Performance Evaluation Report

Reference Number: PPE:BAN 2009-42
Project Number: 21182-01
Loan Number: 1505-BAN(SF)
December 2009

Bangladesh: Ninth Power Project

Independent Evaluation Department

Asian Development Bank

CURRENCY EQUIVALENTS
(as of November 2009)

Currency Unit – taka (Tk)

		At Appraisal (November 1996)	At Project Completion (July 2004)	At Independent Evaluation (November 2009)
Tk1.00	=	$0.0236	$0.0169	$0.0145
$1.00	=	Tk42.45	Tk59.23	Tk69.09

ABBREVIATIONS

ADB	–	Asian Development Bank
BERC	–	Bangladesh Energy Regulatory Commission
BPDB	–	Bangladesh Power Development Board
DESA	–	Dhaka Electric Supply Authority
DESCO	–	Dhaka Electric Supply Company Limited
DPDC	–	Dhaka Power Distribution Company Limited
EA	–	executing agency
EIRR	–	economic internal rate of return
FIRR	–	financial internal rate of return
FY	–	fiscal year
IED	–	Independent Evaluation Department
MPEMR	–	Ministry of Power, Energy and Mineral Resources
PBS	–	*palli bidyut samity* (rural cooperative)
PCR	–	project completion report
PGCB	–	Power Grid Company of Bangladesh Limited
RRP	–	report and recommendation of the President
SARD	–	South Asia Regional Department
SDR	–	special drawing rights
TA	–	technical assistance

WEIGHTS AND MEASURES

kV (kilovolt)	–	1,000 volts
kWh (kilowatt-hour)	–	1,000 watt-hours
MW (megawatt)	–	1,000 kilowatts
MVA (megavolt-ampere)	–	1,000,000 volt-amperes

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., FY2000 ends on 30 June 2000.

(ii) In this report, "$" refers to US dollars.

KEYWORDS

adb, asian development bank, bangladesh, dhaka, electric, energy, evaluation, generation, meghnaghat, ninth power project, power, reform, tariff, transmission

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The guidelines formally adopted by the Independent Evaluation Department (IED) on avoiding conflict of interest in its independent evaluations were observed in the preparation of this report. Abul Bashar and Constantine Pappas were the consultants. To the knowledge of the management of IED, there were no conflicts of interest of the persons preparing, reviewing, or approving this report.

BASIC DATA
Ninth Power Project (Loan 1505-BAN[SF])

Project Preparatory and Institution Building

TA No.	TA Project Name	Type	Person-Months	Amount ($)	Approval Date
1962	Preparation of Power System Master Plan	ADTA	34	600,000	11 Oct 1993
2004	Financial Management Upgrade of Bangladesh Power Development Board and Dhaka Electric Supply Authority	ADTA	80	1,000,000	26 Nov 1993
2715	Valuation of Assets of Dhaka Electric Supply Company	ADTA	13	175,000	18 Dec 1996

Key Project Data ($ million)	Per ADB Loan Documents	Actual
Total Project Cost	313.7	162.0
Foreign Exchange Cost	197.7	88.1
ADB Loan Amount/Utilization	134.4[a]	88.1
ADB Loan Amount/Cancellation		37.1
Amount of Cofinancing		
World Bank	63.3	0.0
Government of Bangladesh	116.0	73.9

Key Dates	Expected	Actual
Fact-Finding Mission		4–16 May 1996
Appraisal Mission	7–31 Aug 1996	17 Aug–2 Sep 1996
Loan Negotiations	8–10 Oct 1996	5–8 Nov 1996
Board Approval	8 Nov 1996	18 Dec 1996
Loan Agreement		9 Jan 1997
Loan Effectiveness	9 Apr 1997	17 Jul 1997
First Disbursement		20 Aug 1998
Project Completion		Oct 2003
Loan Closing	13 July 2001	12 Jul 2004
Months (Effectiveness to Completion)	64	84

Internal Rates of Return (%)	Appraisal	PCR	PPER
Economic Internal Rate of Return	17.1	29.2	13.9
Financial Internal Rate of Return	15.0	22.5	15.7

Borrower	People's Republic of Bangladesh
Executing Agencies	Bangladesh Power Development Board Dhaka Electric Supply Authority Dhaka Electric Supply Company Limited Power Grid Company of Bangladesh Limited

Mission Data

Type of Mission	Number of Missions	Number of Person-Days
Fact-Finding and Preappraisal	1	86
Appraisal	1	119
Inception	1	39
Review	10	190
Project Completion Review Mission	1	30
Independent Evaluation Mission	1	36

ADB = Asian Development Bank, ADTA = advisory technical assistance, PCR = project completion report, PPER = project performance evaluation report, TA = technical assistance.

[a] Actual loan amount and cancellation will not add up due to fluctuations in US dollar and special drawing rights exchange.

EXECUTIVE SUMMARY

Between 1989 and 1995, major donors did not provide any new loans to Bangladesh's power sector. However, in December 1994, the Asian Development Bank (ADB), Government of Bangladesh, and various donors agreed that all donors would provide assistance to the power sector on a project- reform link basis. It was also agreed that the first loan would be ADB's Rural Electrification Project. The Ninth Power Project (the Project) was the next reform-linked project.

The objectives of the Project were to (i) enable evacuation of the power generated from the Meghnaghat Power Project; (ii) improve the use of existing system assets through optimized load dispatch; (iii) commence the unbundling of Bangladesh Power Development Board into separate generation, transmission, and distribution entities; and aid the corporatization of the transmission segment; (iv) create a corporatized distribution entity for the Dhaka area; and (v) prepare projects for possible financing by private sector developers and ADB. Improvements to the electricity supply in Dhaka and nearby rural areas were expected to promote economic growth, and the poor would benefit from improved employment opportunities.

The estimated project cost at appraisal was equivalent to $313.7 million, but the actual cost was $162.0 million. ADB's portion at time of approval was $134.4 million, but its actual cost at completion was $88.1 million. The World Bank was to contribute an additional $63.3 million for the national load dispatch center under part B, but later decided not to fund it. ADB financed the entire foreign exchange cost for the Project. The Government was to provide the equivalent of $116.0 million to cover local currency requirements but needed to provide only $73.9 million at completion. Following a review in November 2002, around $25.0 million of surplus loan proceeds were canceled, effective 31 December 2002. An additional $6.7 million and $5.4 million were canceled in October 2003 and July 2004, respectively. The net loan amount was reduced to $88.1 million. The actual cost of project works were much lower than envisaged at appraisal due to a reduced level of output for some components of the project and lower-than-expected bid prices for the procurement of goods, services, and turnkey contracts.

The Project was originally set up in four parts.

(i) **Part A.** This part featured the construction of 230-kilovolt transmission lines and substations associated with the Meghnaghat Power Project.

(ii) **Part B.** This part focused on the construction of a national load dispatch center and associated communication network.

(iii) **Part C.** This part aimed to construct 280 kilometers of 132-, 33-, 11-, and 0.4-kilovolt distribution systems, provide about 91,000 new consumer connections in metropolitan Dhaka, and enhance distribution capacity by about 200 megavolt-ampere and 22,000 new consumer connections in the Mirpur area of the city.

(iv) **Part D.** This part aimed to provide engineering services for the West Zone combined-cycle and the East Zone open-cycle peaking power projects.

Lower-than-expected bid prices created a loan surplus that was used to extend the project scope during implementation. In 1997, ADB approved a minor change in scope under part A to finance eligible costs of a 132-kilovolt transmission line connecting Mymensingh substation to Mymensingh power plant. This line, which was being constructed with ADB's assistance under the Rural Electrification Project, had experienced a cost overrun. ADB also approved (i) construction of about 10 kilometers of transmission lines from the Meghnaghat power plant to the Haripur–Hasnabad transmission line, (ii) replacement of two transformers at

Mirpur substation with two upgraded transformers, (iii) construction of turn-in lines from the Ullon–Tongi transmission line at Rampura substation, and (iv) procurement of an emergency restoration system and replacement of old protection systems. Finally, in September 2001, ADB approved a change in scope under part D to use around $8.3 million in surplus loan proceeds to compensate Bangladesh Power Development Board (BPDB) staff members who joined the Power Grid Company of Bangladesh Limited (PGCB). Under part B, ADB also funded consulting services for drafting bidding documents, and assisted in the evaluation of bids for the national load dispatch center.

The Project is rated "successful." All components were consistent with Government priorities as well as ADB's strategy for power sector reform. Major institutional reforms were initiated due to the Project, and the power grid network has been expanded and strengthened.

The Project is rated "relevant." The Project, as designed, was in line with ADB's 1993 country strategy for Bangladesh and its strategy on power sector reform. All components were also "relevant" as the power system at the time of loan appraisal was in need of significant upgrading, and load shedding was widespread. Additionally, major donors at the time were not willing to lend to the Government unless and until major reforms were made to the power sector.

The Project is rated "effective." In assessing effectiveness, the evaluation examined if outcomes were achieved and the effect of project implementation on the expected outcomes, including delays in outcome. The Project was successful in (i) expanding and strengthening the network to deliver from independent power producers to end-users, (ii) collecting adequate revenue for operation and maintenance, (iii) establishing sustainable power distribution companies for the Dhaka area, and (iv) supporting the preparation of future generation projects in accordance with the least-cost generation expansion plan.

The Project is rated as "efficient" even though the Project experienced significant time delays, as the original loan closing date of 31 July 2001 was extended three times to 12 July 2004. The reestimated economic internal rate of return of 13.9%—although lower than the project appraisal estimate of 17.1% and project completion estimate of 29.2%—is still above the 12% threshold ADB uses. The willingness-to-pay estimate implies there is considerable consumer surplus in Dhaka, which could be tapped through tariff increases or restructuring of the lifeline tariff. The fuel gas subsidies have resulted in underpricing for power, and this issue needs to be addressed by the Government.

The Project is rated "likely to be sustainable." The physical sustainability of the transmission lines and equipment purchased under the Project is high, as Dhaka Electric Supply Company Limited (DESCO), PGCB and Dhaka Power Distribution Company Limited (DPDC) are all experienced in maintenance of such facilities. The power utilities in Bangladesh generally have the necessary engineering and operational human resources to sustain the investments financed by ADB. The financial internal rate of return for the Project is recalculated to be 15.7%, which compares well with the weighted average cost of capital computed at 4.0% and approximated the 15.0% at appraisal. This indicates adequate financial resources to keep the assets well maintained and operations profitable. As part of the evaluation, a survey was undertaken of households and commercial and industrial consumers in the project area. While the Project has significantly increased the number of new consumers, the survey found that about 80% of consumers were concerned about the reliability and quality of their electricity supply and were willing to pay a higher tariff in return for an improved supply.

ADB's performance is rated "satisfactory." ADB worked effectively with the Borrower and the executing agencies (EAs) in formulating the Project and processing the loan. During implementation, ADB project staff members actively monitored project activities, and advised EA staff members on project implementation. ADB provided useful advice in many areas, including procurement and project management. Moreover, its timely approval of contract awards and disbursements—and interventions to resolve implementation issues—contributed greatly to the Project's success. However, project cost estimates could have been more accurate, and implementation delays could have been better managed.

The Borrower's performance is rated "satisfactory." The Borrower demonstrated commitment to the Project by (i) ensuring that sufficient counterpart funds were available; (ii) unbundling of BPDB into PGCB and DESCO; (iii) amending the Dhaka Electric Supply Authority (DESA) Act (1998) for rationalization of the DESA's boundary with the Rural Electrification Board, and; (iv) making the boards of directors of DESCO, DPDC, and PGCB fully autonomous in deciding financial and administrative matters. However, the Government's efforts toward establishing the Bangladesh Energy Regulatory Commission have been unnecessarily prolonged, which has delayed tariff adjustment since September 2003, making the EAs unable to meet some financial performance targets in the loan covenants.

The EAs generally carried out their functions and implemented their respective components in accordance with the design envisaged at appraisal. However, the Project did experience significant delays, and 3 of the 63 loan covenants were not fully complied with at the time of this evaluation. DESCO initially had trouble establishing a management team, and frequent changes of DESA's project director impeded project implementation. The performance of the EAs ranged from highly satisfactory (DESCO and PGCB) to poor (DESA).

While the Project has been rated "successful," several outstanding issues still need to be addressed. The 230- and 132-kilovolt networks are still suffering from depressed voltages and low power factor loads. A rigorous examination of the system and its reactive power requirements needs to be undertaken and remedial action implemented. Further, peak and off-peak tariffs are applied only for high-voltage consumers, but consideration should be given to extending this to domestic consumers. Once the present load shedding crisis has been stemmed, the Government should consider introducing disincentives to stop the proliferation of inefficient captive generation plants by gradually increasing the price of gas to such plants. ADB and development partners are presently funding major new peaking plants, but there is a severe shortage of base-load capacity. ADB must revisit the rationale of not financing base-load plants. Finally, the current power crisis in Bangladesh provides an opportunity for ADB's regional cooperation initiative in South Asia to facilitate discussions on assisting Bangladesh. Neighboring India is capable of supplying power to Bangladesh, and in return, Bangladesh may be able to offer or sell an equivalent amount of gas or pay in cash. Should such negotiations prove fruitful, clean hydropower could be wheeled from Bhutan or Nepal, providing the Government some relief from its annual burden of trying to meet growing electricity demand.

The evaluation identifies several lessons from the Project.

(i) The approach of reform-linked lending has proved to be highly appropriate for the sector. The strategy of focusing on parts of the system and demonstrating what can be achieved has been proved to be the correct one. In particular, the transfer of distribution systems from DESA to rural cooperatives and DESCO achieved transformational changes in performance.

(ii) Repeated rebidding for independent power producers has discouraged private sector participation in base-load plant procurement. The Government must take this into account and minimize rebidding.

(iii) DESCO and PGCB have demonstrated that in-house capability in design, contracting, and supervision of project implementation can be attained through learning by doing with limited or no support from consultants, particularly where EA ownership and commitment are strong. This compares with DESA's inability to attain such expertise and technology transfer despite full-time assistance from international consultants. Therefore, over reliance on external assistance can be counterproductive.

The evaluation identified two issues that require follow-up actions.

Actions	Responsible Department	Time Frame
The system voltage profile needs to be improved, and as an interim measure, capacitor banks will need to be installed in strategic areas to prop up the voltage. A short study should be undertaken to determine where best to locate capacitors (para. 80).	South Asia Regional Department (SARD)	2010
SARD should initiate discussions with the Bangladesh Energy Regulatory Commission for the reinstatement of the automatic pass-through of fuel and exchange risk costs in electricity distribution tariffs. This should also be considered as a covenant in future power sector loans to Bangladesh (paras. 38, 58, and 81).	SARD	2010

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I. INTRODUCTION

A. Evaluation Purpose and Process

1. The Independent Evaluation Department (IED) of the Asian Development Bank (ADB) included the Ninth Power Project[1] (the Project) in Bangladesh in its annual work program for 2009 (the design and monitoring framework is in Appendix 1). The Project was selected for evaluation because (i) IED planned to conduct a sector assessment program evaluation in 2009 for Bangladesh's energy sector, and (ii) IED wished to undertake a more in-depth assessment following its May 2009 validation of the project completion report (PCR).[2]

2. The Project was approved in December 1996 to assist the Government of Bangladesh in reforming its power sector and improving operational performance. Almost 5 years after the loan's closure (July 2004), IED fielded an independent evaluation mission from 10–23 May 2009 to evaluate the Project in terms of its relevance, effectiveness, efficiency, sustainability, and other impacts.[3]

3. The Independent Evaluation Mission prepared this report in accordance with IED guidelines.[4] This evaluation draws upon a review of project documents as well as project validation documents, other relevant studies, and discussions with ADB staff members. Discussions were also held with (i) Bangladesh Energy Regulatory Commission (BERC); (ii) Bangladesh Power Development Board (BPDB); (iii) Dhaka Electric Supply Company Limited (DESCO); (iv) Dhaka Power Distribution Company Limited (DPDC); (v) Ministry of Power, Energy and Mineral Resources (MPEMR); and (vi) Power Grid Company of Bangladesh Limited (PGCB). A copy of the draft evaluation report was shared with the South Asia Regional Department (SARD) and the Government through the Ministry of Finance. Their views were incorporated where relevant.

B. Project Objectives

4. As stated in the 1996 report and recommendation of the President (RRP) (footnote 1), the objectives of the Project were to (i) enable evacuation of power generated from the Meghnaghat Power Project;[5] (ii) improve the use of existing power system assets through optimized load dispatch; (iii) commence the unbundling of BPDB into separate generation, transmission, and distribution entities, and aid the corporatization of the transmission segment; (iv) create a corporatized distribution entity for the Dhaka area; and (v) prepare projects for possible financing by private sector developers and ADB. The RRP stated that improvement to the electricity supply in Dhaka and rural areas, which is supplied by the *palli bidyut samitys* (rural electricity cooperatives, known as PBSs) from the Dhaka Electric Supply Authority (DESA), would promote economic growth. The poor would also benefit indirectly from improved employment opportunities.

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1 ADB. 1996. *Report and Recommendation of the President on a Proposed Loan and Technical Assistance Grant to the People's Republic of Bangladesh for the Ninth Power Project*. Manila. (Loan 1505-BAN[SF], for $134.4 million, approved on 18 December).

2 ADB. 2009. *Project Validation Report for the Ninth Power Project in Bangladesh.* Manila.

3 The Independent Evaluation Mission comprised Scott Bayley, Evaluations Specialist and Team Leader; Barbara Palacios, Senior Evaluation Officer; Constantine Pappas, International Consultant; and Abul Bashar, National Consultant.

4 ADB. 2006. *Guidelines for Preparing Performance Evaluation Reports for Public Sector Operations*. Manila.

5 ADB. 2000. *Report and Recommendation of the President on a Proposed Loan, Political Risk Guarantee and Complementary Financing Scheme to Meghnaghat Power Limited for the Meghnaghat Power Project*. Manila.

5. The PCR,[6] which was circulated to the Board of Directors in January 2007, assessed the Project as "highly relevant," "efficacious" (i.e., effective), "efficient," and "most likely to be sustainable." Overall, the PCR rated the Project as "successful." It assessed the project design as highly relevant to the Government and ADB's objective of reducing poverty. The Project was also relevant to ADB's country strategy[7] for the energy sector. It was efficacious, as it achieved its long-term objective of improving power transmission and distribution. The PCR calculated the financial internal rate of return (FIRR) at project completion to be 22.5%, compared to 15.0% at project appraisal. The economic internal rate of return (EIRR) at completion was calculated to be 29.2%, compared to 17.1% at project appraisal.

II. DESIGN AND IMPLEMENTATION

A. Formulation

6. During the 1980s, BPDB and DESA performed poorly, and the Government was reluctant to introduce substantive reforms to the power sector. In response, international donors suspended funding for new projects and technical assistance (TA) to the sector. Between 1989 and 1994, ADB did not provide any new loans to the sector, but it maintained disbursements on its existing loans and TA projects during that period.

7. However, ADB believed that the protracted embargo was not having the desired effect of stimulating reforms in the sector. Instead, it was adding to the hardships of the people of Bangladesh. In December 1992, ADB initiated a donor coordination meeting comprising ADB, the Government, and other institutional development agencies involved in lending to the sector. At the meeting, development partners agreed to resume lending, but only for projects linked to sector reform. As a result, the Government changed its position on reforms, and in September 1994, it adopted a comprehensive reform program, through a policy paper entitled *Power Sector Reforms in Bangladesh*. The policy paper was adopted in consultation with major development partners, including ADB, opening the way for the Project.

8. At the time of loan appraisal, responsibility for the power sector was divided between three government-owned authorities, BPDB, DESA, and the Rural Electrification Board. BPDB was vertically integrated and responsible for generation, transmission, and distribution of power. It distributed power outside of the Dhaka metropolitan area to district towns, municipalities, and some rural areas, while DESA was responsible for distribution within the Dhaka area. Rural power distribution was predominantly the responsibility of the Rural Electrification Board.

9. It was agreed during the ADB-led power sector donor coordination meeting of 1994 that all agencies would provide assistance to the power sector on a project reform link basis, which would follow reforms outlined in the policy paper. These reforms focused on (i) setting up an independent regulatory body for the power sector; (ii) unbundling the power distribution, transmission, and generation operations of BPDB by setting up commercial entities based on sound corporate governance; (iii) transforming DESA into a corporate entity; (iv) attracting private sector investments for power generation through transparent solicitation processes; and (v) expanding rural electrification through rural electricity cooperatives.

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[6] ADB. 2007. *Project Completion Report for the Ninth Power Project (Bangladesh)*. Manila.
[7] ADB. 1993. *Country Operational Strategy for Bangladesh.* Manila.

10. It was also agreed that the first loan would be ADB's Rural Electrification Project,[8] which was approved on 30 May 1995. The Project was the next reform-linked one that followed. Although no project preparatory technical assistance was provided for the Project, in 1993, ADB approved an advisory technical assistance project for updating the 1985 power system master plan.[9] It developed a least-cost, long-term power expansion program for Bangladesh, which, in turn, provided sufficient scope to enable ADB to choose project components from it. The reform aspects of the Project were also discussed with major donors.

B. Rationale and Scope

1. Rationale

11. The rationale for the Project was to link reforms to funding of much-needed power system infrastructure. The needs of the sector at that time were two-fold: (i) investment to reduce power shortages and to improve quality of supply; and (ii) improved operational efficiency through sector reforms. This was in line with the Government's policy paper, ADB's country strategy (footnote 7), and ADB's strategy for power sector reform. Links to reform were achieved on four main levels—physical, organizational, restructuring, and private sector investment. On a physical level, the loan provided a transmission and distribution project that was part of the least-cost expansion plan for the power system. On an organizational level, the Project led to the creation of new power sector entities, DESCO, DPDC, and PGCB. From a restructuring point of view, the Project led to the unbundling of the sector by separating generation from transmission and distribution, leading to managerial accountability of the resulting entities. From a private sector investment point of view, the Project aimed to create three viable projects that would catalyze private sector investments. The Project provided funds for consultant services to prepare feasibility studies, engineering, and bid documents for two peaking power plants in the East Zone and one base-load power plant in the West Zone. However, BPDB was unable to recruit consultants for the West Zone, and the project was taken up later under a subsequent ADB loan.[10]

2. Scope

12. The Project, at appraisal, included four major components.

(i) **Part A.** This part featured construction of the following 230-kilovolt (kV) double-circuit transmission lines and substations:
   (a) Meghnaghat–Haripur 230-kV double-circuit transmission line (about 20 kilometers [km]);
   (b) Meghnaghat–Comilla 230-kV double-circuit transmission line (about 65 km);
   (c) Meghnaghat–Rampura 230-kV double-circuit transmission line (about 45 km);
   (d) Haripur 230-kV substation, extension of two bays;

[8] ADB. 1995. *Report and Recommendation of the President on a Proposed Loan and Technical Assistance Grant to Bangladesh for the Rural Electrification Project*. Manila. (Loan 1356-BAN[SF], approved for $50.0 million on 30 May).

[9] ADB. 1993. *Technical Assistance to Bangladesh for the Preparation of a Power System Master Plan*. Manila. (TA 1962-BAN, approved for $600,000 on 11 October).

[10] ADB. 2001. *Report and Recommendations of the President to the Board of Directors on a Proposed Loan to the People's Republic of Bangladesh for the West Zone Power System Development Project*. Manila (Loans 1884-BAN[SF] and 1885, approved for $75 million and $82 million on 21 December.)

(e) Comilla North 23-kV substation, extension by two bays, and;
(f) Rampura 230/132-kV substation.

(ii) **Part B.** This part focused on the construction of a national load dispatch center and associated communications network.

(iii) **Part C.** This part aimed to construct about 280 km of 132-, 33-, 11-, and 0.4-kV distribution systems in metropolitan Dhaka, including providing about 91,000 new consumer connections and enhancing distribution capacity by about 200 megavolt-amperes (MVA) and 22,000 new consumer connections in the Mirpur area of Dhaka city.

(iv) **Part D.** This part aimed to provide engineering services for the gas-based West Zone combined-cycle base-load power project and the East Zone open-cycle peaking power project.

C. Cost, Financing, and Executing Arrangements

13. The estimated project cost at appraisal was equivalent to $313.7 million. ADB's portion at appraisal was SDR92.93 million ($134.4 million at the time of approval on 18 December 1996). The World Bank was to contribute an additional $63.3 million for the national load dispatch center under part B, but it subsequently decided not to fund it. ADB covered the foreign exchange cost for the Project, and the Government was to provide the equivalent of $116 million to cover local currency needs. Following a review in November 2002, SDR18.64 million ($37.1 million equivalent) of surplus loan proceeds were canceled, effective 31 December 2002. An additional $6.7 million and $5.4 million were canceled in October 2003 and July 2004, respectively. The net loan amount was reduced to $88.1 million.[11]

14. At completion, the actual cost of project works was $162.0 million, much lower than envisaged at appraisal, due to a reduced level of output for some components of the project and lower-than-expected bid prices for the procurement of goods, services, and turnkey contracts. The cost also included the additional scope of the Project, plus compensation payments for BPDB staff members who joined PGCB. A summary of appraisal and actual project costs by component is in Table 1.

Table 1: Cost Breakdown by Project Component
($ million)

Component	Appraisal Cost			Actual Cost		
	Foreign	Local	Total	Foreign	Local	Total
Part A: PGCB	65.54	49.03	114.57	39.02	35.66	74.68
Part B: PGCB	64.14	32.59	96.73	0.29	0.00	0.29
Part C1: DESCO	23.20	12.35	35.56	18.59	22.06	40.65
Part C2: DESA	40.18	20.07	60.25	21.29	15.99	37.28
Part D: BPDB[a]	4.67	1.90	6.57	8.91	0.20	9.11
Total	**197.74**	**115.96**	**313.70**	**88.10**	**73.91**	**162.01**

BPDB = Bangladesh Power Development Board, DESA = Dhaka Electric Supply Authority, DESCO = Dhaka Electric Supply Company Limited, PGCB = Power Grid Company of Bangladesh Limited.
[a] Includes $8,319,233 disbursed for compensation for BPDB staff members.
Sources: Report and recommendation of the President, project completion report, and independent evaluation mission.

[11] The final loan amount and cancellation do not add up to the total loan amount at appraisal due to fluctuations in the dollar and special drawing rights exchange rate.

15. Following discussions with the executing agencies (EAs), the Independent Evaluation Mission concurs with the PCR findings that the cost underrun of part A was due to lower-than-estimated prices of goods and services procured by PGCB for transmission lines and substations plus the actual outputs were slightly less than was estimated at appraisal. PGCB's estimates were based on past procurement by BPDB under bilateral grants or supplier's credit, which were generally high.

16. Part C1 for DESCO had a substantial local cost overrun due to (i) high taxes and duties on imported goods, (ii) importation of additional goods for distribution system improvement, (iii) importation of additional meters required for replacement of faulty meters and additional new connections, and (iv) higher cost of interest during construction.

17. Part C2 for DESA had a significant cost underrun as only 53 km of transmission and distribution lines were constructed compared to the planned 280 km. In addition, the prices of goods and services for transmission lines and substations were lower than estimated. DESA's estimates were based on past procurement under bilateral grants or supplier's credit, which were generally high.

18. In Part D, the detailed engineering and feasibility studies for a gas-based combined-cycle power project in the West Zone was dropped, which reduced the cost. Under the extended coverage, only 80% of $10.36 million was used to compensate BPDB staff members joining PGCB.

19. Despite a time overrun of about 36 months—as well as an expansion of the project scope to include additional components—the actual cost of the Project was $162.01 million, 35.3% less than the appraisal estimate of $250.40 million, excluding the envisaged World Bank financing for part B.

D. Procurement, Construction, and Scheduling

20. Goods and services for the Project were procured through international competitive bidding or international shopping procedures, following ADB's *Guidelines for Procurement* at that time and standard bidding documents for procurement of goods and services. Goods and services under design–build and turnkey contracts were procured through international competitive bidding using ADB's sample bidding documents for design–build and turnkey contracts. Civil construction works were procured through local competitive bidding following the EAs standard bidding procedures. The Independent Evaluation Mission concurs with the findings of the PCR that the Project was delayed due to (i) time taken to appoint managers for PGCB and DESCO; (ii) trade union unrest; (iii) time taken to engage consultants; (iv) in the case of PGCB, litigation by land owners; (v) adverse weather conditions during the rainy season; (vi) flood plain terrain difficulties when erecting towers; and (vii) in the case of DESA, excessive time for bid evaluation following the required government procedures.

21. The original date of loan closing was 31 July 2001, but was extended three times to 12 July 2004. The PGCB portion, which was expected to be completed by the end of 1999, was not finished until October 2003—almost 4 years later than envisaged. PGCB, however, completed its part of the Project in time to evacuate power from the Meghnaghat power plant.

22. Part C for DESCO, which was to be completed by June 2000, was finished in July 2003—a delay of almost 3 years. As a new organization, DESCO had start-up problems. DESCO's first management team was recruited in July 1997, and DESCO was given access to

the Mirpur area only in 1998. Also, all management was dismissed in January 2000 for poor performance, leaving DESCO with no management for a considerable part of the year.

23. Part C for DESA, which was expected to be completed by March 1999, was finished in August 2003—a delay of more than 4 years. In most cases, DESA took excessive time for bid evaluation. Moreover, as a statutory body, DESA had to follow the Government's contract approval process. In some cases, this required approval by the Cabinet Committee on Government Purchases, which was very time-consuming.

E. Design Changes

24. Lower-than-expected bid prices created a significant loan surplus, which was used to extend the project scope during implementation. This became necessary to address additional critical needs and to improve the overall 230-kV system's reliability. On 20 November 1997, ADB approved a minor change in scope under part A to finance eligible costs of a 132-kV transmission line connecting Mymensingh substation to the Mymensingh power plant. This line, which was being constructed with ADB's assistance under the Rural Electrification Project (footnote 8), had experienced a cost overrun. On 13 September 1999, ADB approved (i) deletion of the Meghnaghat–Rampura double-circuit 230-kV transmission line and construction of about 10 km of a double-circuit 230-kV transmission line from Meghnaghat power plant up to the Haripur–Hasnabad 230-kV transmission line; (ii) replacement of two 35/50-MVA, 132/33-kV transformers at the Mirpur substation with two 50/75-MVA transformers; (iii) construction of turn-in lines from the Ullon–Tongi 132-kV transmission line at the Rampura substation; and (iv) procurement of an emergency restoration system and replacement of old protection systems. Finally, in September 2001, ADB approved a change in scope under part D to use around $8.3 million in surplus loan proceeds to compensate BPDB staff members who joined PGCB. Under part B, ADB also funded consulting services for drafting bidding documents, and assisted in the evaluation of bids for the national load dispatch center.

F. Outputs

25. The details of project outputs achieved are as follows.

1. Network Expansion

a. Part A: 230-Kilovolt Transmission Lines and Substations

26. At appraisal, the scope included (i) 130 km of double-circuit 230-kV transmission lines, (ii) one new 230-kV substation at Rampur, and (iii) extension of two existing 230-kV substations at Haripur and Comilla–North. At completion, 108 km of double-circuit 230-kV transmission lines and 0.6 km of a quadruple-circuit 132-kV transmission line at Rampura were built.

27. Technical changes to part A for improvement of system reliability included deletion of the Meghnaghat–Rampura 230-kV line and reconfiguration of the 132- and 230-kV in-feeds at the new Rampura 230-kV substation. The 230-kV Haripur–Ghorasal line was broken and turned into the Rampura substation. This necessitated the building of two 14-km lengths of double-circuit 230-kV lines to effect the turn-in. The turn-ins thus provided added security to the Rampura substation. The 132-kV Tongi–Ullon line was broken, and a 0.6-km quadruple-circuit 132-kV line was built to effect the turn-in at the Rampura substation. This was an unusual arrangement, as the approach to the substation was too narrow to accommodate two double-circuit lines that normally would have been built.

28. Additional changes to part A included (i) provision of a second in-feed to the Hasnabad 230-kV substation from the Meghnaghat 230-kV substation (the existing Haripur–Hasnabad 230-kV line was disconnected at Haripur and connected to the newly built 230-kV line from Meghnaghat financed under the Project); (ii) augmentation of the Mirpur 132/33-kV substation by replacing existing transformers with higher-rated ones; and (iii) financing construction of a 132-kV line connecting the Mymensingh 132-kV substation to Mymensingh power plant.

b. Part B: National Load Dispatch Center

29. As part of the original scope of work, ADB funded preparatory consulting services for the national load dispatch center, while the World Bank was to cofinance the investment costs. The center's purpose was to establish a mechanism for least-cost dispatch of generation, involving civil works for land and buildings along with computer hardware, software, and staff training. The World Bank decided not to provide cofinancing, because it believed that sector reforms were progressing too slowly. The center was thus included as a component of the ADB's Power Sector Development Program at the Government's request,[12] and it is presently under construction and expected to be commissioned in 2010.

c. Part C: 132-, 33-, and 11-Kilovolt Transmission Lines and 0.4-Kilovolt Distribution System Upgrade

30. At appraisal, it was envisaged that 280 km of 132-, 33-, and 11-kV transmission and 0.4-kV distribution lines would be constructed. Provision for enhancement of distribution capacity by 200 MVA in the Dhaka metropolitan area was also made. In addition, 91,000 new consumer connections in Dhaka metropolitan area and 22,000 new consumer connections in the Mirpur area of Dhaka were expected.

31. The Project, at completion, only constructed 53 km of transmission and distribution lines. DESA constructed 1.5 km of 132-kV overhead transmission lines and 19.5 km of underground cables. DESCO laid 12 km of 33-kV underground cables, 20 km of 11-kV underground cables, and 20 km of 415-V overhead distribution lines. The establishment of lines was below target due to (i) delays in setting up DESCO, and (ii) procurement delays both in DESCO and DESA. The main reason for not using loan surplus funds to increase the amount of lines built by DESA was the lengthy procedure for obtaining government approval for changes to the Project. Changes could take up to 2.5 years to be approved, which would have taken completion beyond loan closure. PGCB and DESA instead augmented capacity of the 132/33-kV substations by 450 MVA.

32. The Project proved a catalyst for new connections, and the overall number of consumers at project completion for the DESCO area stood at 205,803 and for the DESA area at 462,678. As of February 2009, the number of consumers in the DESCO and DPDC (formerly DESA) areas stood at 402,580 and 688,926, respectively, a corresponding increase of 96% and 49%. At project completion, 57,000 new connections were made in the Mirpur area.

[12] ADB. 2003. *Report and Recommendation of the President on Proposed Loans to Bangladesh for the Power Sector Development Program*. Manila. (Loan 2039-BAN, approved for $186.0 million on 10 December).

2. New Institutions and Rationalization of the Dhaka Electric Supply Authority's Territory

33. Two new companies, DESCO and PGCB, were created as a result of the Project. The Project set in motion the unbundling of BPDB and dissolution of DESA. The unbundling of BPDB began with the creation of PGCB, and DESCO was created out of DESA to take over part of DESA's network. The two new companies were created under the Companies Act (1994) and are not under the direct managerial control of the Government. Both DESCO and PGCB were incorporated in 1996. PGCB selected its management in 1997 and was originally responsible for connection of the transmission lines under the Project. In 1997, the eastern side of the power transmission system was transferred to PGCB by BPDB. However, PGCB did not begin full operations until December 2003. Today, PGCB has responsibility over all of the high-voltage grid and national load dispatch center. DESCO began operations in September 1998 and initially took over the Mirpur part of DESA, covering an area of 50 square kilometers (km^2). DESCO took over the area of Gulsham from DESA in 2003 and of Tongi in 2007. In 2005, Purbachal—a new area not previously part of DESA—was added, bringing the area now under DESCO control to 246 km^2. The distribution areas of DESA that lay outside Dhaka were transferred to the PBSs.

34. Staff members from DESA were given the opportunity to apply for transfer to DESCO. None did so. Consequently, DESCO staff members were recruited from external sources. This had an added advantage of starting fresh without the encumbrances of DESA, especially its culture of career advancement through seniority rather than merit. The Government, however, needed assistance from ADB to provide severance payments to BPDB staff members who transferred to PGCB. Despite experiencing initial start-up problems, both DESCO and PGCB are now operating successfully and are considered by the Government to be model companies in the power sector.

35. On 1 July 2008, DPDC took over operations from DESA. Its responsibility for electricity supply now covers an area of 350 km^2 of metropolitan Dhaka. Creation of DPDC was not specifically planned as part of the Project but was a consequence of the sector reforms initiated by the Project.

3. Proper Maintenance of the Power System

36. At appraisal, it was intended that the Project would be properly maintained, and fewer than 96 hours per year would be lost for any consumer. At project completion, losses due to transmission system outages were below 96 hours per consumer. However, it was perhaps optimistic to place such a broad target in the outputs of the Project, as outages are caused by problems with transmission maintenance and also by generation shortages. At present, BPDB is unable to meet the unrestricted load and is shedding load on a rotating basis for most days of the year. Table 2 shows the annual trends in load shedding.

Table 2: Trends in Load Shedding

Fiscal Year Ending	Maximum Power Demand (megawatts)	Load Shedding (megawatts)
2000	3,149	536
2001	3,394	633
2002	3,659	367
2003	3,947	468
2004	4,259	694
2005	4,597	770
2006	4,693	1,312
2007	4,500	1,345
2008	4,700	2,087

Source: Bangladesh Power Development Board.

37. Monthly figures for load shedding in 2008 are given in Table 3.

Table 3: Monthly Figures for Load Shedding
(hours)

Month	Average Duration of Load Shedding
January	127.00
February	129.00
March	141.73
April	156.07
May	131.60
June	144.93
July	127.40
August	139.20
September	128.67
October	137.13
November	126.00
December	132.47
Total	**1,621.20**
Monthly Average	**135.10**
Daily Average	**5.40**

Source: Bangladesh Power Development Board.

4. Electricity Tariffs

38. The target set at appraisal was for an average increase in tariff of 15%. In 1996, the Government increased average tariffs by 15% in two stages. In 1997, the Government adopted a formula for semiannual adjustments to the electricity tariff, enabling an automatic pass-through to consumers of fuel costs and exchange rate fluctuations. As a result, tariffs were adjusted regularly until August 2002, but since then, only two adjustments have been made on 1 September 2003 and 1 January 2007. In April 2004, BERC was established, but it was 3 years before its members were appointed, which also had the effect of delaying tariff increases. In October 2008, BPDB was given approval for a 16% increase in bulk tariffs to DESCO and to DPDC as well as to other distribution companies, including the Rural Electrification Board. A special dispensation was given to the Rural Electrification Board with the present bulk tariffs standing at Tk2.41 per kilowatt-hour (kWh) for DESCO and DPDC and Tk2.30/kWh for the Rural Electrification Board. BERC plans to conduct a public hearing on retail tariffs in early 2010.

5. Effective Billing and Collection

39. The target set at appraisal for the percentage of collection to billing was greater than 97%. At project completion, the ratios for PGCB and BPDB were less than the target, but both have improved substantially since then (Table 4). Most agencies have now introduced computerized billing and collection systems. DPDC is still below the target, but it is expected to improve once it also introduces new systems.

Table 4: Collection–Billing Ratios
(%)

Agency	Fiscal Year 2005	Fiscal Year 2008
Bangladesh Power Development Board Limited	91.9	110
Dhaka Electricity Distribution Company Limited	97.1	100
Dhaka Electric Supply Authority	99.9	n.a.
Dhaka Power Distribution Company Limited	n.a.	81
Power Grid Company of Bangladesh Limited	90.4	100
Rural Electrification Board	99.5	100

n.a. = not applicable.
Source: Annual reports of the agencies.

6. Private Sector Participation

40. At appraisal, the Project provided consulting service support to the Meghnaghat Power Project as well as two loan-financed engineering studies that were to be undertaken under part D. One study was for the creation of a 300–450-megawatt (MW) West Zone base-load combined-cycle gas-fired power station situated near Sirajganj and the western edge of the Jamuna Bridge, which was to be financed through private sector participation. The other was for two East Zone peak-load open-cycle gas-fired 200–250-MW power stations near Feni and Dhaka. BPDB was able to engage a consultant to carry out the feasibility study for the peaking plants but failed to engage a consultant for the feasibility study of the West Zone base-load station within the project implementation period. The feasibility study for a base-load power plant was included later under West Zone Power System Development Project (footnote 10).

41. The Project only directly contributed to private sector participation through provision of the owner's engineer for the Meghnaghat Power Project. However, at appraisal, it was intended that ADB would have invested in two base-load independent power producer power plants, which would have been a catalyst for private investment in the sector. The Government tried to solicit investments between 2001 and 2008, but did not succeed.[13] At the time of evaluation, no major independent power producer contracts had been let since Meghnaghat in 2002. Governance issues on the part of the Government has contributed to a lack of interest from experienced and competent investors.[14] Nevertheless, the Government is still trying to solicit bids for major base-load independent power producers, but in the meantime, three peaking plant power stations have been included in two ADB loans. One power plant of 2 x 120-MW open-cycle gas turbines at Siddhirganj is included in the Power Sector Development Program (footnote 12). Two are included in the scope of Sustainable Power Sector Development

[13] For further information on private sector investment in power generation see: ADB. 2009. *Sector Assistance Program Evaluation for Bangladesh Energy Sector*: Manila.
[14] ADB. 2009. *Sector Assistance Program Evaluation for Bangladesh Energy Sector*: Manila.

Program,[15] each with a 150 MW output located at Sarjganj and Khulna. Further, the Government has created a new category of independent power producers classified as "rental" as a short-term measure to meet the prevailing generation capacity shortages. Rental independent power producers are supplied with fuel by the Government and are only paid a capacity charge for generation. A total of 676 MW of additional rental independent power producer generation is expected to come on line by end of fiscal year (FY) 2009.

42. From the completion of the Project to the end of FY2008, BPDB installed 1,511 MW of generation capacity to the system, comprising 854 MW of independent power producers and 657 MW of public generation. In addition, 348 MW of public generation is planned to be commissioned by the end of FY2009. This will bring the total additional generation capacity between FY2003 and FY2009 to 2,517 MW.

G. Consultants

43. The Project provided consulting services for assisting (i) PGCB in procurement and supervision of project transmission lines and substations required to evacuate power from the Meghnaghat power plant under part A; (ii) PGCB with bid evaluation, design verification, and partial supervision of the implementation of the national load dispatch center under part B; (iii) DESCO in designing, engineering, and supervising construction of the distribution facilities under part C1; (iv) BPDB in conducting feasibility studies, engineering, preparing bid documents, and assisting in bid evaluation for the combined-cycle power project in the West Zone under part D; and (v) BPDB in conducting feasibility studies, engineering, preparing bid documents, assisting in bid evaluation, and post-contract engineering for the peaking power project in the East Zone under part D. The scope and status of utilization are in Table 5.

Table 5: Scope of Consulting Services and Status of Utilization
(person-months)

Component	Scope		Utilization	
	International	National	International	National
Part A	20.0	15.0	19.7	0.0
Part B	30.0	25.0	15.0	6.5
Part C1	10.0	15.0	0.0	0.0
Part D	80.0	90.0	16.7	58.5
Total	**140.0**	**145.0**	**51.4**	**65.0**

Sources: Report and recommendation of the President and project completion reports of executing agencies.

44. At the request of the World Bank, ADB financed consultant services for part B. When World Bank financing for the national load dispatch center did not materialize, ADB included it under the ongoing Power Sector Development Program. PGCB engaged the same consultant used in the Eighth Power Project to update the feasibility study and to prepare the bidding documents following ADB's *Guidelines for Procurement.* This facilitated the national load dispatch center contract being awarded in 2005.

45. DESCO hired the required qualified staff members for project implementation through open competition. As such, DESCO did not recruit any consultants for project supervision.

[15] ADB. 2007. *Report and Recommendation of the President for a Proposed Loan to Bangladesh for the Sustainable Power Sector Development Program*. Manila (Loans 2332 and 2333[SF]-BAN, approved for $400 million and $5 million, respectively on 26 June).

46. BPDB was allowed to take advance actions for the recruitment of consultants for the feasibility studies. However, BPDB did not utilize this facility. BPDB did engage a consultant for the feasibility study for the East Zone peaking power plant in February 2003, and the study was completed in September 2003. BPDB was unable to engage a consultant for the feasibility study for West Zone combined-cycle power project, mainly due to the limited financial authority of BPDB and the lengthy project approval procedures of the Government. Thus, BPDB was unable to complete the scope of works under part D.

H. Loan Covenants

47. At the time of project completion, only 4 of 63 covenants were either not complied with or partly complied with. Covenant 14 was partly met, covenants 32 and 42 were not met, and covenant 61 was partly met (Appendix 2). The Independent Evaluation Mission found that covenant 14 had now been met, but covenants 32, 42, and 61 were still partly met.

(i) **Covenant 14.** This covenant was considered partly complied with at project completion, as at that time no tariff increases were taking place because BERC was not fully established. The Independent Evaluation Mission now considers this covenant has been complied with as BERC is fully functional in its operations.

(ii) **Covenant 32.** Although at project completion this covenant was not complied with, the Independent Evaluation Mission now finds that it was partly complied with as (a) two base-load combined-cycle 450-MW plants at Sirajganj and Bibiyana were tendered as independent power producers, and (ii) the Siddhirganj 2 x 120-MW open-cycle gas turbine peaking plant financed under the Power Sector Development Program (footnote 12) was entrusted to Electricity Generation of Bangladesh Limited. However, the 2 x 150-MW peaking plants under the Sustainable Power Sector Development Program (footnote 15) were still with BPDB.

(iii) **Covenant 42.** Regarding each EA taking out and maintaining responsible insurers, the Independent Evaluation Mission finds that this covenant has been partly complied with. All EAs are currently self-insuring.

(iv) **Covenant 61.** The Independent Evaluation Mission finds this covenant partly complied with. PGCB and DESCO have a debt service coverage ratio of 2.65 and 1.62, respectively. The rates of return on equity are 19% for PCGB and 50% for DESCO. The rates of return on net fixed assets are 10% for PCGB and 29% for DESCO. PCGB has a debt–equity ratio of 75–25, and DESCO of 68–32. Also, DESCO has a collection–import ratio of 89.03%.

I. Policy Framework

48. In keeping with the principles of linked reform projects as agreed to in December 1994, the Government demonstrated its political commitment to the reform process. On 7 September 1996, the Government approved a two-step increase in retail power tariffs by 9.72% effective 1 October 1996, and an additional 5.21% effective 1 December 1996. On 18 September 1996, it approved the Project as well as (i) the creation of the two new EAs, DESCO and PCGB; (ii) unbundling of BPDB and commencement of corporatization of BPDB and DESA; and (iii) rationalization of DESA's distribution boundaries. DESCO and PGCB were incorporated on 20 November 1996 and 3 November 1996, respectively, and public advertisements requesting applications for appointment of their management were issued on 20 November 1996.

49. The Government continued its commitment to the reform process. The West Zone Power Distribution Company was established in 2003. In an order to BPDB in December 2003, the Government assigned responsibility for the Siddhirganj peaking power plant to Meghnaghat Power Company Limited, which was incorporated in 1996 and later renamed Electricity Generation Company of Bangladesh Limited. In March 2004, it approved the corporatization of BPDB's northwest zone distribution network, and the North West Zone Power Distribution Company Limited was registered in August 2005. In April 2004, BERC was established by the Government, but it did not become operational until 2007 when all of its members were appointed. On 25 October 2005, DPDC was incorporated and became operational from 1 July 2008 as DESA's successor. In August 2007, the North West Power Generation Company was registered, but it is still not yet fully operational. The Central Zone Power Distribution Company Limited, East Zone Power Distribution Company Limited, North West Zone Power Distribution Company Limited, and South Zone Power Distribution Company Limited are all expected to become fully operational during 2009.

50. Although the Project was not large in terms of the amount lent to the Government, its effect has been quite dramatic in the reforms that it has initiated in the power sector.

III. PERFORMANCE ASSESSMENT

A. Overall Assessment

51. The Project is rated "successful." All components were consistent with government priorities as well as ADB's strategy for power sector reform. Major institutional reforms were initiated as a consequence of the Project, and the power grid network has been expanded and strengthened. These reforms have improved the commercial performance of the sector by reducing power distribution losses, and stabilizing bill collection and the operational performance of the transmission system. The FIRR is recalculated to be 15.7%, which compares well with the weighted average cost of capital. The power utilities have the necessary engineering and operational human resources to sustain the investments financed by ADB.

Table 6: Overall Assessment of the Project

Criterion	Weight (%)	Assessment	Rating Value	Weighted Rating
Relevance	20	Relevant	2	0.4
Effectiveness	30	Effective	2	0.6
Efficiency	30	Efficient	2	0.6
Sustainability	20	Likely	2	0.4
Overall Rating		**Successful**		**2.0**

Overall ratings: Highly successful, successful, partly successful, and unsuccessful.
Highly successful: Overall weighted average is greater than or equal to 2.7.
Successful: Overall weighted average is greater than or equal to 1.6 and less than 2.7.
Partly successful: Overall weighted average is greater than or equal to 0.8 and less than 1.6.
Unsuccessful: Overall weighted average is less than 0.8.
Source: Independent Evaluation Mission.

B. Relevance

52. The Project is rated "relevant." The Project, as designed, was in line with the Government's policy for power sector reform, ADB's country strategy, and ADB's strategy for the sector (footnote 14). The Project addressed major aspects of the policy paper by (i)

beginning the unbundling of BPDB, (ii) creating BPDC and DESCO out of BPDB and DESA, and (iii) attempting to bring in private sector involvement in the base-load generation plant. All components were highly relevant as the power system at the time of loan appraisal was in need of significant upgrading, and load shedding was widespread. Additionally, major donors at the time were not willing to lend to the Government unless and until major reforms were made to the power sector. Major reforms were initiated as a consequence of the Project.

53. All project parts were consistent with government priorities, which were directed toward (i) providing a least-cost expansion to the transmission and distribution systems, (ii) facilitating private sector investment in power generation, and (iii) restructuring the power sector. At appraisal, the building of the three 230-kV transmission lines to evacuate power from Meghnaghat power plant was a top priority of the Government in mitigating existing widespread load shedding.

C. Effectiveness

54. The Project is rated "effective." In assessing effectiveness, the Independent Evaluation Mission examined if outcomes were achieved as well as the effect of project implementation on the expected outcomes, including delays in outcome. The expected outcomes were to meet current and future demand in the Dhaka area by (i) expanding and strengthening the network to deliver power from independent power producers to end-users; (ii) collecting adequate revenue for operation and maintenance and for expansion; (iii) establishing sustainable power distribution companies for the Dhaka area; (iv) preparing future generation projects in accordance with the least-cost generation expansion plan; and (v) establishing a national load dispatch center to manage the transmission network, cofinanced by the World Bank.

55. The expansion and strengthening of the network were achieved late but in sufficient time to enable evacuation of power from the Meghnaghat power plant. The lines added under the Project can carry the target set at appraisal of 1,500 MW. However, the 230-kV transmission lines (PGCB portion) were almost 4 years late. The delay was primarily due to (i) setbacks in appointing PGCB management, (ii) delays in BPDB handing over project-associated assets to PGCB, (iii) resistance from BPDB unions to the break-up of BPDB, (iv) court cases over the location of transmission line towers, and (v) limited working season for transmission line construction due to the rainy season.

56. DESCO's portion was almost 3 years late. The reasons for this delay were (i) late recruitment of the management team; (ii) late handover of the Mirpur area, which was DESCO’s initial focus; and (iii) replacement of the entire management team in January 2000, leaving DESCO with no management for almost 1 year.

57. DESA’s portion of the Project was delayed for almost 5 years. DESA often took excessive time for bid evaluation, and its performance reflected management issues, which were part of the reason for its restructuring. As a statutory body, DESA was also required to follow government contract approval procedures that, in certain cases, required time-consuming approval by the Cabinet Committee for Government Purchases. As a result of the delays by DESCO and DESA, expansion of the lower-voltage system (i.e., 132-, 33-, 11-, and 0.4-kV)—though it was sufficient to meet requirements—did not fully meet project targets.

58. In 1997, the Government adopted a formula for semiannual adjustments to the electricity tariff, enabling an automatic pass-through to consumers of fuel costs and exchange rate fluctuations. As a result, tariffs were adjusted regularly up until August 2002, but since then, only

two adjustments have been made on 1 September 2003 and 1 January 2007. In April 2004, BERC was established, but it was 3 years before its members were appointed. In October 2008, BPDB was given approval for a 16% increase in bulk tariffs to DESCO and DPDC.[16] A special dispensation was given to the Rural Electrification Board, with the present bulk tariffs standing at Tk2.41/kWh for DESCO and DPDC, and Tk2.30/kWh for the Rural Electrification Board. BERC plans to conduct a public hearing on retail tariffs in early 2010. Cost recovery in the sector has been improving due to reduced transmission and distribution losses, and higher bill collection. Power tariffs are currently set at a level below full cost recovery, and the required tariff adjustment (below 30%) would still leave Bangladesh with the lowest energy prices in South Asia (footnote 14).

59. As a result of the Project, two new companies—DESCO and PGCB—have been created from DESA and BPDB. DESCO and PGCB were incorporated in 1996. The remaining operations of DESA were corporatized as DPDC in 2006 as a policy condition to meet the requirements of ADB's Sustainable Power Sector Development Project (footnote 15). These new corporate entities set up under ADB assistance have demonstrated better managerial efficiencies and lower cost of service delivery (footnote 14).

60. The target for reduction of transmission losses was set at 2% at appraisal. Though transmission losses have been reduced since project completion, they are still above the target. As of FY2008, PGCB's transmission losses stood at 3.6%. A double-circuit 400-kV transmission line is currently under construction between Meghnaghat and Aminbazar under the Sustainable Power Sector Development Program (footnote 15), which will further reduce losses.

61. The Project's direct contribution to preparation for future generation expansion was in the form of two loan-financed detailed engineering and feasibility studies for combined-cycle gas-fired base-load power stations and peaking plant of open-cycle gas fired power plants of approximately 100,000 MW of total capacity. It was expected that from these two studies that the power plants built would form the basis for the Project's target of a 1,000-MW increase in generation capacity. Although BPDB could not implement the study for the base-load plants, it did manage to carry out the peaking plant study. The base-load plant study was later implemented under the West Zone Power System Development Project (footnote 10). Nevertheless, the Project's target in overall generation has been met. From the commencement of the Project to end of FY2008, BPDB has installed a total of 1,511 MW of generation capacity to the system, comprising 854 MW of independent power producer and 657 MW of public generation. In addition, 348 MW of public generation is planned to be commissioned by end of FY2009, and the rental independent power producers (para. 41) were created as a short-term measure to meet the prevailing generation capacity shortages. A total of 676 MW of additional rental independent power producer generation is expected to come on line by the end of FY2009. This will bring the total additional generation capacity between FY2003 and FY2009 to 2,517 MW.

62. Notwithstanding the additional generation capacity installed since project completion, BPDB has been unable to keep up with the load growth brought about by the high yearly increase in electricity demand over the same period. This, coupled with shortages in supply of gas to power stations, has led to severe and widespread load shedding across Bangladesh. The government's policy of expecting the private sector to develop independent power producers for base load capacity while providing development partner support for peaking plants has not proved successful due to a variety of reasons ranging from poor investors climate for foreign

[16] DPDC, the successor of DESA, began operations on 1 July 2008.

investments, governance issues associated with solicitation of investments for power generation, and lack of domestic private sector investors capable of investing in power generation projects (footnote 14). At present, BPDB is unable to meet the unrestricted load and is shedding load daily on a rotating basis. Although the Project's target of no load shedding by 2005 has not been met, the Project initiated major and far-reaching reforms to the power sector as a whole.

D. Efficiency

63. Efficiency of the Project refers to the extent to which ADB resources were delivered on time and optimally utilized. As discussed in paras. 21–23, the Project experienced significant time delays, and the original loan closing date of 31 July 2001 was extended three times to 12 July 2004. The EIRR was reestimated at 13.9% for the Project, lower than the appraisal estimate of 17.0% and project completion estimate of 29.0%. The economic benefits used to reestimate the EIRR comprise resource cost savings and consumer benefits of incremental consumption (Appendix 3). The resource cost savings are valued at the cost of the alternative energy resources. The consumer benefits of incremental consumption are valued at consumers' demonstrated willingness to pay for energy. The lower EIRR highlights the subsidies that have supported the low selling prices of electricity. The Project is thus rated as "efficient."

E. Sustainability

64. The Project is rated "likely to be sustainable." The physical sustainability of the transmission lines and equipment purchased under the Project is high, as DESCO, DPDC, and PGCB are all experienced in maintenance of such facilities. The power utilities in Bangladesh generally have the necessary engineering and operational human resources to sustain the investments financed by ADB.

65. The reestimated FIRR is 15.7% (Appendix 3). This approximates appraisal estimates but is lower than PCR estimates. It is, however, still well beyond the weighted average cost of capital estimated at 4% and indicates adequate financial resources to keep the assets well maintained and operations profitable. Sustainability of the institutions created as a result of the Project (DESCO, DPDC, and PGCB) will depend on their ability to remain profitable, which will occur as long as tariffs are maintained at a level sufficient to cover costs, service debts, and provide maintenance. BERC approved a 16% increase in bulk supply tariffs to BPDB in October 2008, and is planning its first public hearing on retail tariffs in early 2010. Due to delays in starting BERC operations, the last retail tariff increase took place in 2007.

66. Despite no recent increase in the retail price of electricity, the Independent Evaluation Mission found that DESCO and PGCB are both profitable and have sound balance sheets. However, the finances of the BPDB and DESA are far less favorable. Neither BPDB nor DESA has been managed as a commercial entity, and their accounts are not fully reliable. DPDC was established in 2008 to take over the operations of DESA with a clean balance sheet. Yet BPDB's 2008 bulk supply tariff increase will have a major adverse impact on the finances of DPDC. Unless it is permitted to increase retail tariffs, DPDC will struggle to break even despite further performance improvements.

67. The reform of Bangladesh's power sector has been driven by changes in central government policies. In this environment, there is always the risk that reforms could be reversed, if, for example, a newly elected government does not support the reform agenda for the sector that has been pursued over the past 15 years. However, the likelihood of a policy

reversal is limited in an environment where newly created agencies such as DESCO and PGCB have demonstrated their worth.

IV. OTHER ASSESSMENTS

A. Impacts

1. Poverty Impact

68. Although not evaluated directly, the Project has contributed to poverty reduction in Dhaka through improved power supply to the poor, and had an indirect impact through spurring economic growth.

2. Consumer Survey

69. As part of this evaluation, a consumer survey was undertaken for households and commercial and industrial consumers in the Project area. The survey of 205 household consumers found the following.

(i) The monthly average consumption and expenditure for electricity are 257.14 kWh and Tk1,375.69, respectively.
(ii) About 70.3% of respondents experienced 4–6 incidents of load shedding per day.
(iii) About 82% of respondents experienced 3–6 hours of load shedding daily.
(iv) Most respondents (41.5%) use candles during load shedding, which indicates their inability to afford other solutions such as generators and instant power supplies.
(v) About 63.4% of respondents experienced voltage fluctuations, of whom about 24.9% experienced damage to their electrical appliances.
(vi) About 84.9% of respondents perceived the reliability and quality of their electric supply to be poor.
(vii) About 81% of respondents are willing to pay a higher fee to receive a more reliable electric supply, and 84% are willing to pay up to 10% over the present tariff.
(viii) One third of respondents reported paying a bribe to avoid difficulties in getting a new supply connection, extension, and/or meter connection.

70. The survey of 204 commercial consumers (e.g., retail shops, beauty salons, hotels, and business offices) found the following.

(i) Monthly average consumption and expenditure for electricity are 296.92 kWh and Tk1,573.67, respectively.
(ii) About 83.4% of respondents experienced 3–6 incidents of load shedding per day.
(iii) About 77% of respondents experienced 3–6 hours of load shedding daily.
(iv) About 71.6% of respondents made use of diesel generators and instant power supplies during load shedding.
(v) About 49% of respondents experienced voltage fluctuations, 21.1% of whom had experienced damage to their electrical appliances.
(vi) About 69.1% of respondents perceived the reliability and quality of their electric supply to be poor.

(vii) About 80% of respondents are willing to pay a higher fee to receive a more reliable electric supply, and 50% are willing to pay up to 20% more over the present tariff.
(viii) One third of respondents reported paying a bribe to avoid difficulties in getting a new supply connection, extension, and/or meter connection.

71. The survey of 17 small and medium-sized industrial consumers (e.g., chemical, packaging, steel, clothing, and rubber manufacturing) found the following.

(i) Monthly average consumption and expenditure for electricity are 17,383.59 kWh and Tk92,182.08, respectively.
(ii) Respondents experienced load shedding on an average of 135.1 hours per month and 5.4 hours per day.
(iii) About 88.2% of respondents use diesel generators during load shedding for which the cost of fuel and lubricants alone was on average Tk60,636.98 per month.
(iv) About 88.2% of respondents experienced voltage fluctuation, 82.4% of whom experienced damage to electric appliances. No respondent reported receiving compensation for such damage.
(v) About 88.2% of respondents rated the reliability and quality of their electric supply as poor.
(vi) About 70% respondents are satisfied with their billing arrangements.
(vii) About 82% of respondents are willing to pay a higher fee to receive a more reliable electric supply, of whom 60% are willing to pay up to 10% more over the present tariff.
(viii) About 12% of the respondents reported paying bribes to avoid difficulties in getting a new supply connection, extension, and/or meter connection.

72. Further information on the survey methodology and findings are in Appendix 4.

3. Environmental Impact

73. The Project was classified as environmental category B because limited environmental impacts were expected during construction and operational stages. The EAs advised that project impacts on the environment have been minimal. Acquisition of land for a 230 kV/132 kV substation at Rampura affected a small number of families who were provided with compensation by the relevant government department.

B. Asian Development Bank Performance

74. ADB's performance is rated "satisfactory." In the months leading up to appraisal, ADB took a lead role in dialogues with the Government, and in coordinating donors' positions on needed reforms in the power sector. ADB worked effectively with the Borrower and EAs in formulating the Project and processing the loan. ADB fielded ten project review missions, and interacted regularly with the Borrower and EAs. During implementation, ADB project staff members actively monitored the project activities, and advised EA staff members on project implementation matters. ADB provided useful advice in many areas, including procurement and project management. The Bangladesh Resident Mission took over project administration after loan effectiveness, resulting in close coordination among ADB, the Borrower, EAs, consultants, and contractors. ADB's timely approval of contract awards and disbursements—and interventions to resolve implementation issues—contributed greatly to the success of the Project. After the World Bank withdrew its support for implementation of the national load

dispatch center, ADB stepped in at the Government's request to provide assistance under another project. The Borrower and EAs appreciated ADB's flexibility in approving changes to the scope of work, particularly increasing the scope of investment components, which enabled the Borrower to utilize loan savings. It also appreciated ADB extending the loan closing dates, which was required as a result of delays in project implementation. Offsetting these achievements by ADB, project cost estimates could have been more accurate and implementation delays could have been shortened.

C. Borrower Performance

75. The Borrower's performance is rated "satisfactory." The Borrower demonstrated commitment to the Project by (i) ensuring that sufficient counterpart funds were available; (ii) acquiring necessary land for the Project in a timely manner; and (iii) supporting the EAs in implementation of the Project. The Borrower also showed commitment to reform the power sector by (i) timely unbundling of BPDB into PGCB and DESCO; (ii) amending the DESA Act (1998) for rationalization of DESA's boundary with the Rural Electrification Board; (iii) making the boards of directors of PGCB and DESCO fully autonomous in deciding financial and administrative matters; and (iv) allowing PGCB and DESCO to introduce market-oriented pay structures and commercially oriented service conditions for operating on a commercial basis.

76. However, the Government's efforts toward operationalizing BERC have been unnecessarily prolonged. This had the effect of delaying tariff adjustment since September 2003, so the EAs could not meet some financial performance targets in the loan covenants. Following the creation of BERC in 2004, it was expected that the regulation of tariffs will be unlinked from political influences, and the longer-term objectives of creating development opportunities for public and private sector entities will be pursued. However, the Government did not provide BERC with the resources required to commence actual operations until 2007, and BERC's level of independence from the Government is the subject of debate in Bangladesh.

77. The EAs generally carried out their functions and implemented their respective components in accordance with the design envisaged at appraisal, although the Project did experience significant delays, and 3 of the 63 loan covenants were not fully complied with at the time of this evaluation. Although PGCB and DESCO were both new companies, they were reasonably well staffed. The performance of the consultants, suppliers, and contractors, under the management of the project implementation offices, was generally satisfactory, although not without problems. The engineering for the West Zone combined-cycle plant, under part D, was dropped because BPDB failed to engage a consultant, but this did not become a serious issue as this work was included under another ADB-funded project. DESCO had problems in establishing a management team, but it managed to overcome these problems. Frequent changes of DESA's project director impeded the smooth implementation of its components under part C2.

78. This report notes that the performance of the Borrower and EAs ranged from the poor performance of DESA to the highly satisfactory performance of PGCB and DESCO, with the overall rating being "satisfactory."

D. Technical Assistance

79. TA on valuation of assets of DESA for $175,000 was attached to the loan. The TA is rated "successful." Its objective was to estimate the current value of DESA's assets proposed to be transferred to DESCO. The total cost of the TA was estimated at $210,000, of which

$175,000 was to be financed by ADB and the remaining $35,000 by DESCO. The TA became effective in January 1997. ADB's database indicates that the consultants were fielded in August 1997, and the final report was submitted in February 1998. The TA was financially closed in June 2000 with 38% savings. DESA and DESCO both accepted the recommended methodology of valuing the assets. The basis was the historical book value of assets less accumulated depreciation. No separate TA completion report is available.

V. ISSUES, LESSONS, AND FOLLOW-UP ACTIONS

A. Issues

80. **System Reactive Power Requirements**. The 230-kV and 132-kV networks are still suffering from depressed voltages and low power factor loads. A rigorous examination of the system and its reactive power requirements needs to be undertaken, and remedial action implemented. The system voltage profile needs to be improved, and as an interim measure, capacitor banks will need to be installed in strategic areas to prop up the voltage, which has fallen by as much as 25% at the 132-kV level. The 400-kV line planned between Meghnaghat and Aminbazar should also improve the present situation. In the long term as more power stations are introduced and more 33-kV lines are installed, the system will present a much better voltage profile, and the need for capacitor banks will be reduced.

81. **Tariffs**. Peak and off-peak tariffs are applied only to high-voltage consumers; consideration should be given to extending this also to domestic consumers. In line with lifeline tariff levels used in other countries, consideration should also be given to narrowing down the lifeline tariff block from 100 kWh to a lower value. Further, the automatic pass-through of fuel and exchange rate costs needs to be restored by BERC. However, BERC's capacity to conduct a comprehensive review of power tariffs and implement price adjustments in the face of likely opposition from consumer groups is not yet proven (footnote 14).

82. **Captive Generation**. Load shedding has been a common occurrence in Bangladesh since the beginning of the Project. At the time of appraisal, load shedding was primarily due to transmission bottlenecks and lack of generation capacity. Currently, an additional factor has emerged—restrictions in the supply of gas. Many industrial and commercial companies have decided to purchase their own captive generation plant in response to the poor reliability of supplies from the utilities. No exact information is available on how much capacity or generation is available in captive plants, but anecdotal evidence suggests that it is more than 1,800 MW. The latest Petrobangla figures (as of April 2009) show demand for gas of a captive generation plant is 280 million cubic feet per day, whereas demand for bulk power generation is 845 million cubic feet per day. Most captive generation plants would use an open-cycle gas turbine or gas-fired internal combustion engine (i.e., diesel engines) that are much less efficient than a combined-cycle plant, such as Meghnaghat. A combined-cycle plant would have an efficiency of 55%–60%, depending on size and type, whereas an open-cycle gas turbine would have efficiency below 30%, depending on size and type. Using gas as fuel in captive generation plants is a very inefficient use of a scarce resource. Once the present load shedding crisis has been stemmed, the Government should consider introducing disincentives to stop the proliferation of captive plant by gradually increasing the price of gas to such plants.

83. **Load Shedding**. The daily cyclic outages throughout the country are a major burden on the people and economy of Bangladesh. The Government is doing its best to encourage private sector participation, but the current global economic crisis and mismanagement of the domestic bidding process has not resulted in any major independent power producer contracts since

Meghnaghat (footnote 14). ADB and development partners are presently funding major new peaking plants, but there is a severe shortage of base-load capacity. ADB will need to revisit the rationale of not financing a base-load plant.

84. **Regional Cooperation**. For mainly political reasons, regional cooperation on power issues has not made much headway in South Asia. The current power crisis in Bangladesh provides an opportunity for ADB's regional cooperation initiative in South Asia[17] to facilitate discussions on assisting Bangladesh out of its current difficulties. Neighboring India is capable of supplying power to Bangladesh, and in return, Bangladesh may be able to offer or sell an equivalent amount of gas or pay in cash. Should such negotiations prove fruitful, this could lead to clean hydropower being wheeled from Bhutan or Nepal, providing the Government some relief from its annual burden of trying to meet growing electricity demand.

85. **Power Cell**. The Power Cell of MPEMR has been established and is still operating under a World Bank project, though the Government pays the salaries of its staff members. Its role involves (i) power sector reform, (ii) private power generation, and (iii) a "watch-dog" coordinating role. The Power Cell, in effect, has become the technical arm of the ministry with regards to power. The Power Cell should become a permanent member of the ministry, and this needs to be formalized. The Government needs to look into security of service and the salary structure of specialists in the Power Cell to not lose valuable staff to the private sector.

B. Lessons

86. The approach of reform-linked lending has proved to be highly appropriate for the sector. The reform program has resulted in better management in the power sector, reduced technical and nontechnical losses, and improved the collection of revenue. The strategy of focusing on parts of the system and demonstrating what can be achieved has proved to be the correct one. In particular, the transfer of distribution systems from DESA to PBSs and DESCO achieved transformational changes in performance. The establishment of PGCB has also shown that performance of the transmission grid can be improved.

87. Repeated rebidding for independent power producers has discouraged private sector participation in base-load plant procurement. The Government has to take this into account and minimize rebidding.

88. PGCB and DESCO have demonstrated that in-house capability in design, contracting, and supervision of project implementation can be attained through learning by doing, with limited or no support from consultants, particularly where EA ownership and commitment are strong. This compares with DESA’s inability to attain such expertise and technology transfer, despite full-time assistance from international consultants. Overreliance on external assistance can be counterproductive.

C. Follow-Up Actions

89. The independent evaluation mission identified two issues that require follow-up actions.

(i) The system voltage profile needs to be improved, and as an interim measure, capacitor banks will need to be installed in strategic areas to prop up the voltage. A short study should be undertaken to determine where best to locate capacitors. (SARD, 2010)

[17] ADB. 2008. *Regional Cooperation Operations Business Plan, South Asia 2009–2010*. Manila.

(ii) SARD should initiate discussions with BERC to reinstate the automatic pass-through of fuel and exchange risk costs in the electricity distribution tariffs. This should also be considered as a covenant in future power sector loans to Bangladesh. (2010)

PROJECT DESIGN AND MONITORING FRAMEWORK AND ASSESSMENT RESULTS AT PROJECT COMPLETION AND PERFORMANCE EVALUATION

Design Summary	Performance Targets and Indicators	Project Completion Review Assessment (January 2007)	Project Completion Review Remarks	Project Performance Evaluation Review Assessment Results and Comments
Impact To meet current and future demand for electric energy in Dhaka area.	No load shedding by 2005.	Load shedding, which prevailed in the northeastern part of Dhaka due to transmission bottlenecks, improved following completion of 230-kV transmission lines and the new substation at Rampura.	Implementation of 450 MW Meghnaghat Phase I and 360 MW Haripur BOOT projects with associated evacuation facilities persuaded the Government to implement similar BOOT projects. PGCB emerged as an efficient project implementation agency.	The Project has mitigated load shedding from lack of transmission capacity. However, load shedding has persisted and become acute due to inability to keep up with load growth. Although the target of no load shedding by 2005 has not been met, the Project initiated major, far-reaching reforms to the power sector as a whole. Maximum Load Shedding–Installed Capacity Ratio: FY2007: 19% FY2008: 39%
	No applications for electrical connection pending for more than 2 months by 2005.	DESCO took over the Mirpur area from DESA in October 1998, strengthened the distribution system, and streamlined connection procedures. No connection applications are now pending beyond 2 months.	DESCO operations, in terms of customer satisfaction, are commendable.	Target met by both DESCO and DPDC.
Outcome To expand and strengthen the network to deliver from BOOT stations to individual consumers.	Network is able to handle a 1,500-MW peak load.	The 230-kV transmission system built under the Project is capable of handling more than a 1,500-MW peak load.	Load growth during the project period was about 8%, as projected in the 1995 power system master plan.	Target met. Meghnaghat is now planned as a complex of 4 x 450 MW combined-cycle power plants. The three ADB-funded 230-kV lines out of the Meghnaghat substation can easily carry the output of the 3 x 450 MW Meghnaghat stations envisaged at appraisal. However, they will be unable to carry the additional output of the

<table>
<tr><th>Design Summary</th><th>Performance Targets and Indicators</th><th>Project Completion Review Assessment (January 2007)</th><th>Project Completion Review Remarks</th><th>Project Performance Evaluation Review Assessment Results and Comments</th></tr>
<tr><td></td><td></td><td></td><td></td><td>fourth Meghnaghat power station. Therefore, a 400-kV double-circuit transmission line is being constructed between Meghnaghat and Aminbazar.</td></tr>
<tr><td>To collect adequate revenue for operation and maintenance and expansion.</td><td>ROE > 15%, SFR > 30%</td><td>ROE and SFR in FY2004 (%)
<table><tr><th>Item</th><th>ROE</th><th>SFR</th></tr><tr><td>DESCO</td><td>24.97</td><td>88.00</td></tr><tr><td>PGCB</td><td>1.96</td><td>29.30</td></tr></table></td><td>In FY2006, the ROEs of DESCO and PGCB improved to 42.84% and 11.63%, respectively; and the SFRs of DESCO and PGCB also increased to 94.00% and 78.50%, respectively.</td><td>For FY2008, the ROE was 50.1% for DESCO and 19.1% for PGCB; the SFR for DESCO was 4,366.7 and 61.9 for PGCB.</td></tr>
<tr><td>To establish sustainable and efficient power sector institution(s) in and around Dhaka.</td><td>Incorporation under Companies Act (1994), and have board members from outside the Government.</td><td>DESCO was incorporated on 3 November 1996 under the Companies Act (1994) with board members from outside the Government.</td><td>New generation, transmission, and distribution corporate entities have been created following the same principles.</td><td>PGCB was created in 1996 and has achieved an ISO 9001 rating. It is 24% listed on the stock exchange.</td></tr>
<tr><td>To establish a mechanism for least-cost dispatch of generation.</td><td>Decrease transmission losses by 2%.</td><td>Overall transmission losses reduced from 4.52% in FY1994 to 3.42% in FY2004.</td><td>The World Bank did not finance the national load dispatch center, as envisaged in the Project. This had been included under Power Sector Development Project in 2003.

BPDB upgraded its existing load dispatch center and handed it over to PGCB for managing the system during the interim period.</td><td>PGCB's transmission loses were 3.6% in FY2008.

Although PGCB staff members mostly came from BPDB, they have since adapted well to the PGCB corporate culture.

The site for the new national load dispatch center building is adjacent to the Rampura 230/132-kV substation.</td></tr>
<tr><td>To prepare for future least-cost generation expansion.</td><td>Increase generation capacity by 1,000 MW.</td><td>BPDB prepared feasibility report for peaking power plants around Dhaka. A 2 x 120-MW peaking power plant is under construction at Siddhirganj under the Power System Development Project.</td><td>BPDB could not conduct a feasibility study for a gas base-load power plant due to failure to engage a consultant within the project implementation period. This is now being done under West Zone Power System Development Project.</td><td>From completion of the Project to end of FY2008, the Government has had installed 1,511 MW of generation, comprising 854 MW of independent power producer generation and 657 MW financed by the Government.</td></tr>
</table>

Design Summary	Performance Targets and Indicators	Project Completion Review Assessment (January 2007)	Project Completion Review Remarks	Project Performance Evaluation Review Assessment Results and Comments
Outputs 1. New institutions established.	PGCB and DESCO created.	PGCB and DESCO were incorporated in 1996.	Efficiency and project management capability of PGCB and DESCO have improved.	DESCO and PGCB have become two of the more efficient companies in the Bangladesh power sector.
2. DESA's territory rationalized.	Core metropolitan areas retained; semirural areas and noncontiguous areas handed over to PBSs.	DESA's boundary was redefined through amendment of the DESA Act (1998) by Parliament. More than 5,500 km of distribution lines and associated assets outside redefined DESA area were handed over to eight PBSs.	This has significant impact on system loss reduction and improving financial health of the PBSs.	The DESCO area acquired from DESA totals 246 square km. DPDC began operations on 1 July 2008, and its area of operations covers 350 square kilometers of the Greater Dhaka City metropolitan area.
3. New plant installed.	Establish the following lines: (i) 130-km 230 kV; (ii) 280-km 132 kV, 33 kV, 11 kV, and 0.415 kV; and (iii) 132/33-kV substation capacity augmented by 200 MVA.	PGCB constructed 108-km, double-circuit 230-kV and 1.5-km, four-circuit 132-kV transmission lines. DESA constructed 1.5-km, 132-kV overhead transmission and 19.5-km, 33-kV underground cables. DESCO constructed 12-km, single-circuit, 33-kV, underground; 20-km, single-circuit, 11-kV, underground; and 20-km, 0.415-kV, overhead lines. PGCB and DESA augmented capacity of 132/33-kV substations by 450 MVA.	Construction of new lines was below target. However, augmentation of 132/33-kV substation's capacity substantially exceeded the target.	PGCB constructed 108 km of double-circuit 230-kV and 0.6 km of 4-circuit 132-kV line. DESA constructed 1.5 km of 132-kV overhead transmission lines and 19.5 km of underground cable. DESCO constructed 12 km of underground cable, 20 km of 11-kV underground cable, and 20 km of overhead 415-kV distribution lines. PGCB and DESA augmented the capacity of their 132/33-kV substations by 450 MVA. Establishment of lines was below target due to (a) delays in setting up DESCO; (b) procurement delays in DESCO and DESA; and (c) DESA was discouraged in seeking government approval for procurement of additional equipment as the government project pro-forma approvals took 2–2.5 years, which would have brought the contract completion beyond the loan closing date.
	Establish national load dispatch center.	The national load dispatch center was not constructed. PGCB utilized a consultant to (a) prepare bidding documents as per World Bank procurement guidelines; and (b) prepare bidding documents, as per ADB *Procurement Guidelines.*	The World Bank did not finance the national load dispatch center. This has been taken up under the Power Sector Development Project.	

Design Summary	Performance Targets and Indicators	Project Completion Review Assessment (January 2007)	Project Completion Review Remarks	Project Performance Evaluation Review Assessment Results and Comments
				The national load dispatch center contract was signed in 2005 but has been delayed. Commissioning is not expected until April 2010.
4. New consumers connected.	Gain 13,000 new consumers.	DESCO connected more than 57,000 new consumers in the Mirpur area between FY1999 and FY2003. PBSs connected more than 200,000 new consumers during the same period.	New connection includes regularization of unrecorded consumers in DESA data.	The number of consumers in DESCO stood at 402,580 as of February 2009.
5. System loss reduced.	Loss less than 15% of import.	DESCO reduced system loss in Mirpur area from 41% in FY1999 to 20% in FY2006. Eight PBSs that took over assets from DESA reduced system loss in taken-over areas from more than 40.0% to 11.7% in FY2006.	This had substantial impact on overall loss reduction (including power station consumption and transmission loss) from 37% in FY1994 to 25% in FY2005.	DESCO further reduced its system losses to 10.91% in FY2008. FY — Losses (%) 1999 — 40.61 2000 — 32.47 2001 — 29.87 2002 — 26.66 2003 — 21.06 2004 — 19.24 2005 — 16.64 2006 — 16.20 2007 — 13.44 2008 — 10.91
6. Power system properly maintained.	Maximum loss of 96 hours per year for any consumer.	Loss due to transmission system fault reduced to well below the target of 96 hours per year per consumer.		The target was not met due to inadequacy of generation capacity and fuel shortages. Cumulative number of hours of load shedding in 2008 was 1,622 hours, resulting in a monthly average of 135 hours or 5.4 hours daily.

Design Summary	Performance Targets and Indicators	Project Completion Review Assessment (January 2007)	Project Completion Review Remarks	Project Performance Evaluation Review Assessment Results and Comments
7. Tariffs restructured and raised.	Average tariff increased by 15% per kWh.	The Government increased the average tariff by 15% in two stages in 1996.		There has been no increase in retail tariffs since 1 January 2007.
8. System established for regular tariff adjustments.	Automatic tariff adjustment linked to Tk per $ exchange rate and fuel costs.	Automatic tariff adjustment formula introduced in March 1997.	Regular adjustment continued up to September 2003. The Bangladesh Energy Regulatory Commission will implement the same adjustment.	On 1 October 2008, BERC gave approval to BPDB for a 16% increase in the bulk supply tariff. Bulk tariffs of DPDC and DESCO are Tk2.41/kWh, and of the Rural Electrification Board, Tk2.30. However, no increase as yet has been granted for retail tariffs since the last increase in 2007, but a review of retail tariffs is planned for early 2010.
9. Effective billing and collection.	Collection–billing ratio more than 97%.	In FY2005, collection–billing ratios were (i) DESCO, 97.1%; (ii) BPDB, 91.9%: (iii) DESA, 99.9%; (iv) Rural Electrification Board, 99.5%; and (v) PGCB, 90.4%.	Billing and collection efficiency has improved substantially. Most agencies introduced a computerized billing and collection system.	Collection–Billing Ratios for FY2008: BPDB: 110 DESCO:100% DPDC: 81% PGCB:100% Rural Electrification Board: 100%
10. Engineering studies for future expansion.	Conduct studies for 600-MW West Zone base-load station and 2 x 200-MW East Zone peak-load stations.	BPDB engaged a consultant for a feasibility study of peaking plants, which was completed. BPDB failed to engage a consultant for a feasibility study for the West Zone base-load station within the project period.	A project for 2 x 120-MW peaking plant at Siddhirganj has been included in Power Sector Development Project. Provision has been made under West Zone Power System Development Project to study a west zone base-load station.	The Siddhirganj plant is due to be commissioned in late 2009 and is being financed by the Government. ADB is financing 1 x 150-MW peaking plant at Sirajganj and another 1 x 150-MW peaking plant at Khulna through the Sustainable Power Sector Development Project.
Inputs Finance: Foreign: $197.7 million Local: $116.0 million		Actual Finance: Foreign: $88.1 million Local: $73.9 million	The World Bank did not finance part B of the Project, which had an estimated cost of $95.7 million (foreign currency of $63.3 million, local currency of $32.4 million).	

<table>
<tr><th>Design Summary</th><th>Performance Targets and Indicators</th><th colspan="3">Project Completion Review Assessment (January 2007)</th><th>Project Completion Review Remarks</th><th>Project Performance Evaluation Review Assessment Results and Comments</th></tr>
<tr><td rowspan="8">Consulting services:
285 person-months</td><td rowspan="8"></td><td colspan="3">Consulting Services:
116.4 person-months</td><td rowspan="8">BPDB could not conduct one of two feasibility studies under part D.

DESCO did not engage any consultants.</td><td rowspan="8"></td></tr>
<tr><td>Item</td><td>Foreign</td><td>Local</td></tr>
<tr><td>Part A</td><td>19.7</td><td>0.0</td></tr>
<tr><td>Part B</td><td>15.0</td><td>6.5</td></tr>
<tr><td>Part C</td><td>0.0</td><td>0.0</td></tr>
<tr><td>Part D</td><td>16.7</td><td>58.5</td></tr>
<tr><td>Total</td><td>51.4</td><td>65.0</td></tr>
</table>

ADB = Asian Development Bank, BPDB = Bangladesh Power Development Board, BOOT = build–own–operate–transfer, DESA = Dhaka Electric Supply Authority, DESCO = Dhaka Electric Supply Company Limited, DPDC = Dhaka Power Distribution Company Limited, km = kilometer; kV = kilovolt, kWh = kilowatt-hour, MVA = megavolt-ampere, MW = megawatt, PBS = *palli bidyut samity* (rural cooperative), PGCB = Power Grid Company of Bangladesh Limited, ROE = return on equity, SFR = self-financing ratio.

LOAN COVENANT STATUS
(As of May 2009)

Covenant	Reference in Loan Agreement	Status of Compliance in PCR (Jan 2007)	PPER Assessment
Sector			
1. The Borrower shall relend the proceeds of the Loan to the Project Executing Agencies (EAs) under respective Subsidiary Loan Agreements upon terms and conditions satisfactory to the Bank. Except as the Borrower and the Bank may otherwise agree, the terms for relending the proceeds of the Loan shall include interest at the rate of eight percent per annum inclusive of foreign-exchange risk and a repayment period of 25 years, including a grace period of five years.	LA, Section 3.01(a)	Complied with.	
2. The Borrower shall cause the Project EAs to apply the proceeds of the Loan to the financing of expenditures on the Project in accordance with the provisions of this Loan Agreement and the Project 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 the Bank.	LA, Section 3.02	Complied with.	
4. Except as the Borrower and the Bank may otherwise agree, all goods and services to be financed out of the proceeds of the Loan shall be procured in accordance with the provisions of Schedule 4 and Schedule 5 to this Loan Agreement. The Bank may refuse to finance a contract where goods or services have not been procured under procedures substantially in accordance with those agreed between the Borrower and the Bank or where the terms and conditions of the contract are not satisfactory to the Bank.	LA, Section 3.03	Complied with.	
5. Except as the Borrower and the Bank may otherwise agree, the Borrower shall cause all goods and services financed out of the proceeds of the Loan to be used exclusively in the carrying out 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 the services which are supplied from such member countries of the Bank as shall have been specified by the Bank from time to time as eligible sources for procurement, and (b) goods and services which meet such other eligibility requirements as shall have been specified by the Bank from time to time.	LA, Section 3.05	Complied with.	
7. The closing date for withdrawals from the Loan Account for the purposes of Section 8.03 of the Loan Regulations shall be 31 July 2001 or such other date as may from time to time be agreed between the Borrower and the Bank.	LA, Section 3.06	Complied with.	

Covenant	Reference in Loan Agreement	Status of Compliance in PCR (Jan 2007)	PPER Assessment
8. The Borrower shall cause the Project EAs to carry out the Project with due diligence and efficiency and in conformity with sound administrative, financial, engineering, environmental and public utility practices.	LA, Section 4.01(a)	Complied with.	
9. In the 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 to the Project EAs, promptly as needed, and on terms and conditions acceptable the Bank, the funds, facilities, services, land and other resources which are required, in addition to the proceeds of the Loan, for the carrying out of the Project.	LA, Section 4.02	Complied with.	
11. 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 4.03	Complied with.	
12. The Borrower shall furnish, or cause to be furnished, to the Bank all such reports and information as the Bank 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 Project EAs; (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 purposes of the Loan.	LA, Section 4.04	Complied with.	
13. The Borrower shall enable the Bank's representatives to inspect the Project, the goods financed out of the proceeds of the Loan, and any relevant records and documents.	LA, Section 4.05	Complied with.	
14. The Borrower shall take all necessary actions which shall be necessary on its part to enable the Project EAs to perform its obligations under the Project Agreement including the establishment of tariffs as stipulated in Section 2.16 thereof, and shall not take or permit any action which would interfere with the performance of such obligations.	LA, Section 4.06	Partially complied with.	Complied with. Tariffs are being established by BERC.
15. The Borrower shall exercise its rights under the Subsidiary Loan Agreements in such a manner as to protect the interests of the Borrower and the Bank and to accomplish the purposes of the Loan.	LA, Section 4.07(a)	Complied with.	
16. No rights or obligations under the Subsidiary Loan Agreements shall be assigned, amended, abrogated or waived without the prior concurrence of the Bank.	LA, Section 4.07(b)	Complied with.	
17. It is the mutual intention of the Borrower and the Bank that no other external debt owed a creditor other than the Bank shall have any priority over the Loan by way of a lien on the assets of the Borrower. To that	LA, Section 4.08(a)	Complied with.	

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end, the Borrower undertakes (i) that, except as the Bank 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 service 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.			
18. The provisions 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 4.08(b)	Complied with.	
19. The term "assets of the Borrower" as used in paragraph (a) of this Section includes assets of any administrative unit, including any such assets held by the Bangladesh Bank and any other institution performing the functions of a central bank for the Borrower.	LA, Section 4.08(c)		
Others			
20. Established, Staffed, and Operating PMU/PIU		Complied with.	
21. Fielding of Consultants			
22. (a) For the consulting services required under Part A and Part B and referred to in paragraph 1(a) of this LA, Para. 3, Schedule 5, a contract may be negotiated by PGCB with the consultants who have been engaged under the Bank-financed Eighth Power project (Loan No. 963-BAN[SF]). Before a contract is signed with such consultants, three copies of the draft contract as negotiated shall be furnished to the Bank for approval. Promptly after the contract is signed, the Bank 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 the Bank for prior approval.		Complied with.	
23. (b) Except as the Bank may otherwise agree, the negotiation of a contract with the above-mentioned consultants shall be concluded within 90 days of the date of this Loan Agreement. If a contract is not negotiated, other consultants shall be engaged in accordance with the Bank's "Guideline on the Use of Consultants."		ADB's approval obtained before contract.	
24. The Borrower shall ensure that the Project EAs carry out Project implementation as follows: Part A and Part B by PGCB, Part C by DESA and DESC, and Part D by BPDB.	LA, Para 1, Schedule 6	Complied with.	
25. The Borrower (a) shall have (i) expedited or assisted in expediting the issue or execution of permits, licenses and other instruments required by law to enable PGCB and DESC to operate properly, and (ii) caused BPDB and DESA respectively, no later than the	LA, Para 2, Schedule 6	Complied with.	

Covenant	Reference in Loan Agreement	Status of Compliance in PCR (Jan 2007)	PPER Assessment
Effective Date, to appoint, in consultation with the Bank, the first boards of directors, who shall be full-time, of PGCB and DESC; and (b) shall ensure that at least 25 percent of the membership of such boards is representative of consumer and professional interests and is not drawn from the staff of the Borrower or any of its departments and agencies.			
26. The Borrowers shall ensure that PGCB and DESCO appoint a sufficient number of qualified and experienced professional and support, technical and non technical staff, including engineers to enable PGCB and DESCO at all times to carry on their operations.	LA, Para 3, Schedule 6	Complied with.	
27. The Borrower shall, at all times, emphasize, respect and support the autonomy of PGCB and DESCO with respect to decisions regarding implementation of the Project, operation and maintenance and carrying out their administrative, financial and commercial responsibilities.	LA, Para. 4, Schedule 6	Complied with.	
Financial 28. With reference to Section 4.02 of this Loan Agreement, the Borrower shall ensure that all local-currency funds required for expeditious Project implementation are (a) committed in advance in its Annual Development Program on the basis of anticipated expenditure for the relevant year, and (b) transferred to PGCB and DESC at least one quarter of the year prior to the anticipated need or disbursement.	LA, Para. 5, Schedule 6	Complied with. Borrower allocated necessary funds in Annual Development Program by the Borrower.	
Social 29. The Borrower shall ensure that all land, rights in land or rights of way, and other rights or privileges are promptly acquired by or made available to PGCB, DESA and DESCO to ensure timely Project implementation.	LA, Para. 6, Schedule 6	Complied with.	
Environment 30. The Borrower shall ensure that during Project implementation measures satisfactory to the Bank are taken to minimize displacement or resettlement of people and environmental injury or damage cause by or resulting from Project implementation. Upon Project completion measures are also taken to meet national and international standards in respect of such resettlement and environmental concerns.	LA, Para. 7, Schedule 6	Complied with.	
31. Upon completion of the Project, the Borrower shall cause the Project EAs to be responsible for proper O&M of the Project facilities, including the provision of adequate funds for O&M, as follows: PGCB for Part A and Part B, and DESA and DESC for Part C.	LA, Para. 8(a) Schedule 6	Complied with.	
32. The Borrower shall ensure that implementation of the proposed (i) West Zone project engineered under Part D is entrusted in the first instance to independent private-sector generators of power, and (ii) East Zone projects engineered under Part D are entrusted to a corporatized generation subsidiary of BPDB.	LA, Para. 8(b) Schedule 6		Partly complied with. (i) 450 MW of base load combined cycle

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			plants at Sirajganj and Bibiyana were tendered as IPPs. (ii) The Siddhirganj 2x120 MW open cycle gas turbine peaking plant was entrusted to Electricity Generation of Bangladesh Ltd. But the 1x150 MW Sirajganj and 1x150 MW Khulna peaking plants are still with BPDB.
33. Before 31 December 2002, the Borrower shall ensure that (a) ownership and O&M of all transmission responsibilities in the Borrower are effected by PGCB, and (b) O&M of all distribution responsibilities in Dhaka and its environs are undertaken by DESCO.	LA, Para. 9, Schedule 6	Complied with. DESCO's area of operation has been redefined.	
34. The Borrower shall cause Project BME to be carried out by PGCB for Part A and Part B and by DESA and DESC for Part C. The BME, which will be reviewed by the Bank, shall include verification under Part C of (a) the number of new connections, (b) the consumer categories of such connections, and (c) the improvement, or not, of service to consumers in Dhaka and its environs.	LA, Para. 10, Schedule 6	Complied with. DESA and DESC maintain consumer connection statistics by category. Service quality improved.	
35. The Borrower shall cause at least 2.5 million cubic meters per day of natural gas to be allocated and supplied to the Meghnaghat Power Company (MPC) for the Meghnaghat Project under a contract between MPC and Titas Gas Transmission and Distribution Company Limited to ensure uninterrupted operation of the Meghnaghat Project.	LA, Para. 11, Schedule 6	Complied with. 450 MW Meghnaghat plant in commercial operation since November 2002.	
36. Each Project Executing Agency shall carry out the Project with due diligence and efficiency, and in conformity with sound administrative, financial, engineering, environmental, and public utility practices.	PA, Section 2.01(a)	Complied with.	
37. In the carrying out of the Project and operation of the Project facilities, each Project Executing Agency shall perform all obligations set forth in Schedule 6 to the Loan Agreement to the extent that they are applicable to the Project Executing Agency.	PA, Section 2.01(b)	Complied with.	
38. Each Project Executing Agency shall make available, promptly as needed, the funds, facilities, services, equipment, land and other resources which are required, in addition to the proceeds of the Loan, for the carrying out of the Project.	PA, Section 2.02	Complied with.	

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39. In the carrying out of the Project, each Project Executing Agency shall employ competent and qualified consultants and contractors, acceptable to the Bank, to an extent and upon terms and conditions satisfactory to the Bank.	PA, Section 2.03(a)	Complied with.	
40. Except as the Bank may otherwise agree, all goods and services to be financed out of the proceeds of the Loan shall be procured in accordance with the provisions of Schedule 4 and Schedule 5 to the Loan Agreement. The Bank may refuse to finance a contract where goods or services have not been procured under procedures substantially in accordance with those agreed between the Borrower and the Bank or where the terms and conditions of the contract are not satisfactory to the Bank.	PA, Section 2.03(b)	Complied with.	
41. Each Project Executing Agency shall carry out the Project in accordance with plans, design standards, specifications, work schedules and construction methods acceptable to the Bank. Each Project Executing Agency shall furnish, or cause to be furnished, to the Bank, promptly after their preparation, such plans, design standards, specifications and work schedules, and any material modifications subsequently made therein, in such detail as the Bank shall reasonably request.	PA, Section 2.04	Complied with.	
42. Each Project Executing Agency shall take out and maintain with responsible insurers, or make other arrangements satisfactory to the Bank, for insurance of the Project facilities to such extent and against such risks and in such amounts as shall be consistent with sound practice.	PA, Section 2.05(a)	Not complied with.	Partially complied with. EAs now self insure.
43. Without limiting the generality of the foregoing, each Project Executing Agency 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 repair such goods.	PA, Section 2.05(b)	Complied with.	
44. Each Project Executing Agency 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, its operations and financial conditions.	PA, Section 2.06	Complied with.	
45. The Bank and each Project Executing Agency shall cooperate fully to ensure that the purposes of the Loan will be accomplished.	PA, Section 2.07(a)	Complied with.	
46. Each Project Executing Agency shall promptly inform the Bank of any condition which interferes with,	PA, Section 2.07(b)	Complied with.	

Covenant	Reference in Loan Agreement	Status of Compliance in PCR (Jan 2007)	PPER Assessment
or threatens to interfere with, the progress of the Project, the performance of its obligations under this Project Agreement or the subsidiary Loan Agreements, or the accomplishment of the purposes of the Loan.			
47. The Bank and each Project Executing Agency shall from time to time, at the request of either party, exchange views through their representatives with regard to any matters relating to the Project, the Project Executing Agency and the Loan.	PA, Section 2.07(c)	Complied with.	
48. Each Project Executing Agency shall furnish to the Bank all such reports and information as the Bank shall reasonably request concerning (i) the Loan and the expenditure of the proceeds thereof; (ii) the goods and services and other items of expenditure financed out of such proceeds; (iii) the Project; (iv) the administration, operations and financial condition of the Project Executing Agency; and (v) any other matters relating to the purposes of the Loan.	PA, Section 2.08(a)	Complied with.	
49. Without limiting the generality of the foregoing, each Project Executing Agency shall furnish to the Bank quarterly reports on the execution 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 the Bank 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.	PA, Section 2.08(b)	Complied with.	
50. Promptly after physical completion of the Project, but in any event not later than six months thereafter or such later date as the Bank may agree for this purpose, each Project Executing Agency shall prepare and furnish to the Bank a report, in such form and in such detail as the Bank shall reasonably request, on the execution and initial operation of the Project, including its cost, the performance by the Project Executing Agency of its obligations under this Project Agreement and the accomplishment of the purposes of the Loan.	PA, Section 2.08(c)	Complied with.	
51. Each Project Executing Agency shall (i) maintain separate accounts for the Project and for its overall operations; (ii) have such accounts and related financial statements (balance sheet, statement of income and expenses, and related statements) audited annually, in accordance with appropriate auditing standards consistently applied, by independent auditors whose qualifications, experience and terms of reference are acceptable to the Bank; and (iii) furnish to the Bank, promptly after their preparation but in any event not later than nine months after the close of the fiscal year to which they relate, 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 the covenants of this Loan	PA, Section 2.09(a)	Complied with.	

Covenant	Reference in Loan Agreement	Status of Compliance in PCR (Jan 2007)	PPER Assessment
Agreement), all in the English language. Each Project Executing Agency shall furnish to the Bank such further information concerning such accounts and financial statements and the audit thereof as the bank shall from time to time reasonably request.			
52. Each Project Executing Agency shall enable the Bank, upon the Bank's request, to discuss the Project Executing Agency's financial statements and its financial affairs from time to time with the Project Executing Agency's auditors, and shall authorize and require any representative of such auditors to participate in any such discussions requested by the Bank, provided that any such discussion shall be conducted only in the presence of an authorized officer of the Project Executing Agency unless the Project Executing Agency may otherwise agree.	PA, Section 2.09(b)	Complied with.	
53. Each Project Executing Agency shall enable the Bank's representatives to inspect the Project, the goods financed out of the proceeds of the Loan, all other plants, sites, works, properties and equipment of the Project Executing Agency, and any relevant records and documents.	PA, Section 2.10	Complied with.	
54. Each Project Executing Agency shall, promptly as required, take all action within its powers to maintain its corporate existence, to carry on its operations, and to acquire, maintain and renew all rights, properties, powers, privileges and franchises which are necessary in the carrying out of the Project or in the conduct of its business.	PA, Section 2.11(a)	Complied with.	
55. Each Project Executing Agency shall at all times conduct its business in accordance with sound administrative, financial, environmental and public-utility practices, and under the supervision of competent and experienced management and personnel.	PA, Section 2.11(b)	Complied with.	
56. Each Project Executing Agency shall at all times operate and maintain its plants, equipment and other property, and from time to time, promptly as needed, make all necessary repairs and renewals thereof, all in accordance with sound administrative, financial, engineering, environmental, public-utility, and O&M practices.	PA, Section 2.11(c)	Complied with.	
57. Except as the Bank may otherwise agree, the Project EAs shall not sell, lease or otherwise dispose of any of their assets which shall be required for the efficient carrying on of their operations or the disposal of which may prejudice their ability to perform satisfactory any of their obligations under this Project Agreement.	PA, Section 2.12	Complied with.	
58. Except as the Bank may otherwise agree, the Project EAs shall apply the proceeds of the Loan to the financing of expenditures on the Project in accordance with the provisions of the Loan Agreement and this Project Agreement, and shall ensure that all goods and	PA, Section 2.13	Complied with.	

Covenant	Reference in Loan Agreement	Status of Compliance in PCR (Jan 2007)	PPER Assessment
services financed out of such proceeds are used exclusively in the carrying out of the Project.			
59. Except as the Bank may otherwise agree, the Project EAs shall duly perform all their obligations under the Subsidiary Loan Agreements, and shall not take, or concur in, any action which would have the effect of assigning, amending, abrogating or waiving any rights or obligations of the parties under the Subsidiary Loan Agreements.	PA, Section 2.14	Complied with.	
60. Each Project EAs shall promptly notify the Bank of any proposal to amend, suspend or repeal and provision of its Charter and shall afford the Bank an adequate opportunity to comment on such proposal prior to taking any action thereon.	PA, Section 2.15	Complied with.	
61. PGCB and DESCO shall maintain: (i) debt service coverage ratio of at least 1.3; (ii) rate of return on equity of at least 15 percent; iii) rate of return on net fixed assets of at least 10 percent; (iv) debt/equity ratio not exceeding 70.30. Also DESCO shall maintain a collection/import ratio of at least 85 percent beginning 30 June 2000.	PA, Section 2.16	Partially complied with.	Partly complied with. For FY2008: (i) ratios for PGCB and DESCO were 2.65 and 1.62; (ii) PGCB at 19% while DESCO as at 50%; (iii) PGCB at 10% and DESCO at 29%; (iv) 75:25 and 68:32 respectively. DESCO's collection/ import ratio was 89.03%.
62. Submission of Quarterly Progress Reports.	PA, Section 2.08	Complied with.	
63. Submission of Project Completion Report six months after completion of the Project	PA, Section 2.08(c)	Delayed submission. Partially complied with.	Complied with. Completion reports submitted.

REEVALUATION OF THE FINANCIAL AND ECONOMIC INTERNAL RATES OF RETURNS

A. Basic Assumptions

1. The main objectives of the Ninth Power Project (the Project) were to (i) evacuate and use the power generated from the Meghnaghat Power Plant, and (ii) upgrade Dhaka's power distribution system. As a result of the project transmission lines and substations were constructed to evacuate power from the plant, a multiple circuit distribution system was built, and Dhaka's distribution capacity was enhanced.

2. A financial and economic analysis of the Project was carried out on an incremental basis. All prices and costs are expressed in US dollars and adjusted for inflation to second-quarter 2009 constant values. The World Bank unit value manufacturing index was used as a proxy for world price movements and to convert all prices to a 2009 base.[1] Actual transmission losses until 2009 of the Power Grid Company of Bangladesh Limited (PGCB) and distribution losses of Dhaka Electric Supply Company Limited (DESCO), Dhaka Power Distribution Company Limited[2] (DPDC), and Rural Electrification Board as obtained by the independent evaluation mission were used (Table A3.1). End-user tariffs of Tk3.805265 per kilowatt-hour (up to 2007) and Tk3.930465 per kilowatt-hour (from 2007) were also used.

Table A3.1: Transmission and Distribution Losses
(%)

Year	Transmission Loss	Distribution Loss		
		DESCO	DPDC	REB
2003	3.8	21.1	20.5	17.3
2004	3.5	19.2	26.2	15.6
2005	3.4	16.6	28.8	13.8
2006	3.4	16.2	27.1	12.7
2007	3.2	13.4	25.2	12.1
2008	3.6	10.9	21.5	11.4
2009	3.5	9.1	20.8	11.6

DESCO = Dhaka Electric Supply Company Limited, DPDC = Dhaka Power Distribution Company, REB = Rural Electrification Board.
Sources: Various annual reports, and independent evaluation mission.

3. The power generated by the Meghnaghat Power Plant as estimated by the project performance evaluation report was used. It was assumed that all power from the plant was evacuated by the project transmission facilities. The evacuated power—net of transmission losses—goes to DESCO, DPDC, and Rural Electrification Board for distribution to end-users. It was assumed that 49.8% of the power is distributed by Dhaka Electric Supply Authority (DESA), 19.9% by DESCO, and 30.4% by Rural Electrification Board, based on data from the Bangladesh Power Data Book.[3]

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[1] Available: http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1121797363539/MUV_012809.xls.

[2] DPDC, created as part of the Power Sector Reform Program, was registered on 25 October 2005 under the Companies Act (1994). DPDC took over the redefined boundaries of DESA.

[3] Ministry of Power, Energy and Mineral Resources. 2006. *Bangladesh Power Data Book*. Dhaka. Available: http://www.powerbangladesh.com/Bangladesh%20Power%20Data.pdf?bcsi_scan_D4A612CF62FE9576=mrZLgEwj5sy7kK92QOha7igAAAB4MVMn&bcsi_scan_filename=Bangladesh%20Power%20Data.pdf.

Table A3.2: Power Sold from the Meghnaghat Power Plant
(gigawatt-hours)

Year	MPP Generation	Power for Distribution	Power Sold in Dhaka		
			DESCO	DPDC	REB
2003	3,029	2,914	457	1,153	732
2004	3,013	2,908	466	1,067	746
2005	3,225	3,114	516	1,102	816
2006	2,711	2,618	436	949	695
2007	3,432	3,324	571	1,238	888
2008	3,351	3,232	572	1,262	870
2009	3,351	3,232	584	1,275	869

DESCO = Dhaka Electric Supply Company Limited, DPDC = Dhaka Power Distribution Company, MPP = Meghnaghat Power Plant, REB = Rural Electrification Board.
Sources: Meghnaghat Power Plant, various annual reports, and independent evaluation mission.

B. Financial Analysis

4. The Project's financial evaluation was carried out with financial cost flows inclusive of taxes, duties, subsidies, and physical contingencies, but exclusive of any price contingencies and interest during construction. The following general assumptions were adopted.

(i) The Project was evaluated over a 20-year period, with its benefit and cost streams held constant from 2009 to 2024.
(ii) The financial evaluation considered only the incremental revenues and costs directly associated with each part of the Project. Therefore, the revenues and costs of existing systems were not considered.
(iii) All costs and revenues are expressed in 2009 prices and in US dollars.
(iv) Capital costs included physical contingencies but excluded price contingencies and interest during construction from 1998 to 2004.
(v) An average exchange rate of Tk68.736 per $1.00 was used to convert foreign exchange costs to their local currency equivalent in May 2009.
(vi) Operating expenses, repairs, and maintenance of project assets were assumed to be 2% of capital costs, the same assumption used at project appraisal and at project completion.
(vii) The actual costs of power purchased by the distribution companies as reported in their annual reports were used. These were adjusted for inflation and assumed constant at 2009 levels until 2024.

5. The Project derives its revenue from power delivered to end-users. The actual average end-user tariff was used and assumed constant at 2009 levels until 2024.

6. Project capital expenditures included taxes and physical contingencies and were the base costs (before adjustment) set out in the economic evaluation. The capital expenditures included in the analysis were those for parts A (transmission lines and substation) and C (distribution system). Expenses incurred for parts B (consulting services for a national load dispatch center that was subsequently canceled) and D (feasibility study), which were part of the project cost but bear no impact on the delivery of power to end-users, were not included in the analysis.

7. The financial internal rate of return (FIRR) for the Project is recalculated to be 15.7% (Table A3.3), and compares well with the weighted average cost of capital[4] computed at 4.0% and the appraisal estimate of 15.0%, but is lower than the project completion estimate of 22.2%. More determined efforts to reduce transmission losses will further ensure sustainability of the Project.

Table A3.3: Financial Internal Rate of Return, Ninth Power Project
($ million, 2009 constant prices)

Year	Costs				Sales Revenue	Tax	Net Cash Flow
	Capital	Power Purchase	Operations and Maintenance	Total			
1998	6.1			6.1			(6.1)
1999	15.5			15.5			(15.5)
2000	29.7			29.7			(29.7)
2001	28.2			28.2			(28.2)
2002	24.9			24.9			(24.9)
2003	17.4	70.7	1.7	89.8	123.9	11.9	22.2
2004	4.2	76.8	2.0	83.0	126.2	15.1	28.1
2005		80.0	2.5	82.5	124.7	14.8	27.4
2006		67.4	2.5	69.9	100.9	10.8	20.1
2007		95.2	2.6	97.8	137.9	14.0	26.1
2008		113.0	2.8	115.9	148.9	11.6	21.5
2009		123.1	2.9	126.0	152.6	9.3	17.3
2010		123.1	3.0	126.1	152.6	9.3	17.3
2011		123.1	3.0	126.1	152.6	9.3	17.3
2012		123.1	3.0	126.1	152.6	9.3	17.3
2013		123.1	3.0	126.1	152.6	9.3	17.3
2014		123.1	3.0	126.1	152.6	9.3	17.3
2015		123.1	3.0	126.1	152.6	9.3	17.3
2016		123.1	3.0	126.1	152.6	9.3	17.3
2017		123.1	3.0	126.1	152.6	9.3	17.3
2018		123.1	3.0	126.1	152.6	9.3	17.3
2019		123.1	3.0	126.1	152.6	9.3	17.3
2020		123.1	3.0	126.1	152.6	9.3	17.3
2021		123.1	3.0	126.1	152.6	9.3	17.3
2022		123.1	3.0	126.1	152.6	9.3	17.3
2023		123.1	3.0	126.1	152.6	9.3	17.3
2024		123.1	3.0	126.1	152.6	9.3	17.3
						FIRR =	**15.7%**

( ) = negative, FIRR = financial internal rate of return.
Source: Independent evaluation mission.

[4] The weighted average cost of capital at appraisal was estimated at 9.1% based on the cost of ADB Asian Development Fund loan and government equity, and excluding anticipated World Bank loan that was expected to cover 20% of the project cost.

C. Economic Analysis

8. The economic benefits used to reestimate the economic internal rate of return (EIRR) comprised resource cost savings and consumer benefits of incremental consumption. Incremental sales were valued as the simple average at an estimated willingness-to-pay price and actual tariff. The willingness to pay used to estimate the incremental benefit was derived from the average of the residential and nonresidential willingness to pay. The energy available from the Meghnaghat Power Plant is estimated to remain at the 2009 level for the remaining life of the Project. The residential willingness to pay was obtained from the consumer demand curve using data on consumers' purchase of energy at different prices. The household willingness-to pay-price[5] for electricity is shown in Figure A3.

Figure A3

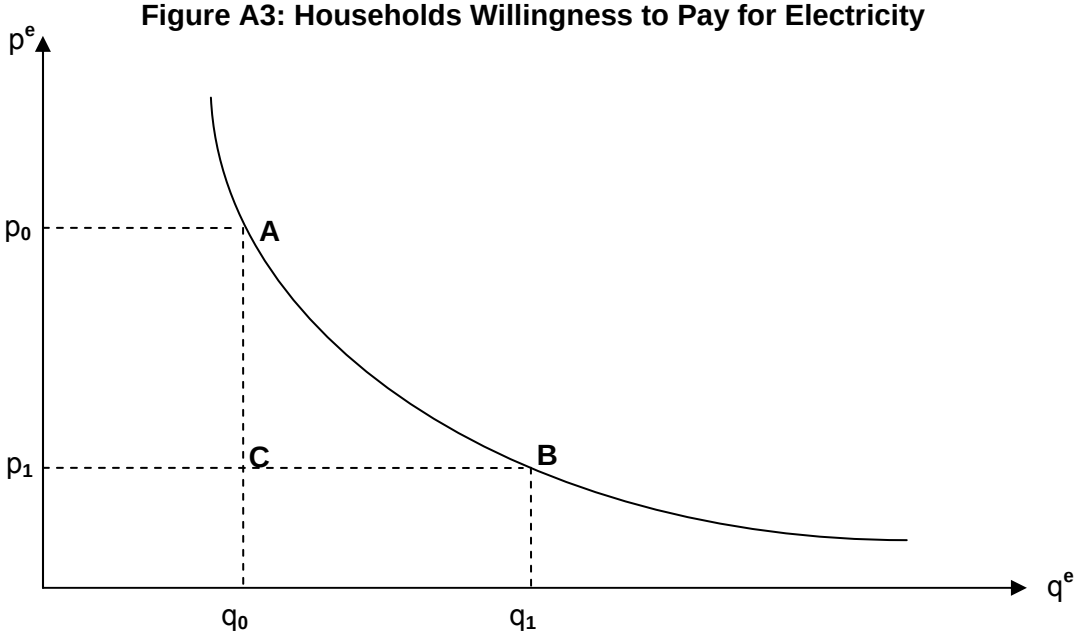
$$ln\ q^e = \alpha + \beta p^e$$

$$\beta = \frac{(\ln q_1 - \ln q_0)}{(p_1 - p_0)}$$

$$\alpha = \ln q_1 - \beta p_1$$

The economic benefit of electricity is represented by the area q^0ACq^1 or $\int_{q_0}^{q_1} p^e dq^e$. The willingness to pay of nonresidential consumers is estimated based on the operating cost of a small generator and levelized cost of a gas turbine.

Figure A3: Households Willingness to Pay for Electricity



Source: Independent evaluation mission estimates.

[5] The estimation of the households' willingness to pay draws heavily from Choynowski, Peter. 2002. *Measuring Willingness to Pay for Electricity*. Economics and Research Department Technical Note Series No. 3. Manila: Asian Development Bank.

where: q_0 = average quantity consumed of alternative sources of power
p_0 = average price paid for alternative sources of power
q_1 = quantity of electricity consumed after the project
p_1 = average price for electricity after the project

9. In estimating the household demand curve, two data points were obtained. Point B in Figure A3.2 represents the price and quantity for kerosene lighting as an indication of willingness to pay for the quantity of lighting consumed. The availability of electricity at a lower price induces households to consume more lighting than the equivalent in kerosene form. The excess electricity consumption is induced consumption and is illustrated by point C in Figure A3.2. It is further assumed that 48% of power sold under the Project is incremental consumption.

10. Resource cost savings occur from diverting the use of inefficient gas turbines, diesel generation plants, and kerosene lamps to power that has become available through the Project. It is assumed that of power sold under the Project, 45% was to gas consumers, 6% was to those connected to the grid, and 1% was to kerosene users. The resource cost savings were valued by the differences in the cost of kerosene, open-market cost of gas for a combined-cycle gas turbine power plant, and cost of diesel fuel.

11. All costs have been expressed at a constant 2009 price level. The world price numeraire was used. Traded inputs were valued at their border price equivalent values, and nontraded inputs were valued at domestic prices, which were then adjusted to the world price numeraire by multiplying by the estimated standard conversion factor of 0.97. Capital costs include physical contingencies, but exclude taxes, price contingencies, and finance charges during construction.

12. The reestimated EIRR of 13.9% (Table A3.4) is lower than project appraisal estimate of 17.1% and project completion estimate of 29.2%. It is still higher than the 12% threshold used by the Asian Development Bank. Most of the benefits accrue to residential consumers belonging to the first residential slab[6] from 100 kilowatt-hour per month down to 20 to 30 kilowatt-hour per month as first step in bringing residential tariffs closer to cost of supply, while still maintaining a life-line for the poor. The willingness-to-pay estimate implies there is considerable consumer surplus in Dhaka, which could be tapped through tariff increases or restructuring of the lifeline tariff.

[6] Tariff category for residential consumers consists of three categories. Households consuming 0 to 100 kilowatt-hours per month belong to the first consumer group or residential slab. The tariff is lowest for this category and is considered a life-line for the poor. Households consuming 101 to 400 kilowatt-hours per month belong to the second residential slab. Households consuming more than 400 kilowatt-hours per month belong to third residential slab and the highest tariff category for residential consumers.

Table A3.4: Economic Internal Rate of Return, Ninth Power Project
($ million, 2009 constant prices)

Year	Costs				Economic Benefit	Net Benefit
	Capital	Power Purchase	Operations and Maintenance	Total		
1998	5.0			5.0		(5.0)
1999	12.6			12.6		(12.6)
2000	24.2			24.2		(24.2)
2001	22.9			22.9		(22.9)
2002	20.2			20.2		(20.2)
2003	14.1	76.0	1.7	91.9	94.2	2.3
2004	3.4	85.7	2.0	91.1	96.5	5.4
2005		124.8	2.5	127.2	122.6	(4.6)
2006		84.2	2.5	86.7	103.0	16.3
2007		114.5	2.6	117.2	136.4	19.2
2008		125.2	2.8	128.1	154.6	26.6
2009		101.3	2.9	104.2	128.4	24.3
2010		101.3	2.9	104.2	128.4	24.3
2011		101.3	2.9	104.2	128.4	24.2
2012		101.3	2.9	104.2	128.4	24.2
2013		101.3	2.9	104.2	128.4	24.2
2014		101.3	2.9	104.2	128.4	24.2
2015		101.3	2.9	104.2	128.4	24.2
2016		101.3	2.9	104.2	128.4	24.2
2017		101.3	2.9	104.2	128.4	24.2
2018		101.3	2.9	104.2	128.4	24.2
2019		101.3	2.9	104.2	128.4	24.2
2020		101.3	2.9	104.2	128.4	24.2
2021		101.3	2.9	104.2	128.4	24.2
2022		101.3	2.9	104.2	128.4	24.2
2023		101.3	2.9	104.2	128.4	24.2
2024		101.3	2.9	104.2	128.4	24.2
					EIRR =	**13.9%**

( ) = negative, EIRR = economic internal rate of return.
Source: Independent evaluation mission estimates.

RESULTS OF THE CONSUMER SURVEY

A. Methodology

1. To obtain representative data for household, commercial, and industrial consumers covered by the Ninth Power Project, various areas of the Dhaka Electric Supply Authority (DESA) and Dhaka Electric Supply Company Limited (DESCO) power distribution systems were selected for inclusion in the survey, including Banashree, Dhaka–Tongi Road (Uttara), Mirpur (sections 10–11.5 and 1–10), Rampura Main Road, Shaympur, Tongi, Ullon, and Uttara (sectors 10–14).

2. Fifteen enumerators were recruited to complete the survey. Survey teams were divided into two groups, and two supervisors were engaged to oversee daily fieldwork. For the enumerators and supervisors, orientation and training was arranged describing the objectives, importance, and methodology of the survey and study. The training also focused on identification, collection, verification, and recording of data on questionnaires, as well as approaches, attitudes, and interactions with the respondents. Prior to undertaking the surveys, three draft questionnaires were pretested with a small sample of respondents.

B. Results for Household Consumers

Table A4.1: Distribution of Ownership Type

Ownership	Frequency	Percent
Own	98	47.8
Rented	107	52.2
Total	**205**	**100.0**

Source: IED survey.

Table A4.2: Distribution of Type of Dwelling House

Type of Dwelling Houses	Frequency	Percent
Pucca	180	87.8
Semi-pucca	17	8.3
Tin shed	6	2.9
Nonresponse	2	1.0
Total	**205**	**100.0**

Source: IED survey.

Table A4.3: Distribution of Monthly Average Family Income
(Tk)

Number	Valid	191
	Missing	14
	Mean	40,497.38
	Median	25,000.00
	Mode	20,000
	Minimum	4,000
	Maximum	600,000

Percentiles	10	15,000.00
	20	16,000.00
	30	20,000.00
	40	20,000.00
	50	25,000.00
	60	30,000.00
	70	35,000.00
	80	45,000.00
	90	68,000.00

Source: IED survey.

Table A4.4: Distribution of Number of Family Members

Number	Frequency	Percent
1	1	0.5
2	10	4.9
3	27	13.2
4	48	23.4
5	57	27.8
6	28	13.7
7	9	4.4
8	12	5.9
9	2	1.0
10	3	1.5
11	2	1.0
12	1	0.5
14	1	0.5
15	1	0.5
Subtotal	202	98.5
Missing	3	1.5
Total	**205**	**100.0**

Source: IED survey.

Table A4.5: Monthly Average Energy Consumption and Expenditure

Type	**Average Monthly Quantity Consumed**	**Average Price per Unit** (Tk)	**Monthly Average Cost** (Tk)
Electricity	257.14 kWh	5.35	1375.70
Kerosene	0.21 liter	43.00	9.03
Candle	13.78 pieces	5.35	73.72
Generator	0.92 liter	48.20	44.34

kWh = kilowatt-hour, Tk = taka.
Source: IED survey.

Table A4.6: Connected Load for Lighting

Type	**Rating** (watt)	**Average Quantity**	**Connected Load** (watt)
GSL	100	2.59	259.00
GSL	60	3.01	180.60
GSL	40	2.67	106.80
TL	60	4.08	244.80
CFL	11	3.91	43.01
		Total	**834.21**

CFL = compact fluorescent lamp, GSL = filament lamp, TL = florescent tube lamp.
Source: IED survey.

Table A4.7: Connected Load for Electrical Appliances

Appliance	Rating (watt)	Average Quantity	Connected Load (watt)
Fan	60	3.89	233.40
Refrigerator	120	1.15	138.00
TV	80	1.12	89.60
Computer	250	0.46	115.00
Iron	1,000	0.32	320.00
Water heater	3,500	0.04	140.00
		Total	**1,036.00**

Source: IED survey.

Table A4.8: Distribution of No. of Daily Load Shedding

No. of Daily Load Shedding	Frequency	Percent
2	2	1.0
3	30	14.6
4	50	24.4
5	53	25.9
6	41	20.0
7	21	10.2
8	8	3.9
Total	**205**	**100.0**

Source: IED survey.

Table A4.9: Distribution of Average Duration of Each Load Shedding (hours)

Hours	Frequency	Percent
0.5	2	1.0
1.0	173	84.4
1.1	1	0.5
1.2	1	0.5
1.3	16	7.8
1.5	11	5.4
2.0	1	0.5
Total	**205**	**100.0**

Source: IED survey.

Table A4.10: Distribution of Daily Total Duration of Load Shedding (hours)

Hours	Frequency	Percent	Valid Percent	Cumulative Percent
3	25	12.2	12.2	12.2
4	46	22.4	22.4	34.6
5	54	26.3	26.3	61.0
6	43	21.0	21.0	82.0
7	18	8.8	8.8	90.7
8	15	7.3	7.3	98.0
9	4	2.0	2.0	100.0
Total	**205**	**100.0**	**100.0**	

Source: IED survey.

Table A4.11: Distribution of Alternative Source of Energy Used during Load Shedding

Alternative Energy source	Frequency	Percent
Generator	13	6.3
Kerosene	4	2.0
IPS	46	22.4
Candle	85	41.5
Charger light	57	27.8
Total	**205**	**100.0**

IPS = instant power system.
Source: IED survey.

Table A4.12: Distribution of Experience of Voltage Fluctuation

Voltage Fluctuation	Frequency	Percent
Yes	130	63.4
No	75	36.6
Total	**205**	**100.0**

Source: IED survey.

Table A4.13: Distribution of Experience of Damage of Electrical Appliances due to Voltage Fluctuation

Damage of Electrical Appliances	Frequency	Percent
Yes	51	24.9
No	151	73.7
Nonresponse	3	1.5
Total	**205**	**100.0**

Source: IED survey.

Table A4.14: Distribution of Getting Any Compensation for such Damage

Received Compensation	Frequency	Percent
Yes	8	3.9
No	67	32.7
Not applicable	112	54.6
Nonresponse	18	8.8
Total	**205**	**100.0**

Source: IED survey.

Table A4.15: Distribution of Rating of Electric Supply
(reliability/quality)

Rating	Frequency	Percent
Poor	174	84.9
Fair	26	12.7
Good	2	1.0
Nonresponse	3	1.5
Total	**205**	**100.0**

Source: IED survey.

Table A4.16: Distribution of Rating of Satisfaction for Electricity Connection and/or Extension

Rating	Frequency	Percent
Very Satisfied	1	0.5
Satisfied	40	19.5
Neither Satisfied nor Dissatisfied	71	34.6
Dissatisfied	58	28.3
Very Dissatisfied	22	10.7
Nonresponse	13	6.3
Total	**205**	**100.0**

Source: IED survey.

Table A4.17: Distribution of Rating of Satisfaction for Electricity (Repairs)

Rating	Frequency	Percent
Satisfied	33	16.1
Neither Satisfied nor Dissatisfied	86	42.0
Dissatisfied	66	32.2
Very Dissatisfied	12	5.9
Nonresponse	8	3.9
Total	**205**	**100.0**

Source: IED survey.

Table A4.18: Distribution of Rating of Satisfaction for Electricity (Billing)

Rating	Frequency	Percent
Very Satisfied	7	3.4
Satisfied	101	49.3
Neither Satisfied nor Dissatisfied	14	6.8
Dissatisfied	61	29.8
Very Dissatisfied	19	9.3
Nonresponse	3	1.5
Total	**205**	**100.0**

Source: IED survey.

Table A4.19: Distribution of Rating of Satisfaction for Cost of Electricity

Rating	Frequency	Percent
Very Satisfied	5	2.4
Satisfied	86	42.0
Neither Satisfied nor Dissatisfied	14	6.8
Dissatisfied	76	37.1
Very Dissatisfied	23	11.2
Nonresponse	1	0.5
Total	**205**	**100.0**

Source: IED survey.

Table A4.20: Distribution of Willingness to Pay for More Reliable Electric Supply

Willingness	Frequency	Percent
Yes	166	81.0
No	31	15.1
Nonresponse	8	3.9
Total	**205**	**100.0**

Source: IED survey.

Table A4.21: Distribution of Affordability for Paying More for More Reliable Electric Supply

Percentage More	Frequency
0–10	84
10–20	29
20–30	24
40–50	15
50–60	4
60–70	8
70–80	3
90–100	3
Nonresponse	35
Total	**205**

Source: IED survey.

Table A4.22: Distribution of Paying Bribe to Avoid Harassment for Electricity

Bribery	Frequency	Percent
Yes	69	33.7
No	133	64.9
Nonresponse	3	1.5
Total	**205**	**100.0**

Source: IED survey.

C. Results for Commercial Consumers

Table A4.23: Distribution of Type of Business

Type	Frequency	Percent
Shop	116	56.9
Community center	4	2.0
Hotel	28	13.7
Saloon	13	6.4
Business house and/or office	16	7.8
Others	24	11.8
Nonresponse	3	1.5
Total	**204**	**100.0**

Source: IED survey.

Table A4.24: Distribution of Monthly Turnover
(Tk)

Number	Valid	200
	Missing	4
	Mean	353,115.01
	Median	150,000.00
	Mode	150,000.00
	Minimum	8,000.00
	Maximum	6,000,000.00
Percentiles	10	25,000.00
	20	35,200.00
	30	60,000.00
	40	105,000.00
	50	150,000.00
	60	180,000.00

	70	300,000.00
	80	490,000.00
	90	885,000.00

Source: IED survey.

Table A4.25: Distribution of Number of Employees

Number of Employees (range)	**Frequency**	**Percent**
1–5	158	77.5
6–10	24	11.8
11–15	11	5.4
16–20	4	2.0
21–25	2	1.0
26–30	3	1.5
36–40	2	1.0
Total	**204**	**100.0**

Source: IED survey.

Table A4.26: Monthly Average Energy Consumption and Expenditure

Type	**Average Monthly Quantity Consumed**	**Average Price per Unit** (Tk)	**Monthly Average Cost** (Tk)
Electricity	296.92 kWh	5.30	1,573.67
Kerosene	4.12 liter	43.00	177.16
Candle	9.17 pieces	5.92	54.29
Generator	26.61 liter	48.20	1,282.78

kWh = kilowatt-hour, Tk = taka.
Source: IED survey.

Table A4.27: Distribution of Average Connected Load for Lighting

Type	**Rating** (watt)	**Average Quantity**	**Connected Load** (watt)
GSL	100	2.00	200.00
GSL	60	6.08	364.80
GSL	40	5.12	204.80
TL	60	8.75	525.00
CFL	11	12.15	133.65
		Total	**1,428.25**

CFL = compact fluorescent lamp, GSL = filament lamp, TL = florescent tube lamp.
Source: IED survey.

Table A4.28: Connected Load for Electrical Appliances

Appliance	**Rating** (watt)	**Average Quantity**	**Connected Load** (watt)
Fan	60	2.72	163.20
Refrigerator	120	0.61	73.20
TV	80	0.20	16.00
Computer	250	0.26	65.00
Photostat Machine	1,500	0.06	90.00
Laminating Machine	500	0.02	10.00
Iron	1,000	0.07	70.00
		Total	**487.40**

Source: IED survey.

Table A4.29: Distribution of Number of Daily Load Shedding

No. of Daily Load Shedding	Frequency	Percent
1	1	0.5
2	7	3.4
3	43	21.1
4	45	22.1
5	47	23.0
6	35	17.2
7	12	5.9
8	8	3.9
10	2	1.0
12	2	1.0
13	1	0.5
15	1	0.5
Total	**204**	**100.0**

Source: IED survey.

Table A4.30: Distribution of Average Duration of Each Load Shedding
(hours)

Duration of Each Load Shedding	Frequency	Percent
Less than 1 hour	4	2.0
1 hour	193	94.6
2 hours	7	3.4
Total	**204**	**100.0**

Source: IED survey.

Table A4.31: Distribution of Daily Total Duration of Load Shedding
(hours)

Hours	Frequency	Percent
1	6	2.9
2	13	6.4
3	37	18.1
4	41	20.1
5	43	21.1
6	35	17.2
7	11	5.4
8	12	5.9
9	1	0.5
10	2	1.0
12	2	1.0
13	1	0.5
Total	**204**	**100.0**

Source: IED survey.

Table A4.32: Distribution of Alternative Source of Energy Used during Load Shedding

Alternative Energy Source	Frequency	Percent
Diesel generator	82	40.2
Gas generator	8	3.9
IPS	64	31.4
Kerosene lighting	1	0.5

Alternative Energy Source	Frequency	Percent
Candle	35	17.2
Nothing	11	5.4
Nonresponse	3	1.5
Total	**204**	**100.0**

IPS = instant power system.
Source: IED survey.

Table A4.33: Distribution of Experience of Voltage Fluctuation

Voltage Fluctuation	Frequency	Percent
Yes	100	49.0
No	104	51.0
Total	**204**	**100.0**

Source: IED survey.

Table A4.34: Distribution of Experience of Damage of Electrical Appliances due to Voltage Fluctuation

Damage of Electrical Appliances	Frequency	Percent
Yes	43	21.1
No	142	69.6
Nonresponse	19	9.3
Total	**204**	**100.0**

Source: IED survey.

Table A4.35: Distribution of Getting Any Compensation for Such Damage

Received Compensation	Frequency	Percent
Yes	4	2.0
No	67	32.8
Not Applicable	118	57.8
Nonresponse	15	7.4
Total	**204**	**100.0**

Source: IED survey.

Table A4.36: Distribution of Rating of Reliability/Quality of Electric Supply

Rating	Frequency	Percent
Poor	141	69.1
Fair	39	19.1
Good	14	6.9
Nonresponse	10	4.9
Total	**204**	**100.0**

Source: IED survey.

Table A4.37: Distribution of Rating of Satisfaction for New Electricity Connection/Extension

Rating	Frequency	Percent
Satisfied	50	24.5
Neither Satisfied nor Dissatisfied	49	24.0
Dissatisfied	95	46.6

Rating	Frequency	Percent
Very Dissatisfied	8	3.9
Nonresponse	2	1.0
Total	**204**	**100.0**

Source: IED survey.

Table A4.38: Distribution of Rating of Satisfaction for Electricity (Repairs)

Rating	Frequency	Percent
Very Satisfied	1	0.5
Satisfied	32	15.7
Neither Satisfied nor Dissatisfied	57	27.9
Dissatisfied	74	36.3
Very Dissatisfied	7	3.4
Nonresponse	33	16.2
Total	**204**	**100.0**

Source: IED survey.

Table A4.39: Distribution of Rating of Satisfaction for Electricity (Billing)

Rating	Frequency	Percent
Very Satisfied	4	2.0
Satisfied	100	49.0
Neither Satisfied nor Dissatisfied	27	13.2
Dissatisfied	65	31.9
Very Dissatisfied	7	3.4
Nonresponse	1	0.5
Total	**204**	**100.0**

Source: IED survey.

Table A4.40: Distribution of Rating of Satisfaction for Cost of Electricity

Rating	Frequency	Percent
Very Satisfied	2	1.0
Satisfied	67	32.8
Neither Satisfied nor Dissatisfied	24	11.8
Dissatisfied	94	46.1
Very Dissatisfied	16	7.8
Nonresponse	1	0.5
Total	**204**	**100.0**

Source: IED survey.

Table A4.41: Distribution of Willingness to Pay for More Reliable Electric Supply

Willingness	Frequency	Percent
Yes	162	79.4
No	42	20.6
Total	**204**	**100.0**

Source: IED survey.

Table A4.42: Distribution of Affordability for Paying More for More Reliable Electric Supply

Percentage More	Frequency	Percent
1–10	66	32.4
10–20	35	17.2
20–30	19	9.3
30–40	10	4.9
40–50	14	6.9
60–70	12	5.9
70–80	1	0.5
80–90	1	0.5
90–100	4	2.0
Subtotal	162	79.4
Nonresponse	42	20.6
Total	**204**	**100.0**

Source: IED survey.

Table A4.43: Distribution of Paying Bribe to Avoid Harassment for Electricity

Bribery	Frequency	Percent
Yes	64	31.4
No	140	68.6
Total	**204**	**100.0**

Source: IED survey.

Table A4.44: Distribution of Reasons for Paying Bribe to Avoid Harassment for Electricity

Reasons	Frequency	Percent
Getting New Electricity Connection	45	22.1
Getting Meter Connection	11	5.4
Billing	4	2.0
Nonresponse	144	70.6
Total	**204**	**100.0**

Source: IED survey.

D. Results for Industrial Consumers

Table A4.45: Distribution of Type of Industry (Electricity)

Types	Frequency	Percent
Plastic	4	23.6
Ready-made Garment	3	17.6
Knit Composite	2	11.8
Chemicals	2	11.8
Packaging	2	11.8
Steel	1	5.9
Sweater	1	5.9
Rubber	1	5.9
Automobile	1	5.9
Total	**17**	**100.0**

Source: IED survey.

Table A4.46: Distribution of Monthly Average Turnover (Electricity)

Number	Valid	17
	Mean	5,267,647.06
	Median	4,000,000.00
	Mode	8,000,000.00
	Minimum	250,000.00
	Maximum	20,000,000.00
Percentiles	20	420,000.00
	40	1,660,000.00
	60	6,600,000.00
	80	8,080,000.00

Source: IED survey.

Table A4.47: Distribution of Average Monthly Consumptions and Expenditure

Month	**Average Consumption** (kWh)	**Average Expenditure** (Tk)
January	15,682.40	86,168.59
February	17,214.47	89,148.21
March	18,125.20	91,905.50
April	15,473.60	76,277.46
May	16,179.73	88,234.17
June	18,053.20	100,792.50
July	17,747.13	99,067.57
August	17,338.33	94,951.93
September	17,155.33	91,088.73
October	17,768.53	95,410.15
November	20,437.80	10,7541.70
December	17,427.40	85,598.57
Total	**208,603.10**	**1,106,185.00**
Monthly Average	17,383.59	92,182.08

kWh = kilowatt-hour, Tk = taka.
Source: IED survey.

Table A4.48: Distribution of Average Connected Load

Type	**Connected Load** (kW)
Machinery	122.21
Lighting	3.69
Air Conditioner	2.79
Fans, Exhaust Fans and Blowers	3.43
Computer, Fax, etc.	0.29
Total	**132.32**

kW = kilowatt.
Source: IED survey.

Table A4.49: Distribution of Monthly Average Duration of Load Shedding (hours)

Month	**Average Duration of Load Shedding**
January	127.00
February	129.00
March	141.73
April	156.07

Month	Average Duration of Load Shedding
May	131.60
June	144.93
July	127.40
August	139.20
September	128.67
October	137.13
November	126.00
December	132.47
Total	**1,621.20**
Monthly Average	135.10
Daily Average	5.40

Source: IED survey.

Table A4.50: Distribution of Alternate Source of Energy Used during Load Shedding

Alternate Energy Source	Frequency	Percent
Using In-house Generators	15	88.2
Non-response	2	11.8
Total	**17**	**100.0**

Source: IED survey.

Table A4.51: Distribution of Monthly Average Monthly Fuel and Lubricant Cost for In-house Generation, 2008

Month	Diesel		Lubricant		Total Cost
	Litre	Cost (Tk)	Litre	Cost (Tk)	(Tk)
January	1,219.21	55,636.14	17.36	3,593.57	59,229.71
February	1,230.36	56,092.14	17.86	3,718.57	59,810.71
March	1,278.14	57,988.29	17.57	3,647.14	61,635.43
April	1,299.00	58,923.86	18.00	3,754.29	62,678.15
May	1,308.21	59,847.86	17.79	3,700.71	63,548.57
June	1,280.07	58,601.71	17.64	3,665.00	62,266.71
July	1,821.71	57,027.93	17.57	3,647.14	60,675.07
August	1,317.07	60,363.29	18.36	3,843.57	64,206.86
September	1,241.43	56,952.50	17.79	3,700.71	60,653.21
October	1,142.36	52,035.50	17.57	3,647.14	55,682.64
November	1,194.43	54,947.36	17.93	3,736.43	58,683.79
December	1,195.00	54,890.00	17.71	3,682.86	58,572.86
Total	**15,526.99**	**683,306.60**	**213.15**	**44,337.13**	**72,7643.70**
			Monthly Average Cost		**60,636.98**

Source: IED survey.

Table A4.52: Distribution of Experience of Voltage Fluctuation

Voltage Fluctuation	Frequency	Percent
Yes	15	88.2
No	2	11.8
Total	**17**	**100.0**

Source: IED survey.

Table A4.53: Distribution of Experience of Damage of Appliances Due to Voltage Fluctuation

Damage of Electrical Appliances	Frequency	Percent
Yes	14	82.4
No	3	17.6
Total	**17**	**100.0**

Source: IED survey.

Table A4.54: Distribution of Getting for Such Damage Compensation

Getting Compensation	Frequency	Percent
No	15	88.2
Nonresponse	2	11.8
Total	**17**	**100.0**

Source: IED survey.

Table A4.55: Distribution of Rating of Reliability/Quality of Electric Supply

Rating	Frequency	Percent
Poor	15	88.2
Fair	1	5.9
Nonresponse	1	5.9
Total	**17**	**100.0**

Source: IED survey.

Table A4.56: Distribution of Rating of Satisfaction for New Electricity Connection and/or Extension

Rating	Frequency	Percent
Satisfied	10	58.8
Dissatisfied	4	23.5
Very Dissatisfied	2	11.8
Nonresponse	1	5.9
Total	**17**	**100.0**

Source: IED survey.

Table A4.57: Distribution of Rating of Satisfaction for Electricity (Repairs)

Rating	Frequency	Percent
Very Satisfied	1	5.9
Satisfied	9	52.9
Dissatisfied	6	35.3
Nonresponse	1	5.9
Total	**17**	**100.0**

Source: IED survey.

Table A4.58: Distribution of Rating of Satisfaction for Electricity (Billing)

Rating	Frequency	Percent
Very Satisfied	1	5.9
Satisfied	10	58.8
Dissatisfied	1	5.9
Very Dissatisfied	4	23.5
Nonresponse	1	5.9
Total	**17**	**100.0**

Source: IED survey.

Table A4.59: Distribution of Rating of Satisfaction for Cost of Electricity

Rating	Frequency	Percent
Very Satisfied	1	5.9
Satisfied	10	58.8
Dissatisfied	3	17.6
Very Dissatisfied	2	11.8
Nonresponse	1	5.9
Total	**17**	**100.0**

Source: IED survey.

Table A4.60: Distribution of Willingness to Pay for More Reliable Electric Supply

Willingness	Frequency	Percent
Yes	14	82.4
No	3	17.6
Total	**17**	**100.0**

Source: IED survey.

Table A4.61: Distribution of Affordability for Paying More for More Reliable Electric Supply

Percentage More	Frequency	Percent
5	2	11.8
10	8	47.1
15	1	5.9
20	1	5.9
25	2	11.8
Nonresponse	3	17.6
Total	**17**	**100.0**

Source: IED survey.

Table A4.62: Distribution of Giving Bribe to Avoid Harassment for Electricity

Bribery	Frequency	Percent
Yes	2	11.8
No	14	82.4
Nonresponse	1	5.9
Total	**17**	**100.0**

Source: IED survey.

Table A4.63: Distribution of Reasons for Giving Bribe to Avoid Harassment for Electricity

Reasons	Frequency	Percent
Repairing	1	5.9
Billing	1	5.9
Nonresponse	15	88.2
Total	**17**	**100.0**

Source: IED survey.