



ISSUE BRIEF

Transforming the Power Sector in Developing Countries: Geopolitics, Poverty, and Climate Change in Bangladesh

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INTRODUCTION

Governments across South Asia face many challenges as they seek to improve the lives of the more than 1.8 billion people that live in the region. Increasing geopolitical competition—especially between and among China, Russia, and the United States—is one factor that is affecting progress. This “great power competition,” including over the South China Sea, is intertwined with regional rivalries (e.g., India and Pakistan, India and China, and the United States and Iran) and has important economic, military, technological, and environmental consequences. Energy is a key strategic sector in this competition as China pursues its expansive Belt and Road Initiative (BRI) infrastructure and trade vision, Russia uses arms sales and nuclear energy to expand its regional presence, and the United States confronts Iran and gears up its free and open Indo-Pacific Strategy and Asia EDGE (Enhancing Development and Growth through Energy) initiative.

The Global Energy Center promotes energy security by working alongside government, industry, civil society, and public stakeholders to devise pragmatic solutions to the geopolitical, sustainability, and economic challenges of the changing global energy landscape

This issue brief considers the transformation of the electricity sector in Bangladesh. It is the fourth country analysis in the Atlantic Council’s “Transforming the Power Sector in Developing Countries” series. This issue brief applies to Bangladesh the analytical framework developed in the first report in the series, which presents general challenges and strategic priorities for developing countries in the context of their implementation of electric power policies and reforms following the 2015 Paris Agreement on climate change.



A Dhaka, Bangladesh, cityscape at night. Source: Unsplash/Ahnaf Tahsin Rafi

Bangladesh is a large (population of 163 million),¹ poor (nominal gross domestic product (GDP) per capita of \$1,827),² and developing country that has seen a steady GDP growth rate of between 6 and almost 8 percent since 2010.³ This growth has increased energy and electricity demand, and placed pressure on domestic gas resources. The development of a viable energy sector and expanding electricity access will be of critical importance to its goal of moving into the ranks of the middle-income countries by 2021.

But Bangladesh has had a history of factious politics and the election year of 2018 saw mounting tensions after the arrest of Bangladesh Nationalist Party (BNP) Chairperson and former Prime Minister Khaleda Zia. Despite protests over election fraud, Sheikh Hasina and her Awami League party won a landslide victory in the December 2018 national election and now have an overwhelming majority in the parliament.⁴

Bangladesh also faces severe impacts from climate change, including frequent flooding and salinity problems that are displacing a growing number of people from the country's huge Ganges river delta and furthering the move to urban areas.⁵ In 2018, Bangladesh was hit by heavy monsoon rains, which had an especially devastating impact on the thousands of Rohingya refugees at the Kutupalong refugee camp in Cox's Bazar. Kutupalong is reportedly the largest refugee camp in the world with more than 630,000 residents.⁶ Bangladesh signed and ratified the Paris Agreement in 2016 and has developed plans for increased mitigation and adaptation activities.

This issue brief explores the linkages between geopolitics, poverty, and climate change as they relate to the transformation of the power sector and the following five key challenges.

1 "Bangladesh Population 2019," World Population Review, accessed November 2019, <http://worldpopulationreview.com/countries/bangladesh-population/>.

2 "Bangladesh GDP per Capita," CEIC, accessed November 2019, <https://www.ceicdata.com/en/indicator/bangladesh/gdp-per-capita>.

3 "Bangladesh GDP Annual Growth Rate," Trading Economics, accessed November 2019, <https://tradingeconomics.com/bangladesh/gdp-growth-annual>.

4 Michael Kugelman, "A Disputed Election and a Dangerous New Era for Bangladesh Politics," CNN, January 1, 2019, <https://www.cnn.com/2019/01/01/opinions/bangladesh-election-oped-intl/index.html>.

5 Tim McDonnell, "Climate change creates a new migration crisis for Bangladesh," National Geographic, January 24, 2019, <https://www.nationalgeographic.com/environment/2019/01/climate-change-drives-migration-crisis-in-bangladesh-from-dhaka-sundabans/>.

6 "World's biggest refugee settlement gets biggest ever waste facility," United Nations High Commissioner for Refugees, February 1, 2019, <https://www.unhcr.org/en-us/news/briefing/2019/2/5c540fe74/worlds-biggest-refugee-settlement-gets-biggest-waste-facility.html>.

CRITICAL CHALLENGES

The energy sector is critical to Bangladesh's progress in improving standards of living and achieving the United Nations' Sustainable Development Goals (SDGs). In this issue brief we consider the five common challenges facing developing countries and their specifics in Bangladesh. These challenges are: (1) meeting growing energy demand and moving to a cleaner energy mix; (2) improving governance and transparency; (3) increasing affordability and access; (4) addressing environmental degradation and climate change; and (5) achieving power sector financial viability.

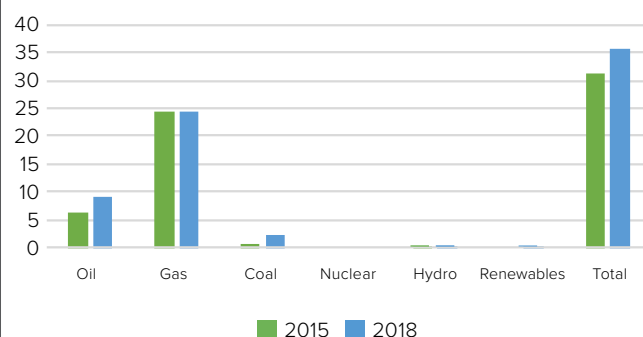
Meeting Growing Energy Demand and Moving to a Cleaner Energy Mix

Developing countries are playing an increasingly important role in global energy markets. In 2018, countries that are not part of the Organisation for Economic Co-operation and Development (OECD) represented almost 60 percent of global primary energy consumption.⁷ That share is expected to increase as these countries account for as much as 90 percent of future energy growth to 2040.⁸

Bangladesh is an example of a country with rapid energy demand growth. Its primary energy consumption has grown at a rate of 6.4 percent over the 2007–2017 period. In 2018, while GDP rose by 7.9 percent, primary energy consumption increased by 8.6 percent over 2017.⁹

Figure 1 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 percent of domestic oil consumption.¹⁰ Bangladesh has seen crude oil and refined product import costs rise from \$3.1 billion or 7 percent of current account

Figure 1: Primary Energy Consumption in Bangladesh in 2015 and 2018
(Million Tons of Oil Equivalent)



Source: BP Statistical Review of World Energy 2019, BP.

imports in fiscal year (FY) 2017 to \$3.67 billion in FY2018 and an estimated \$4.85 billion in FY2019.¹¹ Although Bangladesh's gas production has increased from 19.3 bcm in 2010 to 27.5 bcm in 2018, consumption has grown from 16.6 bcm to 28.4 bcm over the same period.¹²

In Bangladesh, demand for electricity has outpaced the growth in primary energy consumption. Electricity generation growth over the 2007–2017 period averaged a booming 9 percent.¹³ Although installed capacity has grown to about 21,419 megawatts (MW) in September 2019,¹⁴ Bangladesh's peak electricity generation was only 10,958 MW in 2018 and fell short of the peak electricity demand of 14,014 MW, resulting in outages and unserved demand.¹⁵

The Bangladesh Revised Master Plan, prepared by the Japan International Cooperation Agency (JICA) for the government of Bangladesh in 2016, projects that electricity demand will more than double over the period to 2041, rising to 236

7 BP Statistical Review of World Energy 2019, BP, June 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>.

8 World Energy Outlook 2019, International Energy Agency, November 2019, <https://www.iea.org/reports/world-energy-outlook-2019>.

9 BP Statistical Review of World Energy 2019, BP.

10 "Bangladesh Economic Indicators," TheGlobalEconomy.com, accessed November 2019, <https://www.theglobaleconomy.com/Bangladesh/oilproduction/>; BP Statistical Review of World Energy 2019, BP.

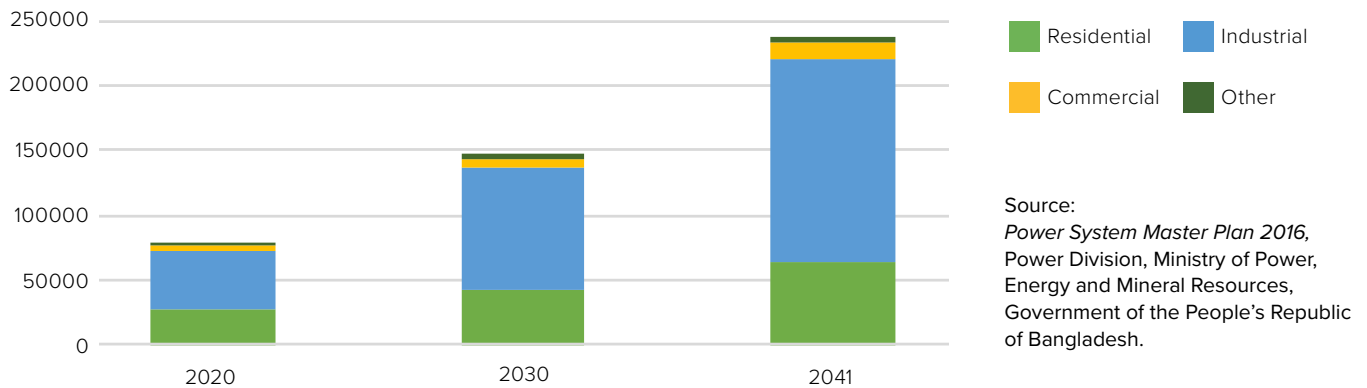
11 Jebun Nesa Alo, "Oil import bill to soar this year," *the Daily Star*, September 28, 2018, <https://www.thedailystar.net/business/news/oil-import-bill-soar-year-1639870>.

12 BP Statistical Review of World Energy 2019, BP.

13 Ibid.

14 "Electricity sector in Bangladesh," Wikipedia, accessed November 2019, https://en.wikipedia.org/wiki/Electricity_sector_in_Bangladesh.

15 Khondaker Golam Moazzem and Mohammad Ali, *The Power and Energy Sector in Bangladesh: Challenges of Moving Beyond the Transition Stage*, Centre for Policy Dialogue, March 10, 2019, <https://cpd.org.bd/wp-content/uploads/2019/03/The-Power-and-Energy-Sector-of-Bangladesh.pdf>.

Figure 2: Bangladesh Projected Electricity Consumption (by Consumer), in GWh

terawatt-hours (TWh) from the 2018 level of 79 TWh.¹⁶ This forecast is driven by the expectation of a large increase in industrial electricity consumption as shown in Figure 2.¹⁷

Although gas is the leading fuel for power generation in Bangladesh (Figure 3), the country has significant oil-fired capacity that its government added in the 2010–2012 period through contracts with private companies for quick fix, “rental units” to meet the emergency electricity supply gap.¹⁸ Grid-connected renewable generation is only at a very nascent stage. This issue brief examines more closely the changing power mix in the strategic priorities section.

Improving Governance and Transparency

The management of the energy and electricity sector in Bangladesh is highly centralized in the Ministry of Power, Energy and Natural Resources, as well as several state-owned corporations. Sheikh Hasina holds this ministry portfolio and her energy adviser, Dr. Tawfiq-e Elahi Chowdhury, has been quite influential in policy decisions, e.g., to pursue coal and gas imports and nuclear power. Unlike in Pakistan, which has major hydro resources, the evolution of the energy institutions in Bangladesh was different with both the early establishment of a Ministry of Power, Energy and Mineral Resources and the separation of water and power. The Bangladesh Power Development Board (BPDB) was established in 1972 as the main body responsible for electric

power under the ministry. Given the large rural population, the Bangladesh Rural Electrification Board (BREB) was created in 1977 with assistance from the US Agency for International Development (USAID), and the US rural electric cooperative system model was adopted. Partial system unbundling in 1995 led to the establishment of the Power Grid Company of Bangladesh in 1996 to manage the high-voltage transmission system. Urban distribution operations are split between the BPDB and several public limited companies—Dhaka Electric Supply Company Ltd., the Dhaka Power Distribution Company Ltd., the Northern Electric Supply Company Ltd., and the West Zone Power Distribution Company Ltd. A separate division of the Ministry of Energy oversees oil and gas while PetroBangla, established in 1974, 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.

Bangladesh has established two energy regulatory bodies, the Bangladesh Energy Regulatory Commission, established 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 Ministry of Energy and are working to develop their capabilities and increase their autonomy.

¹⁶ BP Statistical Review of World Energy 2019, BP.

¹⁷ “Power System Mastery Plan 2016,” Power Division, Ministry of Power, Energy and Mineral Resources, Government of the People's Republic of Bangladesh, September 2016, https://mpemr.gov.bd/assets/media/pdf/files/FR_PSMP_revised.pdf.

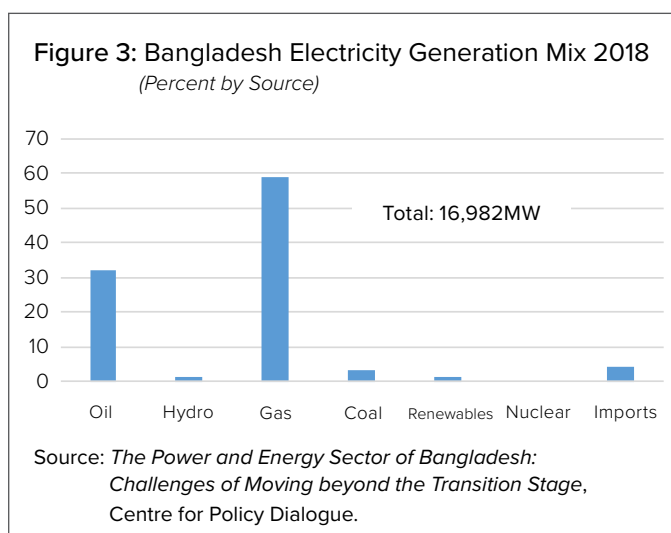
¹⁸ Mustafa K. Mujeer and Tahreen Tahrima Chowdhury, *Quick Rental Power Plants in Bangladesh: An Economic Appraisal*, Bangladesh Institute of Development Studies, June 2013, http://bids.org.bd/uploads/publication/Other_Publications/Discussion_Paper_01.pdf.

The Ministry of Energy has made some progress in increasing transparency of the sector and the government has been generally good at honoring its power purchase agreements with the private sector. A major ministry digital media marketing program has started disseminating information about the sector to the public, and a common web platform, linked to social media sites, integrates the various ministry websites.

Increasing Affordability and Access

Bangladesh is among the top twenty “Access Deficit Countries,” according to the World Bank’s 2019 *Tracking SDG7 Report*. However, Bangladesh is recognized as a leading developing country in improving access; electricity access has increased from 55 percent in 2010 to 88 percent in 2017, with rural areas having 81 percent estimated access.¹⁹ Bangladeshi officials recently indicated that the overall electricity coverage rate has increased to 93 percent,²⁰ reducing the number of people without electricity to as low as 10 million, compared with the 2017 estimate of 20 million.

The government of Bangladesh seeks to achieve 100 percent coverage by 2021. This target is well in advance of SDG 7, which aspires to 100 percent electricity access by 2030. The BREB started with about thirteen Palli Bidyut Samities (PBS) or rural cooperatives. As the population has grown, the number of rural cooperatives has grown to eighty.



Financial viability and losses have been a problem. The World Bank has helped BREB reduce these losses. Lack of reliable power from the BPDB has restricted development. At the same time, the country, through the quasi-governmental Infrastructure Development Company Limited (IDCOL), has pursued solar home systems and micro-grid programs to serve villages where the PBS system has yet to connect. Bangladesh is noteworthy in having the world’s largest off-grid solar program and has increased solar off-grid access from 9 percent in 2016 to 14 percent in 2018.²¹

Addressing Environmental Degradation and Climate Change

The South Asian region faces enormous environmental challenges due to its geographical and ecological situation, and growing population and urban pressures. Bangladesh, with its low-lying coastal position and large, dense population that is projected to grow to 202 million by 2050, has been especially vulnerable.²²

Bangladesh is situated in the extensive riverine system of the Brahmaputra (Jamuna), Ganges (Padma), and the Surma-Meghna systems and their many tributaries that occupy 79 percent of the country and flow into the massive delta in the south. It relies heavily on irrigation and both diesel and electric pumps for its agricultural and urban economies. Bangladesh experiences regular flooding and cyclones with parts of the country flooding almost every year. The German Watch Climate Risk Index ranked Bangladesh sixth on its list of countries affected by climate change during 1997–2016 with 187 severe climate events inflicting estimated losses of \$2.3 billion.²³

Although Bangladesh experiences these damaging climate events, it produces minimal amounts of CO₂ emissions. BP estimates Bangladesh’s CO₂ energy emissions in 2018 at 90.4 metric tons (MT) or only 0.3 percent of global energy-related CO₂ emissions. Despite its very low overall, as well as per capita, level of emissions, Bangladesh did put forward in its 2015 Intended National Determined Contribution (INDC) an unconditional contribution target of 222 MT for power, transport, and industry in 2030 compared with a “business as usual” (BAU) projection of 234 MT. The power sector component of this unconditional scenario totals 86 MT in 2030, or a 5 percent reduction from the BAU number and the

19 *Tracking SDG7: The Energy Progress Report 2019*, World Bank, May 2019, <https://trackingsdg7.esmap.org/data/files/download-documents/2019-Tracking%20SDG7-Full%20Report.pdf>.

20 “Power coverage reaches 93pc people in Bangladesh,” *the Daily Star*, May 26, 2019, <https://www.thedailystar.net/backpage/access-to-electricity-in-bangladesh-coverage-reaches-93-percent-1748935>.

21 *Bangladesh - Second Rural Electrification and Renewable Energy Development Project: additional financing*, World Bank Group, March 20, 2018, <http://documents.worldbank.org/curated/en/568271523584915573/Bangladesh-Second-Rural-Electrification-and-Renewable-Energy-Development-Project-additional-financing>.

22 “Pakistan 2050,” PopulationPyramid.net, accessed November 2019, <https://www.populationpyramid.net/pakistan/2050/>; “Bangladesh 2050,” PopulationPyramid.net, accessed November 2019, <https://www.populationpyramid.net/bangladesh/2050/>.

23 David Eckstein, Vera Künzel, and Laura Schäfer, *Global Climate Risk Index 2018*, German Watch, November 9, 2017, <https://germanwatch.org/en/node/14987>.

2011 base of 21 MT. With external assistance, the conditional target in power drops to 75 MT, an 18 percent reduction from the base.²⁴ But this scenario still sees power sector emissions growing by 257 percent over the 2011–2030 period. We conclude that even meeting the relative reduction targets will require major changes in strategy, which will be discussed later in this document.

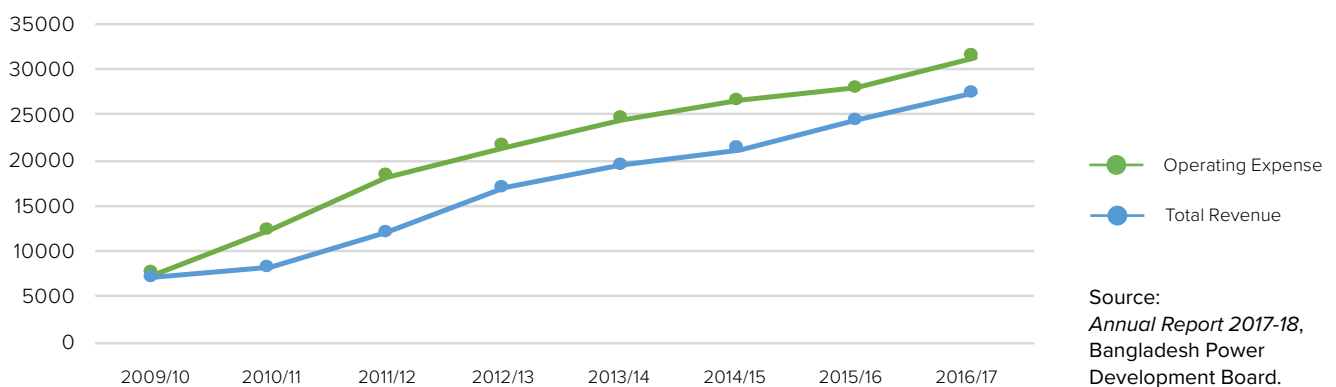
Achieving Power Sector Financial Viability

Like many other developing countries, Bangladesh struggles with cost recovery in the power sector. Inadequate revenue generation by the distribution companies has created difficulties for the BPDB and the government, which has had to cover the losses to maintain payments to the private generators, especially the rental oil units. The gap between total revenues and operating expenses of the BPDB has, however, narrowed, as shown in Figure 4. The overall net BPDB loss in FY2016–17 was reported as 44,348,900,000 Bangladeshi taka (about \$528 million), which was somewhat less than in the previous year. Purchases of power from non-BPDB domestic generators and from India constituted the largest portion of the BPDB's expenses (about 75 percent) with purchases from independent power producers (IPPs) representing the largest share of these expenses (27 percent).²⁵ The BPDB's financial position was helped in FY2016–17 by a 23 percent increase in revenue collections

and a reduction in distribution system losses from 11 percent to 9 percent.²⁶ Increasing revenue generation while ensuring affordability for the poor is a huge challenge, but it is critical to mobilizing the resources needed to invest in the expansion and modernization of the distribution system to meet the rapid demand growth.

The World Bank has estimated the cost to Bangladesh's economy of the subsidies and weak management performance in the power sector to be about \$11.2 billion in FY2016 or 5 percent of GDP, in large part due to underpricing of domestic gas.²⁷ Direct subsidies are provided to both electricity consumers and electricity generators from the BPDB. Gas is primarily used in power generation, where it provides almost 60 percent of electricity generation. Domestic gas is underpriced for power generators compared to the opportunity costs. A second World Bank study concludes: "[I]ncreasing the 2018 price of domestically produced natural gas to import parity so that the weighted average price equals the import price of LNG (\$8.51/GJ) would result in almost \$7 billion of additional government revenue."²⁸ As Bangladesh increases its liquefied natural gas (LNG) imports, the weighted average price will increase. The government has recognized the need to increase gas prices and the regulator in July 2019 raised the average consumer price by 32.8 percent with the power sector receiving a 40 percent increase.²⁹

Figure 4: Electricity Revenues vs. Operating Expenses in Bangladesh (2009/10 to 2016/17), in ten million Tk



24 *Intended Nationally Determined Contributions (INDC)*, Ministry of Environment and Forests (MOEF), Government of the People's Republic of Bangladesh, September 2015, https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Bangladesh%20First/INDC_2015_of_Bangladesh.pdf.

25 *Annual Report 2016-17*, Bangladesh Power Development Board, January 2018, [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).

26 *Ibid.*

27 Fan Zhang, *In the Dark: How Much Do Power Sector Distortions Cost South Asia?*, the World Bank, December 12, 2018, <https://www.worldbank.org/en/region/sar/publication/in-the-dark-how-much-do-power-sector-distortions-cost-south-asia>.

28 Govinda R. Timilsina, Sheoli Pargal, Marinos Tsigas, and Sebnem Sahin, *How Much Would Bangladesh Gain from the Removal of Subsidies on Electricity and Natural Gas?*, World Bank Group, December 2018, <http://documents.worldbank.org/curated/en/409331545076295371/pdf/WPS8677.pdf>.

29 Md. Saidun Nabi, "Gas prices hiked despite opposition," *Dhaka Tribune*, June 30, 2019, <https://www.dhakatribune.com/bangladesh/power-energy/2019/06/30/gas-prices-hiked>.

STRATEGIC PRIORITIES

The government of Bangladesh, in grappling with the above challenges, has had to make a number of strategic choices that have important long-term political, economic, and environmental consequences. These choices have been influenced by both external and domestic factors and interests. This section describes some of these choices and suggests possible ways to improve the policy, institutional, and market framework.

Creating a Sound Policy, Legal, and Regulatory Environment

Strategic Priority: *The government of Bangladesh needs to take a hard look at its current energy policies and power market design. It should consider how to introduce more competition in the market, reduce subsidies, improve efficiencies in the 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.*

Discussion: The government of Bangladesh has received myriad advice from other governments and international financial institutions on its energy approach. In the power sector, a major influence has come from Japanese advisers, who played a significant role in developing the Revised Power Sector Master Plan of 2016. There is reason, however, given the strong interest of Japanese companies in exporting coal plants, to question one of its central premises, i.e., “coal will be the cheapest primary energy now and in the future.”³⁰

A comprehensive analysis of the full costs and benefits of this strategic priority needs to be conducted along with a realistic assessment of viable alternatives. As discussed below, Bangladesh has significant renewable energy resources and its proven natural gas reserves are estimated at 7.3 trillion cubic feet.³¹ Mobilizing private investment in both these resource options should be a high priority. Increasing private investor access to domestic gas fields, as well as offshore areas, along

with domestic gas well-head price reform would be important steps. Reduced losses and full cost recovery of electricity retail prices, together with improved access to land, would reduce investor risks in renewable energy projects.

With the increases in renewable energy, the greater complexity in the system with the addition of nuclear and coal, and the large investment requirements to meet electricity needs, the role of the energy regulator will be of even greater importance to furthering transparency, ensuring that accounting systems meet acceptable standards, rationalizing tariffs and moving to full cost recovery, implementing effective licensing systems, and formulating new market designs and market monitoring systems. The government should provide the resources necessary to strengthen both NERC and SREDA, and ensure they are independent, adequately staffed, and receive opportunities for professional development.

Developing Efficient Institutional and Market Structures

Strategic Priority: *The single buyer with independent power generation system needs further reform and privatization to create a more competitive market environment.*

Discussion: The BPDB is the “single buyer” in Bangladesh’s power system. It buys power from the generators and sells it to urban distribution companies³² and the BREB cooperatives. But BPDB has not been able to pass on the full price of power to the distribution entities. With population and income growth, BREB consumption has grown to more than 42 percent of total electricity sales to distribution.³³ To improve local supply, the BREB has been permitted to develop small IPPs in its service areas. At least twelve units totaling 225 MW with capacity between 11 and 33 MW each are in operation.³⁴

A key element of the Bangladeshi government’s overall economic strategy is the creation of special economic zones. Over the next fifteen years, as many as 100 zones are envisioned. The Bangladesh Economic Zone Authority (BEZA) has approved thirty-seven zones with eight export

30 *Power System Master Plan 2016*, Power Division, Ministry of Power, Energy and Mineral Resources, Government of the People’s Republic of Bangladesh, September 2016, https://mpemr.gov.bd/assets/media/pdf/files/FR_PSMP_revised.pdf.

31 *BP Statistical Review of World Energy 2019*, BP.

32 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.

33 *People’s Republic of Bangladesh: Bangladesh Power System Enhancement and Efficiency Improvement Project, Project Administration Manual*, Asian Development Bank, March 2017, <https://www.adb.org/sites/default/files/project-documents/49423/49423-005-pp-en.pdf>.

34 “Power Generation Under BREB,” Bangladesh Rural Electrification Board, last updated October 15, 2019, <http://www.reb.gov.bd/site/page/3c130bd6-7c9b-4f01-a645-232230a2a743/->.

zones already in operation. Companies from countries with strong government support, especially China, Japan, and South Korea, are negotiating deals to establish industrial plants in these zones.³⁵

These economic developments and the growth in incomes and urbanization require a comprehensive review of the electricity market design that Bangladesh will need in the future. Given the investment requirements, opportunities should be pursued for private investors to participate both in urban distribution companies and in these new economic zones, including the building of grid interactive mini-grids and generation plants.

Achieving a Cleaner and Resilient Generation Mix

Strategic Priority: *Bangladesh should continue to diversify its electricity mix, but reorient its strategy to give priority to lower carbon sources and away from oil and coal by focusing on gas, renewables, and increased energy efficiency. Given the growing demand for gas and potential for declines in major gas fields, high priority should be given to increasing onshore and offshore gas exploration and development, including through the increase in the well-head price of gas. Given the declining costs of renewables and its favorable solar resources, Bangladesh should also reexamine, considering the new World Bank solar park model, its grid-based renewable targets and how mini-grids and distributed solar power systems can play a larger role in its future mix.*

Discussion: With current installed capacity at about 21,419 MW,³⁶ the BPDB seeks to reach 24,000 MW by 2021, 40,000 MW by 2030, and 60,000 MW by 2041.³⁷ Bangladesh has had difficulty in meeting peak electricity demand, which reached 14,796 MW on May 29, 2019, against generation of 12,893 MW.³⁸ Peak demand was more than 3,500 MW higher than the recorded level of 11,387 MW on July 18, 2018.³⁹ Below is a discussion of the various strategic options for meeting the increases in electricity demand.

Natural Gas: Bangladesh's domestic, onshore gas fields have long been the main source of gas for the power and industrial sectors. Gas production has increased at an average rate of 5.7 percent over the 2007–2017 period and 3.2 percent in the 2017–2018 year.⁴⁰ Chevron's three fields have supplied about 58 percent of the production. After considering the sale of its gas assets in 2017 to Chinese investors, Chevron decided to remain in Bangladesh and invest in maintaining production. In April 2019, the company was awarded rights to explore Block 9, an onshore area east of Dhaka near the Bakhrabad gas field.⁴¹ This award is hopefully a sign that the government will begin to open other onshore areas to foreign investors that can make the needed investment. But there is concern about the potential decline in production from Chevron's Bibiyana and several PetroBangla fields in the future. The government's efforts to attract companies in expensive offshore exploration has been unsuccessful. A new model production-sharing agreement with improved prices and allowance for exports has been prepared, but auctions

35 "Bangladesh Export Processing Zone Authority," Wikipedia, accessed November 2019, https://en.wikipedia.org/wiki/Bangladesh_Export_Processing_Zone_Authority.

36 Md. Saidun Nabi, "Bangladesh sees highest ever power generation," *Dhaka Tribune*, May 29, 2019, <https://www.dhakatribune.com/bangladesh/development/2019/05/29/bangladesh-sees-highest-ever-power-generation>.

37 Md. Saidun Nabi, "Can Bangladesh meet its 10% renewable energy target by 2020?," *Dhaka Tribune*, January 19, 2019, <https://www.dhakatribune.com/bangladesh/power-energy/2019/01/12/can-bangladesh-meet-its-10-renewable-energy-target-by-2020>.

38 Ibid.

39 "Power blackouts to continue till Dec due to overloaded transmission systems," *Pakistan Today*, August 31, 2018, <https://www.pakistantoday.com.pk/2018/08/31/loadshedding-to-affect-overloaded-transmission-systems-till-dec-report/>; "Bangladesh Power Development Board," Bangladesh Power Development Board, accessed November 2019, http://www.bpdb.gov.bd/bpdb_new/.

40 *BP Statistical Review of World Energy 2019*, BP.

41 "Chevron Wins Right to Explore Huge Exploration Tract in Bangladesh," Chevron Human Energy, April 11, 2019, <http://phx.corporate-ir.net/phoenix.zhtml?c=66900&p=irol-pressreleaseArticle&ID=165630>.

for new blocks have not yet occurred.⁴² These factors, in the face of the 6.4 percent growth in gas demand, have led the government to pursue imported LNG to both meet new requirements and reduce dependence on fuel oil and high-speed diesel units, which represents about 30 percent of installed electricity generation capacity and have been a major drain on the government budget since electricity retail prices do not cover these costs.

Bangladesh joined the ranks of LNG importers in 2018 with the connection of a Floating Storage Regasification Unit (FSRU), moored at Moheshkhali Island near Chittagong, with a capacity of 3.75 million tonnes per annum (mtpa). As with Pakistan's first import facility, US company Exceleerate Energy, with partial funding from the International Finance Corporation (IFC) and a fifteen-year terminal fee agreement with PetroBangla, supplied the FSRU, which began regasifying the first Qatar LNG on August 12, 2018. But inadequate pipeline capacity initially limited output and a 30-kilometer (km) pipeline is being built between Anwara and Fouzdarhat.⁴³ PetroBangla has entered into a fifteen-year contract with Qatar's RasGas for 2.5 mtpa. In addition, Oman Trading International began deliveries to the Exceleerate Energy FSRU in January 2019 under a ten-year contract for 1 million tons.⁴⁴ The International Gas Union (IGU) reports that Bangladesh imported 0.7 million metric tons (MMT) in 2018.⁴⁵

In late November 2019, the first shipment of Russian LNG reached the Summit LNG Terminal in Bangladesh.⁴⁶

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 between Summit Power and Mitsubishi subsidiary Diamond Gas was announced for a two, 1,200 MW unit plant based on imported LNG.⁴⁷ The Japanese company JERA has also taken a stake in the power project.⁴⁸ Bangladesh's second FSRU arrived in April 2019 with Qatar LNG under the agreement between Summit LNG Terminal and Exceleerate Energy.⁴⁹ While these first two FSRUs have been installed relatively quickly despite some issues with rough waters during the monsoon season, ExxonMobil, Qatar Petroleum, and twelve other firms have expressed an interest in building Bangladesh's first onshore LNG regasification terminal with a larger 7.5 mtpa capacity.⁵⁰ 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.⁵¹ At the same time, PetroBangla is reported to be talking with Chinese and Indian companies about building a 7.5 mtpa onshore LNG terminal in Cox's Bazar.⁵² As of this writing, Bangladesh had just announced an agreement between the BPDB and the Saudi private power company ACWA Power for a 3,600 MW gas-to-power complex, including an LNG import facility.⁵³

42 Rejaul Karim Byron and Md Fazlur Rahman, "IOCs can now export gas," *the Daily Star*, September 3, 2019, <https://www.thedailystar.net/frontpage/international-oil-companies-can-now-export-gas-from-bangladesh-1794613>.

43 M. Azizur Rahman, "Bangladesh Begins Regasifying LNG," *Natural Gas World*, August 13, 2018, <https://www.naturalgasworld.com/bangladesh-begins-regasifying-lng-63553>.

44 Aziz Rahman, "Oman Trading International Delivers LNG to Bangladesh," *Natural Gas World*, January 29, 2019, <https://www.naturalgasworld.com/oman-trading-international-delivers-lng-to-bangladesh-67601>.

45 *2019 World LNG Report*, International Gas Union, April 2019, https://www.igu.org/sites/default/files/node-news_item-field_file/IGU%20Annual%20Report%202019_23%20loresfinal.pdf.

46 William Powell, "Yamal LNG Reaches Bangladesh," *Natural Gas World*, November 29, 2019, <https://www.naturalgasworld.com/yamal-lng-reaches-bangladesh-74869>.

47 Jessica Jaganathan, "Summit Power to develop \$3 billion LNG-to-power Bangladesh project with Japan firms," *Reuters*, March 13, 2018, <https://www.reuters.com/article/us-bangladesh-japan/summit-power-to-develop-3-billion-lng-to-power-bangladesh-project-with-japan-firms-idUSKCN1GP0W1>.

48 Jessica Jaganathan, "Japan's JERA buys stake in power unit of Bangladesh's Summit for \$330 million," *Reuters*, October 7, 2019, <https://www.reuters.com/article/us-japan-bangladesh-lng/japans-jera-buys-stake-in-power-unit-of-bangladeshs-summit-for-330-million-idUSKBN1WM0KD>.

49 Shardul Sharma, "Bangladesh's Second FSRU Arrives at Moheshkhali," *Natural Gas World*, April 22, 2019, <https://www.naturalgasworld.com/bangladeshs-second-fsru-arrives-at-moheshkhali-69526>.

50 "Tellurian Market Commentary for June 24, 2019," Tellurian, email newsletter, June 24, 2019.

51 M. Azizur Rahman, "Bangladesh Liberalises LNG Market," *Natural Gas World*, June 27, 2019, <https://www.naturalgasworld.com/bangladesh-liberalises-lng-market-70945>.

52 Shardul Sharma, "Dhaka Looks for Firms to Build Onshore Terminal," *Natural Gas World*, January 31, 2019, <https://www.naturalgasworld.com/dhaka-looks-for-firms-to-build-onshore-terminal-67649>.

53 "Saudi ACWA signs deal with Bangladesh to set up 3,600 MW LNG-based power plants," *Dhaka Tribune*, October 17, 2019, <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>.



Coal workers are seen at a market as they unload a ferry in Dhaka, Bangladesh, January 13, 2019.
Source: REUTERS/Mohammad Ponir Hossain

Coal: Bangladesh's master plan envisions coal providing 40 percent of power generation in the high-demand case and 34 percent in the low-demand case by 2030.⁵⁴ With Indian, Chinese, Japanese, and possibly South Korean financing, power plants using imported coal are under construction at Rampal (1,320 MW) and at Payra (1,320 MW) in southern Bangladesh, and a large 1.3 gigawatt (GW) coal facility has been proposed for Moheshkhali Island in Cox's Bazar district, although this may be developed as a gas complex.⁵⁵ There have been both local and international protests against these coal plants. A draft decision memorandum for review

by UNESCO's World Heritage Committee advised the government of Bangladesh to cease development of the power plant until a strategic environmental assessment could be undertaken as well as place the Sundarbans—the largest mangrove forest in the world where the Rampal plant is being built—on a list of natural sites that are in danger.⁵⁶ The decision to place the site on the endangered list was postponed to 2020.⁵⁷ 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

54 *Revisiting Power System Master Plan (PSMP) 2016*, Power Division, Ministry of Power, Energy and Mineral Resources, Government of the People's Republic of Bangladesh, November 2018, https://powerdivision.portal.gov.bd/sites/default/files/files/powerdivision.portal.gov.bd/page/4f81bf4d_1180_4c53_b27c_8fa0eb1e2c1/Revisiting%20PSMP2016%20%28full%20report%29_signed.pdf.

55 "\$2bn coal-fired power plant set for Bangladesh," *Power Engineering International*, May 9, 2018, <https://www.powerengineeringint.com/2018/05/09/2bn-coal-fired-power-plant-set-for-bangladesh/>; Simon Nicholas, "IEEFA Update: Bangladesh's coal expansion plans stir criticism," *Institute for Energy Economics and Financial Analysis*, June 26, 2019, <http://ieefa.org/ieefa-update-bangladeshs-coal-expansion-plans-stir-criticism/>; "Payra power station," *Source Watch*, accessed November 2019, https://www.sourcewatch.org/index.php/Payra_power_station; and "Rampal power station," *Source Watch*, accessed November 2019, https://www.sourcewatch.org/index.php/Rampal_power_station.

56 "Bangladesh's coal-fired power plants puts Sunderbans on 'natural sites in danger': report," *Business Standard*, June 15, 2019, https://www.business-standard.com/article/pti-stories/bangladesh-s-coal-fired-power-plants-puts-sunderbans-on-natural-sites-in-danger-report-119061500321_1.html.

57 "Unesco delays decision on Sundarbans," *the Daily Star*, July 5, 2019, <https://www.thedailystar.net/backpage/news/unesco-delays-decision-sundarbans-1767046>.

due to concerns over potential destruction of agricultural land and displacement of indigenous communities; the government had suspended plans for the project.⁵⁸ But in early 2019, Chinese interests were pursuing projects both in Phulbari and in Dinajpur. An agreement was reportedly signed between GCM Resources with the Chinese company POWERCHINA for a \$4 billion domestic coal mine-power project in Dinajpur District in northwest Bangladesh.⁵⁹

The Bangladeshi decision to start developing a “greenfield” coal power capacity raises serious questions about economic as well as environmental sustainability. These investments are creating long-term, external financial dependence as well as raising concerns as to the possibility that these plants may become economically unviable as the costs of alternatives falls and climate costs rise.

Nuclear: Bangladesh has been caught up in the aggressive Russian nuclear export drive that together with its military sales has expanded Russian influence in both the Middle East and South Asia. Russia, with its long-standing political, military, and energy relationships with Bangladesh, has been pursuing a nuclear export project since 2009. In late 2015, Russia concluded a twenty-eight-year (ten years grace) \$11.38 billion state loan at a favorable rate of Libor plus 1.75 percent for two Generation III VVER-1200 reactors at Rooppur, 87 miles west of Dhaka.⁶⁰ Bangladesh is to provide 10 percent of the project costs. Construction started in late 2017 and the first unit is planned for completion in 2023, with a second unit one year later. Russia is working with India on similar units and India is training Bangladeshi operators. Indian architectural and engineering (A&E) companies are engaged in some of the civil works for the units in Bangladesh. Russia is pursuing a long-term Build, Own, Operate (BOO) approach in some of its export deals, but it is reported that Rosatom, the Russian state atomic energy corporation, will operate the Rooppur plant for only the first year. Nuclear power is projected in the Bangladesh Revised Power Sector Master Plan to account for about 4 percent of electricity generation in 2030.⁶¹

Given the current US strategic paradigm focusing on “great power competition,” there is concern in the Trump Administration and Congress over Russia’s nuclear power exports and the implications of the long-term dependency this is creating in countries like Egypt, Turkey, and now Bangladesh. Security and safety issues for a nuclear start-up program are significant even though Bangladesh, unlike Pakistan and India, has signed the Nuclear Non-Proliferation Treaty (NPT) and is a member of the International Atomic Energy Agency (IAEA). Despite the IAEA’s technical assistance to the Bangladesh Nuclear Regulatory Commission in reviewing nuclear laws, preparing for adhering to international legal instruments, developing and reviewing regulations, assessing sites, and developing a radioactive waste management system,⁶² transparency concerns exist based on experience with other Rosatom projects. For example, 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 per installed kilowatt (kW), suggesting a relatively high levelized cost of electricity (LCOE).

Renewables: Bangladesh has begun to take a greater interest in renewable generation, but it has experienced difficulties in pursuing large renewable energy projects for electricity grid connection (unlike for off-grid applications). Bangladesh’s Vision 2021 proposes a 10 percent renewable target in 2021 (2,000 MW out of 20,000 MW forecasted), and its recent renewable energy development targets call for 2,458 MW of renewable energy capacity to be installed by 2021. Most of the new capacity is planned from solar (1,270 MW, or 52 percent) and wind (1,150 MW, or 47 percent), and there are also targets for biomass (30 MW), biogas (2 MW), and small hydro (6 MW). The World Bank notes that there have to date been no utility-scale wind projects, and the largest solar project is the 28 MW Teknaf photovoltaic project in the Cox’s Bazar region, which became operational in September 2018.⁶³ Access to land has been a major factor holding up new projects. But, in March 2019, the World Bank approved an \$185 million loan to the government of Bangladesh for

58 Sadid Nuremowla, “Land, Place and Resistance to Displacement in Phulbari,” *South Asia Multidisciplinary Academic Journal*, 13 | 2016, March 8, 2016, <https://journals.openedition.org/samaj/4113>.

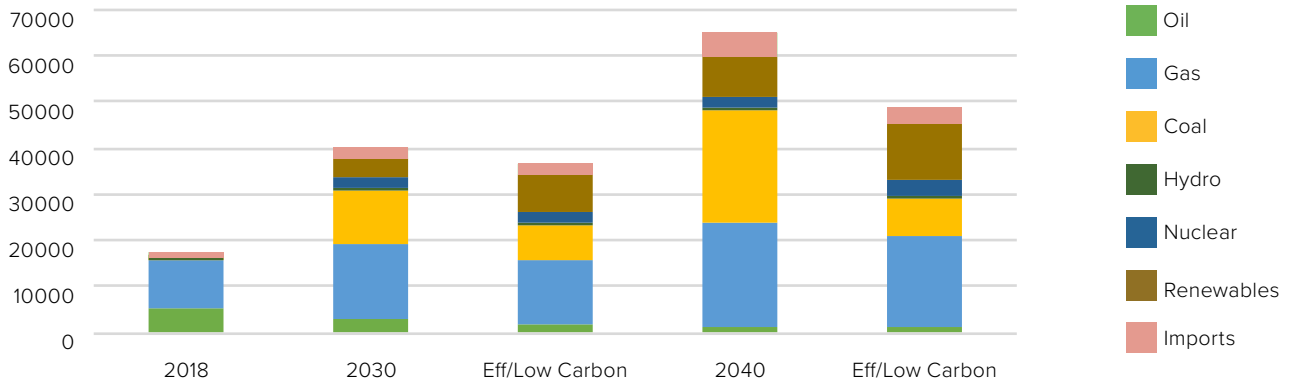
59 “GCM and POWERCHINA inks \$4bn power deal,” *Energy News of Bangladesh*, January 17, 2019, <http://energynewsbd.com/details.php?id=1327>.

60 “Bangladesh, Russia Ink \$12.65 billion Rooppur plant deal,” *World Nuclear News*, December 29, 2015, <http://www.world-nuclear-news.org/NN-Bangladesh-Russia-ink-12.65-billion-Rooppur-plant-deal-29121501.html>.

61 *Revisiting Power System Master Plan (PSMP) 2016*, Power Division, Ministry of Power, Energy and Mineral Resources, Government of the People’s Republic of Bangladesh, November 2018, 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.

62 Laura Gil, “Construction Progresses on Bangladesh’s First Nuclear Power Plant,” International Atomic Energy Agency, January 31, 2019, <https://www.iaea.org/newscenter/news/construction-progresses-on-bangladeshs-first-nuclear-power-plant>.

63 *Project Information Document-Integrated Safeguards Data Sheet - Bangladesh Scaling-up Renewable Energy Project - P161869*, the World Bank, October 12, 2018, <http://documents.worldbank.org/curated/en/755101539349793732/Project-Information-Documents-Integrated-Safeguards-Data-Sheet-Bangladesh-Scaling-up-Renewable-Energy-Project-P161869>.

Figure 5: Bangladesh Power Expansion Strategies Installed Capacity by Source, 2030 and 2040

Source: *Power System Master Plan 2016*, Power Division, Ministry of Power, Energy and Mineral Resources, Government of the People's Republic of Bangladesh and the author's construction of "energy efficiency/low carbon" scenarios for 2030 and 2040.

the first 50 MW phase of a 310 MW solar park in Feni District in the southeast in the administrative district of Chittagong, which will be implemented by the Electricity Generation Company of Bangladesh, an enterprise of the BPDB.⁶⁴ World Bank officials indicate that this project will require building of dikes and elevation of the photovoltaic modules to prevent flooding, thereby increasing costs.

An Alternative Expansion Scenario

Bangladesh can move towards a more sustainable, lower-carbon future by limiting coal development, installing efficient natural gas, expanding renewables, and improving end-use energy efficiency. Figure 5 presents an alternative "energy efficiency, low-carbon case" compared to the modified case in the master plan that projects installed capacity growing from the current 20 GW to 40 GW in 2030 and 60 GW in 2040. In the master plan, fossil fuel continues to provide more than 80 percent of the fuel for power generation. The author's alternative scenario projects a 20 percent lower demand case with an aggressive renewable energy growth to 22 percent in 2030 and 30 percent in 2040, with reduced coal capacity and a doubling of gas capacity by 2040. Even in this case, fossil fuels still account for more than 60 percent of total installed generation, but carbon emissions will be considerably lower given the increase in renewables, nuclear, hydro imports, and less carbon-intensive gas generation. Recent assessments have raised the prospect of lower-

capacity additional requirements in the future given the many current plants in the pipeline. A high-level committee reporting to the Power Cell of the Ministry of Energy has concluded that the requirement in 2030 with planned plants and improved efficiency would be 29,619 MW. A pause in new approval by the BPDB has been debated.⁶⁵

Expanding Electricity Access to Poor and Rural Areas

Strategic Priority: *The government of Bangladesh should seek to facilitate even faster private deployment of solar power systems in rural areas, building on IDCOL's experience, but working with private banks to develop project aggregation mechanisms for the financing of mini-grids for communities and with REB cooperatives on system integration.*

Discussion: Bangladesh has followed the US electric cooperative model and, with USAID/NRECA assistance over several decades, has developed a system under the BREB, which has grown to eighty PBS (rural cooperatives), covering 460 upazillas and serving 66,087 villages with more than 30 million residents.

As the government has built out the BREB and urban distribution grids, it has also given support to off-grid solar systems. More than 4 million solar home systems (SHS) have been installed in Bangladesh⁶⁶ and private companies like

64 "World Bank Helps Bangladesh Expand Renewable Energy," the World Bank, press release, March 1, 2019, <https://www.worldbank.org/en/news/press-release/2019/03/01/world-bank-helps-bangladesh-expand-renewable-energy>.

65 M. Azizur Rahman, "Pause in approval to new power plants likely," *the Financial Express*, May 15, 2019, <https://thefinancialexpress.com.bd/trade/pause-in-approval-to-new-power-plants-likely-1557891145>.

66 Bangladesh's prime minister's energy advisor indicated on October 22, 2019 at the Atlantic Council that the number of SHS had grown to 6 million. "The Current Energy Scenario in Bangladesh and Future Possibilities: A Conversation with Dr. Tawfiq-e Elahi Chowdhury," Atlantic Council, October 21, 2019, <https://www.atlanticcouncil.org/event/the-current-energy-scenario-in-bangladesh-and-future-possibilities-a-conversation-with-dr-tawfiq-e-elahi-chowdhury/>.



A village proudly displaying the first solar panel they purchased with a micro loan from the Grameen Bank in the rural town of Bogra in the Rajshahi division of northern Bangladesh. Source: Flickr/International Labour Organization (ILO) Asia-Pacific

Solaric, with some commercial financing, have advanced to developing small “nano-grids” in rural villages.⁶⁷ Although most of the SHS have been financed under IDCOL’s donor-supported programs with private providers, the BREB has begun to support installation of SHS, solar irrigation systems, rooftop solar, and some mini-grids and conducted training for more than 1,000 technicians. IDCOL and the BREB have developed a memorandum of understanding on selection and approval of sites for mini-grids. At least twenty-five IDCOL mini-grids have been approved (4.69 MW) and ten are operational. IDCOL was targeting fifty mini-grids by 2018.⁶⁸ The BREB irrigation tariffs are lower than the costs from solar irrigation systems, but the solar power systems can compete with diesel gensets. IDCOL had a target of 1,550 solar irrigation pumps by 2018. Despite the successes and estimated savings of more than \$400 million from SHS substitution for kerosene in Bangladesh, the rapid expansion of SHS sales and providers has given rise to

problems due to the growth of unregulated entrepreneurs selling cheaper, but poor quality systems, as well as the rapid extension of BREB grid programs and the use of social safety net funds to subsidize low-income consumers. High priority should be placed on maintaining high standards as well as good cost-recovery in order to continue the scale-up of system deployment and encourage greater interest by local banks.

Collaborating with Neighbors on Regional Electricity and Gas Networks and Markets

Strategic Priority: Bangladesh should continue to diversify its electricity imports from India, Nepal, and Bhutan as part of an effort to promote peaceful relationships that advance economic development. Bangladesh should give priority to hydro-based imports and avoid dependence on electricity from Indian coal generation plants.

67 “Nano Grid,” Solaric, accessed December 2019, <http://solar-ica.com/solaricdev/major-innovations/nano-grid/>.

68 “Solar Mini Grid Projects,” Infrastructure Development Company Limited, accessed November 2019, http://idcol.org/home/solar_min.

Discussion: Regional energy cooperation has been difficult in South Asia, but Bangladesh and India have been working on forging electricity links for more than six years. Bangladesh imported about 8 percent 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 international transmission line in South Asia. It was funded by the Asian Development Bank.⁶⁹ 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 hydro facilities in Bhutan and Nepal, and 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 mainland through Bangladesh. In return, Bangladesh would get 20 percent of the electricity.⁷⁰ Bangladesh is investing in the 1,125 MW Kuri Gongri hydro plant in Bhutan along with India and Nepal, and looking to participate in other hydro projects. Bangladesh is looking to import power from the Upper Kamali 900 MW hydro plant being built by the GMR Group of India in Nepal.⁷¹ With Myanmar's huge hydro resources and prospective offshore natural gas resources, it may also be a potential source of electricity and/or possibly gas in the coming decades.⁷² In September 2018, Total announced the successful appraisal of Myanmar's Shwe Yee Htun-2 offshore gas field with a preliminary reserve estimate of 2–3 trillion cubic feet.⁷³

Attracting Domestic and International Investment and Financing

Strategic Priority: *Besides the institutional and regulatory reforms discussed above, Bangladesh needs to focus on maximizing private investment in the sector and be especially careful, as it deals with the pressures to add new generation capacity, about assuming external loans*

from China and other state sources that put unsustainable debt pressure on its fiscal system. The gas and renewable energy sub-sectors should be given highest priority since they are both economically viable and can attract private equity and debt financing, reducing the public debt burden. With growing energy demands from rapid urbanization, greater attention should be given to improving energy efficiency, especially through building envelope, appliance, and HVAC (Heating, Ventilation, Air Conditioning) system standards and incentives for building owners to invest in modern energy management systems. Improvement in the transparency, professional capability, and credibility of the national energy regulators will be increasingly important for attracting transparent and sustainable financial investments in the sector.

Discussion: Despite the domestic political risks, Bangladesh's State Minister for Power, Energy and Mineral Resources Nasrul Hamid said on October 17, 2019, that power investment in Bangladesh had reached \$22 billion.⁷⁴ Bangladesh is looking to a wide range of investment options to meet future requirements, including green bonds and capital from insurers and pension funds as well as sovereign wealth funds. Bangladesh's central bank has been very active in pursuing these options with the IFC, ADB, and other international financial institutions. It is even considering deploying foreign exchange reserves to support domestic bond issuances.⁷⁵

An important issue is the role of China with its large infrastructure financing under the BRI, of which Bangladesh is a signatory. While criticism of "debt-trap" diplomacy has been especially aimed at the huge \$62 billion BRI program in Pakistan, China has also pledged \$26 billion for BRI infrastructure projects in Bangladesh.⁷⁶ But unlike in Pakistan, Chinese lending for energy in Bangladesh appears to be a much smaller, but not insignificant, share of the overall package and the debt implications not as severe. Although

69 "Bangladesh: Bangladesh-India Electrical Grid Interconnection Project," Asian Development Bank, accessed on December 8, 2019, <https://www.adb.org/projects/44192-013/main>.

70 Pratim Ranjan Bose, "Power exports from India to meet 25% of Bangladesh demand," *the Hindu Business Line*, October 20, 2017, <https://www.thehindubusinessline.com/economy/policy/power-exports-from-india-to-meet-25-of-bangladesh-demand/article9916980.ece>.

71 "GMR Group," Wikipedia, accessed November 2019, https://en.wikipedia.org/wiki/GMR_Group#Projects_under_Construction.

72 Imtiaz Salim, "Government plans to import 9000MW of power by 2041," *Dhaka Tribune*, April 18, 2018, <https://www.dhakatribune.com/bangladesh/power-energy/2018/04/18/government-plans-import-9000-mw-power-2041/>.

73 William Powell, "Total's Gas Find off Myanmar Moves Forward," *Natural Gas World*, September 24, 2018, <https://www.naturalgasworld.com/totals-gas-find-off-myanmar-moves-forward-64548>.

74 "Saudi ACWA signs deal with Bangladesh to set up 3,600 MW LNG-based power plants," *Dhaka Tribune*, October 17, 2019, <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>.

75 "Bangladesh Bank plans to invest in green bonds," Green Banking Consultants Home Ltd., accessed November 2019, <http://greenbankingbd.com/index.php/9-latest-news/36-bangladesh-bank-plans-to-invest-in-green-bonds>.

76 ANM Muniruzzaman, "Belt and Road Initiative and what's in it for Bangladesh," *the Daily Star*, May 30, 2019, <https://www.thedailystar.net/opinion/perspective/news/belt-and-road-initiative-and-whats-it-for-bangladesh-1750666>.

Bangladesh's external borrowing for domestic energy infrastructure projects is expected to increase external debt, which was estimated by the IMF at \$35 billion at the end of FY2017 or 14.3 percent of GDP, the IMF debt sustainability analysis designates Bangladesh as a "medium performer" and concludes that "the risk of external debt stress is low."⁷⁷

As indicated above, Bangladesh has, in its coal expansion strategy, turned to China and also Japan for financing. The Overseas Development Institute's recent report on Group of Twenty (G20) coal subsidies estimates that China and Japan accounted for 87 percent of the G20 countries' \$16 billion in average annual public financing for coal projects in 2016–2017. Nearly half of their \$14.6 billion in coal financing went to Pakistan and Bangladesh in these years, with Pakistan receiving \$3.975 billion from China and Bangladesh obtaining \$1.650 billion from China and \$1.207 billion from Japan.⁷⁸ As noted above, the Chinese are supporting a new 2,000 MW coal plant in Bangladesh that will use domestic coal, with a potential expansion to 6,000 MW.⁷⁹

Officials from the World Bank and other financial institutions have increasingly expressed concern over the economic sustainability of these coal projects and the financial risks to the government, as witnessed in Bangladesh government's prior experience with the imported-oil rental plants. These projects are, according to a senior Bangladeshi official, likely to have an LCOE of around 8 cents per kWh, which may be higher than future gas and renewable costs. There are, however, recent signs that Chinese companies are pursuing projects in renewable energy. In August 2019, Reuters reported that the China National Machinery Import and Export Company (CMC) had entered into a joint venture with Bangladesh's North-West Power Generation Company to implement 500 MW of renewable energy capacity through an estimated investment of \$400 million.⁸⁰

The competition among sources will be strongly influenced by the domestic gas pricing policy as Bangladesh ramps up its LNG and coal imports. The government in July 2019 increased domestic gas prices by a weighted average of 32.8 percent to take into account the higher LNG gas prices compared with subsidized domestic prices. S&P Global Platts reports that while this action will help the financial position of PetroBangla, it will negatively affect textile and other key industries. Furthermore, the government will still need to provide funding through the Energy Security Fund and other subsidies to cover the full cost of the LNG imports.⁸¹

Both the World Bank and the ADB now have lending policies that focus on lower carbon options. Recent World Bank projects in Bangladesh have focused on transmission improvement, rural electrification, and renewable energy, i.e., the \$156 million Scaling-up Renewable Energy project and the \$155 million Rural Electrification and Renewable Energy Development II (RERED II) Project, the \$450 million Enhancement and Strengthening of Power Transmission Network in Eastern Region, and the \$59 million Power System Reliability and Efficiency Improvement Project.⁸² These projects help support policies to reduce losses, increase electricity access and off-grid solar applications, and stimulate investment in grid-connected renewable energy.

The ADB has also been a major energy lender to Bangladesh. Current ADB projects in Bangladesh include a \$583 million debt and risk guarantee package for India's Reliance Power's LNG terminal and a 750 MW gas combined cycle power plant south of Chittagong, which has an overall estimated cost of \$1 billion;⁸³ loans totaling \$616 million to enhance power transmission and distribution;⁸⁴ and \$526 million in support for the Third Public-Private Infrastructure Development Facility (PPIDF-3), which includes funding for renewable energy and IDCOL.⁸⁵

77 "Bangladesh - Joint Bank-Fund Debt Sustainability Analysis: 2018 Update," the World Bank, October 15, 2018, <http://documents.worldbank.org/curated/en/930921539630112023/Bangladesh-Joint-Bank-Fund-Debt-Sustainability-Analysis-2018-Update>.

78 *G20 coal subsidies: Tracking government support to a fading industry*, the Natural Resources Defense Council, the International Institute for Sustainable Development, and Oil Change International, June 2019, <https://www.odi.org/sites/odi.org.uk/files/resource-documents/12744.pdf>.

79 "GCM and POWERCHINA inks \$4bn power deal," *Energy News of Bangladesh*, January 17, 2019, <http://energynewsbd.com/details.php?id=1327>.

80 "Chinese firm to build renewable power projects in Bangladesh: official," Reuters, August 28, 2019, <https://www.reuters.com/article/us-bangladesh-renewables/chinese-firm-to-build-renewable-power-projects-in-bangladesh-official-idUSKCN1V11Q7>.

81 Azizur Rahman, "Analysis: Biggest ever gas price hike in Bangladesh to foot LNG import bill," *S&P Global Platts*, July 2, 2019, <https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/070219-analysis-biggest-ever-gas-price-hike-in-bangladesh-to-foot-lng-import-bill>.

82 "Bangladesh Receives \$185 Million World Bank Financing for Renewable Energy," the World Bank, press release, August 29, 2019, <https://www.worldbank.org/en/news/press-release/2019/08/29/bangladesh-receives-185-million-world-bank-financing-for-renewable-energy>.

83 "ADB to Support Reliance LNG Terminal, Power Project in Bangladesh," Asian Development Bank, December 5, 2017, <https://www.adb.org/news/adb-support-reliance-lng-terminal-power-project-bangladesh>.

84 "ADB to Help Improve Power System Efficiency, Coverage in Bangladesh," Asian Development Bank, March 29, 2017, <https://www.adb.org/news/adb-help-improve-power-system-efficiency-coverage-bangladesh>.

85 "ADB \$526 Million Assistance to Further Boost Public-Private Infrastructure in Bangladesh," Asian Development Bank, July 18, 2017, <https://www.adb.org/news/adb-526-million-assistance-further-boost-public-private-infrastructure-bangladesh>.

Among bilateral donors, USAID's energy program in Bangladesh, while not of the same magnitude as its past capital lending in rural electrification, has focused on developing clean energy sources, energy efficiency, off-grid solar systems, and clean cooking programs. USAID programs helped catalyze cooperation between Bangladesh and India that led to the completion of the 500 kV transmission line mentioned above.⁸⁶ The Overseas Private Investment Corporation (OPIC), now known as the US International Development Finance Corporation, and the US Trade and Development Agency have recently focused on working with US companies on LNG and gas development.

LNG and gas-fired power generation have opened new opportunities for private sector investment. General Electric, which has had a long presence in Bangladesh, has developed new joint ventures with both Summit Power International from Singapore, which is the largest independent power producer in Bangladesh, and Mitsubishi. One project with Summit is for the 583 MW gas combined cycle Meghnaghat II power plant near Dhaka for operation by 2022, and the second project is with Mitsubishi and Summit for a \$3 billion, 2,400 MW thermal power and import terminal facility at Matarbari on Moheshkhali Island.⁸⁷

CONCLUSION

The Bangladeshi 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 booming 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 with coal, nuclear, and renewable energy. Foreign financing of more than \$20 billion from China, Russia, Japan, and India is expanding electricity capacity while the World Bank and the ADB have been supporting transmission and distribution projects. There are clearly political, economic, and environmental risks in this heavy external dependence. The Chinese have increased their presence in Bangladesh through the BRI and financing for both imported and domestic coal projects. Russia is using military sales and nuclear and oil and gas project financing to augment its influence and create long-term dependencies.

In contrast to this state-driven financing and given a projected need for \$70 billion in power investment by 2035,⁸⁸ Bangladesh should work on attracting increased private investment in the sector by improving its financial viability, strengthening the regulatory framework, and reforming its market structure. Priority should be given to gas and renewable generation and energy efficiency from an economic and environmental perspective to minimize debt and fiscal impacts and fulfill Bangladesh's commitments under the Paris Agreement. The potential for private investment in generation, transmission, and demand management should be fully pursued as the government proceeds with the implementation of its ambitious scheme to establish industrial and export zones.

The United States should increase its engagement with Bangladesh under the free and open Indo-Pacific Strategy and Asia EDGE initiative, work with European countries and international financial institutions to promote clean energy options, and raise concerns with China and Japan over their continued financing of coal plants.

Finally, developing countries like Bangladesh face enormous challenges in attaining the UN SDGs approved by world leaders in late 2015. The energy sector is central to realizing these aspirations. It is precisely for this reason that Bangladesh and its supporters should chart a course that can lead to a more efficient, clean, and affordable power and energy system.

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