

## SECTOR ASSESSMENT: ENERGY

### A. Introduction

1. Bangladesh is a low-lying country with a population of 163 million. It has the highest population density in the world among countries with populations of over 10 million and a high vulnerability to risks arising from climate change and natural disasters. About 35% of the population lives in urban areas and 65% in rural areas. The per capita income was \$1,827 in 2019,<sup>1</sup> well above the lower middle-income country category threshold which it crossed in fiscal year (FY) 2014. Poverty incidence declined from 44.2% in 1991 to 14.8% in 2016. Bangladesh's performance against most of the Millennium Development Goal (MDG) indicators was impressive compared with the South Asia region average.

2. Bangladesh has placed a high priority on providing modern energy services for its population, beginning with the Solar Home System (SHS) initiative in 2003. It aims to achieve universal access to electricity in 2021. However, load-shedding due to power transmission bottlenecks and distribution network overloads is still a common occurrence and a major obstacle to economic activity, although generation shortages have been eliminated as a source of power blackouts. In order to prepare for a population of 200 million or more by 2050 and to achieve a national goal of developed country status by 2041, the government plans to build a total of 60 gigawatts (GW) of new generation by 2041; i.e., three times its current nominal installed capacity and five times the current average available capacity. Bangladesh is highly reliant on heavily subsidized domestic sources of natural gas (61% of total generation) which are slowly being depleted.

3. Since the mid-1990s and in collaboration with other development partners, the Asian Development Bank (ADB) has been providing extensive support for energy sector reforms in Bangladesh and for the sustainable development of the sector. As part of its strategy for the sector, ADB has supported the corporatization and commercialization of energy entities as well as the expansion and upgrading of the power system as part of a least-cost expansion plan. ADB has been a key financier of gas and power transmission and distribution infrastructure and of the upgrading of generation efficiency through its support for combined cycle gas turbine (CCGT) power plants. ADB and the Ministry of Power, Energy and Mineral Resources are co-chairs of the Local Consultative Group for the energy sector.

4. ADB is the largest partner in the energy sector in Bangladesh (if investments in crude and refined oil infrastructure and coal power generation are excluded). The portfolio of projects approved or being implemented during the evaluation period consisted of 34 sovereign loans and grants with an approved loan and grant value of \$4.4 billion (Table C.1). These can be grouped into 16 operations, including one multitranche financing facility (MFF) with three tranches. Of these 16, eight have been closed and eight are still active. The nonsovereign portfolio contains eight investments in five projects, although five investments were cancelled; the value of the remaining three projects is \$512 million. One project has closed and the other two are active but implementation has not started. These investments are complemented by a TA portfolio of \$14.5 million across 20 TA projects, most of which have now closed, with four remaining active.

**Table C.1: Energy Portfolio for Bangladesh,  
1 January 2011–30 September 2020**

<b>Modality</b>	<b>Approved Amount (\$ million)</b>
Sovereign lending and grants	4,364.5
Technical assistance	14.5
Nonsovereign operations	763.0
<b>Total</b>	<b>4,669.0</b>

Note: Total excludes nonsovereign project cancellations.  
Source: Asian Development Bank.

<sup>1</sup> CEIC. *Bangladesh GDP per Capita*. <https://www.ceicdata.com/en/indicator/bangladesh/gdp-per-capita>

5. Bangladesh faces a number of significant energy sector challenges including:
- (i) **Meeting growing energy demand and moving to a cleaner energy mix.** Bangladesh should continue to diversify its electricity mix, but it needs to reorient its strategy away from oil and coal by focusing on gas and renewables, and by increasing energy efficiency. Given the growing demand for gas and the potential for declines in major gas fields, high priority should be given to increasing onshore and offshore gas exploration and development. Bangladesh should also reexamine its grid-based renewables targets, given new solar park models.
  - (ii) **Collaborating with neighbors on regional electricity and gas networks.** Bangladesh should continue to diversify its electricity imports while avoiding overdependence on coal-based energy from India. It should prioritize expanding gas and liquefied natural gas (LNG) trade links.
  - (iii) **Improving sector governance and the regulatory environment.** The government of Bangladesh needs to introduce more competition in the energy market, reduce subsidies, improve efficiencies in state companies, strengthen the role and competence of energy regulators, and develop a more attractive environment for private investment, particularly in domestic gas development and renewable energy.
  - (iv) **Achieving financial viability in the power sector.** Inadequate revenue generation by the distribution companies has created pressure on the Bangladesh Power Development Board (BPDB)—the power market’s single buyer—and the government, which has had to cover the losses to maintain payments to the private generators. Bangladesh needs to increase revenues while ensuring energy remains affordable for the poor. This is a huge challenge but will have to be met if the distribution system is to meet growing demand.

## 1. Findings of Previous Evaluations

6. The only previous portfolio-wide assessment of the Bangladesh energy program was a sector assistance program evaluation (SAPE) in 2009.<sup>2</sup> This found that ADB’s sector strategy and interventions were substantially aligned in their efforts to address the key challenges facing the Bangladesh energy sector and that ADB had provided appropriate assistance to address most, if not all, of the challenges. The SAPE found that ADB had contributed to achieving key development outcomes, including (i) promoting commercial orientation and corporate governance of energy sector utilities, (ii) improving the performance and reach of power and gas transmission networks, and (iii) ensuring private sector investment in power generation (Table C.2).

**Table C.1: Ratings of the Energy Sector Assistance Program Evaluation in 2009**

Criteria	Rating
Overall performance	Successful
Relevance	Highly relevant
Strategic positioning	Substantial
Efficiency	Efficient
Effectiveness	Effective
Sustainability	Likely Sustainable
Impact	Substantial

ADB = Asian Development Bank.

Source: Independent Evaluation Department.

7. The key lessons highlighted by the SAPE were: (i) programmed lending for investments linked to an agreed-upon medium-term road map for sector reforms can achieve development impacts even in difficult environments; (ii) improved corporate governance, managerial autonomy, and performance-based incentives can significantly change institutional performance even if there is no change in ownership and personnel; (iii) earlier success in attracting private foreign investments to power generation will not guarantee continued private sector investments in a country like Bangladesh with a

<sup>2</sup> Independent Evaluation Department. 2009. *Sector Assistance Program Evaluation for Bangladesh Energy Sector*. Manila: ADB.

weak investment climate; (iv) the domestic private sector is capable of investing in relatively capital-intensive new industries such as compressed natural gas (CNG) supply, if appropriate incentives and policy regimes are established; and (v) continuity of senior ADB headquarters staff and increased involvement of competent and senior national officers from the resident mission made a significant impact on the performance of ADB in delivering energy sector assistance to Bangladesh.

8. The SAPE described the Bangladesh power sector as having been in crisis in 1994–1996 because of the poor financial and operational performance of key power sector utilities. The commercial performance of the state agencies was poor as reflected by high power distribution losses, pilferage of electricity, non-collection of electricity bills, and frequent outages due to lack of maintenance of the power generation plants owned by the BPDB. The corporate culture was highly politicized; staff lacked incentives to improve performance and were constrained by bureaucratic controls. The sector was not in a position to undertake urgently required investments and, because of poor cost recovery, could not attract private investments. The gas subsector was in a better position due to the commercial orientation of the public sector entities engaged in gas production and distribution. However, it lacked the financial and technical capacity to expand production capacity to meet the anticipated increase in the demand for gas.

9. By 2009, Bangladesh had achieved significant progress in reforming the power distribution and transmission sector. The reforms improved the commercial performance of the sector by significantly reducing power distribution losses, stabilizing bill collection, and improving the operational performance of the transmission system. The electrification ratio increased from about 10% in 1994 to over 37% in 2008 and national electricity consumption more than doubled during the 1998–2008 period. However, power shortages increased during 2002–2008 due to insufficient public sector investments in power generation and a failure to attract new investments from the private sector. Although Bangladesh managed to attract significant investments from the private sector for gas exploration and increased gas production by over 100% during 1998–2008, the country again increasingly faced gas shortages due to the rapid increase in demand for gas for power generation for residential areas and for industry. Given the power sector's high degree of dependence on supply of natural gas, planning the development of the two subsectors required close coordination.

## **2. Purpose of the Sector Program Assessment**

10. This sector assessment forms part of the Independent Evaluation Department (IED) country assistance program evaluation (CAPE) for Bangladesh. The CAPE provides the ADB Board of Directors and Management with an independent assessment of ADB's past operational performance in Bangladesh. The CAPE findings and recommendations will be an input into the preparation and design of the new country partnership strategy (CPS) that will guide ADB operations in Bangladesh from 2021 to 2025. Specifically, the CAPE: (i) provides an independent assessment of the performance of ADB's country programs and identifies factors affecting performance, and (ii) draws forward-looking lessons and makes recommendations for the next CPS.

### **B. Energy Sector Context**

11. Driven by manufacturing and services, Bangladesh's gross domestic product (GDP) has grown well above the average for developing countries in recent years, averaging growth of 6.5% a year since 2010.<sup>3</sup> This has increased energy and electricity demand, and placed pressure on domestic gas resources. Bangladesh's primary energy consumption has grown at an average rate of 6.4% a year over 2007–2017. In 2018, while GDP rose by 7.9%, primary energy consumption increased by 8.6% over 2017.<sup>4</sup>

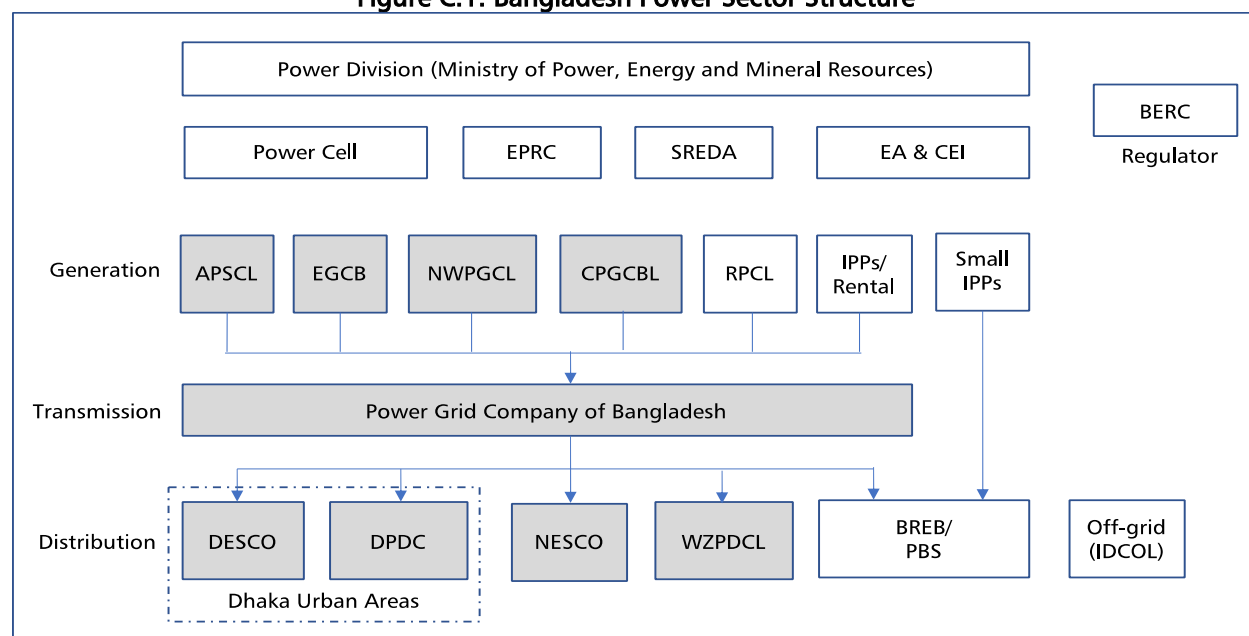
<sup>3</sup> World Bank country data at <https://data.worldbank.org/country/bangladesh>

<sup>4</sup> British Petroleum. *BP Statistical Review of World Energy 2019*. <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2019-full-report.pdf>

## 1. Institutional Structure

12. The management of the energy and electricity sector in Bangladesh is highly centralized in the Ministry of Power, Energy and Natural Resources (MPENR), as well as in several state-owned corporations (Figure C.1). The BPDB was established in 1972 as the main body responsible for electric power under the ministry. BPDB is the “single buyer” in Bangladesh’s power system. It buys power from the generators and sells it to urban distribution companies<sup>5</sup> and the Bangladesh Rural Electrification Board (BREB) cooperatives, although BPDB has not been able to pass on the full price of power to the distribution entities. Given the large rural population, the BREB was created in 1977 and the United States rural electric cooperative system model was adopted. Partial system unbundling in 1995 led to the establishment of the Power Grid Company (PGC) of Bangladesh in 1996 to manage the high-voltage transmission system. A separate division of the MPENR—the Energy and Mineral Resources Division—oversees oil and gas while PetroBangla is the main state oil and gas operator. Chevron, under contract with PetroBangla, is the largest gas producer and has been working in Bangladesh since 1989, when it was awarded contracts to develop the Bibiyana, Jalalabad, and Moulavi Bazar gas fields.<sup>6</sup>

**Figure C.1: Bangladesh Power Sector Structure**



APSCL = Alshuganj Power Station Company Limited, BERC = Bangladesh Energy Regulatory Commission, BREB = Bangladesh Rural Electrification Board, CPGCBL = Coal Power Generation Company Bangladesh Limited, DESCO = Dhaka Electric Supply Company Limited, DPDC = Dhaka Power Distribution Company Limited, EPRC = Energy and Power Research Council, EA & CEI = Electrical advisor and Chief Electrical Inspector, EGCB = Electricity Generation Company of Bangladesh, IDCOL = Infrastructure Development Company Limited, IPPs = independent power producers, NESCO = Northern Electricity Supply Company Limited, NWPGCL = North-West Power Generation Company Limited, PBS = Palli Bidyut Samity, RPCL = Rural Power Company Limited, SREDA = Sustainable and Renewable Energy Development Authority, WZPDCL = West Zone Power Distribution Company Limited.

Note: Grey boxes indicate power companies owned or participated by the Bangladesh Power Development Board (BPDB).

Source: Independent Evaluation Department, adapted from Power Sector Organogram, Power Cell website. [Accessed on 15 October 2020] <http://www.powercell.gov.bd/site/page/a3daca9f-e274-4f5e-b581-19f7c27c2e56/->

13. Bangladesh has established two energy regulatory bodies, the Bangladesh Energy Regulatory Commission (BERC), founded in 2003 to oversee tariffs and operations in electricity, gas, and oil; and the Sustainable and Renewable Energy Development Authority (SREDA), established in 2014 to promote renewable energy and energy efficiency. Both bodies are strongly influenced by the MPENR and are working to develop their capabilities and increase their autonomy. The MPENR has made some progress

<sup>5</sup> The main urban distribution companies are the Dhaka Electric Supply Company, the Dhaka Power Distribution Company, the Northern Electric Supply Company, and the West Zone Power Distribution Company. These are public limited companies.

<sup>6</sup> The Atlantic Council. 2020. *Transforming the Power Sector in Developing Countries: Geopolitics, Poverty, and Climate Change in Bangladesh*. Washington, DC.

in increasing transparency of the sector and the government has generally been good at honoring its power purchase agreements with the private sector.

14. ADB is the major partner in the sector and therefore takes a coordinating role and acts as the focal point for energy dialogue with the government of Bangladesh. All international partner activities in the energy sector are coordinated by the Local Consultative Group, led by ADB. The World Bank is also active in the sector and provides financing to increase electricity generation, transmission, and distribution capacity and was also the lead partner in the Rural Electrification and Renewable Energy Development Program (REREDP) solar home systems program, the world's largest, with some 4.2 million installations to date. The Japan International Cooperation Agency (JICA) is helping Bangladesh in planning and investments for power generation. The Global Environment Facility (GEF) has been an active supporter of REREDP and other renewable energy and energy efficiency initiatives.

## 2. National Energy Strategies and Priorities

15. The government's policies in the energy sector will be critical to the country's national security, economic development, and environmental sustainability. Energy demand in Bangladesh has been burgeoning and the country has become increasingly dependent on imported oil, and recently gas and coal, to sustain its economic growth. Although gas will remain the main source of power generation, a more diversified mix is developing and sources also include coal, nuclear, and renewable energy. Foreign financing of more than \$20 billion from the People's Republic of China (PRC), Japan, India, and Russia is expanding electricity capacity while the World Bank and the ADB have been supporting gas-to-power, transmission and distribution, and solar projects.

16. The 2016 Power System Master Plan (PSMP), sponsored by JICA, aimed at formulating an extensive energy and power development plan up to year 2041, covering energy balance, power balance, and tariff strategies. The plan projects that electricity demand will more than double over the period to 2041, rising to 236 terawatt-hours (TWh) from the 2018 level of 79 TWh, driven by the expectation of a large increase in industrial electricity consumption.<sup>7</sup>

17. The strategic priorities in the energy sector may be summarized as:

- (i) **Diversify fuels.** Given Bangladesh's heavy dependence on limited domestic gas supplies, the majority of new power supplies coming online include imported LNG, coal, nuclear, and regional electricity imports.
- (ii) **Attract financing and private sector participation.** Bangladesh is looking at a wide range of investment options to meet future requirements, including green bonds and capital from insurers, pension funds, and sovereign wealth funds. In parallel, the government has put in place several incentives to enhance independent power producer (IPP) investment and is advancing the liberalization of private involvement in gas production.<sup>8</sup>
- (iii) **Modernize grid infrastructure.** Inadequate transmission and distribution systems, particularly in the southern and western regions of the country, create bottlenecks. There are plans to build 8,000 kilometers (km) of new transmission lines and 120,000 km of new distribution lines by 2021. Very high population densities are a challenge to these new developments, especially in Dhaka.
- (iv) **Harness renewable energy resources.** Due to seasonal water flows and the limited land area, renewables are not seen as a primary contributor to the energy mix, although developments such as rooftop photovoltaic (PV) energy have potential.
- (v) **Enhance energy efficiency.** In a situation where demand exceeds available power at prevailing prices, energy efficiency improvements across the supply and demand chain can help to close the

<sup>7</sup> Government of Bangladesh. Ministry of Power, Energy and Mineral Resources. *Power System Master Plan 2016*. [https://mpemr.gov.bd/assets/media/pdf/files/FR\\_PSMP\\_revised.pdf](https://mpemr.gov.bd/assets/media/pdf/files/FR_PSMP_revised.pdf).

<sup>8</sup> PwC. 2018. *Transforming the Power Sector in Bangladesh*.

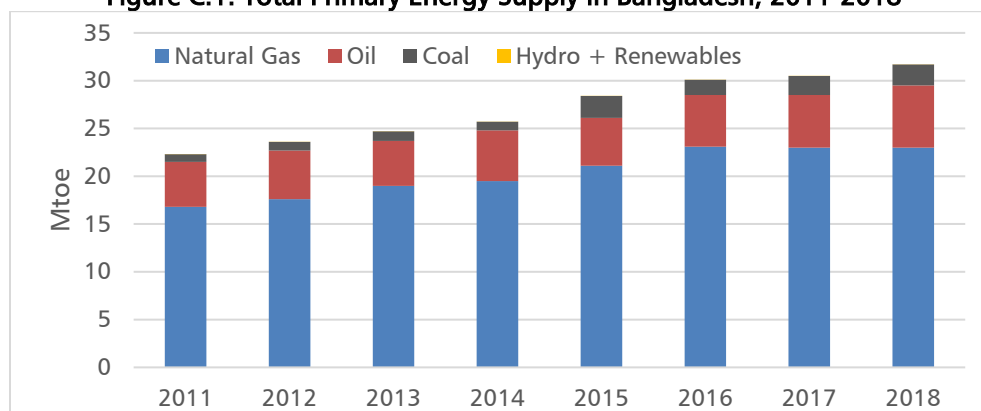
- gap. The government's Energy Efficiency Master Plan prepared by SREDA aims to reduce primary energy consumption per unit of GDP by 15% by 2021, with a target of 20% by 2030.<sup>9</sup>
- (vi) **Rationalize tariffs.** The government has recognized the need to increase gas prices, which are heavily subsidized, to the power sector. In July 2019 the regulator raised average consumer prices by 33%, with the power sector receiving a 40% increase.<sup>10</sup>
- (vii) **Expand regional cooperation for cross-border power trade.** Bangladesh intends to import power from Bhutan, India, Nepal, and Thailand (via Myanmar). Bangladesh is doubling the capacity of its interconnection with India to 1 GW, and the government and its neighbours have begun exploring potential co-investments in hydropower plants.

### 3. Evolution and Status of the Energy Sector

#### a. Oil and Gas Production

18. Figure C.2 shows the dominant position of gas and oil in Bangladesh's primary energy mix. Although Bangladesh has considerable domestic natural gas production, crude oil production in 2018 was only 3,000 barrels per day (b/d) or less than 2% of domestic oil consumption.<sup>11</sup> Bangladesh has seen crude oil and refined product import costs rise from \$3.1 billion in FY2017 to \$3.67 billion in FY2018 and an estimated \$4.85 billion in FY2019.<sup>12</sup> Although Bangladesh's gas production increased from 19.3 billion cubic meters (bcm) in 2010 to 27.5 bcm in 2018, consumption grew from 16.6 bcm to 28.4 bcm over the same period, causing gas supply shortages.<sup>13</sup>

Figure C.1: Total Primary Energy Supply in Bangladesh, 2011-2018



Mtoe = megatonnes of oil equivalent.

Notes: Primary energy supply comprises commercially-traded fuels, including modern renewables and hydropower, but excludes traditional biomass and waste fuels (e.g., charcoal, firewood, cow dung).

Source: International Energy Agency. IEA World Energy Balances 2020: available at

<https://www.iea.org/countries/Bangladesh>

19. Bangladesh's domestic onshore gas fields have long been the main source of gas for the power and industrial sectors. Gas production increased at an average annual rate of 5.7% per year in 2007–2017 and by 3.2% in 2017–2018.<sup>14</sup> Chevron's three fields have supplied about 58% of the production. After considering selling its gas assets in 2017 to Chinese investors, Chevron decided to remain in Bangladesh and to invest in maintaining production. In April 2019, the company was awarded rights to

<sup>9</sup> World Bank. 2017. *Lighting the Way: Achievements, Opportunities, and Challenges in Bangladesh's Power Sector*. Washington, DC.

<sup>10</sup> Footnote 6.

<sup>11</sup> Bangladesh Economic Indicators. TheGlobalEconomy.com, accessed November 2019. <https://www.theglobaleconomy.com/Bangladesh/oilproduction/>; and British Petroleum. *BP Statistical Review of World Energy 2019*.

<sup>12</sup> *The Daily Star*. 2018. Oil import bill to soar this year. <https://www.thedailystar.net/business/news/oil-import-bill-soar-year-1639870>.

<sup>13</sup> Footnote 3.

<sup>14</sup> Footnote 3.



explore an onshore area east of Dhaka.<sup>15</sup> This award may be a sign that the government will begin to open other onshore areas to foreign investors. However, there is concern about the potential decline in production from Chevron's Bibiyana field as well as several PetroBangla fields, and it is estimated that the country's existing gas reserves will be depleted by 2038 if no new exploration and discoveries take place. The government's efforts to encourage companies to conduct expensive offshore exploration have been unsuccessful. A new model production-sharing agreement with improved prices and allowance for exports has been prepared, but auctions for new blocks have not yet occurred.<sup>16</sup> These factors, in the face of the 6.4% growth in gas demand, have led the government to import LNG both to meet new requirements and to reduce dependence on fuel oil and high-speed diesel units, which represents about 30% of installed electricity generation capacity and have been a major drain on the government budget, since electricity retail prices do not cover these costs.

20. Bangladesh joined the ranks of LNG importers in 2018 with the connection of a floating storage regasification unit (FSRU), moored near Chittagong, with a capacity of 3.75 million tonnes per annum (mmtpa).<sup>17</sup> Bangladesh plans additional LNG import capacity to meet the needs of large, new gas combined cycle generation plants. In March 2018, a \$3 billion project by Summit Power and Mitsubishi subsidiary Diamond Gas was announced for a 1,200 megawatt (MW) unit plant based on imported LNG.<sup>18</sup>

21. Bangladesh's second FSRU arrived in April 2019. While these first two FSRUs have been installed relatively quickly despite some issues with rough waters during the monsoon season, ExxonMobil, Qatar Petroleum, and 12 other firms have expressed an interest in building Bangladesh's first onshore LNG regasification terminal with a larger 7.5 mmtpa capacity. This strong private sector interest has spurred the government to approve a new policy to allow private companies to import LNG while limiting their sales to the state company, PetroBangla.<sup>19</sup> At the same time, PetroBangla is reported to be talking with Chinese and Indian companies about building a 7.5 mmtpa onshore LNG terminal in Cox's Bazar.<sup>20</sup> In late 2019, Bangladesh announced an agreement between the Bangladesh Power Development Board (BPDB) and the Saudi private power company ACWA Power for a 3,600 MW gas-to-power complex, including an LNG import facility.<sup>21</sup>

## **b. Electricity**

22. Demand for electricity has outpaced growth in primary energy consumption. Electricity generation growth over 2007–2017 averaged a booming 9% per year.<sup>22</sup> Installed capacity had grown to about 22,562 MW by October 2019, up from a little over 4,000 MW in 2009.<sup>23</sup> However, Bangladesh's peak electricity generation was only 10,958 MW in 2018, which fell short of the peak electricity demand of 14,014 MW, resulting in outages and unserved demand, particularly in rural areas.<sup>24</sup> It is estimated

<sup>15</sup> *Chevron Human Energy*. 2019. Chevron Wins Right to Explore Huge Exploration Tract in Bangladesh. <http://phx.corporate-ir.net/phoenix.zhtml?c=66900&p=irol-pressreleaseArticle&ID=165630>.

<sup>16</sup> *The Daily Star*. 2019. IOCs can now export gas. <https://www.thedailystar.net/frontpage/international-oil-companies-can-now-export-gas-from-bangladesh-1794613>.

<sup>17</sup> *Natural Gas World*. 2018. Bangladesh Begins Regasifying LNG. <https://www.naturalgasworld.com/bangladesh-begins-regasifying-lng-63553>.

<sup>18</sup> Reuters. 2018. Summit Power to develop \$3 billion LNG-to-power Bangladesh project with Japan firms. <https://www.reuters.com/article/us-bangladesh-japan/summit-power-to-develop-3-billion-lng-to-power-bangladesh-project-with-japan-firms-idUSKCN1GPOW1>.

<sup>19</sup> *Natural Gas World*. 2019. Bangladesh Liberalises LNG Market. <https://www.naturalgasworld.com/bangladesh-liberalises-lng-market-70945>.

<sup>20</sup> *Natural Gas World*. 2019. Dhaka Looks for Firms to Build Onshore Terminal. <https://www.naturalgasworld.com/dhaka-looks-for-firms-to-build-onshore-terminal-67649>.

<sup>21</sup> *Dhaka Tribune*. 2019. Saudi ACWA signs deal with Bangladesh to set up 3,600 MW LNG-based power plants. <https://www.dhakatribune.com/bangladesh/government-affairs/2019/10/17/saudi-acwa-signs-deal-with-bangladesh-to-set-up-3-600-mw-lng-based-power-plants>.

<sup>22</sup> Footnote 3.

<sup>23</sup> Bangladesh Power Development Board. *Annual Report 2018-2019*. Dhaka.

<sup>24</sup> Centre for Policy Dialogue. 2019. The Power and Energy Sector in Bangladesh: Challenges of Moving Beyond the Transition Stage. <https://cpd.org.bd/wp-content/uploads/2019/03/The-Power-and-Energy-Sector-of-Bangladesh.pdf>.

that Bangladesh's reserves of natural gas will begin to deplete from 2020 if no new gas reserves are discovered or if technology does not allow for more efficient extraction. Consequently, the share of coal-based generation is expected to grow. The shortage of gas and the growing electricity demand have also increased the use of expensive imported diesel-oil-based generation which has increased its share of generation from 5% in 2009 to 30% in 2018.<sup>25</sup>

23. Bangladesh has achieved notable success in increasing access to electricity. A decade ago, fewer than 50% of Bangladeshis had access to electricity; today, about 83% have access to grid electricity. Furthermore, Bangladesh has implemented one of the most successful off-grid access programs in the world, providing electricity to another 10% of the population. It is expected that Bangladesh will achieve universal access to electricity long before the Sustainable Energy for All (SE4ALL) 2030 target.<sup>26</sup>

24. Regional energy cooperation has been difficult in South Asia, but Bangladesh and India have been working on forging electricity links for more than 8 years. Bangladesh imported about 8% of its power from India in 2016–2017 over the 500 kilovolt (kV), high-voltage, direct current (HVDC) line, which was put into service in October 2013 as the first grid-to-grid international transmission line in South Asia, funded by ADB.<sup>27</sup> There are plans to expand its capacity by 900 MW by 2021. The Adani Group has announced plans to build a 1,600 MW coal plant in India to sell power to Bangladesh. Bangladesh is also pursuing increased imports from hydropower facilities in Bhutan and Nepal and is forecasting steadily increasing imports of 1,200 MW by 2020, 2,500 MW by 2025, and 5,000 MW by 2030. An ambitious scheme proposes to build a 5,000 MW transmission grid connecting India's northeastern states to the rest of India through Bangladesh. In return, Bangladesh would receive 20% of the electricity.<sup>28</sup> Myanmar's huge hydropower resources and prospective offshore natural gas resources mean that it may also be a potential source of electricity and/or possibly gas in the coming decades.<sup>29</sup>

### c. Renewable Energy Generation

25. Bangladesh is yet to achieve its potential for renewable energy generation. The total installed renewable energy generation capacity is currently only 461 MW and renewable energy's share of the grid supply is only 1.5%. Most renewable energy generation comes from a single 230 MW hydropower plant developed in the 1960s. The remainder is mostly from off-grid solar homes (175 MW), two solar PV plants (31 MW), urban rooftop solar (15 MW), and biogas and biomass plants, which account for the remainder.<sup>30</sup>

26. The potential for increasing renewable energy generation in Bangladesh is significant. Resource assessments indicate a potential additional 3,666 MW of renewable energy capacity. To exploit this, the government of Bangladesh set a number of targets for adding renewable energy capacity: the 2008 National Renewable Energy Policy (2,000 MW by 2020), the 2016 Renewable Energy Development Targets (2,458 MW by 2021), and the 2016 PSMP which emphasized increasing renewable energy. Bangladesh's Nationally Determined Contribution (NDC) under the Paris Agreement on climate change sets a somewhat more conservative objective of adding 1,000 MW of solar PV and 400 MW of wind power generation by 2030. These targets all seem ambitious, given the limited progress in renewable energy deployment to date. There are a number of reasons for the slow pace, including lack of project implementation experience and institutional capacity, financing challenges, land constraints, and an inadequate information base for project development.<sup>31</sup>

<sup>25</sup> Footnote 17.

<sup>26</sup> World Bank. 2019. *Bangladesh Scaling-up Renewable Energy Project*. Washington, DC.

<sup>27</sup> ADB. 2016. *Completion Report: Bangladesh-India Electrical Grid Interconnection Project*. Manila.

<sup>28</sup> *The Hindu Business Line*. 2017. Power exports from India to meet 25% of Bangladesh demand. <https://www.thehindubusinessline.com/economy/policy/power-exports-from-india-to-meet-25-of-bangladesh-demand/article9916980.ece>.

<sup>29</sup> *Natural Gas World*. 2018. Total's Gas Find off Myanmar Moves Forward. <https://www.naturalgasworld.com/totals-gas-find-off-myanmar-moves-forward-64548>.

<sup>30</sup> World Bank. 2019. *Bangladesh Scaling-up Renewable Energy Project*. Washington, D.C.

<sup>31</sup> Footnote 23.



27. The severity of these barriers is demonstrated by the lack of progress on the unsolicited proposals for grid-tied solar and wind, which total over 1,000 MW. Power purchase agreements (PPAs) have been signed for about 600 MW of them. The project sponsors include a mix of domestic and international developers. All but one of the unsolicited proposals propose that the project be implemented on private land, which the developers have difficulty to fully secure. Only one of these projects has progressed to financial closure or implementation.<sup>32</sup>

#### d. Coal Power

28. Bangladesh's master plan envisions coal providing 40% of power generation by 2030 in the high-demand case and 34% in the low-demand case.<sup>33</sup> With financing from the People's Republic of China (PRC), India, Japan and possibly the Republic of Korea, power plants using imported coal are under construction at Rampal (1,320 MW) and Payra (1,320 MW) in southern Bangladesh, and a large 1,300 MW coal facility has been proposed for Moheshkhali Island in Cox's Bazar district, although this may be developed as a gas complex.<sup>34</sup> There have been both local and international protests against these coal plants.

29. In addition to these imported coal projects, there have been proposals for the development of a large open-pit coal mine in the Phulbari region in the northeast of the country. There have been local protests against this project due to concerns over the potential destruction of agricultural land and displacement of indigenous communities, leading the government to suspend plans for the project.<sup>35</sup> However, in early 2019, PRC companies were pursuing projects in both Phulbari and Dinajpur. An agreement has been signed between GCM Resources and the Chinese company POWERCHINA for a \$4 billion domestic coal mine and power project in Dinajpur District in northwest Bangladesh.<sup>36</sup>

30. The World Bank and other financial institutions have increasingly expressed concern over the economic sustainability of these coal projects and the financial risks they pose to the government, as in its earlier experience with the imported-oil rental plants. These coal projects are, according to a senior Bangladeshi official, likely to have a levelized cost of electricity (LCOE) of around \$0.08 per kWh, which may be higher than future gas and renewable costs.<sup>37</sup>

#### e. Nuclear Power

31. In late 2015, Russia concluded a \$11.38 billion state loan to Bangladesh for two VVER-1200 reactors at Rooppur, 87 miles west of Dhaka.<sup>38</sup> Construction started in late 2017 and the first unit is planned for completion in 2023, with a second unit 1 year later. Rosatom, the Russian state atomic energy corporation, will operate the Rooppur plant for only the first year and is training Bangladeshi operators. Bangladesh is to provide 10% of the project costs, although the full cost of the project is not clear. Based on reported loan amounts, it is reasonable to estimate that this cost will be at least \$5,000

<sup>32</sup> Footnote 23.

<sup>33</sup> Government of Bangladesh. Ministry of Power, Energy and Mineral Resources. 2018. Revisiting Power System Master Plan 2016. [https://powerdivision.portal.gov.bd/sites/default/files/files/powerdivision.portal.gov.bd/page/4f81bf4d\\_1180\\_4c53\\_b27c\\_8fa0eb11e2c1/Revisiting%20PSMP2016%20%28full%20report%29\\_signed.pdf](https://powerdivision.portal.gov.bd/sites/default/files/files/powerdivision.portal.gov.bd/page/4f81bf4d_1180_4c53_b27c_8fa0eb11e2c1/Revisiting%20PSMP2016%20%28full%20report%29_signed.pdf).

<sup>34</sup> *Power Engineering International*. 2018. \$2bn coal-fired power plant set for Bangladesh. <https://www.powerengineeringint.com/2018/05/09/2bn-coal-fired-power-plant-set-for-bangladesh/>; Institute for Energy Economics and Financial Analysis. 2019. *IEEFA Update: Bangladesh's coal expansion plans stir criticism*. <http://ieefa.org/ieefa-update-bangladeshs-coal-expansion-plans-stir-criticism/>; Source Watch. Payra power station. [https://www.sourcewatch.org/index.php/Payra\\_power\\_station](https://www.sourcewatch.org/index.php/Payra_power_station); and Source Watch. Rampal power station. [https://www.sourcewatch.org/index.php/Rampal\\_power\\_station](https://www.sourcewatch.org/index.php/Rampal_power_station)

<sup>35</sup> Sadid Nuremowla. 2016. Land, Place and Resistance to Displacement in Phulbari. *South Asia Multidisciplinary Academic Journal*. Vol 13. <https://journals.openedition.org/samaj/4113>.

<sup>36</sup> *Energy News of Bangladesh*. 2019. GCM and POWERCHINA inks \$4bn power deal. <http://energynewsbd.com/details.php?id=1327>.

<sup>37</sup> Footnote 6.

<sup>38</sup> *World Nuclear News*. 2015. Bangladesh, Russia Ink \$12.65 billion Rooppur plant deal. <http://www.world-nuclear-news.org/NN-Bangladesh-Russia-ink-12.65-billion-Rooppur-plant-deal-29121501.html>

per installed kilowatt (kW), suggesting a relatively high LCOE. In the Bangladesh Revised Power Sector Master Plan, nuclear power is projected to account for about 4% of electricity generation in 2030.<sup>39</sup>

#### 4. Sector Challenges

32. Bangladesh is ranked 94 out of 108 countries in the 2020 World Energy Council's Energy Trilemma Index.<sup>40</sup> The "energy trilemma" involves the complex tradeoffs across three core dimensions: energy security, energy equity, and environmental sustainability. Energy security can be defined as having a reliable and adequate supply of energy and resilience against shocks that may be external or internal. Energy equity concerns the accessibility and affordability of energy within a country. Environmental sustainability mainly focuses on climate change mitigation. Notably, Bangladesh ranks as one of the top performers in the world in terms of the rate of increase in modern energy access.<sup>41</sup> Bangladesh's per capita emissions of carbon dioxide (CO<sub>2</sub>) stood at 0.47 tonnes of CO<sub>2</sub> equivalent (tCO<sub>2</sub>e) in 2016, a fraction of the comparable figures for the United States (16.5 tCO<sub>2</sub>e per capita) or the PRC (7.5 tCO<sub>2</sub>e per capita). Nevertheless, with increasing industrialization and population growth, total greenhouse gas (GHG) emissions have been growing at 4%–6% per year and are poised to accelerate.<sup>42</sup>

33. Bangladesh struggles with cost recovery in the power sector, although the gap between the total revenues and operating expenses of the BPDB has narrowed. The overall net BPDB loss in FY2017 was reported to have been \$528 million.<sup>43</sup> The World Bank has estimated the cost to Bangladesh's economy of the subsidies and weak management performance in the power sector to have been about \$11.2 billion in FY2016 or 5% of GDP, in large part due to the underpricing of domestic gas.<sup>44</sup>

34. The development of a viable energy sector and an expansion of electricity access, particularly the quality and reliability of power, will be of critical importance to Bangladesh's goal of moving into the ranks of the middle-income countries by 2021. Bangladesh was ranked 105 in the 2019 Global Competitiveness Index out of 141 countries, and 68 on quality of electricity supply.<sup>45</sup> In the World Bank Doing Business indicator for 2020, Bangladesh was ranked 168 out of 190 economies and in the indicator for "Getting Electricity", it was ranked on the 176<sup>th</sup> place out of 190 economies.<sup>46</sup>

35. Bangladesh, in common with many developing member countries, faces four broad energy challenges:

- (i) **Meeting growing energy demand and moving to a cleaner energy mix.** Bangladesh needs to continue to diversify its electricity mix away from oil and coal by focusing on gas, renewables, and increased energy efficiency, particularly in buildings, equipment, and air conditioning. Given the growing demand for gas and the potential for declines in major gas fields, high priority should be given to increasing onshore and offshore gas exploration and development, including through an increase in the well-head price of gas. Bangladesh should also reexamine its grid-based renewables targets, given new solar park models with improved access to land and the potential for building-mounted solar.
- (ii) **Collaborating with neighbors on regional electricity and gas networks.** Bangladesh should continue to diversify its electricity imports while avoiding overdependence on Indian coal-based energy. It should give more priority to expanding gas and LNG trade links.

<sup>39</sup> Footnote 6.

<sup>40</sup> World Energy Council. 2020 Energy Trilemma Index. <https://trilemma.worldenergy.org/>

<sup>41</sup> World Energy Council. 2020 Energy Trilemma Country Profile: Bangladesh. <https://trilemma.worldenergy.org/#!/country-profile?country=Bangladesh&year=2020>

<sup>42</sup> <https://www.worldometers.info/co2-emissions/bangladesh-co2-emissions/>

<sup>43</sup> Bangladesh Power Development Board. 2018. *Annual Report 2016-2017*.

[http://www.bpdb.gov.bd/bpdb\\_new/resourcefile/annualreports/Annual%20Report%202016-17%20\(3\).pdf](http://www.bpdb.gov.bd/bpdb_new/resourcefile/annualreports/Annual%20Report%202016-17%20(3).pdf).

<sup>44</sup> World Bank. 2018. *In the Dark: How much do Power Sector Distortions Cost South Asia?* Washington, DC.

<sup>45</sup> World Economic Forum. 2019. *The Global Competitiveness Report 2019*. Geneva.

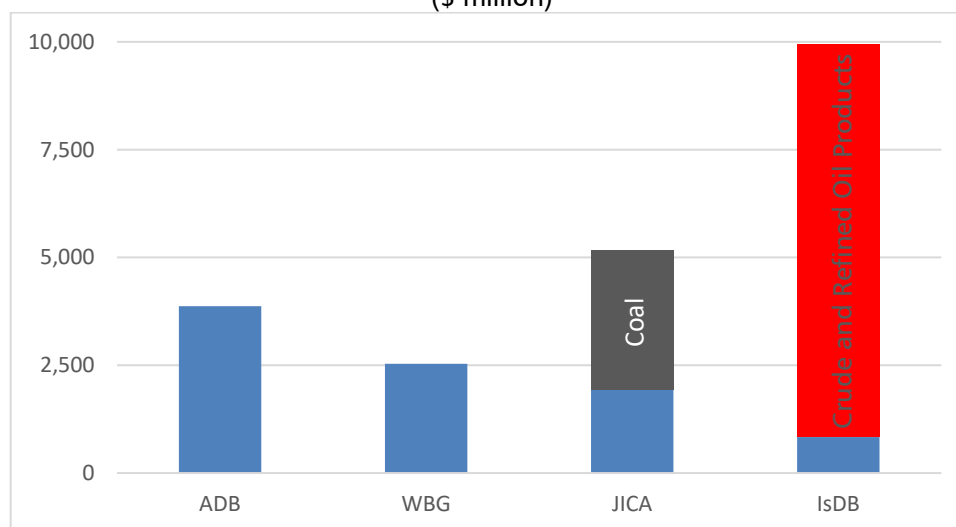
<sup>46</sup> World Bank Group. *Doing Business website: Bangladesh profile*. [online]

- (iii) **Improving sector governance and the regulatory environment.** The government needs to review its power market design in order to introduce more competition, reduce subsidies, improve efficiencies in state companies, strengthen the role and competence of energy regulators, and develop a more attractive environment for private investment, particularly in domestic gas development and renewable energy.
- (iv) **Achieving power sector financial viability.** Inadequate revenue generation by the distribution companies has created pressure on the BPDB and the government, which has had to cover the losses to maintain payments to the private generators. Bangladesh needs to increase revenues while ensuring affordability for the poor. This is a huge challenge but will be required for the modernization of the distribution system to meet growing demand.

## 5. Programs of Other Development Partners

36. In addition to ADB, other multilateral and bilateral development partner agencies also support the Bangladesh energy sector. The two largest are the Islamic Development Bank (IsDB), which is focused on the development of upstream oil and refined petroleum products, and JICA, whose focus is on coal- and gas-fired power generation (Figure C.3). If financial support to oil infrastructure and coal-fired power generation is not counted, the support of these two partners is significantly below that of ADB or the World Bank Group.

**Figure C.2: Total Approved Portfolio of Major Development Partners, 2011–2019**  
(\$ million)



ADB = Asian Development Bank, IsDB = Islamic Development Bank, JICA = Japan International Cooperation Agency, WBG = World Bank Group.

Note: This chart includes only projects approved from 2011 to 2019. The ADB column includes private sector projects, while the WBG column includes projects financed by the International Development Association and the International Finance Corporation.

Source: Independent Evaluation Department (Asian Development) and published project databases of the World Bank ([https://projects.worldbank.org/en/projects-operations/projects-list?countrycode\\_exact=BD](https://projects.worldbank.org/en/projects-operations/projects-list?countrycode_exact=BD)), International Finance Corporation (<https://disclosures.ifc.org/#/enterpriseSearchResultsHome/bangladesh>), Islamic Development Bank (<https://www.isdb.org/projects/data?loc=BD&sector=energy&status=>), and Japan International Cooperation Agency ([https://www2.jica.go.jp/en/yen\\_loan/index.php/module/search?anken\\_name=&area1=0&area2=0&area3=0&country1=70&country2=0&country3=0&section1=1&section2=0&section3=0&industry1=0&industry2=0&industry3=0&chotatsu\\_kubun=0&from\\_year=&to\\_year=&currency=jpy&submit=Search](https://www2.jica.go.jp/en/yen_loan/index.php/module/search?anken_name=&area1=0&area2=0&area3=0&country1=70&country2=0&country3=0&section1=1&section2=0&section3=0&industry1=0&industry2=0&industry3=0&chotatsu_kubun=0&from_year=&to_year=&currency=jpy&submit=Search)).

37. Other development partners include the Asian Infrastructure Investment Bank (AIIB), which has participated as a cofinancing partner with ADB, the European Investment Bank, the German development agency GIZ, the United States Agency for International Development (USAID), and several global and

bilateral cooperation funds. These agencies also support sector reform, improvements to the transmission and distribution networks, rural electrification, renewable energy development, and energy efficiency.

## C. ADB Strategy and Program

### 1. ADB Sector Strategy

38. The overarching guidance for ADB operations in Bangladesh during the evaluation period was provided by ADB's Strategy 2020, a long-term strategic framework published in 2008. This focuses on three complementary strategic agendas: inclusive growth, environmentally sustainable growth, and regional integration. Under the strategy, ADB concentrated on five "drivers of change": (i) private sector development and private sector operations, (ii) good governance and capacity development, (iii) gender equity, (iv) knowledge solutions, and (v) partnerships.<sup>47</sup>

39. ADB's energy sector framework, the Energy Policy, 2009,<sup>48</sup> was published as a policy document but also contained substantial strategic guidance. The policy was well aligned with Strategy 2020 and was anchored on three pillars: (i) promoting energy efficiency and renewable energy; (ii) maximizing access to energy for all; and (iii) promoting energy sector reform, capacity building, and governance. Support for energy efficiency improvements and renewable energy projects aimed to: (i) ease growth in fossil fuel demand and reduce the upward pressure on energy prices, (ii) improve energy security, and (iii) reduce emissions of GHGs. Efforts to provide energy services for inclusive economic growth recognized that MDG targets could not be met without access to modern energy services, and therefore access to energy was essential to reducing poverty. Effective regional cooperation in the energy sector was seen as an effective way to strengthen energy security. Energy sector reforms, capacity building, and governance were emphasized to increase investment and efficient use of resources. Private sector participation and public-private partnerships (PPPs) were encouraged to enhance energy sector efficiency through competition, and to increase investable resources, but not as the end objective of reforms.

40. The thrusts of Strategy 2020 and Energy Policy, 2009 are reflected in the objectives of the two CPSs adopted over the evaluation period. The energy-specific outcomes, investment areas and targeted outcomes highlighted in the CPSs are detailed in Appendix 2 and summarized in Table C.3.

**Table C.2: Energy-Specific Outcomes of Country Partnership Strategies, 2011-2020**

CPS, 2011–2015	CPS, 2016–2020
<b>Outcome:</b> <ul style="list-style-type: none"> <li>expanded access to power.</li> </ul>	<b>Outcomes:</b> <ul style="list-style-type: none"> <li>more efficient infrastructure;</li> <li>higher availability, reliability, and enhanced access to power supply; and</li> <li>improved energy connectivity.</li> </ul>
(i) enhance access to power, improve energy efficiency, develop a policy and regulatory setting conducive to private sector participation, boost power trade, and support green growth;	(i) support government efforts to expand power generation capacity, improve the efficiency of transmission and distribution networks, and expand regional interconnections.
(ii) support power system improvement;	
(iii) support private power projects in renewable energy, energy conservation, and other off-grid operations;	
(iv) provide capacity building support to develop model PPPs in the power sector; and	
(v) prioritize ADB's private sector operations on innovative and catalytic power projects based on gas, dual fuels, and renewable energy, as well as on developing gas fields, a liquefied natural gas terminal, and associated gas facilities.	

ADB = Asian Development Bank, CPS = country partnership strategy.  
Source: Independent Evaluation Department.

<sup>47</sup> ADB. 2008. *Strategy 2020: The Long-Term Strategic Framework of the Asian Development Bank 2008–2020*. Manila.

<sup>48</sup> ADB. 2009. *Energy Policy 2009*. Manila.

41. Overall, the composition of the Bangladesh energy portfolio was well aligned with the priorities defined in the CPSs. The portfolio consisted of 34 sovereign loans and grants that can be grouped into 16 operations, plus eight nonsovereign operations (five of which were canceled). Most of the projects were concerned with improving and expanding gas and power transmission and distribution networks for access enhancement, reliability improvement, and loss reduction; augmenting power generation capacity through the introduction of highly efficient combined cycle gas turbine power plants, including through pioneering PPP schemes; and improving power system efficiency through a combination of sector reforms and restructuring measures and upgrades to system operations and dispatch controls. The two Bangladesh–India Electrical Grid Interconnection projects were innovative investments that paved the way for the strategically vital power trade between Bangladesh and neighboring countries. The bulk of the TA portfolio consisted of project preparatory (PPTA) grants whose focus paralleled that of the investment projects. They were complemented by policy and advisory TA (PATA) and capacity development TA (CDTA) operations on IPP procurement, gas tariff reform, energy security, renewable energy investment programming, and gender equity through access enhancement. These were all CPS priorities.

42. Off-grid access was provided through investment support (for 400,000 connections) coursed through the Investment Development Company Limited (Public–Private Infrastructure Development Facility), and the Second Public-Private Infrastructure Development Facility, building on a world-leading 4.125 million household national solar home system program launched in 2003.

43. Although in general the program was highly responsive to the guidance in the CPS, two significant gaps must be noted. First, while significant barriers to grid-connected renewable energy development (e.g., land availability) are acknowledged, the level of achievement in the portfolio was only modest, consisting of a 7.4 MW solar power plant and the distribution and installation of 13,420 LED lights, financed under the Power System Efficiency Improvement Project. The nonsovereign Spectra Solar Power Project aims to install 35 MW of PV capacity on the grid west of Dhaka but was only recently approved (July 2019) and has yet to show implementation progress. Similarly, tranche 1 of the Third Public–Private Infrastructure Development Facility targets support for 182 MW of grid-connected solar IPPs with first disbursements expected in late 2017 or early 2018, but at the time of writing there was no documented progress.

44. Second, while supply-side efficiency improvements are well represented in the portfolio, demand-side energy efficiency interventions are few and far between. An attempt to pursue energy efficiency was made through the Industrial Energy Efficiency Finance Program but this was cancelled due to a lack of demand for ADB financing from the target companies (although they may have implemented energy efficiency projects using their own resources). Apart from the initial approval of the Industrial and Infrastructure Development Finance Company loan, no other banks were interested in participating. Due to the absence of a swap market in Bangladesh, it was not possible to provide local currency loans to local banks, who were unwilling to take the currency risk of a loan denominated in US dollars.<sup>49</sup> Other demand-side management ventures included a high-efficiency street lighting component under the Power System Efficiency Improvement Project, 1 million electricity pre-payment meters installed under the Power System Expansion and Efficiency Improvement Program tranche 3, and 8,600 gas pre-payment meters under the Natural Gas Access Improvement Project. A subproject covering energy efficiency in brick manufacture (a loan to Usa Agro and Auto Bricks Ltd) has been submitted for financing under the Third Public–Private Infrastructure Development Facility tranche 1.

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<sup>49</sup> ADB. 2016. *Technical Assistance Completion Report: Industrial Energy Efficiency Finance Program*. Manila.

## 2. Sector Program

45. ADB has been the lead development partner in the Bangladesh power sector since the mid-1990s. During 1993–2008, ADB assisted Bangladesh in all aspects of the government of Bangladesh’s power sector reform program, including (i) providing TA for vertical unbundling of the power sector entities and setting up new companies on a firm commercial basis for power distribution, transmission, and generation; (ii) providing investment financing for new companies established to rehabilitate distribution networks and augment transmission systems; and (iii) promoting private sector investments in power generation through TA for the solicitation process and financing of private sector investments.

46. Over 1993–2008, ADB approved \$1.76 billion in support for the energy sector. ADB lending operations consisted of 14 public sector project loans and one grant to finance nine projects, two public sector program loans, and one nonsovereign loan. The power subsector received nine loans amounting to \$1.29 billion and the gas subsector received five loans and one grant amounting to \$414.6 million. During this period, ADB also provided 19 advisory TA grants. Energy sector assistance amounted to almost 30% of total ADB lending to Bangladesh during 1993–2008.<sup>50</sup>

47. ADB’s lending, grants, and TA to the sector over the 1 January 2011–30 September 2020 evaluation period are detailed in Appendix 1. ADB was the largest development partner of the energy sector in Bangladesh, and actively supported investments in seven broad thematic areas: (i) promoting a commercial orientation for power sector entities, (ii) promoting investments in power generation, (iii) removing transmission constraints, (iv) expanding access to electricity, (v) increasing gas production capacity and mobilizing investments for gas production, (vi) improving the gas transmission and distribution network, and (vii) improving the governance and regulatory framework.

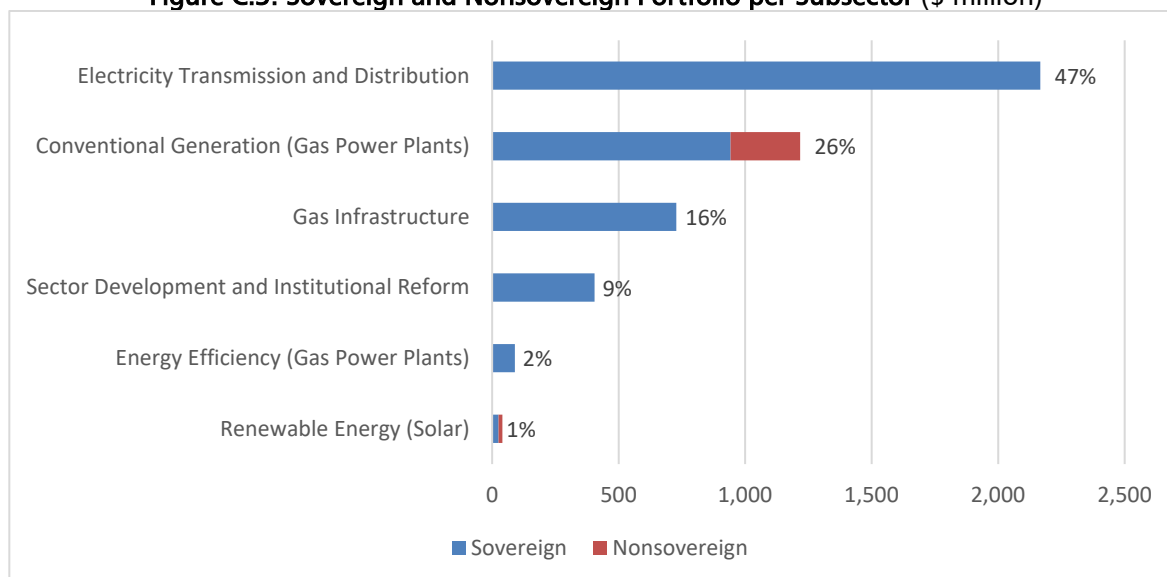
48. The portfolio consists of 34 sovereign loans and grants with a value of \$4.4 billion at approval. These can be grouped into 16 operations (including one MFF program with three tranches), of which seven have been closed, one has been cancelled, and eight remain active. The nonsovereign portfolio contains eight investments. However, five of these approved projects were subsequently cancelled; the value of the remaining three projects is \$290 million. One of the remaining three projects has closed and the other two are active but have not started implementation. These investments are complemented by a TA portfolio of \$14.5 million across 20 TA projects, of which the large majority have closed, with four remaining active.

49. By subsector, about half the approved amount of the portfolio during the evaluation period was allocated to electricity transmission and distribution (47%). This was followed by gas-fired power plants (25%), gas infrastructure (16%) and renewable energies, which were restricted to solar PV (0.9%). Private sector operations were only in gas power plants and in one solar PV project.

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<sup>50</sup> IED. 2009. *Sector Assistance Program Evaluation for Bangladesh Energy Sector*. Manila: ADB.



**Figure C.3: Sovereign and Nonsovereign Portfolio per Subsector (\$ million)**

Note: The portfolio includes active operations as well as loans closed during the evaluation period. It excludes cancelled operations.

Source: Asian Development Bank.

50. Five of the eight nonsovereign investments were cancelled. Of the approved \$373 in ordinary capital resources (OCR) loans, \$60 million in equity, and \$330 million in guarantees, only \$290 million<sup>51</sup> in active loans remain. Various reasons account for the cancellations:

- (i) The \$57.5 million equity investment (\$46 million from ADB and \$11.5 million from the Leading Asia's Private Infrastructure Fund [LEAP]) in the private firm Summit Power International Limited was executed in April 2018 but the 60-day availability period lapsed and the investment was later cancelled. The planned initial public offering (IPO) on the Singapore Stock Exchange (SGX) was delayed and then cancelled.
- (ii) Loans totaling \$30 million for the Industrial Energy Efficiency Finance Program approved in December 2011 (\$6 million to the Industrial and Infrastructure Development Finance Company and \$24 million to Prime Bank Limited) were cancelled in 2015 with no disbursements, due to the deteriorating financial health of both intermediary financing institutions.
- (iii) The \$330 million in partial risk guarantees and \$253 million in OCR loans that was approved in November 2017 to Reliance Bangladesh LNG and Power Limited and Reliance Bangladesh LNG Terminal Limited were restructured due to a project change of scope (the LNG terminal was cancelled). The current project structure involves a \$100 million OCR loan and the administration of a \$100 million loan from LEAP.

<sup>51</sup> The remaining \$290 million consists of: (i) \$75 million for Summit Bibiyana II Power Company Limited (Bibiyana II Gas Power Project); (ii) \$200 million for Reliance Bangladesh LNG And Power Limited (Reliance Bangladesh Liquefied Natural Gas and Power) made up of a \$100 million OCR loan and administration of a \$100 million loan from Leading Asia's Private Infrastructure Fund (LEAP) ; and, (iii) \$15 million for Spectra Solar Park Limited (Spectra Solar Power).

## D. Evaluation of ADB Support

51. The assessment evaluated the performance of the energy portfolio against five criteria: relevance, efficiency, effectiveness, sustainability, and development impact.<sup>52</sup>

52. The assessment of the performance of ADB sovereign support to the energy sector was based on 34 sovereign loans and grants, 11 of which have closed and one of which was canceled. Nine loans had a project completion report (PCR), all of which rated the project *successful*. Six PCRs were validated, with the rating confirmed in each case. Of the 20 assessed TA projects, 16 had been completed and nine had TA completion reports.

53. Of the 20 TA activities, 11 (55%) were PPTA activities directly related to the preparation of the investment portfolio, including one for a nonsovereign loan. Of the balance, CDTA was the main type of TA, followed by PATA.

54. ADB's nonsovereign operations included eight investments, of which five were canceled and three are active. One ongoing project was the subject of an extended annual review report (XARR), which rated the project *successful*, although it has not yet been independently evaluated.

### 1. Relevance

55. ADB's sovereign and nonsovereign support for the Bangladesh energy program was relevant in terms of its alignment with national priorities and consistency with ADB's sector and country strategies, the government's sector plans and partner coordination. The relevance of the design and modality as well as support for capacity development were also considered.

56. At the strategic level, ADB's Strategy 2020 sought to help developing member countries meet their growing energy demands in a sustainable manner by: (i) supporting an expansion of the energy supply through rehabilitated and expanded transmission and distribution facilities; (ii) promoting energy efficiency through supply-side and demand-side measures; (iii) supporting clean energy; and (iv) facilitating the removal of policy, institutional, regulatory, technological, and legal constraints on promoting efficient energy use and promoting regional cooperation.

#### a. Relevance of Sovereign Operations

57. The Gas Transmission and Development Project played a vital role in improving the energy infrastructure, connecting the energy-starved western region and catering to the need for energy in the rapidly growing industrial and commercial zones around Dhaka by constructing 345 km of gas transmission pipelines and 270 km of gas distribution pipelines. The design and formulation of the project were consistent with a poverty reduction strategy paper of 2005, since the project aimed to enhance natural gas production and distribution to promote industrialization and ensure equitable distribution of benefits. At completion, the project was aligned with the government's Seventh Five-Year Plan, 2016–2020, which targeted higher, sustainable, and inclusive growth through a continued focus on natural gas infrastructure. At appraisal, the project was aligned with the ADB country strategy and program (CSP), 2004–2006 and continued to be aligned with the ADB CPS, 2016–2020, which prioritized easing infrastructure constraints in key sectors such as energy. The project is consistent with ADB's Energy Policy, 2009. The project is rated *relevant*.<sup>53</sup>

58. The Sustainable Power Development Program, by financing new generation facilities, expanding transmission capability, and upgrading distribution to ensure a larger and more reliable power supply, played an important role in developing the power infrastructure in Bangladesh, particularly in the major

<sup>52</sup> IED. 2015. *Guidelines for the Preparation of Country Assistance Program Evaluations and Country Partnership Strategy Final Review Validations*. Manila: ADB.

<sup>53</sup> ADB. 2019. *Completion Report: Bangladesh Gas Transmission and Development Project*. Manila.

power-consuming centers. The program was also designed to advance the government's ongoing reform initiatives for corporatization and regulatory measures and to support the unbundling of BPDB's generation services. At completion, the program design was found to be sound and relevant to ADB's CPS and to the government's sector reform and infrastructure development objectives. The PCR, the IED validation and this assessment rate 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.<sup>54</sup>

59. The Power Sector Development Program aimed to improve the power supply, particularly in the northwestern region of the country, which lagged behind the rest of Bangladesh in generation and transmission capability, by: (i) adding two 100 megawatt (MW) of gas-based peaking generation capacity to replace old and inefficient power plants; (ii) constructing a national load dispatch center, to ensure economic dispatch and rationalize regional power supply; and (iii) upgrading distribution systems in the northwest region. The reforms under the program were expected to improve the financial and operating performance of the power sector by converting the BPDB and the Dhaka Electric Supply Authority (DESA) into corporate bodies, changing the business culture, building long-term institutional capacity, and encouraging private sector participation. The creation of the Electricity Generation Company of Bangladesh (EGCB) and the North-West Zone Power Distribution Company (NWZPDCL) were intended to be part of efforts to unbundle BPDB's generation and distribution systems. The program design supported the government's efforts to restructure the power sector, accelerate economic growth, and create jobs. At completion, the program design was assessed to have been *relevant* to the ADB CPS and the sector reform objectives of the government.<sup>55</sup>

60. The principal component of the ongoing Power System Efficiency Improvement Project aims to increase the electricity generation capacity of Bangladesh through the installation of a highly efficient 450 MW combined cycle gas turbine (CCGT) power plant. Other components financed the construction of a 7.4 MW grid-connected solar power plant, solar streetlights, and 2000 solar irrigation systems. Given the need to conserve Bangladesh's scarce gas resources through efficient conversion, the rapid growth in power demand, the poor service reliability particularly in rural areas, and the need to begin diversifying the country's energy supplies, the project was clearly relevant to addressing a range of pressing power sector challenges.<sup>56</sup> Similarly, the Rupsha 800-Megawatt Combined Cycle Power Plant Project is on track to add an additional 800 MW of high-efficiency gas-to-electricity capacity and the project was relevant for the same reasons.<sup>57</sup> Both projects are rated *relevant*.

61. The Natural Gas Access Improvement Project, now nearly completed, targets the expanded capacity and improved efficiency of natural gas production, transmission and distribution, and also begins to address gas demand-side management through the introduction of pre-paid and remote metering and energy conservation feasibility studies for industrial and commercial consumers. Gas is the largest fuel source for power generation and a driver of process industries, including fertilizer manufacture, yet gas remains in scarce supply due to the steady depletion of domestic reserves. This evaluation considers the project *relevant*.<sup>58</sup> The similarly structured Natural Gas Infrastructure and Efficiency Improvement Project extends and amplifies the efficiency of gas production and gas transmission upgrades and is also rated *relevant*.<sup>59</sup>

62. The PCR and IED validation for the Public-Private Infrastructure Development Facility both rated the facility *relevant* at appraisal and at completion. The facility was in line with government's Sixth Five-Year Plan, FY2011–FY2015, which envisaged an increase in infrastructure delivery with private sector investment from 2% to 6% of GDP during the plan period. The facility was aligned with the ADB CSP, 2006–2010 for Bangladesh which supported PPPs and private-sector-led infrastructure development.

<sup>54</sup> IED. 2017. *Validation Report: Bangladesh Sustainable Power Sector Development Program*. Manila: ADB.

<sup>55</sup> ADB. 2013. *Completion Report: Bangladesh Power Sector Development Program*. Manila.

<sup>56</sup> Based on a review of the Power System Efficiency Improvement Project Report and Recommendation of the President (RRP) and the Project Assessment Sheet.

<sup>57</sup> Based on a review of the Rupsha 800-Megawatt Combined Cycle Power Plant Project RRP and the Project Assessment Sheet.

<sup>58</sup> Based on a review of the Natural Gas Access Improvement Project RRP and the project assessment sheet.

<sup>59</sup> Based on a review of the Natural Gas Infrastructure and Efficiency Improvement Project RRP and the project assessment sheet.

During implementation, the scope of the facility was changed, with \$45 million being reallocated from the infrastructure small and medium-sized enterprise (SME) component to the Solar Home System (SHS) component, bringing total support for SHS to \$78 million.<sup>60</sup> An additional \$10 million in financing for the SHS was provided under the Second Public–Private Infrastructure Development Facility.<sup>61</sup> The reallocation of funds and the additional support boosted the penetration of electricity to off-grid populations in rural areas, which had the effect of heightening the project’s responsiveness to the mandate of the Energy Policy, 2009 to prioritize the provision of modern energy for poor and isolated populations. This evaluation concurs with the judgment that these projects were *relevant*.

63. The Power System Expansion and Efficiency Improvement Investment Program is being rolled out as an MFF with three tranches. The program addresses a wide range of investments to increase the efficiency of the Bangladesh power system. First, it is upgrading old open cycle gas turbine power plants to CCGTs and replacing aging steam power plants with CCGTs; these will lead to efficiency gains and hence an increase in power output of about 50% with the same amount of fuel input. Second, the project is expanding and upgrading power transmission capacity to meet increasing demand. Third, the project is financing new distribution lines in Dhaka, enabling 770,000 new consumer connections, complemented by the installation of some 1 million pre-payment meters. These meters will have the benefit of lowering unpaid consumption, thus improving distribution cost recovery and reducing wasteful consumption. These measures are fully appropriate to dealing with Bangladesh’s aging, inadequate, and inefficient electricity infrastructure and to confronting rapid economic and power demand growth. It should be noted, however, that gas supply shortages are pushing operators to use liquid fuels, such as high-speed diesel fuel, with associated increases in cost. This evaluation finds the program *relevant*.<sup>62</sup>

64. The Bangladesh–India Electrical Grid Interconnection Project pioneered Bangladesh’s first cross-border power connection and enabled least-cost power imports from India, a critical development given Bangladesh’s chronic generation deficits and the need to diversify energy sources. For these reasons the project validation report assessed the project *relevant*, and this assessment strongly concurs.<sup>63</sup> The same conclusion is reached regarding the second Bangladesh–India Grid Interconnection Project which has doubled power import capability.<sup>64</sup> This assessment also rates the projects *relevant*.

65. The Bangladesh Power System Enhancement and Efficiency Improvement Project financed almost 1 million new electricity connections, reduced system losses, and improved power reliability through transmission upgrades and distribution rehabilitation and modernization. Given the top priority accorded by ADB and the government of Bangladesh to assuring access to modern and reliable energy for all, the project is judged *relevant*.<sup>65</sup>

66. Inadequate transmission lines and substation transformer capacities in southern and western regions are the main contributors to transmission bottlenecks in Bangladesh. Investments in the transmission network are required to address the bottlenecks for the evacuation of bulk power from power stations, including the ADB-financed Rupsha 800 MW CCGT plant, to major load centers such as Greater Dhaka, Chittagong, and the southwest economic corridor. The Southwest Transmission Grid Extension Project responds to these needs and supports the objectives of the Seventh Five Year Plan, FY2016–FY2020. This assessment rates this project *relevant*.<sup>66</sup> The Dhaka and Western Zone Transmission Grid Expansion Project is of similar design and targeting and is also evaluated as *relevant*.<sup>67</sup>

<sup>60</sup> IED. 2019. *Validation Report: Bangladesh Public-Private Infrastructure Development Facility*. Manila: ADB.

<sup>61</sup> Based on a review of the Bangladesh Second Public-Private Infrastructure Development Facility RRP and project assessment sheet.

<sup>62</sup> Based on a review of the Power System Expansion and Efficiency Improvement Investment Program RRP and project assessment sheets.

<sup>63</sup> IED. 2017. *Validation Report: Bangladesh-India Electrical Grid Interconnection Project*. Manila: ADB.

<sup>64</sup> Based on a review of the Second Bangladesh-India Electrical Grid Interconnection Project RRP and project assessment sheets.

<sup>65</sup> Based on a review of the Bangladesh Power System Enhancement and Efficiency Improvement Project RRP and project assessment sheet.

<sup>66</sup> Based on a review of the Bangladesh Southwest Transmission Grid Extension Project RRP and project assessment sheet.

<sup>67</sup> Based on a review of the Bangladesh Dhaka and Western Zone Transmission Grid Expansion Project RRP and project assessment sheet.

## b. Relevance of Nonsovereign Operations

67. The XARR of the Bibiyana II Gas Power Project was released in November 2019. It noted that the project was the first gas-based IPP project in Bangladesh following an international competitive bidding process where the major sponsor was an entrepreneur from Bangladesh. It demonstrated the private sector could be effective in building and successfully operating a power infrastructure project under the Private Sector Power Generation Policy, 1996 (revised in 2004). The project has been a benchmark, paving the way for more local participation in private power generation. Recognizing the importance of private sector resource mobilization for the energy sector, the XARR considered the project *relevant* and this assessment agrees.<sup>68</sup> The Reliance Bangladesh Liquefied Natural Gas and Power Project was designed to serve similar objectives and is also considered *relevant*, although it was restructured in July 2020 due to changes in the sponsoring partnership and a change of scope, which dropped the LNG terminal but kept the 718 MW CCGT.<sup>69</sup> The Spectra Solar Power project, an early entrant in the effort to diversify power generation fuels and reduce GHG intensity through the introduction of renewable energy on the grid, is clearly *relevant* to these priority objectives.<sup>70</sup> Regarding the cancelled programs, while the equity investment in Summit International Power Limited was cancelled due to external factors, the IEEFP cancellation was cancelled because it was a financial intermediary project that could not find sound financial intermediaries.

## c. Relevance of Technical Assistance

68. Of 20 TA activities approved over the evaluation period, 11 were PPTAs projects. With the exception of one activity, the TA for the Industrial Energy Efficiency Finance Program, which was canceled, all the PPTA projects resulted in an approved and implemented project that this evaluation has judged *relevant*.

69. The remaining TA projects had capacity building and policy advisory aims, summarized as follows:

- (i) **Tendering Process for Independent Power Producer Plants.** This TA project, approved in 2007, addressed the lack of a competitive procurement for IPPs in the nascent Bangladesh private power market.
- (ii) **Supporting Implementation of the Bangladesh Climate Change Strategy and Action Plan (Subproject 1).** This TA project, approved in 2009, provided guidelines and training for the implementation of the Bangladesh Climate Change Strategy and Action Plan. The Support for Climate Change Mitigation and Renewable Energy Development TA project focused on increasing the readiness and capability of the Sustainable and Renewable Energy Development Authority (SREDA) to fulfill its renewable energy mandate. Similarly, the Capacity Development for Renewable Energy Investment Programming and Implementation TA project aimed to produce a pipeline of large-scale renewable energy projects for investment consideration.
- (iii) **Tariff Reforms and Intersectoral Allocation of Natural Gas.** This TA project, approved in 2010, targeted greater economic efficiency in gas resource utilization.
- (iv) **Study on Energy Security.** This TA project, approved in 2014, informed the BPDB of the options for diversifying energy sources for Bangladesh, concentrating on the baseload generation.
- (v) **Enabling Poor Women's Benefits from Enhanced Access to Energy.** This TA project promoted gender equity by educating vulnerable women on Hatiya Island on the safe and efficient use of electricity in order to enhance welfare.
- (vi) **Bangladesh–India Electrical Grid Interconnection and SASEC Bangladesh–India Electrical Grid Interconnection.** These TA projects built capacity for power trading through assistance for formulating and negotiating interconnection, operations, and power purchase agreements.

<sup>68</sup> IED. 2019. *Extended Annual Review Report: Bibiyana II Gas Power Project*. Manila: ADB.

<sup>69</sup> Based on a review of the Reliance Liquefied Natural Gas and Power Project RRP.

<sup>70</sup> Based on a review of the Spectra Solar Power RRP.

70. The TA portfolio themes of private power development, energy diversification, sector allocative efficiency, renewable energy, climate change and gender equity correspond well with ADB's Strategy 2020 and Bangladesh CPS priorities. This assessment finds the TA activities *relevant*.

**d. Financing Modality**

71. In the early stages of ADB's greater engagement in the Bangladesh energy sector, it made use of program loans: the Power Sector Development Program (approved in 2003) and the Sustainable Power Sector Development Program (approved 2007). The programs combined wide-ranging support for physical improvements to the electricity network with support for the government's efforts to reform the power sector through the restructuring and corporatization of the main sectoral entities. The program modality was appropriate, given the foundational nature of the desired reforms and the wide range of upgrades needed. However, the bulk of ADB's subsequent sovereign loans were project-based, which was appropriate for large-scale procurement and use of engineering, procurement and construction (EPC) contractors that typified the implementation modality of the projects.

72. Other financing modalities included a credit line operation for financing coursed through the Infrastructure Development Company Limited (IDCOL) under a series of public-private infrastructure development loans. This modality maximized private sector leveraging, and was especially suited to the multiplicity of subloans required to empower the large number of SMEs serving the distributed solar home market. The Reliance Liquefied Natural Gas and Power Project featured a nonsovereign partial risk guarantee as a means of risk mitigation and mobilization of private sector capital.

**e. Knowledge Solutions and Innovation**

73. In addition to the capacity development provided by many loans and TA projects, knowledge solutions were provided to innovative projects. Key innovations provided by ADB included promoting Bangladesh's first regional power trade venture, and playing a lead role in incorporating advanced CCGT technology in Bangladesh's generation mix. It is also mentioned that some ADB projects supported the use of technologies for the first time in Bangladesh, such as high temperature low sag conductors, wellhead compressors, or drones for inspection transmission lines. Also, there were some knowledge transfer efforts, such as student scholarships for engineers and capacity building activities on long term power transmission and distribution asset planning and renewable energy system design.

**f. Development Coordination within the Bangladesh Energy Sector**

74. A number of other multilateral and bilateral development partner agencies supported the Bangladesh energy sector, in particular, the World Bank Group, JICA, and the Islamic Development Bank.

75. Assistance from major development partners is coordinated by the Economic Relations Division of the Ministry of Finance, with the support of the Energy and Mineral Resources Division under the Ministry of Power, Energy and Mineral Resources. Coordination among the development partners is carried out through the Local Consultative Group, which has a number of subcommittees for core areas of assistance. As the leading development partner in energy, ADB chairs the energy subcommittee and holds regular meetings with all development partners. Government counterparts credit such coordination efforts with having significantly advanced sector reforms and improving the regulatory environment.

**g. Overall Relevance Rating**

76. Overall, ADB support for the energy sector is rated *relevant*.



## 2. Effectiveness

### a. Effectiveness of Sovereign Operations

77. The program is rated *effective* in terms of the CPS energy sector objectives of (i) increasing access to and consumption of electricity, (ii) improving the availability and reliability of power supply, and (iii) supporting regional energy connectivity. All but one of the completed and evaluated sovereign operations were rated *effective* (the exception was the PPP Development Facility), and most of those that are not yet closed were assessed likely to be effective.

78. The energy program achieved most of its intended outcomes related to the increased capacity and efficiency of electricity transmission and distribution networks and natural gas networks. Reductions to electricity and gas losses surpassed targets. The rehabilitation and construction of new CCGT power plants helped increase power generation efficiency and reduce the average cost of generation. Regarding regional integration, the two Bangladesh–India electrical grid interconnection links (the first grid-to-grid power links funded by ADB) added a total of 1 GW of power trade capacity, helping reduce power shortages and the use of imported oil for expensive rental power plants. Intended sector reforms were only partially achieved, as the unbundling of the Bangladesh Power Development Board (BPDB) was not fully carried out, and it has not yet been corporatized. However, distribution companies were corporatized as commercially viable companies. Completed nonsovereign operations, mainly liquefied natural gas (LNG) import infrastructure and gas combined cycles, were effective in adding generation capacity, increasing supply-side energy efficiency, and strengthening energy security. The PPP development facility (through IDCOL) achieved only the target for installing solar home systems (building on the successful program already being implemented). The target outcomes related to IDCOL’s capital mobilization and financial sector operations were not achieved.

79. Table C.4 summarizes the envisioned outcomes and outputs of sovereign loans at appraisal and evaluation. Five out of seven completed operations were assessed *effective*, although only four received this rating in independent validations. The active projects that are well into implementation have made good progress and most are likely to be rated effective when completed.

**Table C.3: Effectiveness of Energy Sovereign Operations**

Project No.	Project Title	Status	Approval Date	Description of Project Achievements Versus Appraisal Outcomes and Outputs	PVR or (PCR) Rating
35242-013	Gas Transmission and Development Project	Closed	October 2005	Outcome and outputs were substantially achieved: (i) national gas consumption increased to 109% of target, and (ii) population using natural gas increased from 6% to 10%, meeting the target.	E
36107-013	Sustainable Power Sector Development Program	Closed	June 2007	(i) Improvement in power sector financial sustainability was partially achieved. (ii) Expanded peak generation capacity and a reduction in loan shedding was partially achieved. (iii) An improvement in power transmission capacity and a reduction in transmission system losses were achieved. (iv) An improvement in distribution efficiency improvement in the Dhaka area was achieved. (v) Enhanced competitiveness of power sector entities through capacity development was achieved.	E

Project No.	Project Title	Status	Approval Date	Description of Project Achievements Versus Appraisal Outcomes and Outputs	PVR or (PCR) Rating
36205-013	Power Sector Development Program	Closed	December 2003	A reduction in loan shedding and the introduction of competition in power generation were mostly achieved. Targeted outputs were: (i) corporatization of BPDB (not achieved); (ii) corporatization of DESA (achieved); (iii) unbundling of BPDB's generation and distribution services (partially achieved); (iv) promotion of PGCB and DESCO as commercially viable companies (achieved).	(E)
37113-013	Power System Efficiency Improvement Project	Active	August 2011	Increase in electricity generation outcome achieved. 450 MW CCGT and 7.4 MW solar PV plant commissioned. Installation of solar PV pumping systems and LED street lighting on track.	-
38164-013	Natural Gas Access Improvement Project``	Closed	March 2010	Expanded capacity and improved efficiency in natural gas production, transmission and distribution system outcome achieved. Gas sector losses reduced from 2.8% to 1.12% (target was 2%). Transmission capacity increased from 2,000 to 3,000 MMCFD (3,500 target). Average cost recovery for gas used in households increased by 44% (target was 20%).	E
40517-042	Public-Private Infrastructure Development Facility (supplementary grant)	Financially Closed	May 2011	Many of the target outcomes related to IDCOL's financial sector operations and capital mobilization and were either not achieved or only partially achieved. However, for the energy-related output of financing Solar Home Systems, some 400,000 SHS were installed, double the target at appraisal.	LE
42378-015	MFF: Power System Expansion and Efficiency Improvement Investment Program, Tranche 1	Closed	December 2012	The expected outcome of improved efficiency in electricity generation and transmission was mostly achieved. The energy efficiency in two converted 150 MW power plants was increased from 32% to 46% (50% target). Transmission losses in three transmission lines were reduced from 2.72% to 2.6% (2.5% target).	LE
42378-016	MFF: Power System Expansion and Efficiency Improvement Investment Program, Tranche 2	Active	December 2013	The expected outcome of increased transmission and distribution capability in the power system is likely to be achieved. Two new substations have already been energized, representing about two-thirds of the target capacity increase. 612,869 new consumer connections were provided (770,000 target).	-
42378-017	MFF: Power System Expansion and Efficiency Improvement Investment Program, Tranche 3	Active	December 2015	The expected outcome of the increased efficiency and capacity of the power system is likely to be achieved. Demolition of an old power plant has been completed and construction of a new 400 MW power plant is ongoing. BREB's average distribution loss has been reduced from 10% in 2014 to 7.19% (target was 9.5%).	-
44192-013	Bangladesh-India Electrical Grid Interconnection Project	Closed	August 2010	The transmission link between Bangladesh and India was successfully constructed and operations for the import of 500 MW began in 2013. Energy shortages were reduced significantly and the cost of the imported power is less than that of oil for the oil-fired rental power plants.	E
44192-016	SASEC Second Bangladesh-India Electrical Grid Interconnection Project	Active	September 2015	As above. A second 500 MW capacity link was commissioned in 2018.	-

Project No.	Project Title	Status	Approval Date	Description of Project Achievements Versus Appraisal Outcomes and Outputs	PVR or (PCR) Rating
45203-006	Natural Gas Infrastructure and Efficiency Improvement Project	Active	November 2016	Outputs have been delayed and there is a potential risk of missing the targets.	-
49423-005	Bangladesh Power System Enhancement and Efficiency Improvement Project	Active	March 2017	Project is on track. About half of the target new consumer connections have been achieved. System reliability improvement targets have already been exceeded. Transmission and distribution loss reduction targets have been nearly achieved.	-
50161-003	Rupsha 800-Megawatt Combined Cycle Power Plant Project	Active	June 2018	There has been some slippage in the project schedule (26% total weighted progress while 31% of the project period from approval has elapsed). However, despite some delays, the expected outputs are on track.	-
51137-001	Southwest Transmission Grid Extension Project	Active	July 2018	While works and goods are 81% contracted, there have been some delays in execution. However, implementation is on track with 9,000 MVA of target power delivery capacity of the southern and western grids delivered against the 14,135 MVA target. Transmission losses have been reduced to 2.7% (target was 2.5%).	-
51137-003	Dhaka and Western Zone Transmission Grid Expansion Project	Active	November 2019	Insufficient time has passed since project approval to enable a judgment on prospects for effectiveness to be made.	-

BPDB = Bangladesh Power Development Board, BREB = Bangladesh Rural Electrification Board, CAPE = country assistance program evaluation, CCGT = combined cycle gas turbine, DESA = Dhaka Electric Supply Authority, DESCO = Dhaka Electric Supply Company Limited, E = effective, IDCOL = Infrastructure Development Company Limited, LED = light-emitting diode, LE = less than effective, MFF = multitranche financing facility, MMCFD = million standard cubic feet per day, MVA = megavolt ampere, MW = megawatt, n.a. = not available, No. = number, PCR = project completion report, PGCB = Power Grid Company of Bangladesh, PV = photovoltaic, PVR = project completion report validation report, SASEC = South Asia Subregional Economic Cooperation Program. Note: Values and ratings from the PCR are reported when the PVR is not available.

Source: Independent Evaluation Department.

## b. Effectiveness of Nonsovereign Operations

80. The Bibiyana Gas Power Project was commissioned in 2016, adding 341 MW of high efficiency capacity to the grid. The project demonstrated the effectiveness of a private initiative in developing energy infrastructure to meet growing regional demand.<sup>71</sup> This assessment considers the project *effective*.

81. The Reliance Bangladesh Liquefied Natural Gas and Power Project, approved in December 2017, has been delayed due to a change in the government's position on the LNG import infrastructure. The project initially included an LNG terminal located near Kutubdia Island but since approval of the project its scope has been reduced and it will now include only financing for a CCGT power plant. There has been insufficient progress to enable a judgement on the project's effectiveness to be made. Likewise, the Spectra Solar Power project was approved in November 2019 so insufficient time has passed to enable any evaluation of its effectiveness.

## c. Effectiveness of Technical Assistance

82. All the project preparatory TA (PATA) activities with the exception of one resulted in an approved loan. For the Industrial Energy Efficiency Financing TA, the expected project was cancelled for reasons beyond the scope of the TA (a lack of demand for the ADB financing from the target companies).

<sup>71</sup> IED. 2019. *Extended Annual Review Report: Bibiyana II Gas Power Project*. Manila: ADB.

However, the TA completion report rated the TA *partly successful*.<sup>72</sup> Overall, this assessment considers the PATA portfolio to have been *effective*.

83. For the capacity development TA (CDTA) and policy and advisory TA (PATA), the record is more mixed. Of the five CDTA and PATA projects for which completion reports were available, three (supporting Implementation of the Bangladesh Climate Change Strategy and Action Plan, Bangladesh-India Electrical Grid Interconnection Project, and Tariff Reform and Inter-sectoral Allocation of Natural Gas) were rated *successful* and may be considered *effective*. The Support for Climate Change Mitigation and Renewable Energy Development TA was delayed by over 2 years and was rated *less than successful*. The Tendering Process for Independent Power Producer Plants TA did not result in contracts with selected private sector sponsors for two 450 MW CCGT projects, and the TA was rated *unsuccessful*.

84. On balance, and considering the modest scope of the non-PPTA TA portfolio and its mixed record of success, this evaluation views ADB TA support *less than effective*.

#### d. Overall Effectiveness Rating

85. ADB's portfolio in the energy sector is rated *effective*.

### 3. Efficiency

#### a. Efficiency of Sovereign Operations and TA

86. The efficiency of a project is largely based on a calculation of an economic internal rate of return (EIRR) when benefits are well defined.<sup>73</sup> Ex-post reestimates of EIRRs were available for five of the sovereign investment operations (Table C.5). Despite often substantial implementation delays ranging up to 6 years, the reestimated EIRRs were uniformly high and substantially above the benchmark economic opportunity cost of capital of 12%. As the cost-benefit ratios (e.g., cost of generation and transmission and distribution technologies, and the value of electricity consumption) have not substantially changed over the evaluation period, a similar conclusion would likely hold for the ongoing projects.

**Table C.4: Efficiency of Evaluated Sovereign Operations**

Project No.	Project Title	Estimated Closing	Actual Closing	Delay (years)	PVR or (PCR) EIRR	PVR or (PCR) Rating
35242-013	Gas Transmission and Development Project	December 2010	May 2017	6.4	(40%)	E
36107-013	Sustainable Power Sector Development Program	June 2010	October 2014	4.3	24%–38% <sup>a</sup>	E
36205-013	Power Sector Development Program	June 2008	April 2014	3.8	(29%–39%) <sup>b</sup>	(E)
38164-013	Natural Gas Access Improvement Project	March 2015	December 2018	3.8	(44%)	E
40517-042	Public–Private Infrastructure Development Facility (supplementary grant)	June 2014	October 2015	1.8	36% <sup>c</sup>	E
42378-015	Power System Expansion and Efficiency Improvement Investment Program, Tranche 1	December 2018	December 2019	1.0	27%	E
44192-013	Bangladesh–India Electrical Grid Interconnection Project	June 2013	December 2014	1.5	> 12% <sup>d</sup>	E

CAPE = country assistance program evaluation, EIRR= economic internal rate of return, n.a. = not available, PCR = project completion report, PVR = project completion report validation report.

Notes: Values and ratings from the PCR are reported when the PVR is not available.

<sup>72</sup> ADB. 2016. *Technical Assistance Completion Report: Energy Efficiency Finance Program*. Manila.

<sup>73</sup> ADB. 1997. *Guidelines for Economic Analysis of Projects*. Manila.

- <sup>a</sup> The PVR noted that the PCR should have calculated the EIRR on the basis of a connected system rather than for separate components. The PVR was therefore unable to perform a recalculation.
  - <sup>b</sup> Estimate varies by component.
  - <sup>c</sup> The PCR estimate was for the entire facility. The PVR provided a separate estimate for the SHS component, which is more relevant for this energy evaluation.
  - <sup>d</sup> The PVR criticized the economic analysis methodology employed by the PCR and was unable to perform a recalculation, but it estimated that it would be higher than the 12% threshold.
- Source: Independent Evaluation Department.

87. Several implementation delays affected the portfolio, ranging up to 6 years. The reasons for the delays included: (i) long procurement processes, rebidding, or failing to use the advanced procurement facility; (ii) a long acquisition time for land for substations or transmission line right-of-way; (iii) staff turnover at the executing agency; (iv) inadequate staffing at the project implementation unit; (v) coordination issues with cofinanciers; (vi) changes in project scope, technical specifications and other requirements; and (vii) overambitious implementation schedules.<sup>74</sup> The delays were caused by both the executing agencies and ADB, and some could have been mitigated with appropriate measures at the design stage.

88. The bulk of the TA projects were associated with investment operations and would have similar efficiency ratings to those operations.

#### **b. Efficiency of Nonsovereign Operations**

89. The XARR for the Bibiana II Gas Power Project noted that BPDB in its 2018 Annual Report had found that the ADB-supported power plant had lower generation costs per kilowatt-hour than those of other operating combined cycle plants using gas in Bangladesh. It can therefore be safely assumed that the investment was efficient, as most of the economic benefits of these plants relate to providing a more affordable and reliable electricity supply. A similar conclusion would likely apply to the Reliance CCGT power plant. Procurement for the Spectra Solar Power Project PV plant has not yet taken place and therefore an estimate of its economic attractiveness based on installed costs cannot be made at this time.

#### **c. Overall Efficiency Rating**

90. ADB's portfolio in the energy sector is rated *efficient*.

### **4. Sustainability**

#### **a. Sustainability of Sovereign Operations and Technical Assistance**

91. The sustainability of investment operations can be assessed along many dimensions, including financial, institutional, environmental, and social. Of these, financial sustainability is the most easily quantifiable through the financial internal rate of return (FIRR) criterion. When this is compared to the weighted average cost of capital (WACC), it provides a summary indicator of sustainability for the ongoing operation and for replication. Ex post evaluated FIRRs available for the sovereign portfolio are given in Table C.6.

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<sup>74</sup> These examples of project delays were extracted from project completion reports of the projects listed in Table C.5.

Table C.5: Analysis of Sustainability of Evaluated Sovereign Operations

Project No.	Project Title	Status	PVR or (PCR) FIRR	PVR or (PCR) WACC	PVR or (PCR) Rating
35242-013	Gas Transmission and Development Project	Closed	(3.2%)	(1.5%)	LS
36107-013	Sustainable Power Sector Development Program - NWPGC - PGCB - DPDC - DESCO	Closed	4.6% 6.2% 10.4% 9%	2.7% 2.4% 2.9% 1.2%	LS
36205-013	Power Sector Development Program - EGCB - PGCB - BPDB	Closed	(7.7%) (7.2%) (16.9%)	n.a.	(LS)
38164-013	Natural Gas Access Improvement Project	Closed	(4.1%)	(1.5%)	LS
40517-042	Public–Private Infrastructure Development Facility (Supplementary Grant)	Financially Closed	9%	6.6%	LS
42378-015	Power System Expansion and Efficiency Improvement Investment Program, Tranche 1	Closed	6.3%	2.1%	LS
44192-013	Bangladesh–India Electrical Grid Interconnection Project	Closed	(4.9%) <sup>a</sup>	(2.9%) <sup>b</sup>	LS

CAPE = country assistance program evaluation, Dhaka Electric Supply Company Limited, DPDC = Dhaka Power Distribution Company Limited, EGCB = Electricity Generation Company of Bangladesh, FIRR = financial internal rate of return, LS = likely sustainable, n.a. = not available, NWPGCL = North-West Power Generation Company Limited, PCR = project completion report, PGCB = Power Grid Company of Bangladesh, PVR = project completion report validation report, WACC = weighted average cost of capital.

Note: Values and ratings from the PCR are reported when the PVR is not available.

<sup>a</sup> The PVR criticized the financial analysis methodology employed by the PCR and was unable to perform a recalculation.

<sup>b</sup> The PVR mentioned that there were no details on the calculation of the WACC and was unable to verify its value.

Source: Independent Evaluation Department.

92. In terms of institutional sustainability, the business risks of the gas utilities were assessed to be insignificant, and the Gas Sector Reform Roadmap, the Gas Development Fund, the gas sector master plan and associated policy commitments are expected to uphold the business and financial sustainability of the gas sector entities.<sup>75</sup> Underpricing of gas remains a threat to the sustainability of the sector and it has ripple effects in the electricity sector. However, the government enacted price increases in July 2019, demonstrating a willingness to bring gas prices closer to economic opportunity costs. In the power sector, the Electricity Generation Company of Bangladesh (EGCB) has shown promising operating performance by ensuring over 90% plant availability, and Power Grid Company of Bangladesh (PGCB) has proven its ability to maintain over 99% system availability. The operational performance of the Dhaka Electric Supply Company (DESCO) in 2015 was exceptional with distribution losses at 8.4%; Dhaka Power Distribution Company (DPDC) has also performed well.<sup>76</sup> However, distribution margins remain very thin, and BPDB as the single buyer is squeezed as it is unable to pass on the full cost of generation to the distribution entities. Nevertheless, a positive trend is in place and in recent years the gap between operating expenses and total revenue has narrowed.<sup>77</sup> For the Bangladesh–India interconnection, there are strong incentives on both sides as the revenue received on the Indian side is higher than the marginal cost of production, while it is highly likely that Bangladesh will need to import fuel and/or electricity in

<sup>75</sup> ADB. 2019. *Completion Report: Bangladesh Gas Transmission and Development Project*. Manila.

<sup>76</sup> ADB. 2013. *Completion Report: Power Sector Development Program*. Manila; and IED. 2017. *Validation Report: Sustainable Power Sector Development Program*. Manila: ADB.

<sup>77</sup> Bangladesh Power Development Board Annual Report 2017–2018.



the foreseeable future.<sup>78</sup> However, the asset quality of the Infrastructure Development Company Limited (IDCOL) has weakened since 2015 due to poor collection in the SHS portfolio. IDCOL was supported by ADB TA to enhance its risk management capability and it instituted a special collection efficiency improvement program. As a result, the program is now on a sounder financial footing.<sup>79</sup>

93. Environmental and social risks have been manageable across the energy portfolio. The main source of conflict with affected peoples has been securing the rights of way for transmission and distribution projects. Vehement and at times violent public protests have been associated with new coal power station development, but ADB has not been associated with these plans and investments.

94. On balance, this evaluation finds the sovereign portfolio *likely sustainable*.

95. While TA activities were not uniformly successful, they contributed positively to the outcomes of ADB projects and provided valuable capacity building to support the implementation of these projects. ADB TA projects were *likely sustainable*.

#### b. Sustainability of Nonsovereign Operations

96. The Bibiyana II Gas Power project was assessed in November 2019 as having an adequate level of investment return in view of the project's stable risk rating, and the borrower is current with its debt service obligations. The project's environmental, health, safety and social performance was rated satisfactory. This assessment considers the project *likely sustainable*.

#### c. Overall Sustainability Rating

97. ADB's portfolio in the energy sector is rated *likely sustainable*.

### 5. Development Impact

98. All available evidence indicates that ADB's impact in the energy sector over the period covered by this CAPE has been substantial. ADB was a key motivator and supporter of early efforts to unbundle and corporatize the Bangladesh energy sector, and to install independent regulation. ADB provided finance and risk mitigation for the introduction of highly efficient CCGT technology, first through public sector sponsorship and then from private sources. ADB has been the lead partner for the expansion and modernization of the country's power and gas transmission and distribution systems, which has provided a solid foundation for the provision of electricity to almost the entire population, and opened the door to regional power trade.

99. ADB's contribution to the development of the energy sector can be obtained from statistics compiled from the 2018 Development Effectiveness Review (Table C.7).

**Table C.6: ADB Contributions to Development Results (completed ADB operations, 2010–2018)**

Indicator		
Greenhouse gas emission reduction	974,284	tCO <sub>2</sub> e/year
Energy saved	120	GWh per year
New households connected to electricity	1,811,530	households
Ratio of rural to urban new electricity connections	72:28	rural:urban
Installed energy generation capacity	1,591	MW
of which, renewable energy	686	MW
Transmission lines installed or upgraded	1,244	km
Distribution lines installed or upgraded	13,384	km
Cross-border transmission of electricity	3,504	GWh per year

GWh = gigawatt hour, km = kilometer, MW = megawatt, tCO<sub>2</sub>e = ton of carbon dioxide equivalent

Source: ADB. 2019. *2018. Development Effectiveness Review*. Manila.

<https://www.adb.org/documents/development-effectiveness-review-2018-report>

<sup>78</sup> IED. 2017. *Validation Report: Bangladesh–India Electrical Grid Interconnection Project*. Manila: ADB.

<sup>79</sup> IED. 2019. *Validation Report: Bangladesh Public–Private Infrastructure Development Facility*. Manila: ADB.

100. An overview of ADB's contribution to key thematic areas may be obtained by examining the links between higher-level CPS objectives and energy project designs (Table C.8).

**Table C.7: Country Partnership Strategy Objectives in Project Design**

Operations	Project Design: Explicit Link to Higher-Level CPS Objectives										
	CON	DIV	HR and Skills	Gender Equality	Climate Change	DRR & DRM	Rural Livelihoods	Good GOV	PSD	CAP	RCI
Gas Transmission and Development	Y		Y	Y						Y	
Sustainable Power Sector Development	Y							Y	Y	Y	
Power Sector Development	Y							Y	Y	Y	
Power System Efficiency Improvement	Y	Y		Y	Y		Y				
Natural Gas Access Improvement	Y		Y								
Public-Private Infrastructure Development Facility	Y	Y			Y			Y	Y	Y	
MFF: Power System Expansion and Efficiency Improvement Investment Program, Tranche 1	Y	Y								Y	
MFF: Power System Expansion and Efficiency Improvement Investment Program, Tranche 2	Y										
MFF: Power System Expansion and Efficiency Improvement Investment Program, Tranche 3	Y										
Bangladesh-India Electrical Grid Inter-connection	Y	Y									Y
Second Bangladesh-India Electrical Grid Inter-connection	Y	Y									Y
Natural Gas Infrastructure and Efficiency Improvement Project	Y										
Power System Enhancement and Efficiency Improvement	Y		Y	Y	Y					Y	
Rupsha 800-Megawatt Combined Cycle Power Plant	Y		Y	Y						Y	
Southwest Transmission Grid Expansion	Y		Y								
Dhaka and Western Zone Transmission Grid Expansion	Y		Y								
Bibiyana II Gas Power (NS)	Y								Y		
Reliance Bangladesh LNG and Power (NS)	Y	Y							Y		Y
Spectra Solar Power (NS)	Y	Y		Y	Y				Y		

CAP=capacity development, CON = connectivity, DIV = diversification, DRM = disaster risk management, DRR = disaster risk reduction, HR and Skills = human resources and skills development, GOV = government, NS = nonsovereign, PSD = private sector development, RCI = regional cooperation and integration, Y = yes.

Sources: Independent Evaluation Department estimates.

101. **Connectivity.** In this evaluation, all the energy projects responded to the emphasis in the CPS on connectivity, interpreted in a broad, energy system context. The projects included enhancements to the

energy network at the fuels, generation, transmission, distribution and end-use levels designed to provide efficient, reliable and affordable modern energy services. Greater connectivity will support economic growth and poverty reduction. This interpretation is consistent with the emphasis on energy access embraced by the Energy Policy, 2009. Widening connectivity was ADB's strongest contribution to Bangladesh's development.

102. **Diversification.** The development of new sources for natural gas, electricity, and LNG imports, plus efforts to advance renewable energy, supported diversification. The two Bangladesh-India Electrical Grid Interconnection projects also made a major contribution to regional energy integration.

103. **Private sector development.** Sovereign operations promoted policy and regulatory changes in order to introduce competition and private participation in the power sector. Private capital was leveraged in recent and on-going nonsovereign investments.

104. **Capacity development.** The energy portfolio frequently addressed capacity development through support for sector planning, reforms, organizational development, and training of technical personnel. Promotion of good governance featured in a number of the earlier operations, which aimed to introduce new sector alignments, corporatization and strengthened independent regulation.

105. **Climate change.** About half of the sovereign energy projects explicitly targeted climate change in their design descriptions and targets, including the replacement of aging open gas cycle for more efficient combined cycle turbines, installation of a new combined cycle power plant (albeit it started operation using Diesel as fuel for the first two years), deployment of solar home systems, or with the use of high temperature low sag conductors in new transmission lines.<sup>80</sup> It should be noted that all the energy projects resulted in a net reduction in greenhouse gas (GHG) emissions against a business-as-usual baseline, and operations such as the substitution of modern and efficient gas turbines for aged oil-fired steam units, as well reduction of technical losses in the distribution networks helped reduce GHG emissions.

106. **Gender equality.** Only six energy projects incorporated gender equality concerns. In some cases this was through gender-informed planning and training for populations that were newly served with electricity on its beneficial and safe use. In other operations, efforts were made to ensure greater participation of women in the energy sector workforce.

107. Overall, the CAPE considers ADB's development impacts *satisfactory*.

## 6. Overall Evaluation

108. The overall rating based on this assessment of ADB support for the energy sector in Bangladesh is *successful* (Table C.9). ADB assistance was *relevant, effective, efficient, likely sustainable, and satisfactory* in terms of development impact.

Table C.8: Overall Assessment

Rating Criteria	Criteria Weight	Assessment	Score	Weighted Average Score
Relevance	0.2	Relevant	2	0.4
Effectiveness	0.2	Effective	2	0.4
Efficiency	0.2	Efficient	2	0.4
Sustainability	0.2	Likely Sustainable	2	0.4
Development impacts	0.2	Satisfactory	2	0.4
<b>Overall assessment</b>	<b>1.0</b>	<b>Successful</b>		<b>2.0</b>

Source: Independent Evaluation Department.

<sup>80</sup> ADB classification criteria were revised in 2015. Financing for natural-gas-based projects is no longer regarded as "climate finance."

## 7. ADB Performance

109. ADB's performance in the Bangladesh energy sector is rated *satisfactory*, based on the adequacy and quality of ADB country energy sector strategies and its program and ADB's responsiveness to client needs. ADB collaborated well with the borrower and executing agencies in formulating the program, providing suggestions, and processing the loans, although the estimated time frames for investment projects at approval were often unrealistic. ADB staff actively monitored project implementation and approved contract awards, disbursements and variations, and intervened to resolve implementation issues in a timely fashion through regular missions and review meetings. Delegation of various projects to the Bangladesh Resident Mission enhanced interaction among ADB, the executing agencies, consultants, and contractors. For nonsovereign operations, ADB's overall performance in relation to investment screening, appraisal and structuring was satisfactory, although it is noted that a large number of operations were cancelled for various reasons, some external to the project (as in the equity investment in Summit Power International Limited), but some because of inadequate program designs that made it impossible to implement the project due to the lack of sound financial intermediaries.

## 8. Government Performance

110. The borrower demonstrated strong commitment to the program and generally gave high priority to reforms. However, in the case of the early Power Sector Development Program (approved December 2003), the borrower failed to convince and control BPDB regarding its corporatization and the operationalization of the North-West Zone Power Distribution Company (NWZPDCL). The borrower also interfered with the decision making of the Bangladesh Energy Regulatory Commission (BERC). Political considerations resulted in the inability to appropriately restructure the generation, transmission and end-use tariffs.<sup>81</sup>

111. During program implementation, the borrower ensured that sufficient counterpart funds were available and that land was acquired on time, although some projects experienced delays in land acquisition for substations and right-of-way of transmission lines. Project management units (PMUs) were, with a few exceptions, established on time with proper resources. Loan covenants were complied with and PCRs were prepared on time.

112. Overall, the performance of the borrower and executing agencies was *satisfactory*.

## E. Conclusion

113. ADB designed and delivered a coherent and impactful energy sector program in Bangladesh. ADB is a trusted partner in the sector, and can be credited with laying the groundwork that enabled an extraordinary expansion of electricity access from just 10% of the population to near universal access in a space of just over 25 years. ADB has been an efficient and effective provider of finance and implementation for the energy infrastructure, and had a large and wide-ranging portfolio.

### 1. Lessons

114. This study of the ADB energy portfolio in Bangladesh identified the following lessons that can be applied to the selection of new program objectives and activities.

- (i) Strong project designs that avoid or reduce project implementation delays can significantly improve the efficiency and impact of projects. Most investment operations in the portfolio suffered significant delays in implementation, ranging from 2 to 6 years beyond the estimates at appraisal. In many cases, delays were due to political disruptions, changes in government, or emergency conditions, occasioned by civil unrest. However, equal blame can be assigned to an

<sup>81</sup> ADB. 2013. *Completion Report: Bangladesh Power Sector Development Program*. Manila.

undue sense of optimism among project planners, including ADB project staff. In the case of credit line operations, delays in first disbursements underscore the importance of ensuring a credible and investment-worthy pipeline of subprojects before project approval.

- (ii) Well defined and properly structured design and monitoring frameworks (DMFs) can improve project monitoring during implementation and increase project impacts. Greater care in formulating indicators and ensuring they can be monitored will result in more accurate and useful project performance data linked to project outputs and outcomes. In some cases, the portfolio's DMFs suffered from a lack of coherence and realism.
- (iii) Well executed and comprehensive high-level planning can optimize resources and reduce operating inefficiencies, which impose costs on the country. For example, the Power Sector Master Plan has facilitated joint optimization of energy use, fuels, and generation resources, but the lack of a robust study on the long-term availability of domestic gas has led to underutilized assets (e.g., compressors with no gas). Inadequate infrastructure planning in the use of imported gas led to the underutilization of the Khulna CCGT power plant, which had to operate with diesel as there was not enough gas supply.<sup>82</sup>
- (iv) Client interaction and ownership and project troubleshooting can be significantly enhanced if project formulation and implementation monitoring responsibilities are delegated to staff based in the resident mission.

## 2. Issues

115. Despite ADB's record of success in the sector, some shortcomings that reduced the impact of ADB's support to the energy sector were noted.

- (i) Early ADB engagement included strong support for reform measures alongside project investment. However, ADB seemingly lost momentum in the sector reform push. While basic reforms are mostly in place, ambitions for a deeper or second stage of reforms appear to have faded in the past decade.
- (ii) ADB has been more of a follower than a leader in two critical areas: renewable energy and energy efficiency. Only two solar PV projects and one energy efficiency project featured in the last decade's energy portfolio.
- (iii) The related themes of disaster risk reduction and vulnerability to climate change seem not to have been explicitly addressed in ADB-supported planning and investment design.
- (iv) For an investment program of over \$4.7 billion in the sector, the corresponding TA program of \$14.5 million over 20 activities (with 55% being project preparatory TA) seems meagre compared with the depth of ADB's financing support to the sector. Put another way, investments averaged almost \$500 million per year over the decade whereas capacity building and advisory or knowledge generation support was limited to one activity per year at an average of \$0.7 million each (about 0.13% of investment value). While early investment programs compensated through a heavy dose of built-in capacity development activities, this was not maintained over time.

## 3. Sector Recommendations

116. This evaluation offers the following recommendations for future ADB involvement in the sector:

- (i) ADB should intensify its dialogue on energy sector reform with the Bangladesh authorities with the aim of relaunching significant, perhaps programmatic, policy-based interventions focusing on: (a) improving the investment climate for the private sector, particularly in gas exploration and production, distribution privatization, and renewable energy generation; (b) enhancing

<sup>82</sup> According to the completion report submitted by the government, the first-year energy output from the additional 75 MW Khulna CCGT unit was 259 GWh with a utilization rate of only 39%. The national load dispatch cent did not allow the unit to operate as base load because of the higher cost of using diesel as fuel instead of natural gas. The additional natural gas supply pipeline infrastructure was reported to have been completed in September 2020. This would lower the cost of power generation by more than half. *Energy Bangla*. 2020. [Natural Gas Supply Finally Reaches Khulna](#). 13 September.

regulatory independence and the transparency of energy sector governance, notably tariff setting; and (c) enhancing competition in the generation market through liberalization and movement to wholesale power exchange.

- (ii) Together with the recently approved World Bank Bangladesh: Scaling-up Renewable Energy Project, ADB should help relieve land and planning constraints for grid-connected renewable energy through the establishment of solar parks as a public-private partnership, and plan replication or expansion investments accordingly. These should include assessing the potential for building integrated solar installations ("rooftop PV") as another means of addressing constraints on renewable energy development.
- (iii) In view of the lack of success of private investors to date, ADB should expand its support for private-sector-led grid-connected renewable energy by offering financing and risk mitigation instruments, including equity participation, partial risk guarantee facilities, and green bond market development.
- (iv) ADB should redouble its efforts to promote demand-side energy efficiency, starting with energy-intensive industries, the commercial sector, and the building sector. While Bangladesh's financial markets are not as deep or developed as those of some neighboring countries, notably India, there are likely to be energy management institutional structures in those countries that could be replicated in Bangladesh, with concomitant capacity building.
- (v) Given Bangladesh's extraordinary vulnerabilities, ADB should routinely integrate natural disaster and climate change risk reduction into its sector planning assistance and energy infrastructure designs.
- (vi) Building on the success of the Bangladesh-India 1000 MW power interconnection, ADB should expand its efforts to promote regional power and gas trade and support Bangladesh to expand the number of its trading partners, which would bring benefits for both energy security and climate change.
- (vii) ADB should complement its large investment presence with a heightened commitment to innovation and new knowledge generation in the sector, which will be critical to maintain ADB's and Bangladesh's edge in the power sector. The sector needs to be transformed if it is to meet the multiple challenges of responding to the high demand growth for energy services, ensuring affordability, strengthening energy security, and promoting low carbon development.



## APPENDIX 1: ADB ENERGY PROJECTS, GRANTS, AND TECHNICAL ASSISTANCE IN BANGLADESH, 2011–2020

Table A1.1: Sovereign Loans and Grants

Project No.	Loan/Grant No.	Project Title	Status	Approval Date	Closing Date	Fund Source	Approved Amount (\$ million)	Commitment Amount (\$ million)	PCR or (PVR/PPER) Rating
35242-013	0019	Gas Transmission and Development Project	Financially Closed	27/10/2005	13/02/2014	Government of Norway	5.00	5.00	S(S)
35242-013	2188	Gas Transmission and Development Project	Closed	27/10/2005	18/05/2017	OCR	225.00	225.00	
35242-013	2189	Gas Transmission and Development Project	Closed	27/10/2005	04/06/2013	COL	5.00	5.02	
36107-013	2332	Sustainable Power Sector Development Program	Closed	26/06/2007	22/10/2014	OCR	400.00	400.00	S(S)
36107-013	2333	Sustainable Power Sector Development Program	Closed	26/06/2007	15/04/2014	COL	5.00	5.10	
36205-013	2039	Power Sector Development Program	Closed	10/12/2003	09/04/2012	OCR	186.00	186.00	S
37113-013	0583	Power System Efficiency Improvement Project (Additional Financing)	Active	05/07/2018	30/06/2021	CEFPF-CEF	3.00	3.00	-
37113-013	0584	Power System Efficiency Improvement Project (Additional Financing)	Active	05/07/2018	30/06/2021	CIF-SCF	22.44	22.44	
37113-013	2769	Power System Efficiency Improvement Project	Active	11/08/2011	30/06/2021	OCR	300.00	300.00	-
38164-013	2622	Natural Gas Access Improvement Project	Closed	26/03/2010	05/08/2019	OCR	261.00	261.00	S(S)
38164-013	2623	Natural Gas Access Improvement Project	Closed	26/03/2010	05/01/2017	COL	5.00	4.79	
40517-042	0253	Public-Private Infrastructure Development Facility (Supplementary Grant)	Financially Closed	17/05/2011	01/10/2015	Climate Change Fund	1.30	1.30	S(S)
40517-042	0254	Public-Private Infrastructure Development Facility (Supplementary Grant)	Financially Closed	17/05/2011	21/07/2014	CEFPF-ACEF	2.00	2.00	
42378-015	0320	MFF: Power System Expansion and Efficiency Improvement Investment Program	Cancelled	28/11/2012	31/12/2018	-	7.00	7.00	-
42378-015	2966	MFF: Power System Expansion and Efficiency Improvement Investment Program, Tranche 1	Closed	12/12/2012	23/12/2019	OCR	185.00	185.00	LS(LS)
42378-016	3087	MFF: Power System Expansion and Efficiency Improvement Investment Program, Tranche 2	Active	09/12/2013	31/12/2020	OCR	310.00	310.00	-
42378-017	3350	MFF: Power System Expansion and Efficiency Improvement Investment Program, Tranche 3	Active	08/12/2015	30/06/2021	OCR	205.00	205.00	-
44192-013	2661	Bangladesh–India Electrical Grid Interconnection Project	Closed	31/08/2010	23/06/2015	COL	100.00	103.45	S(S)
44192-014	3031	Bangladesh–India Electrical Grid Interconnection Project (Additional Financing)	Closed	25/09/2013	23/06/2015	COL	12.00	12.20	
44192-016	3298	SASEC Second Bangladesh–India Electrical Grid Interconnection Project	Closed	29/09/2015	19/05/2020	OCR	35.00	35.00	-

Project No.	Loan/Grant No.	Project Title	Status	Approval Date	Closing Date	Fund Source	Approved Amount (\$ million)	Commitment Amount (\$ million)	PCR or (PVR/PPER) Rating
44192-016	3299	SASEC Second Bangladesh–India Electrical Grid Interconnection Project	Closed	29/09/2015	19/05/2020	COL	85.00	84.20	
45203-006	3461	Natural Gas Infrastructure and Efficiency Improvement Project	Active	18/11/2016	30/06/2022	OCR	100.00	100.00	-
45203-006	3462	Natural Gas Infrastructure and Efficiency Improvement Project	Active	18/11/2016	30/06/2022	COL	67.00	64.15	
45203-006	8318	Natural Gas Infrastructure and Efficiency Improvement Project	Active	15/08/2016	30/06/2022	AIIB	60.00	60.00	
49423-005	3522	Bangladesh Power System Enhancement and Efficiency Improvement Project	Active	29/03/2017	31/12/2020	OCR	600.00	600.00	-
49423-005	3523	Bangladesh Power System Enhancement and Efficiency Improvement Project	Active	29/03/2017	31/12/2020	COL	16.00	16.02	
49423-005	9190	Bangladesh Power System Enhancement and Efficiency Improvement Project	Active	29/03/2017	31/12/2020	JFPR	2.00	2.00	
50161-003	3676	Rupsha 800-Megawatt Combined Cycle Power Plant Project	Active	26/06/2018	31/12/2022	OCR	500.00	500.00	-
50161-003	9194	Rupsha 800-Megawatt Combined Cycle Power Plant Project	Active	26/06/2018	31/12/2022	JFPR	1.50	1.50	
51137-001	589	Southwest Transmission Grid Expansion Project	Active	31/07/2018	31/12/2023	JFJCM	7.00	7.00	-
51137-001	590	Southwest Transmission Grid Expansion Project	Active	31/07/2018	31/12/2023	EAKPF	0.50	0.50	
51137-001	3683	Southwest Transmission Grid Extension Project	Active	31/07/2018	31/12/2023	OCR	350.00	350.00	
51137-003	0675	Dhaka and Western Zone Transmission Grid Expansion Project	Active	08/11/2019	31/12/2024	PRCF	0.75	0.75	
51137-003	3853	Dhaka and Western Zone Transmission Grid Expansion Project	Active	08/11/2019	31/12/2024	OCR	300.00	300.71	
<b>Subtotal:</b>							<b>4,364.49</b>	<b>4,365.13</b>	

ACEF = Asian Clean Energy Fund, BAN = Bangladesh, CEFPF = Clean Energy Financing Partnership Facility, CEF = Clean Energy Fund, CIF = Climate Investment Fund, SCF = Strategic Climate Fund, COL = concessional ordinary capital resources lending, eAKPF = Republic of Korea e-Asia and Knowledge Partnership Fund, IND = India, JFJCM = Japan Fund for Joint Crediting Mechanism, JFPR = Japan Fund for Poverty Reduction, LS = less than successful, MFF = multitranché financing facility, OCR = ordinary capital resources, PCR = program/project completion report, PPER = program/project performance evaluation report, PRCF = Poverty Reduction Cooperation Fund, PVR = project completion report validation report, S = successful, SASEC = South Asia Subregional Economic Cooperation.

Source: Asian Development Bank.

Table A1.2: Nonsovereign Operations

Project No	Company [Project Name]	Status	Approval Date	Approved Amount (\$ million)				Cancelled Amount (\$ million)	Signed Amount (\$ million)	XVR or (XARR) Rating
				Equity	Guarantee	OCR	Total			
45916-014	Industrial and Infrastructure Development Finance Company [Industrial Energy Efficiency Finance Program]	Cancelled	14/12/2011			6.00	6.00	6.00	0.00	
	Prime Bank [Part of Industrial Energy Efficiency Finance Program]	Terminated	14/12/2011			24.00	24.00	24.00	0.00	
44951-014	Summit Bibiyana II Power Company Limited [Bibiyana II Gas Power Project]	Closed	05/12/2014			75.00	75.00	0.00	75.00	(S)/S
50253-001	Reliance Bangladesh LNG And Power Limited [Reliance Bangladesh Liquefied Natural Gas and Power]	Active	01/12/2017		240.00	182.00	422.00	322.00	100.00 100.00 <sup>a</sup> 100.00 <sup>a</sup>	
	Reliance Bangladesh LNG Terminal Limited [Reliance Bangladesh Liquefied Natural Gas and Power]	Cancelled	01/12/2017		90.00	71.00	161.00	161.00	0.00	
51400-001	Summit Power International Limited [Cornerstone Investment in A Leading Power Developer]	Cancelled	28/03/2018	60.00			60.00	60.00	0.00	
52362-001	Spectra Solar Park Limited [Spectra Solar Power]	Approved	29/07/2019			15.00	15.00	0.00	13.28	
						<b>Total</b>	<b>763.00</b>	<b>573.00</b>	<b>288.28</b>	

OCR = ordinary capital resources, S = successful, XARR = extended annual review report, XVR = extended annual review report validation report,.

<sup>a</sup> It is excluded the cancellation of a \$100 million loan from Leading Asia's Private Infrastructure Fund (LEAP).

Source: Asian Development Bank.

Table A1.3: Technical Assistance

Project No.	TA No.	TA Title	Type	Status	Approval Date	Closing Date	Funding Source	Approved Amount (\$ million)	TCR Rating
37113-012	7242	Power System Efficiency Improvement Project	PPTA	Closed	20/02/2009	31/10/2012	JSF	1.20	-
41125-012	4953	Tendering Process for Independent Power Producer Plants	AOTA	Closed	16/07/2007	28/02/2011	TASF	0.60	U
42378-012	7889	Power System Efficiency Improvement Project II	PPTA	Closed	17/10/2011	31/12/2014	TASF	0.70	-
42478-022	7273	Supporting Implementation of the Bangladesh Climate Change Strategy and Action Plan, Subproject 1	CDTA	Closed	27/04/2009	31/12/2012	JSF	0.68	S
44192-017	8823	SASEC Bangladesh India Electrical Grid Interconnection Project II	PPTA	Closed	12/12/2014	30/06/2017	TASF	0.20	-
44203-012	7542	Bangladesh-India Electrical Grid Interconnection Project	CDTA	Closed	01/06/2010	31/05/2015	TASF	0.23	S
44305-012	7826	Support for Climate Change Mitigation and Renewable Energy Development	CDTA	Closed	21/06/2011	31/12/2014	TASF	0.50	LS
44405-012	7758	Tariff Reforms and Inter-Sectoral Allocation of Natural Gas	PATA	Closed	08/12/2010	12/07/2013	TASF	0.23	S

Project No.	TA No.	TA Title	Type	Status	Approval Date	Closing Date	Funding Source	Approved Amount (\$ million)	TCR Rating
45203-002	8474	Natural Gas Transmission and Distribution Development Investment Program	PPTA	Closed	04/10/2013	30/06/2017	TASF	1.00	-
45916-012	8024	Industrial Energy Efficiency Finance Program	PPTA	Closed	14/12/2011	23/02/2016	TASF	1.50	LS
48277-004	8839	Study on Energy Security	CDTA	Closed	17/12/2014	15/03/2019	TASF	1.00	S
48432-001	8927	Enabling Poor Women's Benefits from Enhanced Access to Energy	CDTA	Closed	10/07/2015	31/03/2018	STCF	0.21	LS
	8927	Enabling Poor Women's Benefits from Enhanced Access to Energy	CDTA	Closed	10/07/2015	31/03/2018	SPCF	0.23	LS
	8927	Enabling Poor Women's Benefits from Enhanced Access to Energy	CDTA	Closed	10/07/2015	31/03/2018	EAKPF	0.50	LS
49102-001	9628	Capacity Development for Renewable Energy Investment Programming and Implementation	CDTA	Active	02/11/2018	31/12/2020	CTF	0.40	-
	9628	Capacity Development for Renewable Energy Investment Programming and Implementation	CDTA	Active	02/11/2018	31/12/2020	ACEF	1.50	-
49423-004	9083	Bangladesh Power System Enhancement and Efficiency Improvement Project	PPTA	Closed	09/03/2016	31/05/2018	TASF	0.23	-
49423-007	9869	Preparing the Additional Financing for Bangladesh Power System Enhancement	PPTA	Active	20/11/2019	31/12/2024	TASF	0.45	-
50161-004	9164	Khulna 800 MW LNG Based Power Plant Project (Supplementary Financing)	PPTA	Closed	01/09/2016	13/11/2018	TASF	0.20	-
	9164	Khulna 800 MW LNG Based Power Plant Project	PPTA	Closed	12/05/2017	13/11/2018	TASF	0.23	-
51137-002	9342	Southwest Transmission Grid Expansion Project	PPTA	Closed	14/07/2017	06/08/2020	TASF	0.50	-
	9342	Southwest Transmission Grid Expansion Project	PPTA	Closed	22/08/2018	06/08/2020	TASF	0.75	-
51236-002	9470	SASEC Bangladesh–India Electrical Grid Interconnection Project	PATA	Closed	12/12/2017	04/05/2020	TASF	0.23	S
52362-002	9762	Spectra Solar Power Project	PPTA	Active	12/07/2019	31/12/2020	CFPS	0.23	-
54108-001	9961	Sustainable and Resilient Energy Sector Facility in Bangladesh	TRTA	Approved	14/04/2020	31/12/2023	TASF	1.0	-
<b>Subtotal:</b>								<b>14.5</b>	

ACEF = Asian Clean Energy Fund, AOTA = advisory and operational technical assistance, BAN = Bangladesh, CDTA = capacity development technical assistance, CFPS = Canadian Climate Fund for the Private Sector, CTF = Clean Technology Fund, eAKPF = Republic of Korea e-Asia and Knowledge Partnership Fund, IND = India, JSF = Japan Special Fund, LS = less than successful, PATA = policy advisory technical assistance, PPTA = project preparatory technical assistance, S = successful, SASEC = South Asia Subregional Economic Cooperation, SPCF = Spanish Cooperation Fund, STCF = Strategic Climate Fund, TA = technical assistance, TASF = Technical Assistance Special Fund, TCR = technical assistance completion report, TPER = technical assistance performance evaluation report, TRTA = Transaction Technical Assistance, U = unsuccessful.

Sources: Asian Development Bank.

## APPENDIX 2: BANGLADESH COUNTRY PARTNERSHIP STRATEGIES, 2011-2020: ENERGY INVESTMENT AREAS

CPS, 2011–2015			CPS, 2016–2020		
Item	Key Implementation Measures	Outcomes that ADB Contributes to	Item	Key Implementation Measures	Outcomes that ADB Contributes to
<b>Proposed Priority Sectors and Investment Areas</b>					
Energy	<ul style="list-style-type: none"> <li>(i) Enhance access to power, improve energy efficiency, develop a policy and regulatory setting conducive to private sector participation, boost power trade, and support green growth</li> <li>(ii) Support power system improvement</li> <li>(iii) Support private power projects in renewable energy, energy conservation, and other off-grid operations</li> <li>(iv) Provide capacity building support to develop model PPPs in the power sector</li> <li>(v) Prioritize ADB's private sector operations on innovative and catalytic power projects based on gas, dual fuels, and renewable energy, as well as on developing gas fields, the liquefied natural gas terminal, and associated gas facilities</li> </ul>	Expanded access to power	Easing infrastructure constraints	<ul style="list-style-type: none"> <li>(i) Focus on area-based investments (special economic zones and information technology parks to boost job creation)</li> <li>(ii) Update master plans for transport connectivity nationwide</li> <li>(iii) Support government efforts to expand power generation capacity, improve the efficiency of transmission and distribution networks, and expand regional interconnections</li> <li>(iv) Focus on strategic economic corridors</li> <li>(v) Combine improvements in basic urban services in water supply and sanitation with better services for urban health and skills training.</li> </ul>	<ul style="list-style-type: none"> <li>(i) More efficient infrastructure</li> <li>(ii) Greater transport connectivity</li> <li>(iii) Greater availability, reliability, and enhanced access to power supply</li> <li>(iv) Improved energy connectivity</li> <li>(v) Improved connectivity and trade</li> <li>(vi) Better urban infrastructure and services.</li> <li>(vii) Sustainable good quality urban primary health care</li> </ul>

ADB = Asian Development Bank, CPS = country partnership strategy, PPP = public–private partnership.

Source: Asian Development Bank.