effective, efficient, and sustainable*. As a result, the overall performance of the project is rated *successful*.

B. Lessons

81. Dependence on consultants for project preparation and implementation undermines the initiatives of executing agencies' staff for implementing projects on time and for maintaining satisfactory standards. Therefore, executing agencies should build in-house capability to prepare and implement projects.

82. Timely acquisition of land is a fundamental requirement for successful completion of a project. The acquisition process should start earlier, maybe before appraisal, so that possession of land can be achieved before loan effectiveness.

83. The executing agencies should use the advance-action provision of ADB to their best. As a result, contracts could be signed immediately after loan effectiveness and the project could be successfully completed.

84. The onlending facilities to the private sector through commercial banks worked well under the project. This modality may also be used in future for private sector financing.

85. The loan covenants should be clearly set during project design so that they can be monitored properly during project implementation.

86. The design and supervision consultancy contract should ensure that the supervision services are made available during construction even if the mobilization of construction work is delayed by a considerable period.

C. Recommendations

1. Project Related

87. **Future monitoring.** The operation and maintenance of the gas supply system has improved significantly in the last ten years. Given the size of investments to increase capacity and bolster reliability, the investments should be monitored regularly. This monitoring could take place during the annual country portfolio review, and during further project processing.

88. **Covenants.** To ensure an efficient gas supply system, the government should emphasize, respect, and support the autonomy of corporate entities.

89. **Further action or follow-up.** To maximize the benefits of the model created under the project to facilitate private sector participation, similar projects focusing on balanced development of all segments of the sector should be developed in future.

90. **Additional assistance.** Given the rising demand, the energy sector will require large investments to sustain the economic growth of the country. However, any future assistance from ADB to the energy sector should accelerate implementation of the gas sector reform road map.

91. **Timing of the project performance evaluation report.** The facilities created under the project have in most cases almost reached full capacity utilization. As the full benefit of the project is almost known, post evaluation of the project may be carried out anytime from 2011.

2. General

92. Retail gas tariffs should be reviewed regularly, following the adopted pricing policy with periodic adjustment for fuel price increases and currency fluctuations, to enable executing agencies to meet the financial requirements.

93. To ensure efficient management of the gas sector, the restructuring of Petrobangla may be brought forward as early as possible.

94. Some of the training components of Loan 1943-BAN were not implemented for lack of funds as a result of higher contract prices for other packages due to an increase in global steel prices. The contingency amount may be raised in future projects to take care of such situations.

95. The loan effectiveness conditions should be minimal and achievable so that the loan can be made effective within the specified period.

PROJECT FRAMEWORK

| Design Summary | Performance Indicators/Targets | Assessment after Completion | Remarks |
|---|--|---|---------|
| <p>1. Goal To improve urban environment and health through widespread use of compressed natural gas (CNG) as automobile fuel in Bangladesh</p> | <p>By 2012 at least 80% of the public transportation vehicles using CNG and 20% of the petrol cars in metropolitan areas of Dhaka</p> <p>Long-term reduction in incidence of respiratory death and sickness cases reported</p> | <p>Target achieved.</p> <p>Incidences reduced due to improved air quality</p> | |
| <p>2. Purpose Reduce urban vehicle pollution problems in Dhaka and other metropolitan areas.</p> | <p>Significant reduction in roadside suspended particulate matter (SPM) concentrations compared with pre-project situation.</p> <p>Significant reduction in SPM10 concentration in the metropolitan area of Dhaka by 2010</p> | <p>Significant reduction has been achieved in air pollution by replacement of two-stroke auto-rickshaws by 4-stroke CNG auto-rickshaws.</p> <p>Significant reduction has been achieved.</p> | |

| | | | |
|---|---|---|---|
| <p>3. Outputs</p> <p>Transmission and distribution gas pipeline;</p> <p>New CNG filling stations and 2 workshops</p> <p>Replacement of buses and conversion of petrol cars</p> <p>Improved capacity among executive agencies staff</p> | <p>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.</p> <p>26 new CNG filling stations implemented by June 2005</p> <p>Operations of 300 CNG buses, 2000 auto-rickshaws, and 10,000 converted petrol cars by October 2005</p> <p>Price and tax structure, safety and emission standards in place by December 2003</p> | <p>60 km of transmission line from Dhanua to Aminbazar via Savar along with 2 CGS and 94.04 km of distribution pipeline constructed in different parts of the city with several TBS/DRS which are functioning well and generating revenue.</p> <p>With financial support from the project 23 new CNG filling stations were established in private sector on highways leading to Dhaka</p> <p>149 CNG buses, 5000 CNG kits, 5,966 cylinders, and 2 workshop equipments were procured;</p> <p>Safety standards for CNG vehicles and CNG filling stations were prepared by the consultants. For gazette notification this is under the consideration of Bangladesh Energy Regulatory Commission.</p> <p>Price and tax structure of CNG gas is in place since 1992.</p> | <p>2 CNG filling stations could not be established due to non-availability of gas supply on Dhaka-Mawa highway where the stations were planned. For the other CNG filling station the entrepreneur was reluctant to use the fund.</p> <p>Revised scope included purchase of 100 nos. of CNG buses, 5,000 nos. of CNG conversion kits, and 6,000 nos. of CNG cylinders for petrol vehicles. Auto-rickshaw was dropped from the scope.</p> <p>CNG Rules are in place from 2002. The rules were revised in 2005.</p> |
|---|---|---|---|

| | | | |
|--|--|---|---|
| <p>4. Activities</p> <p>Expansion of transmission gas lines Procurement Construction Operation</p> <p>Expansion of distribution gas lines 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 Construction Operation</p> <p>Consulting services and Training Procurement Construction Operation</p> | <p>Start: January 2002 Complete: December 2005 Responsible: GTCL</p> <p>Start: January 2002 Complete: October 2005 Responsible: TGTDCL</p> <p>Start: April 2004 Complete: June 2006 Responsible: RPGCL</p> <p>Start: September 2002 Complete: December 2006 Responsible: RPGCL</p> | <p>Start: July 2002 Complete: June 2008 Responsible: GTCL</p> <p>Start: July 2002 Complete: June 2008 Responsible: TGTDCL</p> <p>Start: June 2007 Complete: December 2009 Responsible: RPGCL</p> <p>Start: July 2005 Complete: December 2009 Responsible: RPGCL</p> | <p>Reasons for time over-run: (i) delayed loan effectiveness from December 2003; (ii) delayed supply of line pipe materials; (iii) delayed land acquisition; (iv) monsoon, and (v) delay in awarding contract for construction of City Gate Stations (CGSs) at Ashulia and Aminbazar.</p> |
|--|--|---|---|

| | | | |
|--|--|---------------------------|--|
| 5. Inputs | | | |
| Consultants | International/domestic-140/115 person-months | 24.40/10.75 person-months | |
| Civil works | \$11.5 million | \$8.42 million | |
| Equipment and supplies | \$54.5 million | \$39.01 million | |
| Training | International 200 person-months | 100 person-months | |
| Counterpart and project management support | \$20.2 million | | |
| Awareness and beneficiary program | \$1.0 million | | |

CAPITAL COST ESTIMATES

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

| Cost Component | Appraisal | | | Actual | | |
|--|--------------|-------------|--------------|--------------|--------------|--------------|
| | Foreign | Local | Total | Foreign | Local | Total |
| A. Preconstruction Expenditure (Route Survey, Land Acquisition/ Requisition, Resettlement, Environment Management Site Development, etc.) | - | 0.59 | 0.59 | - | 5.70 | 5.70 |
| Sub total (A) | - | 0.59 | 0.59 | - | 5.70 | 5.70 |
| B. Equipment | | | | | | |
| 1. Line Pipe | 4.00 | - | 4.00 | 8.64 | - | 8.64 |
| 2. Coating and Wrapping Materials | 1.00 | - | 1.00 | 0.12 | - | 0.12 |
| 3. Miscellaneous Fittings (Fittings & Insulating Joints, Valves, Induction Bends, Pig Traps). | 1.00 | - | 1.00 | 0.81 | - | 0.81 |
| 4. Cathodic Protection Materials | 0.53 | - | 0.53 | 0.10 | - | 0.10 |
| 5. Transport/Vehicle | | - | | | 0.05 | 0.05 |
| Sub total (B) | 6.53 | - | 6.53 | 9.67 | 0.05 | 9.72 |
| C. Pipeline Construction (Civil Works) | | | | | | - |
| 1. Concrete Coating of Line Pipe | 0.50 | 0.14 | 0.64 | - | - | - |
| 2. Internal Transportation | - | 0.06 | 0.06 | - | 0.33 | 0.33 |
| 3. Pipeline Construction | 5.85 | 0.08 | 5.93 | 1.52 | 1.93 | 3.45 |
| 4. River Crossing | 1.00 | 0.10 | 1.10 | 1.08 | 0.01 | 1.09 |
| Sub total (C) | 7.35 | 0.38 | 7.73 | 2.60 | 2.27 | 4.87 |
| D. Regulating and Metering Stations (Turnkey) | 2.00 | 0.47 | 2.47 | 6.23 | 0.75 | 6.98 |
| E. Telecom Facility (Turnkey) | 0.15 | 0.03 | 0.18 | - | - | - |
| Sub total (D, E) | 2.15 | 0.50 | 2.65 | 6.23 | 0.75 | 6.98 |
| F. Consulting Services | 0.30 | 0.15 | 0.45 | 0.05 | 0.00 | 0.05 |
| G. Overhead (Including Manpower & Office Equipment) | - | 0.62 | 0.62 | - | 0.52 | 0.52 |
| H. Capacity Building and Training | 0.13 | 0.06 | 0.19 | - | - | - |
| Sub total (F,G,H) | 0.43 | 0.83 | 1.26 | 0.05 | 0.52 | 0.57 |
| I. Custom Duty and Value-Added Tax | - | 1.96 | 1.96 | - | 4.26 | 4.26 |
| Total Base cost | 16.46 | 4.26 | 20.72 | 18.55 | 13.56 | 32.10 |
| Physical Contingency/ Pre Shipment Inspection. | 1.65 | 0.43 | 2.08 | - | - | - |
| Price Contingency | 0.65 | 0.48 | 1.13 | - | 0.04 | 0.04 |
| Front-End fee and IDC | 1.56 | 1.86 | 3.42 | 1.68 | 0.18 | 1.86 |
| Grand Total | 20.32 | 7.03 | 27.35 | 20.23 | 13.78 | 34.00 |

CAPITAL COST ESTIMATES *(continued)*

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

| Cost Component | Appraisal | | | Actual | | |
|---|-------------|-------------|--------------|--------------|-------------|--------------|
| | Foreign | Local | Total | Foreign | Local | Total |
| A. Preconstruction Expenditure (Route Survey, Road Restoration, Environment Management, Site Development) | | 0.99 | 0.99 | | 2.23 | 2.23 |
| B. Equipment | 6.87 | | 6.87 | 9.11 | 0.07 | 9.18 |
| 1. Line Pipe | 5 | | 5 | | | |
| 2. Coating and Wrapping Materials | 0.5 | | 0.5 | | | |
| 3. Miscellaneous Fittings | 0.5 | | 0.5 | | | |
| 4. Cathodic Protection Materials | 0.3 | | 0.3 | | | |
| 5. TBS/DRS | 0.57 | | 0.57 | | | |
| C. Internal Transportation | | 0.06 | 0.06 | | 0.24 | 0.24 |
| D. Pipeline Construction | | 1.85 | 1.85 | | 1.87 | 1.87 |
| E. River Crossing (Civil Works) | 1 | 0.1 | 1.1 | 0.45 | | 0.45 |
| F. Construction of TBS/DRS | | 0.15 | 0.15 | | 0.06 | 0.06 |
| G. Overhead | | 0.62 | 0.62 | | 0.06 | 0.06 |
| H. Capacity Building and Training | 0.13 | 0.06 | 0.19 | 0.04 | 0.04 | 0.08 |
| Subtotal (A-H) Custom Duty and Value Added | 8 | 3.83 | 11.83 | 9.56 | 4.57 | 14.13 |
| I. Tax | | 2.06 | 2.06 | | 3.07 | 3.07 |
| Total Base Cost | 8 | 5.89 | 13.89 | 9.56 | 7.64 | 17.2 |
| Physical Contingency | 0.8 | 0.59 | 1.39 | | | |
| Price Contingency | 0.43 | 0.4 | 0.83 | | | |
| Front-End fee and IDC | 0.62 | 0.9 | 1.52 | 0.64 | | 0.64 |
| Grand Total | 9.85 | 7.78 | 17.63 | 10.24 | 7.65 | 17.89 |

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

CAPITAL COST ESTIMATES *(continued)*

Table A4.3: RPGCL Component (Part-C, D, E and F)
(\$ million)

| Cost Component | Appraisal | | | Actual | | |
|---|---------------|---------------|---------------|---------------|--------------|---------------|
| | Foreign | Local | Total | Foreign | Local | Total |
| A. Preconstruction Expenditure (Route Survey, Land Acquisition/ Requisition, Resettlement, Environment Management, Site Development. Etc.) | - | 2.000 | 2.000 | - | 0.388 | 0.388 |
| B. Equipment | | | | | | |
| 1. Conversion Kits for Petrol Cars (unit) 10,000 | 2.500 | 0.250 | 2.750 | | | |
| 2. 40-90 Liters Cylinders (no.) 10,000 | 3.000 | 0.300 | 3.300 | 2.936 | - | 2.936 |
| 3. 4-stroke three wheeled vehicles (no.) 2,000 | 6.000 | 0.500 | 6.500 | - | - | - |
| 4. CNG Operated Buses (with recommended spares) (no.) 300 ^a | 19.270 | 1.860 | 21.130 | 4.270 | - | 4.270 |
| C. Turnkey Contract | | | | | | |
| 1. CNG Filling Station | | | | | | |
| Compressors 10 x 160 cm/hr | 1.600 | 0.130 | 1.730 | | | |
| 10 x 300 cm/hr | 2.250 | 0.180 | 2.430 | | | |
| 6 x 700 cm/hr | 4.500 | 0.300 | 4.800 | 6.425 | - | 6.425 |
| 2. 2 Workshops for Conversion with Diagnostic Equipment | 0.500 | 1.300 | 1.800 | 0.570 | - | 0.570 |
| 3. Vehicle Maintenance Workshop | 0.200 | 0.050 | 0.250 | - | 0.420 | 0.420 |
| Subtotal (A-C) | 39.820 | 6.870 | 46.690 | 14.201 | 0.808 | 15.009 |
| D. Consulting Services | 2.000 | 0.500 | 2.500 | 0.643 | 0.130 | 0.773 |
| E. Capacity Building and Training | 0.500 | 0.200 | 0.700 | 0.456 | 0.009 | 0.465 |
| F. F. Duties and Taxes(@ 10%) | - | 3.940 | 3.940 | | 0.148 | 0.148 |
| Total Base Cost | 42.320 | 11.510 | 53.830 | 15.300 | 1.095 | 16.395 |
| Physical Contingency | 4.240 | 1.150 | 5.390 | - | - | - |
| Price Contingency | 4.240 | 1.070 | 5.310 | - | - | - |
| Service Charge and IDC | 0.900 | 3.000 | 3.900 | - | 1.198 | 1.198 |
| Grand Total | 51.700 | 16.730 | 68.430 | 15.300 | 2.293 | 17.593 |

CNG= Compressed Natural Gas; IDC=Interest during construction; RPGCL=Rupantarita Prakritik Gas Company Ltd
^a 100 buses to be co-financed by Nordic Development Fund

L1942 BAN (SF): DISBURSEMENT BY CATEGORY, YEAR AND EXECUTING AGENCY (SDR)

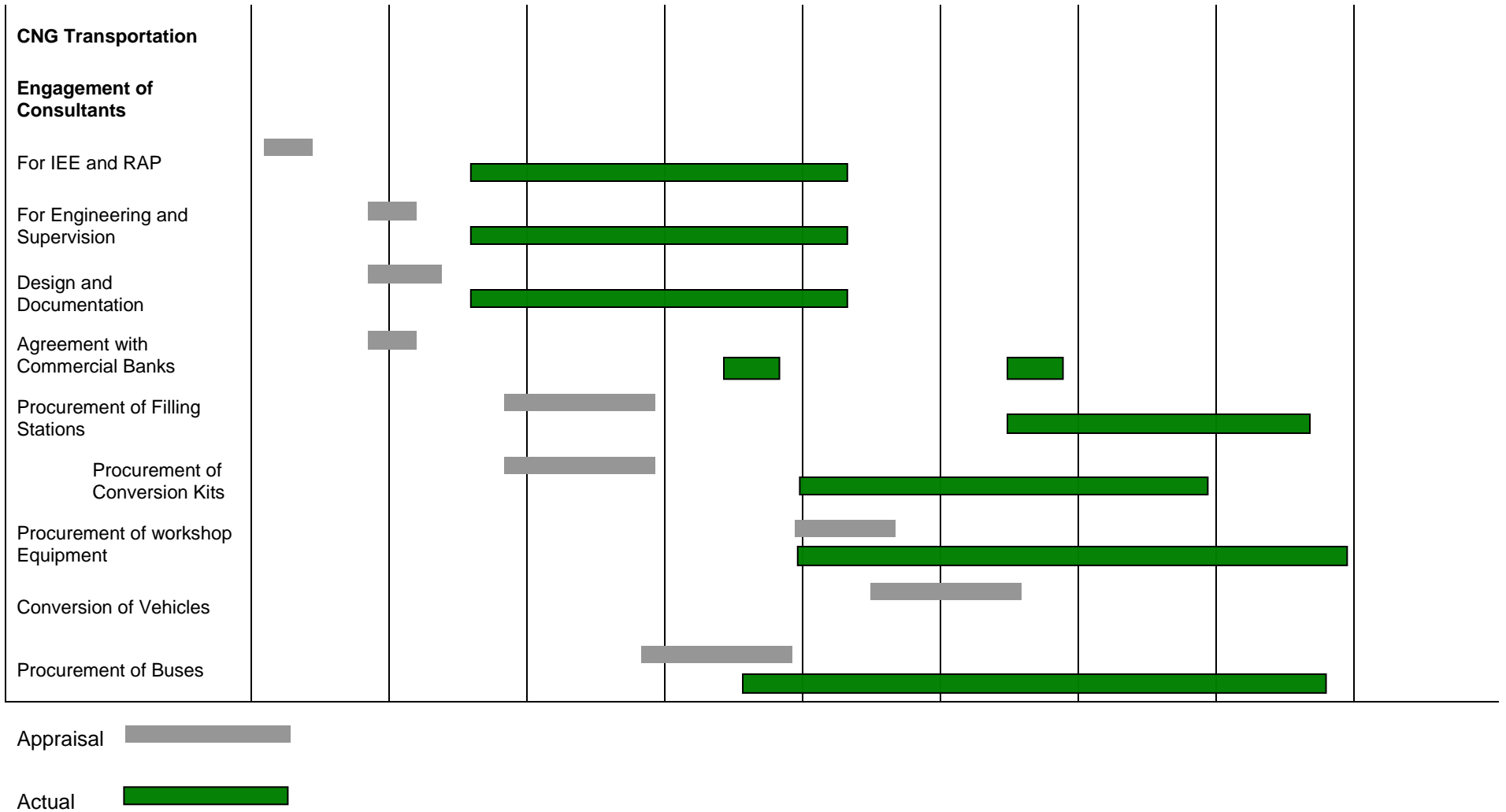
| Category | Executing Agency | Disbursement Year | | | | | | Total | |
|--------------|----------------------------|-------------------|-------------------|-------------------|---------------------|---------------------|---------------------|-------------------|----------------------|
| | | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | | |
| 01A | Equipment-Vehicles | RPGCL | - | - | 2,436,793.22 | 416,901.45 | 1,489,007.04 | 656,735.74 | 4,999,437.45 |
| 01B | Equipment-Filling Stations | RPGCL | - | - | - | 1,977,082.24 | 2,167,871.57 | - | 4,144,953.81 |
| 01C | Equipment-Workshops | RPGCL | - | - | 1,365.80 | - | 198,242.91 | 169,667.89 | 369,276.60 |
| 02 | Training | RPGCL | - | - | - | - | 160,183.14 | 63,438.99 | 223,622.13 |
| 03 | Consulting Services | RPGCL | 190,079.40 | 248,482.75 | 22,453.12 | - | - | - | 461,015.27 |
| 04 | Interest charges | RPGCL | - | 11,233.51 | 24,457.54 | 44,473.28 | 69,755.48 | - | 149,919.81 |
| 05 | Unallocated | RPGCL | - | - | - | - | - | - | - |
| 99 | Imprest Account | RPGCL | (0.07) | - | (0.30) | 0.37 | - | - | (0.00) |
| Total | | | 190,079.33 | 259,716.26 | 2,485,069.38 | 2,438,457.34 | 4,085,060.14 | 889,842.62 | 10,348,225.07 |

RPGCL=Rupantarita Praktik Gas Company Limited

L1943 BAN: DISBURSEMENT BY CATEGORY, YEAR AND EXECUTING AGENCY (\$)

| Category | Executing Agency | Disbursement Year | | | | | | Total |
|-----------------------------------|------------------|-------------------|---------------------|---------------------|----------------------|---------------------|---------------------|----------------------|
| | | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | |
| 01 Civil Work | GTCL | - | - | - | 2,640,095.50 | - | - | 2,640,095.50 |
| | TGTDC | - | - | - | - | - | - | - |
| 02 Equipment | GTCL | - | - | 841,727.03 | 8,733,030.80 | 3,435,852.38 | 2,883,939.69 | 15,894,549.90 |
| | TGTDC | - | 2,347,635.35 | 6,111,991.02 | 369,750.52 | - | - | 8,829,376.89 |
| 03 Training | GTCL | - | - | - | - | - | - | - |
| | TGTDC | - | - | - | 29,600.00 | 31,673.60 | - | 61,273.60 |
| 04 Consulting Services | GTCL | - | - | 55,278.81 | - | - | - | 55,278.81 |
| | TGTDC | - | - | - | - | - | - | - |
| 05 Interest and Commitment Charge | | - | 68,512.94 | 236,672.98 | 735,806.63 | 1,159,007.45 | - | 2,200,000.00 |
| 06 Front End Fee | | 302,000.00 | - | - | - | - | - | 302,000.00 |
| 07 Unallocated | | - | - | - | - | - | - | - |
| Total | | 302,000.00 | 2,416,148.29 | 7,245,669.84 | 12,508,283.45 | 4,626,533.43 | 2,883,939.69 | 29,982,574.70 |

GTCL=Gas transmission Company Ltd, TGTDC= Titas Gas Transmission & Distribution Company Ltd.



Sources: The EA's *Project Completion Reports* for the Dhaka Clean Fuel Project. *Report and Recommendation of the President to the Board of Directors on the Proposed Loan to Bangladesh for the Dhaka Clean Fuel Project*. Manila

Appendix 5

Status of Compliance with Loan Covenants

| SI No | Covenant | Reference in Loan/Project Agreements | Status |
|-------|--|--------------------------------------|--|
| 1 | The borrower shall re-lend the proceeds of the Loan to RPGCL under the RPGCL Subsidiary Loan Agreement for financing Parts C, D, E and F of the Project in accordance with the provisions of this Loan Agreement and the RPGCL Project Agreement. Except as ADB may otherwise agree, the Borrower shall re-lend the proceeds of the loan to RPGCL on the following terms: a term of 10 years including a grace period of three years, with interest rate of 7.5% per annum. The Borrower shall bear the foreign exchange risk. | LA, Section 3.01 (a) | Complied with, interest rate revised to 5% per annum |
| 2 | The Borrower shall cause the proceeds of the loan to be applied to the financing of expenditure on the Project in accordance with the provisions of this Loan Agreement | LA, Section 3.01 (b) | Complied with |
| 3. | The goods and services and other items of expenditure to be financed out of the proceeds of the Loan and the allocation of amounts of the Loan among different categories of such goods and services and other items of expenditure shall be in accordance with the provisions of Schedule 3 to this Loan Agreement, as such Schedule may be amended from time to time by agreement between the Borrower and ADB. | LA, Section 3.02 | Complied with |
| 4 | Except as ADB may otherwise agree, all goods and services to be financed out of the proceeds of the Loan shall be procured in accordance with the provision of Schedule 4 and Schedule 5 to this Loan Agreement. ADB may refuse to finance a contract where goods and services have been procured under procedures substantially in accordance with those agreed between Borrower and ADB or where the terms and conditions of the contract are not satisfactory to ADB | LA, Section 3.03 | Complied with |
| 5. | Except as ADB may otherwise agree, the Borrower shall cause all goods and services financed out of the proceeds of the Loan to be used exclusively I the carrying of the Project | LA, Section 3.04 | Complied with |
| 6. | Withdrawals from the Loan Account in respect of goods and services shall be made only on account of expenditures relating to (a) goods which are produced in and supplied from such member countries of ADB as shall have been specified by ADB from time to time as eligible sources for procurement, and (b) goods and | LA, Section 3.05 | Complied with |

| | | | |
|-----|---|----------------------|---------------|
| | services which meet such other eligibility requirements as shall have been specified by ADB from time to time. | | |
| 7. | The closing dates for withdrawals from the Loan Account for the purposes of Section 8.03 of the Loan Regulations shall be 30 June 2007 or such other date as may from time to time be agreed between the Borrower and ADB. | LA, Section 3.06 | Complied with |
| 8. | The Borrower shall cause the Project to be carried out with due diligence and efficiency and in conformity with sound administrative, financial, engineering, environmental, and gas supply, distribution and managerial practices | LA, Section 4.01(a) | Complied with |
| 9. | In carrying out of the Project and operation of the Project facilities, the Borrower shall perform, or cause to be performed, all obligations set forth in Schedule 6 to this Loan Agreement | LA, Section 4.01(b) | Complied with |
| 10. | The Borrower shall make available, promptly as needed, the funds, facilities, services, land and other resources which are required, in addition to the proceeds of the Loan, for carrying out of the Project and for operation and maintenance of the Project facilities. | LA, Section 4.02 | Complied with |
| 11. | In carrying out of the Project, the Borrower shall cause competent and qualified consultants and contractors, acceptable to the Borrower and ADB, to be employed to an extent and upon terms and conditions satisfactory to the Borrower and ADB. | LA, Section 4.03(a) | Complied with |
| 12. | The Borrower shall cause the Project to be carried out in accordance with plans, design standards, specifications, work schedules and construction methods acceptable to the Borrower and ADB. The Borrower shall furnish , or cause to be furnished, to ADB, promptly after their preparation, such plans, design standards, specifications and work schedules, and any material modifications subsequently made therein, in such detail as ADB shall reasonably request | LA, Section 4.03(b) | Complied with |
| 13. | The Borrower shall ensure that the activities of its departments and agencies with respect to the carrying out of the Project and operation of the Project facilities are conducted and coordinated in accordance with sound administrative policies and procedures. | LA, Section 4.04 | Complied with |
| 14. | The Borrower shall make arrangements satisfactory to ADB for insurance of the Project facilities to such extent and against such risks and in such amounts as shall be consistent with sound practice. | LA, Section 4.05 (a) | Complied with |
| 15. | Without limiting the generality of the foregoing, the Borrower undertakes to insure, or cause to be insured, the goods to be imported for the Project and to be financed out of the proceeds of the Loan against hazards incident to the acquisition, transportation and delivery thereof to the place of use or installation, and for such insurance any indemnity shall be payable in a currency freely usable to replace or | LA, Section 4.05 (b) | Complied with |

| | | | |
|-----|---|----------------------|---------------|
| | repair such goods. | | |
| 16. | The Borrower shall maintain, or cause to be maintained, records and accounts adequate to identify the goods and services and other items of expenditure financed out of the proceeds of the Loan, to disclose the use thereof in the Project, to record the progress of the Project (including the cost thereof) and to reflect, in accordance with consistently maintained sound accounting principles, the operations and financial condition of the agencies of the Borrower responsible for the carrying out of the Project and operation of the Project facilities, or any part thereof. | LA, Section 4.06 (a) | Complied with |
| 17. | The Borrower shall (i) maintain or cause to be maintained, separate accounts for the Project; (ii) have such accounts and related financial statements audited annually, in accordance with appropriate auditing standards consistently applied, by independent auditors, whose qualifications, experience and terms of reference are acceptable to ADB; (iii) furnish to ADB, as soon as available but in any event not later than 9 months after the end of each related fiscal year, certified copies of such audited accounts and financial statements and the report of the auditors relating thereto (including the auditors' opinion on the use of the Loan proceeds and compliance with covenants of this loan), all in English language; and (iv) furnish to ADB such other information concerning such accounts and financial statements and the audit thereof as ADB shall from time to time reasonably request. | LA, Section 4.06 (b) | Complied with |
| 18. | The Borrower shall enable ADB, upon ADB's request, to discuss the Borrower's financial statements for the Project and its financial affairs related to the Project from time to time with Borrowers' auditors, and shall authorize and require any representative of such auditors to participate in any such discussions requested by ADB, provided that any such discussion shall be conducted only in the presence of an authorized officer of the Borrower unless the Borrower shall otherwise agree. | LA, Section 4.06 (c) | Complied with |
| 19. | The Borrower shall furnish, or cause to be furnished, to ADB all such reports and information as ADB shall reasonably request concerning (i) the loan, and the expenditure of the proceeds and maintenance of the service thereof; (ii) the goods and services and other items of expenditure financed out of the proceeds of the Loan; (iii) the Project; (iv) the administration, operations and financial condition of the agencies of the Borrower responsible for the carrying out of the Project and operations of the Project facilities, or any part thereof; (v) financial and economic conditions in the territory of the Borrower and the international balance of payments position of the Borrower; and (vi) any other matters relating to the | LA, Section 4.07 (a) | Complied with |

| | | | |
|-----|---|----------------------|--|
| | purposes of the Loan. | | |
| 20. | Without limiting the generality of the foregoing, the Borrower shall furnish, or cause the Project Executing Agencies to furnish, to ADB quarterly reports on the carrying out of their respective Parts of the Project and on the operation and management of the Project facilities. Such reports shall be submitted in such form and in such detail and within such a period as ADB shall reasonably request, and shall indicate, among other things, progress made and problems encountered during the quarter under review, steps taken or proposed to be taken to remedy these problems, and proposed program of activities and expected progress during the following quarter. | LA, Section 4.07 (b) | Complied with |
| 21. | Promptly after physical completion of the Project, but in any event not later than 3 months thereafter or such later date as may be agreed for this purpose between the Borrower and ADB, the Borrower shall prepare and furnish to ADB a report, in such form and in such detail as ADB shall reasonably request, on the execution and initial operation of the Project, including its cost, the performance by the Borrower of its obligations under this Loan Agreement and the accomplishment of the purposes of the Loan | LA, Section 4.07 (c) | Partly complied with. Reports were prepared within 6 months. |
| 22. | The Borrower shall enable ADB's representatives to inspect the Project, the goods financed out of the proceeds of the Loan, and any relevant records and documents. | LA, Section 4.08 | Complied with |
| 23. | The Borrower shall ensure that the Project facilities are operated, maintained and repaired in accordance with sound administrative, financial, engineering, environmental, and maintenance and operational practices. | LA, Section 4.09 | Complied with |
| 24. | It is the mutual intention of the Borrower and ADB that no other external debt owed a creditor other than ADB shall have any priority over the Loan by way of a lien on the assets of the Borrower. To that end, the Borrower undertakes (i) that, except as ADB may otherwise agree, if any lien shall be created on any assets of the Borrower as security for any external debt, such lien will ipso facto equally and ratably secure the payment of the principal of, and interest charge and any other charge on the Loan; and (ii) that the Borrower, in creating or permitting the creation of any such lien, will make express provision to that effect. | LA, Section 4.10 (a) | Complied with |
| 25. | The provision of paragraph (a) of this Section shall not apply to (i) any lien created on property, at the time of purchase thereof, solely as security for payment of the purchase price of such property; or (ii) any lien arising in the ordinary course of banking transactions and securing a debt maturing not more than one year after its date. | LA, Section 4.10 (b) | Complied with |

| | | | |
|-----|---|---|---------------|
| 26. | The term 'assets of the Borrower' as used in paragraph (a) of this Section includes assets of any administrative unit or any agency of the Borrower and assets of any agency of any such administrative unit, including assets thereof held by Bangladesh Bank and any other institution performing the functions of a central bank for the Borrower. | LA, Section 4.10 (c) | Complied with |
| 27. | The services of international and domestic consultants shall be utilized in the carrying out Part F of the Project. The terms of reference of the consultants shall be as determined by agreement between ADB and the Borrower | LA, Para 1 Schedule 5 | Complied with |
| 28. | The selection engagement and services of the consultants shall be subject to the provisions of Schedule 5 and the provisions of the 'Guidelines on the Use of Consultants by Asian Development Bank and its Borrowers' dated April 2002, as amended from time to time, which have been furnished to the Project Executing Agencies. | LA, Para 2 Schedule 5 | Complied with |
| 29. | The consultants to be selected and engaged as a firm by the Borrower shall be selected and engaged using the quality-and-cost-based selection method in accordance with the following procedures, and other procedures as agreed with ADB: (a) <u>Invitation of technical and financial proposals</u> . The invitation to submit technical and financial proposals and all related documents shall be approved by ADB before they are issued. For this purpose, three copies of the draft invitation to submit both proposals, a list of consultants to be invited, the proposed criteria for evaluation of both proposals, draft consultancy contract, and other related documents shall be submitted to ADB. A period of at least 60 days shall be allowed for submission of both proposals. A copy of the final invitation as issued, together with all related documents, shall be furnished to ADB for information promptly after issuance. (b) <u>Evaluation and ranking of technical proposal</u> : Immediately after the technical proposals have been evaluated, approval of ADB shall be obtained to the evaluation and ranking of technical proposals. For this purpose, ADB shall be furnished with 3 copies of the technical proposals. The financial proposals of the firms whose technical proposals meet the minimum qualifying technical score shall be opened publicly after adequate notice is given to such firms or their representatives to attend the opening of the financial proposals. (c) <u>Evaluation of financial proposals and final ranking of the technical and financial proposals</u> : After the financial proposals have been evaluated, the final ranking of both technical and financial proposals shall be made. Before negotiations are started with the first-ranked consultants, approval of ADB shall be obtained to the evaluation of the financial and the final ranking of both proposals. | LA, Paras 3, 4, 5, 6 and 7, Schedule 5 | Complied with |

| | | | |
|-----|--|---------------------------|--|
| | For this purpose, ADB shall be provided with three copies of (i) the evaluation of the financial proposals and (ii) the final ranking of both proposals. (d) <u>Execution of the contract</u> : After the conclusion of negotiations but before the signing of the contract, ADB shall be furnished with three copies of the contract as negotiated for approval. Promptly after the contract is signed, ADB shall be furnished with three copies of the signed contract. If any substantial amendment of the contract is proposed after its execution, the proposed changes shall be submitted to ADB for prior approval. | | |
| 30. | The individual consultants shall be selected and engaged by in accordance with Section VIII of the 'Guidelines on the Use of Consultants by Asian Development Bank and its Borrower' dated April 2002, as amended from to time. | LA, Para 8 Schedule 5 | Complied with |
| 31. | Prior to the Effective Date, the consultants under ADB's regional technical assistance- (TA No. 5936-REG): Identification and Prioritization of Projects in the South Asia Subregional Economic Cooperation- the Gas Authority of India Limited shall have provided initial basis inputs to RPGCL for designs, standards, layouts, specifications, safety regulations and practices on the use of compressed natural gas. | LA, Para 9 Schedule 5 | Complied with |
| 32. | Prior to the Effective Date, ADB approved certain advance action to be undertaken for the selection of consultants. The Borrower shall have selected such consultants in accordance with the provisions of this Loan Agreement. The approval of advance action shall not in any way derogate from the obligations set forth in this Loan Agreement. | LA, Para 10 Schedule 5 | Complied with |
| 33. | Project Executing Agencies: GTCL shall be the Project Executing Agency for Parts A and F 1 of the Project; TGTDCCL shall be the Project Executing Agency for Parts B and F 2 of the Project, and RPGCL shall be the Project Executing Agency for Parts C, D, E and F3 of the Project. | LA, Para 1 Schedule 6 | Complied with |
| 34. | During the first year of Project implementation, the Borrower shall set and approve (a) international standard safety codes related to compressed natural gas filling stations, and the installation of compressed natural gas conversion kits; (b) the use of compressed natural gas including emission standards for different kinds of fuels. By 31 December 2003, the Borrower shall have instituted a mandatory vehicle inspection program to ensure the enforcement of safety and emission standards. | LA, Para 2 Schedule 6 | Partly complied with. CNG rules are in place since 2002 which were revised in 2005. Safety codes prepared by the consultants |

| | | | |
|--|--|--------------------------|--|
| | | | are awaiting gazette notification after approval by BEREC. |
| 35. | The Borrower shall 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 compressed natural gas and other fuels | LA, Para 3 Schedule 6 | Complied with till completion of this PCR. |
| 36. | The Borrower shall ensure that each of the buses and auto rickshaws to be provided under the Project replaces an old diesel-fueled bus or two-stroke auto rickshaw for Dhaka city transportation. In each case, the old diesel-fueled buses or two-stroke auto-rickshaws shall be sent out of Dhaka city or scrapped. | LA, Para 4 Schedule 6 | Complied with |
| 37. | By July 2003, the Borrower shall have commenced a program to phase-out all two-stroke baby taxis from Dhaka and to replace them with four-stroke compressed natural gas ones. The Borrower shall complete this program to phase out two-stroke baby taxis by 31 December 2007. | LA, Para 5 Schedule 6 | Complied with |
| 38. | The Borrower shall phase out diesel-fueled buses in Dhaka as follows: (a) 25% by 2005, (b) 50% by 2008, and (c) 100% and a total ban of diesel fueled buses for urban transportation within Dhaka by 2010. | LA, Para 6 Schedule 6 | Complied with, all diesel-fueled busses converted into CNG buses within February 2009 |
| <u>Resettlement, Social and Environment</u> | | | |
| 39. | The Borrower, through GTCL and TGTDCCL shall ensure that land acquisition activities are implemented in accordance with all applicable laws and regulations, ADB's Policy on Involuntary Resettlement, and the agreed Resettlement Plan, including that the Borrower shall (a) acquire land and rights-of-way in a proper and timely manner; (b) provide compensation and entitlements as stipulated in the Resettlement Plan; (c) provide promptly counterpart funds and disbursements to affected persons; (d) finance unforeseen obligations in excess of budget estimates; (e) provide adequate supervision, monitoring, and reporting on resettlement issues through the relevant Project Executive Agencies; (f) provide external monitoring and evaluation by an independent agencies on resettlement issues; (g) disseminate adequate information and consult with affected persons; and (report regularly on progress to ADB. | LA, Para 7 Schedule 6 | Partly complied with. External monitoring and evaluation by an independent agency on resettlement issues was not done. |

| | | | |
|-----|---|---------------------------|-------------------|
| 40. | The Borrower agrees that ADB's Policy on Involuntary Settlement shall prevail in the case of any difference with the Borrower's laws and regulations and that all compensation shall be at replacement cost. | LA, Para 8 Schedule 6 | Complied with |
| 41. | The Borrower shall ensure that the Resettlement Plan shall be placed in the project office and made available as a reference to affected persons | LA, Para 9 Schedule 6 | Complied with |
| 42. | The Borrower through GTCL, TGTDCCL and RPGCL shall ensure that all environmental mitigation measures and the environmental management plan described in the Initial Environmental examination and in the Summary Initial Environmental Examination, both conducted for the Project, are followed during Project implementation in consultation with the Borrower's Department of Environment and in accordance with ADB's environmental requirements as set forth in Section 20 of ADB's Operation 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) | LA, Para 10 Schedule 6 | Complied with |
| 43. | The Borrower shall ensure that no civil works are carried out until appropriate environmental clearances are received from Borrowers Department of Environment | LA, Para 11 Schedule 6 | Complied with |
| 44. | The Borrower, through GTCL, TGTDCCL and RPGCL shall ensure that all lands temporarily acquired for the carrying out of project activities are restored by contractors to their original condition. | LA, Para 12 Schedule 6 | Complied with |
| 45. | The Borrower, through GTCL, TGTDCCL, and RPGCL shall ensure that all of the civil works contracts under this Project expressly provide that the contractor shall be responsible for, and shall carry out, information and education campaigns on sexually transmitted diseases and human immunodeficiency virus/acquired immunodeficiency syndrome for construction workers as part of the required health and safety program at construction campsites during the construction period | LA, Para 13 Schedule 6 | Complied with |
| 46. | The Borrower shall provide ADB with quarterly environmental reports detailing, among other things, the environmental mitigation measures taken by the Borrowers | LA, Para 14 Schedule 6 | Not complied with |
| 47. | The Borrower, through GTCL, TGTDCCL and RPGCL shall ensure that all civil works contractors under the Project (a) remain in compliance with all applicable labor laws (b) do not employ child labor in construction and maintenance activities. | LA, Para 15 Schedule 6 | Complied with |
| 48. | The Borrower shall set employment targets for women, acceptable to ADB, for pipeline construction activities; (c) provide appropriate facilities to employees' children at construction campsites. | LA, Para 16 Schedule 6 | Complied with |

| | | | |
|-----|--|---------------------------|---------------|
| 49. | The Borrower shall develop and implement an adequate number of public awareness campaigns on safety aspects and benefits of using compressed natural gas. The campaign agenda shall be agreed with ADB and shall involve the active participation of qualified representatives of civil society. | LA, Para 17 Schedule 6 | Complied with |
|-----|--|---------------------------|---------------|

FINANCIAL AND ECONOMIC ANALYSES

1. The financial evaluation of the Project was carried out using mostly the same assumptions as were used in Project appraisal in 2002. In project appraisal the financial evaluation was done in real terms and on incremental basis by comparing with-project and without-project scenarios. The actual project cost and some of the financial projections used in these analyses were available from executing agencies.

A. Financial Internal Rate of Return

2. For estimating the financial internal rates of return (FIRRs), the total project was divided into 3 component: (i) gas transmission; (ii) gas distribution; and (iii) other components including filling stations, workshops and CNG buses. The assumptions for the different segments are discussed in the following paragraphs.

3. Gas Transmission Component (executing agency – GTCL)

- (i) The revenue is calculated at a constant wheeling charge of Tk0.32 per cubic meter against Tk0.25 per cubic meter at appraisal;
- (ii) Incremental gas supply immediately after commissioning of Dhanua-Ashulia Section in July 2006 was 100 MMCFD considered for calculations at appraisal which increased to about 120 MMCFD after commissioning of Ashulia-Aminbazar pipeline section. This is about 60% of the design capacity (200 MMCFD) of the transmission pipeline;
- (iii) Annual operating cost was Tk5.8 million in FY2007 and FY2008, while Tk7.25 million in FY2009 against Tk.6.55 million considered in appraisal;
- (iv) No transmission losses were considered;
- (v) Income tax is 17% against 40% considered in appraisal.

On the basis of the above assumptions, FIRR for gas transmission component at Project completion is 22%, which was 12% at appraisal.

4. Gas Distribution Components (executing agency – Titas)

- (i) According to Titas, approximately 240 MMCFD gas is available through the distribution pipelines to consumers at Project completion from FY2008. However, the pipeline started partial operation from FY2006. It is assumed that 50% and 75% of 240 MMCFD gas was available in FY2006 and FY2007 respectively.
- (ii) The average selling price of gas Tk3.8913 per cubic meter and average purchase price Tk2.7902 per cubic meter have been used;
- (iii) The wheeling charges payable to GTCL at Tk0.32 per cubic meter was considered along with operating and other costs; and
- (iv) Uninterrupted transmission of gas by GTCL.

Based on the above assumptions, the FIRR is 97% at Project Completion, which was 23% at appraisal.

5. Other Project Components (executing agency – RPGCL): RPGCL has been obtaining financial benefits from different activities under this project, which includes (i) converting petrol cars into CNG @ Tk 40,000 per vehicle on the average, (ii) onlending money to CNG filling stations and CNG bus owners through financial institutions at a margin of 0.5% per annum, and (iii) providing various services to CNG vehicles. Based on the above the FIRR for RPGCL component is 16% at Project completion against 14% at appraisal.

6. Using the above assumptions the consolidated FIRR has been calculated for the Project at 46% (Table-A7.1). In the Project Appraisal the FIRR was estimated at 21%. The higher FIRR at Project Completion was mainly due to higher utilization of pipeline capacity from the beginning of their commissioning and reduction in taxes.

Table-A7.1 Consolidated FIRR
(Tk million)

| Year | Investment Cost | Net Benefits | | | Total Net Benefits | Tax | Adjusted after tax |
|--------|--------------------|--------------|------------|----------|-----------------------|----------|-----------------------|
| | | GTCL | TGTDCL | RPGCL | | | |
| FY2004 | 121.32 | 107.67 | (6.22) | (7.42) | (121.32) | | (121.32) |
| FY2005 | 1,339.13 | (125.45) | (1,210.01) | (3.66) | (1,339.11) | | (1,339.11) |
| FY2006 | 2,025.67 | (1,800.42) | 865.61 | (14.42) | (949.22) | | (949.22) |
| FY2007 | 1,148.47 | (21.84) | 1,471.10 | (640.27) | 808.99 | 138.34 | 670.66 |
| FY2008 | 1,156.06 | (185.52) | 1,834.16 | (170.48) | 1,478.16 | 243.02 | 1,235.13 |
| FY2009 | 160.07 | 626.63 | 1,719.65 | 173.32 | 2,519.60 | 414.25 | 2,105.36 |
| FY2010 | | 588.50 | 1,615.00 | 313.10 | 2,516.60 | 413.75 | 2,102.85 |
| FY2011 | | 588.50 | 1,615.00 | 133.60 | 2,337.10 | 384.24 | 1,952.86 |
| FY2012 | | 588.50 | 1,615.00 | 130.60 | 2,334.10 | 383.75 | 1,950.35 |
| FY2013 | | 588.50 | 1,615.00 | 130.60 | 2,334.10 | 383.75 | 1,950.35 |
| FY2014 | | 588.50 | 1,615.00 | 130.60 | 2,334.10 | 383.75 | 1,950.35 |
| FY2015 | | 588.50 | 1,615.00 | 130.60 | 2,334.10 | 383.75 | 1,950.35 |
| FY2016 | | 588.50 | 1,615.00 | 130.60 | 2,334.10 | 383.75 | 1,950.35 |
| FY2017 | | 588.50 | 1,615.00 | 130.60 | 2,334.10 | 383.75 | 1,950.35 |
| FY2018 | | 588.50 | 1,615.00 | | 2,203.50 | 362.28 | 1,841.22 |
| FY2019 | | 588.50 | 1,615.00 | | 2,203.50 | 362.28 | 1,841.22 |
| FY2020 | | 588.50 | 1,615.00 | | 2,203.50 | 362.28 | 1,841.22 |
| FY2021 | | 588.50 | 1,615.00 | | 2,203.50 | 362.28 | 1,841.22 |
| FY2022 | | 588.50 | 1,615.00 | | 2,203.50 | 362.28 | 1,841.22 |
| FY2023 | | 588.50 | 1,615.00 | | 2,203.50 | 362.28 | 1,841.22 |
| FY2024 | | 588.50 | 1,615.00 | | 2,203.50 | 362.28 | 1,841.22 |
| FY2025 | | 588.50 | 1,615.00 | | 2,203.50 | 362.28 | 1,841.22 |
| FY2026 | | 588.50 | 1,615.00 | | 2,203.50 | 362.28 | 1,841.22 |
| Total | 5,950.73 | 8,390.25 | 32,129.28 | 567.37 | 41,086.90 | 7,156.60 | 33,930.30 |
| | | | | | | FIRR= | 46% |

B. Economic Internal Rate of Return

7. The economic analysis requires that all incremental inputs and outputs be expressed in terms of opportunity cost (either in domestic price or border price). As the output of the Project is a non-tradable product, all inputs and outputs are expressed in domestic price level, i.e., at domestic constant Taka price. Traded goods, especially the foreign exchange component of the capital cost, have been converted into domestic price multiplying by a shadow exchange rate factor of 1.20 and the relevant exchange rate. Analysis was carried out in line with the standard cost-benefits analysis framework.

8. Total cost is based on user costs, since natural gas is non-renewable resource. Its exploitation results in its depletion in due course of time. One unit of gas taken out from the resource today will leave less resource to be extracted in future. Therefore there is an additional opportunity cost involved in extraction of gas. This additional cost - depletion premium - has to be incorporated in economic appraisal of non-renewable resource projects. Hence the total costs include capital costs, operations and maintenance costs, gas extraction costs and depletion premium. From capital costs taxes, duties, price contingency and interest during construction were excluded.

9. In a recently concluded ADB PPTA on Preparing the Clean Fuel Sector Development Program, the long run marginal cost (LRMC) of wellhead gas calculated at \$1.32 per mcf was used as the extraction cost. Depletion premium has been calculated using the formula given in ADB *Guidelines for the Economic Analysis of Projects*. In calculating depletion premium 20 years period has been considered.

10. No salvage value was considered at the end of the period.

11. After commissioning in 2006-07 the Dhanua-Ashulia-Aminbazar transmission pipeline GTCL made available about 100 MMCFD additional gas for TGDTCL to transport to consumers through its newly constructed distribution pipeline. This was subsequently increased to 140 MMCFD after 2 years with an average of 130 MMCFD. Thus in the calculation, incremental gas has been assumed as 100 MMCFD in the first year, 105 MMCFD in the second year, 120 MMCFD in the third year, and 130 MMCFD in the fourth and subsequent years.

12. The economic benefits from the additional gas supply were considered under 3 broad categories: industrial and captive power, domestic and transport. From the latest MIS report it is found that about 70% of natural gas in Dhaka city is used for industrial and captive power generation purpose, 20% for domestic use and the remaining 10% for CNG converted vehicles. In industry and captive power, gas has replaced coal and liquid fuel, while at domestic level fire wood and liquid fuel were used before gas connection. Compressed natural gas for vehicles has entirely displaced liquid fuel. Thus there are mainly 3 fuels displaced by natural gas – liquid fuel, coal and wood. It is assumed that the incremental gas being transported through the transmission and distribution line is used in the ratio of 55:35:10 for liquid fuel, coal and firewood respectively. The economic analysis would identify the benefits to be obtained from each fuel that would be displaced by natural gas and assess the overall economic internal rate of return.

13. Gas is not a traded commodity in Bangladesh. However Bangladesh purchases domestically produced gas from International Oil Companies (IOCs) at an average price of \$2.752 per MCF or Tk6.798 per cubic meter. Transmission and distribution cost per cubic meter gas is Tk0.306 and Tk0.496. Thus the economic cost of gas in Dhaka city is Tk7.6 per cubic meter which is equivalent to Tk6.1789 per liter of liquid fuel.

14. The economic cost of coal in Dhaka market including handling and carrying cost is \$130 per ton or Tk.9.10 per kg. Its equivalent⁷ gas price is Tk 5.6295. Thus there is a saving of Tk.3.4704 per kg of equivalent coal.

⁷ 1 cubic meter of natural gas is equivalent to 1.35kg of coal, ref. European Nuclear society, www.euronuclear.org/info/encyclopedia/coalequivalent.htm

15. In Dhaka market its price of firewood is about Tk.5.00 per kg whose equivalent⁸ gas price is Tk.3.209. Thus, the cost savings is Tk. 1.791 per kg for equivalent firewood due to use of natural gas.
16. C & F price of one barrel (159 liters) of liquid fuel including handling and transportation (economic price) is considered \$105 or Tk7,350. Thus the economic price per liter of liquid fuel is Tk46.226.
17. The retail price of CNG is Tk16.75 per cubic meter. After deduction of taxes it comes to Tk13.61 per cubic meter which is equivalent to Tk11.65 per liter of liquid fuel. The resource cost saving due to replacement of liquid fuel by gas for CNG-fueled vehicles is Tk.34.576 (46.226 - 11.65) per liter of liquid fuel which is equivalent to Tk42.528 per cubic meter of gas.
18. Any incremental gas provided through the newly built transmission and distribution pipe networks under the project will be consumed immediately due to shortage of natural gas in the city.
19. The other assumptions used in Project appraisal were considered in the calculation of EIRR at Project completion.
20. Based on the above assumptions, EIRR has been calculated at Project completion and presented in Table A7.2. The EIRR is 61.9%, which is about 1.5 times higher than that at Project appraisal.

⁸ 1 cubic meter of natural gas is equivalent to 2.368kg of firewood, ref. European Nuclear society, www.euronuclear.org/info/encyclopedia/coalequivalent.htm

Table-A7.2 Consolidated EIRR
(Tk million)

| Year | Investment Cost | O & M Cost | Depletion cost | Extraction cost | Total cost | Resource Cost Savings | | | Total Savings | Net savings |
|---------|-----------------|------------|----------------|-----------------|------------|-----------------------|-------|-------------|---------------|-------------|
| | | | | | | Coal | Wood | Liquid Fuel | | |
| 2003-04 | 130.55 | | | | 130.5 | | | | | (130.5) |
| 2004-05 | 1,449.40 | | | | 1,449.4 | | | | | (1,449.4) |
| 2005-06 | 2,301.25 | 237.0 | | | 2,538.2 | | | | | (2,538.2) |
| 2006-07 | 840.04 | 582.2 | 15,330 | 3,372.6 | 20,124.8 | 1,696.0 | 438.7 | 24,192.3 | 26,326.9 | 6,202.1 |
| 2007-08 | 941.43 | 708.2 | 17,170 | 3,541.2 | 22,360.8 | 1,780.8 | 460.6 | 25,402.0 | 27,643.3 | 5,282.5 |
| 2008-09 | 468.02 | 850.6 | 22,075 | 4,047.1 | 27,440.7 | 2,035.2 | 526.2 | 29,030.8 | 31,592.1 | 4,151.4 |
| 2009-10 | 253.50 | 919.6 | 26,572 | 4,384.4 | 32,129.5 | 2,204.8 | 570.3 | 31,450.1 | 34,225.1 | 2,095.6 |
| 2010-11 | | 957.6 | 29,894 | 4,384.4 | 35,236.0 | 2,204.8 | 570.3 | 31,450.1 | 34,225.1 | (1,010.9) |
| 2011-12 | | 957.6 | 33,547 | 4,384.4 | 38,889.0 | 2,204.8 | 570.3 | 31,450.1 | 34,225.1 | (4,663.9) |
| 2012-13 | | 957.6 | 37,533 | 4,384.4 | 42,875.0 | 2,204.8 | 570.3 | 31,450.1 | 34,225.1 | (8,649.9) |
| 2013-14 | | 957.6 | 41,851 | 4,384.4 | 47,193.0 | 2,204.8 | 570.3 | 31,450.1 | 34,225.1 | (12,967.9) |
| 2014-15 | | 957.6 | 46,833 | 4,384.4 | 52,175.0 | 2,204.8 | 570.3 | 31,450.1 | 34,225.1 | (17,949.9) |
| 2015-16 | | 957.6 | 52,480 | 4,384.4 | 57,822.0 | 2,204.8 | 570.3 | 31,450.1 | 34,225.1 | (23,596.9) |
| 2016-17 | | 957.6 | 58,791 | 4,384.4 | 64,133.0 | 2,204.8 | 570.3 | 31,450.1 | 34,225.1 | (29,907.9) |
| 2017-18 | | 957.6 | 66,098 | 4,384.4 | 71,440.0 | 2,204.8 | 570.3 | 31,450.1 | 34,225.1 | (37,214.9) |
| 2018-19 | | 957.6 | 74,069 | 4,384.4 | 79,411.0 | 2,204.8 | 570.3 | 31,450.1 | 34,225.1 | (45,185.9) |
| 2019-20 | | 957.6 | 82,705 | 4,384.4 | 88,047.0 | 2,204.8 | 570.3 | 31,450.1 | 34,225.1 | (53,821.9) |
| 2020-21 | | 957.6 | 92,670 | 4,384.4 | 98,012.0 | 2,204.8 | 570.3 | 31,450.1 | 34,225.1 | (63,786.9) |
| 2021-22 | | 957.6 | 103,963 | 4,384.4 | 109,305.0 | 2,204.8 | 570.3 | 31,450.1 | 34,225.1 | (75,079.9) |
| 2022-23 | | 957.6 | 116,253 | 4,384.4 | 121,595.0 | 2,204.8 | 570.3 | 31,450.1 | 34,225.1 | (87,369.9) |
| 2023-24 | | 957.6 | 130,203 | 4,384.4 | 135,545.0 | 2,204.8 | 570.3 | 31,450.1 | 34,225.1 | (101,319.9) |
| 2024-25 | | 957.6 | 145,814 | 4,384.4 | 151,156.0 | 2,204.8 | 570.3 | 31,450.1 | 34,225.1 | (116,930.9) |
| 2025-26 | | 957.6 | 163,418 | 4,384.4 | 168,760.0 | 2,204.8 | 570.3 | 31,450.1 | 34,225.1 | (134,534.9) |
| Total | | | | | | | | | EIRR= | 61.9% |

21. Higher EIRR at Project completion compared to that at Project appraisal is mainly due to:

- (i) **Higher supply of gas immediately after completion:** The initial supply was higher because of the removal of gas supply bottlenecks through installation of new transmission and distribution facilities under the project, thereby meeting the high demand for gas in Dhaka. A comparison of projected and actual gas sales is shown in Table-A7.3.

Table - A7.3 Projected and Actual Gas Sales

| Year | Projected sales at appraisal | | Sales at Project completion | |
|---------|------------------------------|--------------------------------|-----------------------------|--------------------------------|
| | Annual sales in MMCM | Average daily sales in MMCF | Annual sales in MMCM | Average daily sales in MMCF |
| FY 2004 | - | - | - | - |
| FY2005 | - | - | - | - |
| FY2006 | 12.35 | 1.19 | - | - |
| FY2007 | 243.62 | 23.6 | 1,034.29 | 100.0 |
| FY2008 | 355.55 | 34.4 | 1,086.00 | 105.0 |
| FY2009 | 485.78 | 47.0 | 1,241.14 | 120.0 |
| FY2010 | 608.74 | 58.9 | 1,344.57 | 130.0 |
| FY2011 | 726.83 | 40.3 | 1,344.57 | 130.0 |
| FY2012 | 857.14 | 82.9 | 1,344.57 | 130.0 |
| FY2013 | 943.15 | 91.2 | 1,344.57 | 130.0 |
| FY2014 | 1,034.29 | 100.0 | 1,344.57 | 130.0 |
| FY2015 | 1,034.29 | 100.0 | 1,344.57 | 130.0 |

(ii) **Higher cost savings:** Higher EIRR at Project completion is also due to higher cost savings for using natural gas as substitute largely of liquid fuel, the price of which has increased steadily in the international as well as in Bangladesh market.

22. Based on the above discussion, it can be said that the Project is highly beneficial to the socio-economic development of Dhaka city and its surrounding areas. Gas supply increases by about 130MMCFD. More than 150,000 vehicles are being fed by CNG supplied through the pipeline constructed or CNG filling stations financed by the Project. Moreover, the Project has promoted CNG conversion. Consequently air quality in Dhaka city has improved. On the other hand the dependency of the country on imported liquid fuel has decreased. Thus, the Project has achieved the objectives for which it was launched.