

Validation Report
August 2017

Bangladesh: Sustainable Power Sector Development Program

Reference Number: PVR-503
Project Number: 36107-013 and 36107-023
Loan Numbers: 2332, 2333, and 2334

Independent
Evaluation 

Raising development impact through evaluation

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
EIRR	–	economic internal rate of return
FIRR	–	financial internal rate of return
km	–	kilometer
kV	–	kilovolt
MVA	–	megavolt-ampere
MW	–	megawatt
NWPGC	–	Northwest Power Generation Company Limited
OCR	–	ordinary capital resources
PCR	–	project completion report
PGCB	–	Power Grid Company of Bangladesh
PPM	–	parts per million
PPMS	–	project performance management system
RRP	–	report and recommendation of the President
WACC	–	weighted average cost of capital

NOTE

In this report, “\$” refers to US dollars.

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PROJECT BASIC DATA

Project Numbers	36107-013 and 36107-023	PCR Circulation Date	Sep 2016	
Loan Numbers	2332, 2333, and 2334	PCR Validation Date	Aug 2017	
Project Name	Sustainable Power Sector Development Program			
Sector and Subsector	Energy	Energy efficiency and conservation		
Strategic Agenda	Inclusive economic growth			
Safeguard Categories	Environment	B		
	Involuntary resettlement	A		
	Indigenous peoples	C		
Country	Bangladesh	Approved (\$ million)	Actual (\$ million)	
ADB Financing (\$ million)	ADF: 5.00 (Loan 2333)	Total Project Costs Projects Program	739.9 679.9 60.0	892.5 828.5 64.0
	OCR: 400.00 (Loan 2332) 60.00 (Loan 2334)	Loan		
		2332	400.0	369.0
		2333	5.0	3.6
		2334	60.0	64.0
		Borrower	274.9	379.4
		Beneficiaries	0.0	0.0
		Others	0.0	0.0
		KFW	0.0	37.6
		EAs	0.0	38.9
Cofinancier		Total Cofinancing	0.0	37.6
Approval Date	26 Jun 2007	Effectiveness Date	26 Sep 2007	24 Sep 2007
Signing Date		Closing Date		
2332	28 Jun 2007	Loan 2332	30 Jun 2010	22 Oct 2014
2333	28 Jun 2007	Loan 2333	30 Jun 2010	15 Apr 2014
2334	28 Jun 2007	Loan 2334	30 Jun 2008	16 Jun 2008
Project Officers	P.B. Song M. Khamudhanov A. Guha R. Murshed	Location ADB headquarters ADB headquarters ADB headquarters Resident Mission	From Jun 2007 May 2008 Nov 2009 Dec.2009	To Apr 2008 Sept 2009 Dec 2009 Dec 2010
IED Review Director	N. Subramaniam, IESP			
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ADB = Asian Development Bank; ADF = Asian Development Fund; EAs = executing agencies; IED = Independent Evaluation Department; IESP = Independent Evaluation Department, Sector and Project Division; KFW = Kreditanstalt für Wiederaufbau; OCR = ordinary capital resources; PCR = project completion report.

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I. PROJECT DESCRIPTION

A. Rationale

1. In 2000, the Government of Bangladesh issued its Vision and Policy Statement for Power Sector Reforms that set out the structural arrangements for power generation, transmission, and distribution along with principles for corporatization, commercialization, tariff regime, and private sector participation. In 2006, the government issued a 3-year road map for the reform and investment program in the power sector for 2006–2008. The road map included unbundling the electricity supply system into commercially viable generation and distribution companies.

2. In 2007, inadequate electricity supplies were a major constraint to economic growth and poverty reduction in Bangladesh. The electrification ratio was low, with only a third of the population having access to electricity. The country's per capita generation of 158 kilowatt-hours annually was among the lowest in the world. The country's dependable generating capacity was 4,120 megawatts (MW), while peak demand was about 4,700 MW. As a result, load shedding was required. In fiscal year 2005, it was in the range of 7 MW–770 MW on 287 days (affecting 1,433 hours of service). Load shedding worsened during fiscal years 2002–2005 as peak demand expanded faster than the supply capacity.

3. The power system master plan update,¹ financed by the Asian Development Bank (ADB), estimated that demand for electricity was to grow at an annual rate of 8% for the next 10 years beginning in 2005. The high growth rate of demand meant that there would be a shortfall of generation capacity of over 2,000 MW by 2010 and over 5,500 MW by 2015 if no new generating capacity were to be added. The growing demand also required increases in the capacity of the transmission system. Some areas of the country experienced frequent outages, low voltage, and maintenance problems while distribution systems in Dhaka were inadequate for current and future service. Equipment and circuit breaker protection systems were deteriorating, transformers were overloaded, few substations had backup transformers, and low voltage was a problem at substations. Many capacitors for controlling power factor were not functional and most meters were defective. These operating conditions contributed to high losses and deterioration of equipment and performance.

4. In the early 2000s, the Bangladesh Power Development Board (BPDB) and the transmission and distribution entities were not profitable. These were technically insolvent and had accumulated large debt liabilities to the government. The weak financial performance of these entities was mainly due to the absence of tariff adjustments, despite significant fuel price hikes and local currency depreciations. In 2002, the Power Grid Company of Bangladesh Limited (PGCB) took over the operation of the BPDB transmission assets and that of the Dhaka Electric Supply Authority (DESA). The Dhaka Electric Supply Company Limited (DESCO) took over distribution in parts of Dhaka City. PGCB and DESCO became profitable beginning in 2004. The Bangladesh Energy Regulatory Commission (BERC), established in 2004, had still to gain final approvals for its planned operational structure and, therefore, was unable to recruit staff, impeding its functionality.

5. Beginning in 1994 and in collaboration with other development partners, ADB provided extensive support for the reform and development of the power sector in Bangladesh. ADB strategy for the power sector in Bangladesh included expanding and upgrading the power supply

¹ ADB. 2004. *Technical Assistance to the People's Republic of Bangladesh for Preparing the Power Sector Development Program II*. Manila.

system as part of a least-cost expansion plan. The strategy also aimed to (i) change the business environment to corporatize and commercialize sector entities and increase private sector participation, (ii) improve institutional capacity in power sector entities, (iii) create new power sector companies, (iv) enlarge the scope of rural electricity cooperatives, (v) strengthen long-term planning and regulatory processes, and (vi) promote good governance. In 2007, the Board of Directors of ADB approved the Sustainable Power Sector Development Program consisting of a (i) \$60 million program loan from ADB's Special Funds, (ii) \$400 million project loan from ADB's ordinary capital resources (OCR), and (iii) \$5 million project loan from ADB's special funds.² The program was to support the government's efforts to expand the power supply system and restructure the sector. A project completion report (PCR)³ was prepared in September 2016 and is the subject of this validation.

B. Expected Impacts, Outcomes, and Outputs

6. The expected impact of the program was to promote sustained economic growth in Bangladesh by improving capacity in the power sector and reliability of power supplies. There were five expected outcomes, each with the following multiple indicators: (i) improved power sector sustainability through financial and organizational restructuring, (ii) expanded peak generation capacity and reduction of load shedding, (iii) improved power transmission capacity and reduction in transmission system losses, (iv) improved Dhaka area distribution system efficiency, and (v) institutional capacity development. Outputs were planned for each of the program and project components. Under the program component, expected outputs comprised the following: (i) a national action plan for power sector reform, (ii) fully functional legal and regulatory framework, (iii) financial restructuring of power sector entities, (iv) continued restructuring of power sector entities, and (v) increased use of public–private partnerships. Under the project component, expected outputs comprised the (i) construction of clean, natural, gas-fired power plants; (ii) construction and augmentation of transmission systems; (iii) upgrade of the distribution system in the DESA area; (iv) upgrade of the distribution system in the DESCO area; and (v) institutional capacity development.

C. Provision of Inputs

7. The three loans were signed on 28 June 2007 and declared effective on 24 September 2007. The program loan (Loan 2334–BAN [SF]) was closed on 16 June 2008, slightly ahead of the expected closing date of 30 June 2008. After three extensions, the OCR project loan (Loan 2332–BAN) was closed on 22 October 2014, 4 years and 4 months after the expected closing date of 30 June 2010 at appraisal. The ADB Special Funds project loan (Loan 2333–BAN [SF]) was closed on 15 April 2014 after two extensions, 3 years and 9 months after the expected closing date of 30 June 2010. The main cause for delay in the completion of the project loans was difficulty in acquiring the land for the substations in the Dhaka area. Bid processing time also took more than a year. Contracts for international consulting services and procurement of training equipment were delayed because of a revision to a technical assistance project proposal to ensure counterpart funds, and because of inadequate staffing at the project implementation office.

8. The \$60 million (SDR40.45 million equivalent) program loan was disbursed in two tranches, as planned. The first tranche of SDR20.23 (\$31.31 million equivalent) was disbursed on 25 September 2007 upon effectiveness and fulfillment of first tranche release conditions. The

² ADB. 2007. *Report and Recommendation of the President to the Board of Directors: Proposed Sustainable Power Sector Development Program Loan*. Manila.

³ ADB. 2016. *Completion Report: Sustainable Power Sector Development Program in Bangladesh*. Manila.

second tranche of SDR20.23 million (\$32.69 million equivalent) was disbursed on 16 June 2008. The total program budget, comprising ADB and government funds, was \$183 million at appraisal; the actual cost was \$186 million. The funds were used to support the (i) development of a 3-year reform road map and its implementation monitoring system; (ii) updating of the power sector master plan for generation and transmission; (iii) full operationalization of newly created corporate entities and the BERC, along with the finalization of licensing and tariff regulations; (iv) preparation of a financial restructuring plan for BPDB and DESA; (v) settlement of unfunded pension liabilities of newly corporatized entities (with additional budget from the government); (vi) reduction of electricity dues of the government and its various bodies to the power sector (with additional budget from the government); and (vii) a partial off-loading of PGCB and DESCO shares.

9. The \$400 million OCR project loan and the \$5 million ADB Special Funds loans were to finance the project's four physical components (Part A–D) and capacity building (Part E), which were estimated at \$679.9 million equivalent at appraisal. The actual cost was \$828.5 million, financed by \$369 million from ADB's OCR loan, \$3.6 million from ADB's Special Funds loan, grant financing from Kreditanstalt für Wiederaufbau (KfW) of €31.40 million (\$29 million equivalent),⁴ and government funds.

10. Part A (generation component) was budgeted at \$234.70 million at appraisal; actual cost was \$375.38 million. It exceeded the original cost estimate because (i) the design specifications were revised as per the updated power system master plan, which called for a baseload plant rather than a peak-load plant, and goods and services procured were 35% higher than at appraisal; (ii) owing to natural gas supply constraints, a dual-fuel (oil and natural gas) firing system was selected (along with 1 million liters in oil storage) instead of a gas-fired system; (iii) additional costs were incurred for natural gas regulating and metering stations and associated pipelines; and (iv) higher global metal prices. The total cost of Part A exceeded the estimate at appraisal by 60% and the foreign currency at 104%. ADB financing was limited to \$131.9 million (compared to a revised estimate of \$133.1 million), and the executing agency for Part A met the additional foreign currency cost by borrowing from the government. The local currency cost was lower than the appraisal estimate by 11%, as payment of taxes and duties was much lower than the appraisal estimates.

11. Part B (transmission component) was budgeted at \$186.56 million at appraisal; actual cost was \$237.86 million. Actual costs were higher because the cost of Meghnaghat–Aminbazar 400 kilovolt (kV) transmission line was 180% higher than estimated and the cost of the 230 kV and 132 kV overhead and underground transmission lines in Dhaka were higher by more than 100% due to sharp increases in metal prices. Part C (substation component) was budgeted at \$85.00 million at appraisal; the actual cost was \$102.77 million. The 40% cost overrun for Part C was also caused by higher metal prices. Part D (distribution component) was budgeted at \$164.72 million at appraisal; the actual cost was \$107.47 million. It saved substantially on foreign exchange and local costs because contracts were signed in 2008 when metal prices had declined. The local cost was 67% lower than estimated. In addition, five job lots for Part D had to be cancelled because no qualified bidders could be identified. Part E (capacity development) was budgeted at \$8.80 million at appraisal; the actual cost was \$5.02 million.

12. The two project loans provided for consulting services at appraisal for Parts A, B, and E. Part A required 34 person-months of international and 72 person-months of national consulting with expertise in design, construction, testing, and commissioning of gas-fired power generating

⁴ The KfW funds were used to finance distribution components for DESA; these components were dropped from the use of funds for the ADB loan.

plants. Actual consulting services for Part A comprised 66 person-months in international consultant services and 74 person-months national consultant services. Consulting services for Part B were estimated at 38 person-months of international and 60 person-months of national consultants with expertise in design, construction, testing, and commissioning of 400 kV transmission line and gas-insulated switchyard substations. Actual consulting services for Part B comprised 37 person-months in international consultant services and 70 person-months national consultant services. Consulting services for Part E were estimated at 150 person-months of international and 200 person-months of national consultants with expertise in various areas, including corporate and financial management, information and communication technology, long-term system planning, governance, research and development, and human resource development. Actual consulting services for Part E comprised 10 person-months in international consultant services and 12 person-months national consultant services. Another 38 person-months of national consulting services was provided under government financing. Consulting services were not included in Part D at appraisal. However, the Dhaka Power Distribution Company (DPDC) engaged consultants under KfW financing. International consultants provided 67.5 person-months of services and national consultants provided 91.6 person-months services.

13. The physical investment project was category B for environment, category A for involuntary resettlement, and category C for indigenous peoples in accordance with ADB's policies.⁵ The PGCB acquired 10 acres (about 4 hectares) of land to build a 400 kV/230 kV substation at Aminbazar, and 18 acres (about 7 hectares) to build four substations in the west. The acquisition did not affect indigenous peoples, wildlife reserves, archaeological sites, religious structures, orchards, or houses. At appraisal, the report and recommendation of the Resident (RRP) identified 60 affected households in the project areas. No resettlement was needed during implementation as PGCB rerouted transmission lines and relocated substation sites to avoid households. The PCR stated that landowners were compensated for property losses and damage to crops and trees. ADB provided no technical assistance on safeguards-related issues.

14. Environmental issues were promptly addressed during design and implementation. Power stations installed burners that produced low levels of nitrogen oxide and used transformer oil free of polychlorinated biphenyls. Recorded nitrogen oxide stack emissions were 10.1 parts per million (ppm) at Sirajganj and 12.2 ppm at Khulna plants, against a requirement of 30 ppm. Recorded noise levels at the site perimeter met the limit of 70 decibels. The Sirajganj plant met the limit of 100 micrograms per cubic meter for suspended particulate materials. However, the Khulna plant, which uses diesel fuel, had suspended particulate materials measurements of 180 micrograms per cubic meter—although given that the Khulna plant is surrounded by a number of oil-fired power generation plants, the higher value may not be attributable solely to the Khulna plant.

D. Implementation Arrangements

15. For the program loan, the borrower was the People's Republic of Bangladesh. At appraisal, the executing agencies were to be the Finance Division of the Ministry of Finance and the Power Division of the Ministry of Power, Energy and Mineral Resources, which were to be responsible for the overall coordination of the program loan during the implementation period. The PCR confirmed that the executing agencies for the program loan were as planned at appraisal.

⁵ The policies in effect at appraisal were *Environment Policy (2002)*, *Involuntary Resettlement Policy (1995)*, and *Policy on Indigenous Peoples (1998)*.

16. For the project loans, the executing agency for Part A was BPDB, then subsequently Northwest Power Generation Company Limited (NWPGC). PGCB was the executing agency for Part B, DPDC for Part C, DESCO for Part D and the Power Division of the Ministry of Power, Energy and Mineral Resources implemented Part E. These arrangements—established at appraisal—were confirmed in the PCR. BPDB established a project implementation office for the power plants at Sirajganj and Khulna and then transferred project implementation and seconded project implementation office staff to NWPGC in 2009. PGCB appointed three project directors for Part B, who reported to the chief engineer, the head of the project implementation office. DPDC established a project implementation office for project components financed by ADB and KfW. The Power Division designated the Joint Secretary (Development) as project director, but did not appoint sufficient staff to manage the project implementation office. The PCR concluded that implementation arrangements were adequate to deliver program outputs and achieve the program's purpose.

17. The government and the executing agencies complied with 23 and partly complied with 9 conditions and covenants stipulated in the loan and project agreements, and complied with all 11 conditions and covenants stipulated in the program loan. Covenants that were partly complied with were all for project loans where three were administrative covenants, four were implementation covenants, one was a financial covenant, and one was a good governance covenant. For the administrative covenants, the needs assessment report under Part E was to be submitted to ADB within 4 months of the loan effective date. This report was submitted after 6 months and required another 14 months to be finalized. The second administrative covenant that was partly complied with was all sector entities were to be incorporated. Six of the entities were incorporated and corporatized as planned. One, Northwest Zone Power Distribution Company was incorporated but the corporatization was not activated. BPDB was not corporatized; the PCR reports that BPDB resisted this process. The third covenant that was partly complied with was key officers for the Northwest Zone Power Distribution Company were to be recruited within 6 months of the effective date; recruiting was completed during November 2008–January 2009.

18. For the implementation covenants, the first partly complied with covenant was on the project performance management systems (PPMS), which should be established within 6 months of loan effectiveness to the satisfaction of ADB. These systems were established over the period January 2008–March 2012. The second covenant that was partly complied with was on the submission of quarterly progress reports, which were submitted regularly but submission was sometimes late. For the third, ADB and the executing agencies were to jointly review semi-annually the progress, however, the joint review was sometimes conducted annually, and no midterm review was conducted (as there were no major issues). The fourth covenant that was partly complied with was the submission of PCRs by each executing agency. Two completion reports were completed on schedule, while three were late.

19. The financial covenants had four elements with the same ratios required for each of NWPGC, PGCB, DPDC, and DESCO, except as specified. They are as follows: (i) operating expenses to operating revenue not higher than 85%; (ii) debt–equity ratio to not exceed 70:30; (iii) accounts receivables shall not be more than 2 months billing for PGCB and not more than 3 months billing for BPDB, DESCO, and DPDC; and (iv) debt service coverage shall not be less than 1.2 times. NPGCL complied with all ratios except in the operating ratio covenant, which was not met in 2013 and 2015 (87.67% in 2015). PGCB complied with all financial covenants. DPDC met the covenants for accounts receivable and debt service, but did not meet the operating or gearing ratios. The PCR stated that the DPDC's financial performance improved and is likely to meet financial covenants in the near future; the trend during 2013–2015 was improving. DESCO complied with all covenants except for the operating ratio, which was 90.92% in 2015. The main

reason for DPDC's and DESCO's noncompliance was thinner margins in distribution. In 2012, generation tariffs were raised by BERC by 98%, while retail tariffs were raised by 68%. The PCR reports that BERC took corrective steps in 2015 to help DPDC and DESCO to recover.

20. The governance covenant that was partly complied with was the requirement for the executing agencies to take proactive steps to prevent corruption, including the expanded use of prepaid metering and computerized billing, and in the pre-shipment inspection of goods by an independent third party. Metering and computerized billing use were expanded, and NWPGC and DPDC engaged third-party inspections, while DPDC and PGCB did not.

II. EVALUATION OF PERFORMANCE AND RATINGS

A. Relevance of Design and Formulation

21. The PCR rated the sector development program *relevant*. By financing new generation facilities, expanding transmission capability, and upgrading distribution to ensure larger and more reliable power supply, the program played an important role in developing power infrastructure in Bangladesh, particularly in the energy-starved west and in Dhaka and surrounding areas, the major power-consuming center of Bangladesh. The program was also designed to advance the government's reform initiatives for completing ongoing corporatization and regulatory measures and further unbundle BPDB's generation services. The program was aligned with the ADB country partnership strategy, which envisaged poverty reduction through economic development. At completion, the program design was found to be sound and relevant to ADB's country partnership strategy and to the government's sector reform and infrastructure development objectives. This validation concurs with the PCR and also rates the program *relevant*. The project's focus on good governance in its design and the inclusion of specific covenants to target corruption are particularly recognized.

B. Effectiveness in Achieving Project Outcomes and Outputs

22. The PCR rated the program *effective*. The five intended outcomes were largely achieved. The first outcome was to improve power sector sustainability through financial and organizational restructuring, which had six indicators. To achieve this outcome, the government approved a 3-Year Power Sector Reform Road Map (2006–2008) in 2006, which was later updated in 2007 and 2008. It also established a working group to develop a long-term power system master plan and prepare a plan for a medium-term, sector-wide capacity building program. The power system master plan was updated in 2010 and is currently being updated with external funding. The PCR did not indicate whether a long-term planning mechanism for power sector operations was established. The government approved an organizational chart and pay structure for BERC in 2006 and service regulations in 2008. It appointed commissioners to BERC in 2007. Financial self-reliance of power sector entities by 2010 was partly achieved. The PCR stated that PGCB and DESCO became self-reliant before the target date. However, the PCR indicated that the covenants for the operating ratio of DESCO were not complied with, although it had far exceeded the targeted debt-service coverage ratio. The DPDC is not self-reliant because of the impact of debt liabilities of DESA that DPDC took over.⁶ BPDB was not incorporated, but was further unbundled leading to the creation of corporatized NWPGC, which began commercial operations in 2013. The PCR states that NWPGC has become self-reliant, although it fell somewhat short of achieving the operating ratio. The government began fund-raising from local capital market for power sector development by selling shares in DESCO and PGCB. The requirement for 50% of

⁶ DESA was incorporated as the Dhaka Power Distribution Company in 2005.

new generation capacity from private sector was not achieved although the private power generation policy was adopted in 2006. In sum, the outcome to improve power sector sustainability was partly achieved in this validation's view.

23. The second outcome was to expand peak generation capacity and reduce load shedding. The Sirajganj 150 MW plant was commissioned in 2012 and the Khulna 150 MW plant was commissioned in 2013 against its targeted completion of 300 MW by 2009. Owing to delays in the commissioning of new 300 MW capacity, load shedding increased from 770 MW in 2005 to more than 1,200 MW in 2009 (affecting 2,866 hours of service), instead of reducing to 470 MW as envisaged at appraisal. Since then, there were some improvements. In 2015, the maximum load shedding was 780 MW, but the duration was only 18 hours. This validation concludes this outcome was partly achieved.

24. The third outcome was to improve power transmission capacity and reduce transmission system losses. Under the program, 960 megavolt-ampere (MVA) in transmission capacity was added, compared with the 900 MVA target. Transmission losses were reduced from 3.4% in 2005 to 3.2% by 2009, and further reduced to 2.8% in 2015. This outcome was achieved.

25. The fourth outcome was improvement in the distribution system efficiency in the Dhaka area. Distribution losses for DESCO were 9.8% in 2009, compared to a target of 12.0%, and further reduced to 8.4% in 2015. Distribution losses for DESA were 18.2% in 2009, compared to a target of 20.0%, and further reduced to 8.9% in 2015. Reliability and quality of supply improved significantly. Facilities constructed by DPDC and DESCO enabled 315,000 new connections by 2015, to bring service to over 1.13 million consumers. These investments also reduced load shedding and improved reliability and quality of supply in servicing 820,000 existing DPDC and DESCO connections. An additional 146,000 new consumers were connected by BPDB, West Zone Power Distribution Company Limited, and Rural Electrification Board in the west due to the line extensions completed by PGCB under the project. In total, 461,000 new consumers were added. This outcome was achieved.

26. The fifth outcome was institutional capacity development, specifically to enhance competitiveness of power sector entities. The PCR indicated that competitiveness of the sector was substantially enhanced by (i) training power sector personnel at home and abroad; and (ii) equipping training laboratories of sector entities with power plant simulators, testing equipment, and demonstration equipment. All sector entities introduced management information systems and regularly posted results in their respective websites. This validation deems significant progress has been made and this outcome has been achieved.

27. The program had three categories of outputs: reforms, power supply capacity expansion and efficiency improvements, and institutional capacity development. The reforms category had six outputs, each with multiple indicators. The national action plan for power sector reform output was achieved. As noted earlier, the government approved a 3-Year Power Sector Reform Road Map (2006–2008) in 2006 and the power system master plan was updated in 2006 and again in 2010. A technical project proposal for a sector-wide capacity development program was prepared and is under implementation.

28. The output for a fully functional legal and regulatory framework was achieved. The government approved the BERC organizational chart in 2006 and gazette notification of licensing regulations was issued in the same year. Gazette notification of tariff regulations was issued in 2008. The last vacant commissioner position was filled in 2007.

29. The output for financial restructuring of power sector entities was partly achieved. Financial restructuring plans for BPDB and DESA were prepared in 2006. The plan was endorsed by the National Steering Committee in 2006. In 2007, the Ministry of Finance allocated Tk2.2 billion in the budget for the settlement of unfunded pension liabilities of the newly corporatized entities. However, it was not clear in the PCR whether the allocation was sufficient to cover all unfunded pension liabilities (PCR, footnote 8). In 2007, the outstanding electricity dues of the government and its semi-autonomous agencies were Tk0.59 billion and Tk0.87 billion, respectively. However, since then, outstanding electricity dues of government increased in 2015 and stood at Tk3.87 billion, and its semi-autonomous agencies at Tk4.79 billion. These balances exceed the target set in 2007 of Tk1.0 billion and Tk2.5 billion, respectively.

30. The output to continue restructuring power sector entities was achieved. Boards of directors were constituted and management staff recruited for the DPDC and the NWPGC.

31. The output to increase public–private partnerships was achieved with the indicator for this output set as partial off-loading of government shares in PGCB and DESCO by December 2007. A 25% interest of DESCO shares and 24% of PGCB shares are now being traded on the stock market.

32. The second category of outputs—power supply capacity expansion and efficiency improvements—had four outputs, each with multiple indicators. The output of expanding clean energy capacity was achieved, with the construction of a dual-fuel firing system of 150 MW plant built in Sirajganj, commissioned in November 2012; and a 150 MW plant in Khulna, commissioned in September 2013. The government used its own funds to increase the capacity to 225 MW at Sirajganj, with the additional capacity commissioned in July 2014. The government is also increasing the capacity to 225 MW at Khulna, which the PCR expected to be commissioned in June 2016. The dual-fuel provision allows for oil use given uncertainty in the availability of natural gas.

33. The output of constructing and augmenting transmission systems was also achieved. A 54 kilometer (km), 400 kV double-circuit transmission line was commissioned in 2013 and bay expansions were commissioned in 2014. The bay expansion at the Aminbazar 230/132 kV substation was commissioned in 2012. An 8 km, 230 kV double-circuit transmission line, along with a 2X180/300 MVA, 230/132 kV GIS substation, and one 80/120 MVA, 132/33 kV GIS substation at Agargaon were commissioned in 2013. An 80/120 MVA second transformer for Agargaon 132/33 kV GIS substation was commissioned in 2014 and an 80/120 MVA second transformer for Satmasjid 132/33 kV GIS substation was commissioned in 2015. A double-circuit 132 kV Agargaon–Satmasjid transmission line and a double-circuit 132 kV Agargaon–Dhamalkot transmission line were commissioned in 2013. An 80/120 MVA transformer for Satmasjid 132 kV GIS substation was commissioned in 2014. A 132 kV, double-circuit Rampura–Ullon transmission line was commissioned in 2011. At Dhamalkot, a 132/33 kV, 2X80/120 MVA GIS substation was commissioned in 2013. In addition, 11 km of 132/33 kV underground transmission lines were constructed compared with the target of 10 km.

34. The output for the distribution system upgrade in the DESA area was achieved. Three 132 kV transmission lines for a total of 157 km and four associated 132/33 kV substations of 2X25/41 MVA capacity each were commissioned in 2010. Over 600 MVA additional distribution capacity was installed for 600,000 new connections by 2015 and over 135,000 new consumers were connected.

35. The output for the distribution system upgrade in the DESCO area was achieved. About 600 MVA substation capacity was added in Mirpur and Gulshan Zones by 2014 and more than 180,000 new consumers were connected by 2015. Distribution lines for 1,126 km were constructed compared with the target of 1,380 km.

36. The third category of outputs—institutional capacity development—had outputs to support the sector road map and capacity development, many of which link to the results discussed in the other output categories. These were substantially achieved as discussed under outcomes above. In addition to these achievements, more than 4,000 officials from various sector entities were trained in planning, engineering, procurement, construction supervision, and operation and maintenance of power supply systems.

37. The two outputs that were not achieved were the corporatization of BPDB, and the issuance of PGCB bonds on the market.

38. Overall, three of the five outcomes were achieved and two were partly achieved; and nine of 12 outputs were achieved and one partly achieved, with the program providing tangible benefits to Bangladesh's power sector. This validation also rates the program *effective*.

C. Efficiency of Resource Use

39. The PCR rated the program *efficient*. The program loan complied with all requirements of the policy matrix within the specified time frame. The PCR rated the project loans using the recalculated financial and economic performance as measured by the financial internal rate of return (FIRR) and the economic internal rate of return (EIRR) for each of the four executing agencies, corresponding to Parts A–D of the physical infrastructure projects. The four EIRR calculations in the PCR were as follows: Part A: NWGPC, 38.3%; Part B: PGCB, 29.7%; Part C: DPDC, 36.1%; and Part D: DESCO, 24.3%. The PCR stated that the EIRRs for NWGPC and DESCO were higher at completion than at appraisal because the plants were projected to produce more power, resulting in a better capacity factor, lower per-unit fuel cost, and steady consumer connection growth in DESCO areas. The EIRRs of the PGCB and DPDC components were lower than at appraisal because of cost overruns and delays that affected consumer connections.

40. This validation considers the FIRR as a measure of sustainability. Since EIRRs are calculated from a country perspective, it is incorrect to base EIRRs on specific projects that are part of an interconnected system. One EIRR should have been calculated for the program.

41. In this validation's view, the methodology used in the PCR to calculate EIRR also had several serious shortcomings. The PCR does not indicate the numeraire used in the EIRR calculation, whether it was domestic price or border price, and does not indicate the value of the shadow exchange rate factor or the standard conversion factor. The PCR also does not discuss how costs and benefits were shadow-priced or how they were classified in terms of tradables and non-tradables. The EIRRs were calculated in 2007 local currency prices; as the PCR was written in 2016, the analysis should have been in 2015 or 2016 prices.

42. The PCR assumed that all program outputs are non-tradable and that all benefits are resource cost savings. However, very few households with a service connection (whether connection was obtained before or through this program) have a 100% backup to meet all their power requirements.⁷ Therefore, a significant amount of the program output should have been

⁷ This was clarified by the project team via email dated 24 May 2017.

considered incremental and valued in terms of consumers' surplus or willingness to pay. The valuation of program benefits in terms of net revenue that included transfer prices and wheeling charges, as done in the PCR, means that benefits were financial and not economic values.

43. The assumption that resource cost savings are non-tradable is not valid. Energy displaced by the program output was primarily fuel (diesel, gasoline) used in auto-generation and kerosene for lighting. These fuels are tradable. Reduction in system losses was a direct result of the program. The PCR did not discuss how these losses were valued if, indeed, they were considered.⁸

44. The EIRR calculations in the PCR cannot be validated because of the shortcomings in the methodology. However, given the EIRR values at completion (at least twice the 12% threshold), it is likely that the program achieved EIRRs greater than 12% through its investments in the physical infrastructure of the power system. This validation rates the overall program *efficient*.

D. Preliminary Assessment of Sustainability

45. The PCR rated the program *likely sustainable*. The FIRRs for all executing agencies were above the weighted average cost of capital (WACC). For NWPGC, the FIRR was 4.6%, the WACC was 2.7%; for PGCB, the FIRR was 6.2%, WACC was 2.4%; for DPDC, the FIRR was 10.4%, WACC was 2.9%; and for DESCO, the FIRR was 9%, WACC was 1.2%.

46. The PCR noted that NWPGC is a new entity, and despite significant cost overruns as it set up a combined cycle plant for baseload operation with high capacity factor (rather than an open cycle plant for peak operation), has a FIRR that is significantly higher than WACC, although this was less at appraisal. PGCB proved its ability to maintain over 99% system availability and achieved an FIRR that is almost equal to that at appraisal because of high power flows (including those from the new baseload generation capacity). DPDC began operating on 1 July 2008 and performed satisfactorily, although its takeover of debt liabilities and employees of DESA affected its short-term financial sustainability. DESCO's operational performance in 2015 was exceptional with distribution losses at 8.4% and a collection–import ratio greater than 100% during the year.

47. This validation accepts the FIRR calculations. However, in this validation's view, PCR could have done a better assessment of the financial sustainability of the various executing agencies by assessing and providing insights on some of their underlying issues, such as tariff levels and structures, debt load, staff skills, and other concerns. The PCR also notes that one financial covenant was partly complied with, and the high level of compliance with environmental and social covenants of the two project loans. In addition, the progress made in reforming and restructuring of the power sector with support from the program loan has been sustained for more than 8 years since the program loan closed in mid-2008. In view of the above, this validation rates the overall program *likely sustainable*.

III. OTHER PERFORMANCE ASSESSMENTS

A. Preliminary Assessment of Development Impact

48. The PCR concluded that the program had a *significant* impact that increased access to electricity, reduced load shedding, and promoted economic growth. Access to electricity

⁸ System losses are technical and nontechnical; only technical system losses should be considered in the EIRR calculation. The PCR does not provide the project's contribution to reduction in technical losses.

increased to 75% against the target of 60% by 2015. As of August 2016, there was no load shedding and the economy was growing at an annual rate of 6%.

49. Reliable power supply to garment industries and agricultural pumps benefited poor women who work in these sectors. Poor and vulnerable consumers, as well as hospitals, schools, and other social facilities, also benefited from improved supply reliability. Income-generating opportunities resulted from increased access to electricity and improved governance in the power sector resulted in better service to the public. Rationalization of the tariff structure reduced subsidies to the sector and freed up government funds for social investments. The introduction of a lifeline tariff benefited poor consumers. Students benefited from longer study hours and access to information technology-based learning.

50. The program had few negative impacts from land acquisition (which was minimal) and pollutant emissions-related issues (which were promptly addressed during design and implementation). Further information is provided in paras. 13–14. This validation concurs that the development impact was *significant*.

B. Performance of the Borrower and Executing Agency

51. The PCR rated the performance of the borrower and executing agencies *satisfactory*. The borrower demonstrated strong commitment to the program and gave high priority to reforms. The government ensured sufficient counterpart funds, as well as foreign and local funds for cost overruns and land acquisition. The PCR notes the frequent changes in staff at PGCB and DPDC project implementation offices, particularly in the project director position that affected project implementation—although it did not explain how project implementation was affected. This validation concurs that the performance of the borrower and executing agencies was *satisfactory*.

C. Performance of the Asian Development Bank and Cofinanciers

52. The PCR rated the performance of ADB *satisfactory*. ADB collaborated well with the borrower and executing agencies in formulating the program and in processing the loans although the 3-year time frame for investment projects at approval was unrealistic. Delegation of the project to the Bangladesh Resident Mission enhanced interaction among ADB, the executing agencies, consultants, and contractors. ADB fielded three program and seven project review missions and interacted regularly with the borrower and the executing agencies. ADB was flexible in allowing changes to program scope and in extending loan closing dates. The KfW staff actively monitored project implementation and approved contract awards, disbursements, and variations in a timely fashion. Its performance was also *satisfactory*. This validation concurs that ADB performance was *satisfactory*.

IV. OVERALL ASSESSMENT, LESSONS, AND RECOMMENDATIONS

A. Overall Assessment and Ratings

53. The PCR rated the program *successful* on the basis that it was *relevant, effective, efficient, and likely sustainable*. It noted that the program was implemented as designed with relatively minor changes in scope. Scope changes (construction of a baseload plant instead of a peaking plant) helped manage power shortages better. The outcomes were mostly achieved and ADB interventions helped reduce transmission and distribution losses while improving access. The resulting enhanced economic activity contributed to growth in gross domestic product. The program also accelerated crucial sector reforms, such as (i) corporatizing DESA and some of

BPDB's generation assets, (ii) institutionalizing regular payments by the government and its autonomous and semi-autonomous bodies for the electricity they use, (iii) settling unfunded employee pensions, and (iv) raising funds from the market to reduce dependence on the government for power sector investments. This validation concurs with the ratings for the relevance, effectiveness, efficiency, and sustainability criteria and the overall rating of *successful*. Table 1 provides a summary of the PCR and validation ratings.

Overall Ratings

Validation Criteria	PCR	IED Review	Reason for Disagreement and/or Comments
Relevance	Relevant	Relevant	
Effectiveness	Effective	Effective	
Efficiency	Efficient	Efficient	
Sustainability	Likely sustainable	Likely sustainable	
Overall assessment	Successful	Successful	
Preliminary assessment of impact	Significant	Significant	
Borrower and executing agency	Satisfactory	Satisfactory	
Performance of ADB	Satisfactory	Satisfactory	
Quality of PCR		Less than satisfactory	

ADB = Asian Development Bank, IED = Independent Evaluation Department, PCR = project completion report.

Note: From May 2012, IED views the PCR's rating terminology of "partly" or "less" as equivalent to "less than" and uses this terminology for its own rating categories to improve clarity.

Source: ADB Independent Evaluation Department.

B. Lessons

54. The PCR identified two lessons. The first was on the need to strengthen initiatives to complete the operationalization of NWP GC and the corporatization of BPDB's south and central zones. The second was that the tariff structure needs rationalizing to provide a sufficient margin for power distribution entities to ensure financial sustainability. In this validation's view, these lessons seem more like recommendations rather than lessons. This validation has no lessons to offer.

C. Recommendations for Follow-Up

55. The PCR provided the following seven recommendations. Regular reviews should be conducted to ensure that conditions related to debt service liabilities and the transfer of land ownership to new corporate entities are met. Monitoring of technical and financial covenants should also continue. Subsidies to consumers should be made transparent and the government should compensate power sector entities providing those subsidies. Future ADB assistance to the power sector should incorporate implementation of reforms under this program or in other assistance. ADB should emphasize project readiness and the executing agencies' capacity when establishing time frames for project implementation, allowing enough time for land acquisition and procurement. Information on costs and implementation issues should be collected before project implementation offices are disbanded so that PCRs can be prepared. Executing agencies should also receive guidelines on what information ADB requires for PCRs. This validation concurs with these recommendations and has no other to offer.

V. OTHER CONSIDERATIONS AND FOLLOW-UP

A. Monitoring and Reporting

56. According to the RRP, each executing agency was required to prepare progress reports and submit these to ADB on a quarterly basis. Performance was to be evaluated on the basis of indicators and targets in the design and monitoring framework. The loan agreement specified that the executing agencies establish PPMS to monitor performance, project benefits, and progress in achieving the objectives of the project. The PCR indicated that this covenant was partly complied with. However, the PCR did not discuss the PPMS and it was not possible to assess the design, implementation, and utilization of the PPMS.

B. Comments on Project Completion Report Quality

57. The quality of the PCR is *less than satisfactory* because of the inadequate analysis and assessment of the efficiency and sustainability criteria. The calculation of the EIRR had several shortcomings, principally on the apparent absence of shadow pricing of benefits and costs, and the inadequate identification, quantification, and valuation of economic benefits. The PCR presented a restricted view of sustainability criteria—it did not consider environmental and social sustainability, did not adequately assess executing agencies' financial performance, and did not review the executing agencies' financial statements in sufficient detail. The PCR did not comment on the absence of a PPMS at the appraisal stage, which could have provided detailed information on impacts and outcomes. Lessons identified in the PCR seemed to be recommendations. However, recommendations in the PCR were satisfactory, and the PCR did provide sufficient detail of the program's projects and costs.

C. Data Sources for Validation

58. Data sources included the RRP, PCR, and mission reports.

D. Recommendation for Independent Evaluation Department Follow-Up

59. The PCR suggested that the program be evaluated beginning in 2017. If a project performance evaluation report contributes to another evaluation study, a further evaluation of the program could be undertaken.