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Report No: PAD4596

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROGRAM APPRAISAL DOCUMENT

ON A

PROPOSED IDA SCALE-UP FACILITY CREDIT

IN THE AMOUNT OF US$500 MILLION

AND

CLEAN TECHNOLOGY FUND GRANT

IN THE AMOUNT OF US$15 MILLION

TO THE

PEOPLE'S REPUBLIC OF BANGLADESH
FOR A

ELECTRICITY DISTRIBUTION MODERNIZATION PROGRAM

29 NOVEMBER 2021

Energy and Extractives Global Practice
South Asia Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective October 31, 2021)

| | |
|---|---|
| Currency Unit = | Bangladeshi Taka (BDT) |
| BDT 85.64 = | US$1 |

FISCAL YEAR

July 1 - June 30

| | |
|---|---|
| Regional Vice President: | Hartwig Schafer |
| Regional Director: | Guangzhe Chen |
| Country Director: | Mercy Miyang Tembon |
| Practice Manager: | Simon Stolp |
| Task Team Leader(s): | Bipul Singh, Phillip Hannam |

# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| ADB | Asian Development Bank |
| ADMS | Advanced Distribution Management System |
| AIIB | Asian Infrastructure Investment Bank |
| AMI | Advanced Metering Infrastructure |
| BACS | Budget and Accounts Classification System |
| BREB | Bangladesh Rural Electrification Board |
| BPDB | Bangladesh Power Development Board |
| BERC | Bangladesh Energy Regulatory Commission |
| BESS | Battery Energy Storage System |
| CCAP | Climate Change Action Plan |
| CIF | Climate Investment Fund |
| CPF | Country Partnership Framework |
| CSF | Climate Support Facility |
| CTF | Clean Technology Fund |
| DER | Distributed Energy Resource |
| DLI | DisbursementLinked Indicator |
| DPP | Development Project Proposal |
| EBITDA | Earnings before Interest, Taxes, Depreciation, and Amortization |
| ESSA | Environmental and Social Systems Assessment |
| ESMAP | Energy Sector Management Assistance Program |
| ESMP | Environment and Social Management Plan |
| FSA | Fiduciary Systems Assessment |
| GBV | Gender-Based Violence |
| GDP | Gross Domestic Product |
| GFDRR | Global Fund for Disaster Risk Reduction |
| GIS | Geographic Information System |
| GOB | Government of Bangladesh |
| GRID | Green, Resilient, and Inclusive Development |
| GRS | Grievance Redress Service |
| HFO | Heavy Fuel Oil |
| HR | Human Resource |
| iBAS | Integrated Budget and Accounting System |
| IFC | International Finance Corporation |
| IPSASB | International Public-Sector Accounting Standards Board |
| IPP | Independent Power Producer |
| IVA | Independent Verification Agency |
| JICA | Japan International Cooperation Agency |
| KIAT | Korea Institute of Advanced Technology |
| MPEMR | Ministry of Power, Energy, and Mineral Resource |
| MIS | Management Information System |
| MTBF | Medium-Term Budget Framework |
| NPV | Net Present Value |

| | |
|---|---|
| OC&AG | Office of Comptroller and Auditor General |
| PAP | Program Action Plan |
| PBS | Palli Biyut Samiti |
| PDO | Program Development Objective |
| PforR | Program for Results |
| PGCB | Power Grid Company of Bangladesh |
| PMAP | Project Management Accounting Portal |
| PSMP | Power System Master Plan |
| PV | Photovoltaic |
| SCADA | Supervisory Control and Data Acquisition |
| SHS | Solar Home System |
| SOP | Standard Operating Procedure |
| SREP | Scaling Up Renewable Energy Program in Low Income Countries |
| SUF | Scale-up Facility |
| TPP | Tribal Peoples Plan |
| WEPOWER | South Asia Women in the Power Sector Professional Network |

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**DATASHEET**

## BASIC INFORMATION

| Country(ies) | Project Name | |
|---|---|---|
| Bangladesh | Electricity Distribution Modernization Program | |
| **Project ID** | **Financing Instrument** | **Does this operation have an IPF component?** |
| P174650 | Program-for-Results Financing | No |

### Financing & Implementation Modalities

| | |
|---|---|
| [ ] Multiphase Programmatic Approach (MPA) | [ ] Fragile State(s) |
| [ ] Contingent Emergency Response Component (CERC) | [ ] Fragile within a non-fragile Country |
| [ ] Small State(s) | [ ] Conflict |
| [ ] Alternate Procurement Arrangements (APA) | [ ] Responding to Natural or Man-made Disaster |
| [ ] Hands-on Enhanced Implementation Support (HEIS) | |

| Expected Project Approval Date | Expected Closing Date |
|---|---|
| 21-Dec-2021 | 31-Dec-2026 |

Bank/IFC Collaboration

No

### Proposed Program Development Objective(s)

The PDO is to increase the delivery, reliability and efficiency of electricity supply and strengthen institutional capacity and readiness for its sustainable transformation.

### Organizations

| | |
|---|---|
| Borrower : | People's Republic of Bangladesh |
| Implementing Agency : | Bangladesh Rural Electrification Board |
| Contact: | Md. Khayrul Hasan |

| | |
|---|---|
| Title: | Member (Finance) |
| Telephone No: | 8900007 |
| Email: | memberfin@reb.gov.bd |
| Implementing Agency : | Ministry of Power, Energy and Mineral Resources - Power Cell |
| Contact: | Md. Hossain |
| Title: | Director General |
| Telephone No: | 9556577 |
| Email: | dg@powercell.gov.bd |

## COST & FINANCING

### SUMMARY

| | |
|---|---|
| **Government program Cost** | 3,213.00 |
| **Total Operation Cost** | 902.00 |
| Total Program Cost | 902.00 |
| **Total Financing** | 902.00 |
| **Financing Gap** | 0.00 |

### Financing (USD Millions)

| | |
|---|---|
| **Counterpart Funding** | **250.00** |
| Borrowing Agency | 250.00 |
| **International Development Association (IDA)** | **500.00** |
| IDA Credit | 500.00 |
| **Trust Funds** | **15.00** |
| Climate Investment Funds | 15.00 |
| **Commercial Financing** | **124.00** |
| Unguaranteed Commercial Financing | 124.00 |

| Cofinancing - Other Sources (IFIs, Bilaterals, Foundations) | 13.00 |
|---|---|
| KOREA, Govt. of | 13.00 |

### IDA Resources (in US$, Millions)

| | Credit Amount | Grant Amount | Total Amount |
|---|---|---|---|
| **Bangladesh** | 500.00 | 0.00 | 500.00 |
| Scale-up Facility (SUF) | 500.00 | 0.00 | 500.00 |
| **Total** | **500.00** | **0.00** | **500.00** |

### Expected Disbursements (USD Millions)

| Fiscal Year | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|---|
| Absolute | 150.00 | 63.00 | 114.00 | 111.00 | 62.00 | 0.00 |
| Cumulative | 150.00 | 213.00 | 327.00 | 438.00 | 500.00 | 500.00 |

## INSTITUTIONAL DATA

### Practice Area (Lead)

Energy & Extractives

### Contributing Practice Areas

### Climate Change and Disaster Screening

This operation has been screened for short and long-term climate change and disaster risks

## SYSTEMATIC OPERATIONS RISK-RATING TOOL (SORT)

| Risk Category | Rating |
|---|---|
| 1. Political and Governance | Moderate |
| 2. Macroeconomic | Moderate |
| 3. Sector Strategies and Policies | Moderate |
| 4. Technical Design of Project or Program | Moderate |

| | |
|---|---|
| 5. Institutional Capacity for Implementation and Sustainability | Substantial |
| 6. Fiduciary | Substantial |
| 7. Environment and Social | Moderate |
| 8. Stakeholders | Moderate |
| 9. Other | Substantial |
| 10. Overall | Substantial |

## COMPLIANCE

### Policy

Does the program depart from the CPF in content or in other significant respects?

[ ] Yes [✔] No

Does the program require any waivers of Bank policies?

[ ] Yes [✔] No

### Legal Operational Policies

| | Triggered |
|---|---|
| Projects on International Waterways OP/BP 7.50 | No |
| Projects in Disputed Areas OP/BP 7.60 | No |

### Legal Covenants

Sections and Description

Subsidiary Credit and Grant Agreements
To facilitate the carrying out of the Program Implementing Entity's Respective Part of the Program, the Recipient shall make the proceeds of the Credit and CTF Grant available to the Program Implementing Entity under a subsidiary agreement between the Recipient and the Program Implementing Entity, under terms and conditions approved by the Association, including the provision of the CTF Grant proceeds on a non-reimbursable basis and in accordance with the terms and conditions of this Agreement. [FA, Schedule 2, Section I.C.1 & CTF GA, Article 2.03 (a)]

Sections and Description

Excluded Activities

The Recipient shall ensure that the Program excludes any activities which:

A. in the opinion of the Association, are likely to have significant adverse impacts that are sensitive, diverse, or unprecedented on the environment and/or affected people;

B. involve the procurement of: (1) works, estimated to cost US$75 million equivalent or more per contract; (2) goods, estimated to cost US$50 million equivalent or more per contract; (3) non-consulting services, estimated to cost US$50 million equivalent or more per contract; or (4) consulting services, estimated to cost $20 million equivalent or more per contract; or

C. relate to the mobilization of private capital for distributed energy resources. [FA, Schedule 2, Section II]

Sections and Description

Program Operations Manual

The Program Implementing Entity shall, not later than six (6) months after the Effective Date, (or such other date which the Association has confirmed in writing is reasonable and acceptable under the circumstances), adopt the Program Operations Manual in form and substance acceptable to the Association, and implement the Program in accordance with the provisions of Program Operations Manual. [FA, Schedule 2, Section I.A.3 (a)]

Sections and Description

Program Steering Committees

The Recipient shall, not later than three (3) months of the Effective Date, (or such other date which the Association has confirmed in writing to the Recipient is reasonable and acceptable under the circumstances) establish and thereafter maintain throughout the duration of the Program, two steering committees (the "Program Steering Committees"), headed by MPEMR, with composition and terms of reference acceptable to the Association and in accordance with the provisions of the Program Operations Manual, to ensure coordinated implementation of the Program. [FA, Schedule 2, Section I.A.1]

Sections and Description

Reporting Arrangements

The Recipient shall, and shall cause the Program Implementing Entity to, furnish to the Association each Program Report, which shall include the CTF Grant, not later than forty-five (45) days after the end of each calendar semester, covering the calendar semester.

[FA, Schedule 2, Section III]

Sections and Description

Additional Program Implementation Arrangements

The Recipient shall, and shall cause the Program Implementing Entity and Power Cell to:

(a) Without limitation on the provisions of Article V of the General Conditions, carry out their Respective Part of the Program in accordance with financial management, procurement and environmental and social management systems acceptable to the Association and included in the applicable Program Operations Manual

which are designed to ensure that:
(i) the Credit proceeds are used for their intended purposes, with due attention to the principles of economy, efficiency, effectiveness, transparency, and accountability; and
(ii) the actual and potential adverse environmental and social impacts of the Program are identified, avoided, minimized, or mitigated, as the case may be, all through the agreed environment and social management measures and procedures, as well as through an informed decision-making process;
(b) no later than six (6) months after the Effective Date, (or such other date which the Association has confirmed in writing to the Recipient is reasonable and acceptable under the circumstances) create separate main Program code for the Program Expenditures of the Program;
(c) recruit no later than six (6) months after the Effective Date, (or such other date which the Association has confirmed in writing to the Recipient is reasonable and acceptable under the circumstances) one or more independent verification agents on the basis of terms of reference, qualifications and experience satisfactory to the Association, for the purpose of implementing the activities included in the verification protocol agreed with the Association to document satisfaction of the DLRs; and
(d) thereafter maintain, at all times during the implementation of the Program, one or more Independent Verification Agent(s) under terms of reference acceptable to the Association, to verify the data and other evidence supporting the achievement of one or more DLRs as set forth in the table in Schedule 4 to this Agreement and recommend corresponding payments to be made, as applicable.
[FA, Schedule 2, Section I.D]

**Conditions**

| Type | Financing source | Description |
|---|---|---|
| Effectiveness | IBRD/IDA | The Additional Conditions of Effectiveness consist of the following: (a) the CTF Grant Agreement has been executed and delivered and all conditions precedent to its effectiveness or to the right of the Recipient to make withdrawals under the CTF Grant Agreement (other than the effectiveness of this Agreement) have been fulfilled; and (b) the Subsidiary Credit Agreement has been executed and delivered satisfactory to the Association.<br>[FA, Art. 4.01] |
| Effectiveness | Trust Funds | This Agreement shall not become effective until evidence satisfactory to the Bank has been furnished to the Bank that the conditions specified below have been satisfied:<br>(a) the execution and delivery of this Agreement on behalf of the Recipient has been duly authorized |

| | | |
|---|---|---|
| | | or ratified by all necessary governmental action;<br>(b) the Financing Agreement has been executed and delivered and all conditions precedent to its effectiveness or to the right of the Recipient to make withdrawals under the Financing Agreement (other than the effectiveness of this Agreement) have been fulfilled; and<br>(c) the Subsidiary Grant Agreement referred to in Section 2.03 of this Agreement has been executed on behalf of the Recipient and the Program Implementing Entity.<br>[GA, Art. 5.01] |
| Type<br>Disbursement | Financing source<br>IBRD/IDA | Description<br>Notwithstanding the provisions of Part A of this Section, no withdrawal shall be made:<br>(a) on the basis of DLIs/DLRs achieved prior to the Signature Date, except that withdrawals up to an aggregate amount not to exceed thirty million seven hundred seventy-nine thousand and three hundred eighty two Dollars ($30,779,382), may be made on the basis of DLI 1 and related DLRs achieved prior to this date but on or after December 1, 2020; and/or<br>(b) for any DLI under Category (1) to (7), until and unless the Recipient has furnished evidence satisfactory to the Association that the related DLR(s) has been achieved.<br>2. Notwithstanding the provisions of Part B.1(b) of this Section, the Recipient may withdraw: an amount not to exceed $119,000,000 for the Credit and $3,750,000 for the CTF Grant as an advance; provided, however, that if the DLRs in the opinion of the Association, are not achieved (or only partially achieved) by the Closing Date, the Recipient shall refund such advance (or portion of such advance as determined by the Association). Except as otherwise agreed with the Recipient, the Association shall cancel the amount so refunded. Any further withdrawals requested as an advance under any Category shall be permitted only on such terms and conditions as the Association shall specify by notice to the Recipient.<br>[FA, Schedule 2, Section IV] |

# I. STRATEGIC CONTEXT

## A. Country Context

1. **Bangladesh has experienced a long period of rapid growth, job creation, and poverty reduction, transforming it from one of the poorest countries in the world to a lower-middle-income country.** Annual growth of gross domestic product (GDP) averaged close to 6 percent since 2000. Strong labor market gains contributed to a sharp decline in poverty, with the national poverty rate falling from 48.9 to 24.5 percent between 2000 and 2016, while extreme poverty declined from 34.3 to 13.0 percent. Rapid growth in the ready-made garment sector, whereby Bangladesh became the world's second-largest exporter after China in 2018, helped the economy to diversify away from the agricultural sector. Large inflows of remittances helped strengthen its external position and support private consumption.

2. **The COVID-19 pandemic is severely affecting the Bangladeshi economy, threatening decades of hard-won development gains.** Real GDP growth is estimated to have decelerated to 3.5 percent in FY2020. Slower GDP growth, the income losses of informal workers increased the poverty rate based to 18.1 percent in FY2020. The fiscal deficit expanded to 6 percent of GDP in 2020,[1] as the decline in Government revenues exceeded the decline in development spending. Early signs of a recovery emerged in FY2021, after movement restrictions were progressively lifted. The recovery is expected to be gradual, with some increase in export demand and higher public spending amid potential economic disruptions and increasing fragilities in the banking system.

3. **Climate change presents significant risks to the country's economic recovery efforts and sustainable development.** The Global Climate Risk Index ranks Bangladesh as the seventh most climate change-affected country from 1999 to 2018; catastrophic cyclones could lead to estimated economic losses between 1.5 and 3.0 percent of GDP by 2031 and 13.3 million internal climate migrants by 2050.[2] The power sector is highly vulnerable to natural hazards in Bangladesh, owing to loss of connectivity, fuel supply disruption, and inundation from flooding and storm surge. Managing and adapting to disaster risks in the energy system will be critical to provision of safe, affordable, and reliable electricity and will also increase societal resilience as climate change intensifies.

4. **Bangladesh must focus on policies, institutions, and investments that address structural challenges and climate risks while accelerating its economic transformation.** Bangladesh must find ways to diversify into higher value-added products and services, pursuing enabling improvements to business environment and infrastructure. Digitalization can be a key enabler, helping make its infrastructure and economy more efficient and resilient to climate change. Investments in climate adaptation, resilience, and decarbonization of its energy mix with the assistance of the international community can help Bangladesh manage its climate vulnerability. Bangladesh has an opportunity as part of its COVID-19 recovery efforts to build back better.

## B. Sectoral and Institutional Context

5. **Bangladesh has in the last decade made impressive progress in increasing access to electricity and power generation capacity.** In 2010, the country's electricity access rate was 55 percent. Its installed generation capacity of 6 GW met less than 75 percent of peak demand and shaved off an estimated 3 percent of GDP growth. Annual per capita electricity consumption of 247 kWh was about one-fourth of India's and one of the lowest in

[1] Bangladesh Development Update April 2021.
[2] World Bank. 2018. *Groundswell: Preparing for Internal Climate Migration*.

the world. The Government's prioritization of generation and electrification during the last decade has led to impressive achievements in these areas. Access to electricity is estimated to have increased to more than 99 percent by 2021. Installed generation capacity has increased fivefold to 25 GW in the same period[3] and now exceeds the 14 GW peak demand in the country.[4,5] Annual per capita electricity consumption has almost doubled to 464 kWh.

6. **There has not been a similar improvement in reliability of electricity supply, which is adversely affecting its economic competitiveness and the business environment.** This reflects inadequate investment in the transmission and distribution network. Reliability of electricity supply is the lowest among regional peers due to the poor state of the electricity network.[6] Electricity supply of more than 90 percent of households in Bangladesh, and almost all households in rural areas, corresponds to tier 3 or below (out of 5) in the Multi-Tier Framework for Electricity Access of the Energy Sector Management Assistance Program (ESMAP). A recent International Finance Corporation (IFC) study shows that unreliable power supply is a major challenge for the expansion of medium-size enterprises in sectors with export potential (such as footwear, plastics, and light engineering goods).

7. **Bangladesh faces significant challenges in securing sustainable and affordable electricity to support its rapidly growing economy.** Electricity demand in Bangladesh is projected to more than double to 32 GW by 2030. The Government's Power System Master Plan (PSMP) 2016 leaned heavily on imported coal. Increasing the share of coal to 30 percent of the total energy mix from a low base as planned in the PSMP would be damaging to the local environment and the global climate. Furthermore, coal generation is quickly losing financial and economic competitiveness. Against this backdrop, the Government recently cancelled ten planned coal plants and is considering alternate generation options as part of an ongoing update of its least cost generation plan.

8. **The Government is currently updating its power sector development plan to establish a low carbon energy system.** The Integrated Energy and Power Sector Masterplan, currently under preparation, will provide a road map for the introduction of low carbon policies and technologies to facilitate Bangladesh's transition toward a lower carbon pathway. The Masterplan will consist of scenarios through 2050 for achieving the objectives of the Paris Agreement and the country's Vision 2041. The Masterplan is expected to be consistent with the Government's National Solar Energy Action Plan (2020–2041), which seeks to increase the installed generation capacity of solar photovoltaic (PV) from 0.2 GW of grid-connected capacity in 2021[7] to between 8 and 40 GW by 2041. In parallel to the Masterplan, the Government has prepared the Mujib Climate Prosperity Plan, which calls for an Energy Storage Action Plan including a role for Battery Energy Storage Systems (BESS.

9. **It is imperative that new and emerging technologies are mobilized to help Bangladesh pursue a paradigm shift and achieve sustainable transformation of its electricity systems.** A coordinated deployment of

[3] https://www.dhakatribune.com/bangladesh/2021/08/20/bangladesh-close-to-100-electricity-coverage
[4] BPDB (Sept 2021). Installed Capacity. *https://www.bpdb.gov.bd/bpdb_new/index.php/site/page/13e9-2cc0-ce41-9c09-088d-94d5-f546-04a6-b4fa-1d18*.
[5] The World Bank supported the increase in generation capacity through (a) US$526 million for the 335 MW Siddhirganj high efficiency combined cycle gas plant as well as gas and power transmission and capacity building: and (b) US$217 million for conversion of the 210 MW Ghorashal Unit 4 from a steam turbine to a 409 MW combined cycle plant, increasing efficiency of power generation. It is also supporting the Enhancement and Strengthening of Power Transmission Network in Eastern Region (US$450 million), Rural Electrification and Renewable Energy Development II (US$319 million), and Scaling Up Renewable Energy (US$185 million) projects.
[6] Bangladesh ranked 101 out of 137 countries in the rankings for quality of electricity supply of the Global Competitiveness Report 2017–2018.
[7] Additionally, 350 MW off-grid renewable energy capacity, mainly solar home systems (SHSs), have been installed.

renewable energy and BESS, demand response, electric mobility[8], energy efficiency, and digital technologies as well as electricity imports generated from clean sources in India, Nepal, and Bhutan can help Bangladesh reduce its dependence on fossil fuel generation and make the electricity supply more efficient, reliable, and affordable. While all deployments of solar PV have been modest so far, distributed solar particularly with BESS can help increase the share of renewable energy in the generation mix. Distributed PV features prominently in the Draft National Solar Energy Action Plan because it circumvents land availability constraints faced by utility-scale developments and presents an alternative to expensive diesel generators used in energy intensive manufacturing such as ready-made garments.

10. **Large investments are needed urgently to rehabilitate, expand, and modernize Bangladesh's electricity networks.** Electricity networks are the backbone of a secure and reliable power system. Given the backlog of investments, Bangladesh is estimated to need more than US$66 billion to rehabilitate and upgrade its electricity networks by 2041[9]. Expansion and refurbishment of electricity networks presents an opportunity to strengthen the resilience of electricity systems to climate change and extreme weather events, while smart grid investments will help increase reliability and security and reduce the cost of generating, transmitting, and distributing electricity and increase the penetration of variable renewable energy such as solar PV.

11. **The COVID-19 pandemic reinforced the importance of these investments.** The pandemic caused a temporary slowdown in the growth of electricity demand and harmed the financial positions of power utilities. The reliance of utilities on manual methods for billing and metering and network operations and maintenance in Bangladesh constrained their performance during the pandemic. At the same time, declining levels of employment and household income put renewed focus on electricity affordability. Investments in renewable energy, energy efficiency, and digitalization are an opportunity to build back better while improving sector performance.

12. **The Bangladesh Rural Electrification Board (BREB) will need to play a central role in these efforts.** BREB is the largest distribution utility in the country, serving three quarters of the country's population including the poorest and most vulnerable. BREB was established in 1977 as a means of extending the benefits of electric service to the rural areas of Bangladesh through associated rural electric cooperatives called Palli Bidyut Samities (PBSs). BREB and its associated 80 PBSs provide electricity to more than 90 percent of the country's districts, three-fourths of the population, and account for close to half of electricity sales. BREB purchases power in bulk from Bangladesh Power Development Board (BPDB), which is the single buyer in the sector that also owns its own generation and distribution companies and purchases electricity from other generators. The Power Grid Company of Bangladesh (PGCB) is responsible for transmission and includes the National Load Dispatch Center[10]. The Ministry of Power, Energy, and Mineral Resources (MPEMR), assisted by its technical arm Power Cell, sets the policy directions for the sector and provides oversight to sector agencies.

13. **In the last decade, BREB successfully implemented one of the largest rural electrification programs in the world, delivering access to more than 90 million people.** This puts the Government on the cusp of meeting its universal electrification goals, expected within 2021. BREB has also been able to improve the efficiency of its system operations in this period, reducing system losses from 18 percent in 2009 to 9 percent in 2021. The World

[8] Half are assumed to be battery-assisted pedal-rickshaws and the rest are electric rickshaws.
[9] Revisiting Power System Master Plan 2016
[10] The PGCB is taking the lead in developing the country's transmission network, with more US$31 billion of planned investments by 2041. Besides BREB and BPDB, three other distribution utilities—Dhaka Power Distribution Company, Dhaka Electric Supply Company Limited, and West Zone Power Distribution Company Limited—supply electricity to consumers.

Bank has been supporting BREB through its Rural Electricity Transmission and Distribution Project, which closed in June 2021.

14. **With the access agenda nearing completion, the Government is keen to focus on BREB's modernization and network transformation.** The accelerated efforts to achieve universal electrification has increased the pressure on BREB's distribution network and network congestion and disruption. BREB needs investments to strengthen and expand its distribution network and transition from traditional grid to a modern grid that is lower-carbon, flexible, robust, and agile and can dynamically optimize grid operations and resources; integrate diverse generation sources including distributed solar, demand response, and electric mobility; and provide strong protection against climate and cyber risks.

### C. Relationship to the CPS/CPF and Rationale for Use of Instrument

15. **The proposed Program is aligned with the World Bank Group's Bangladesh Country Partnership Framework (CPF) for FY2016–FY2020** (N°103723-BD; March 8, 2016 discussed at the Board on April 5, 2016), which has been extended to FY2021 after the Program Learning Review. It directly supports the CPF's transformational priority in energy and contributes to the achievement of foundational priorities—macroeconomic stability, human development and strengthened institutions, and business environment. The Program is consistent with the Program Learning Review's emphasis on climate resilience and digital transformation.

16. **The proposed Program is consistent with World Bank Group's Climate Change Action Plan (CCAP) (2021–2025) and Green, Resilient, and Inclusive Development (GRID) approach.** The Program falls under the 'Rebuilding Better' phase activities of the World Bank's Bangladesh engagement in the current COVID-19 crisis. It has the objective of achieving resilient, inclusive, and sustainable recovery by strengthening policies, institutions, and investment in a world transformed by the COVID-19 crisis. The proposed Program contributes also to the mitigation and adaptation objectives of Bangladesh's updated Nationally Determined Contribution.[11]

17. **The Program-for-Results (PforR) instrument was determined to be best suited for the World Bank's support to BREB's large and transformative program.** The World Bank has had a long engagement with BREB going back to 1981 and has undertaken seven operations to support the Government's electrification and access programs. During this period, BREB has, with the World Bank's assistance, strengthened its organizational systems and implementation capacity and has emerged as a capable implementing agency. In the last decade, BREB successfully implemented large Government programs using its own systems and processes. Given its track record, the PforR instrument is considered appropriate for the World Bank's support to BREB's new program as it will (a) provide stronger focus on accountability for results and outcomes while incentivizing the Government's and BREB's ownership and implementation of critical reforms and initiatives in electricity distribution, (b) improve the capacity of BREB and other agencies to deliver the program through their own systems and procedures, and (c) provide flexibility and efficiency in supporting a large program.

[11] Bangladesh Ministry of Environment, Forest and Climate Change (August 26, 2021). Nationally Determined Contributions 2021. https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Bangladesh%20First/NDC_submission_20210826revised.pdf.

## II. PROGRAM DESCRIPTION

### A. Government Program

18. **The Government has prepared a program for modernization and capacity enhancement of BREB to respond to challenges in electricity distribution.** The program aims to (a) upgrade and enhance the capacity of rural electrical distribution network; (b) meet the projected increase in electricity demand; (c) provide access to reliable, affordable, and efficient power supply to consumers; and (d) reduce system loss of the distribution system. The program will support investments to increase the network capacity and develop a smart grid as well as institutional and regulatory strengthening.

19. **The program will strengthen BREB's ability to meet rapid electricity demand growth while supporting power sector decarbonization and improving climate resilience of the electricity system.** As part of the program, BREB and its 80 associated PBSs will increase their readiness and capacity to transition from traditional grid architecture to one with the ability to deliver more power reliably and support two-way flow of electricity and information, growing the number of distributed energy resources, and empowering customers as both power suppliers and demand managers. Digitalization of network operations and integration of distributed energy resources such as rooftop solar and BESS will be prioritized. Program investments will be undertaken in close coordination with more than US$4.0 billion of investments in the transmission network that are proposed to be undertaken by PGCB during the program period.

20. **The Government's program will cover all 80 PBSs in BREB, which together supply about half of the electricity in the country and cover the entire country except Dhaka and some other urban areas.** The program comprises four geographical areas: Dhaka-Mymensingh Division, Chittagong-Sylhet Division, Khulna-Barishal Division, and Rajshahi-Rangpur Division, as well as institutional and regulatory strengthening. The program will cover the period from 2021 to 2026 and will require approximately US$3.2 billion of investments over the period. The Government has asked the World Bank to support program implementation in the Dhaka-Mymensingh Division and is seeking financing from other development partners such as the Asian Development Bank (ADB) and Asian Infrastructure Investment Bank (AIIB) to implement the program in the remaining divisions. Program implementation in the remaining divisions will follow and leverage the experience and learning from the implementation of the program in the Dhaka and Mymensingh division.

21. **About one-third of the required financing is expected to come from the Government.** The private sector is expected to significantly increase investments in distributed solar in the program areas in accordance with the Government's net metering policy and the National Solar Energy Action Plan supported by the Government program. Technical assistance is envisaged to BREB and other sector agencies to improve their capacity in new and emerging technologies including BESS, electric mobility, and demand response.

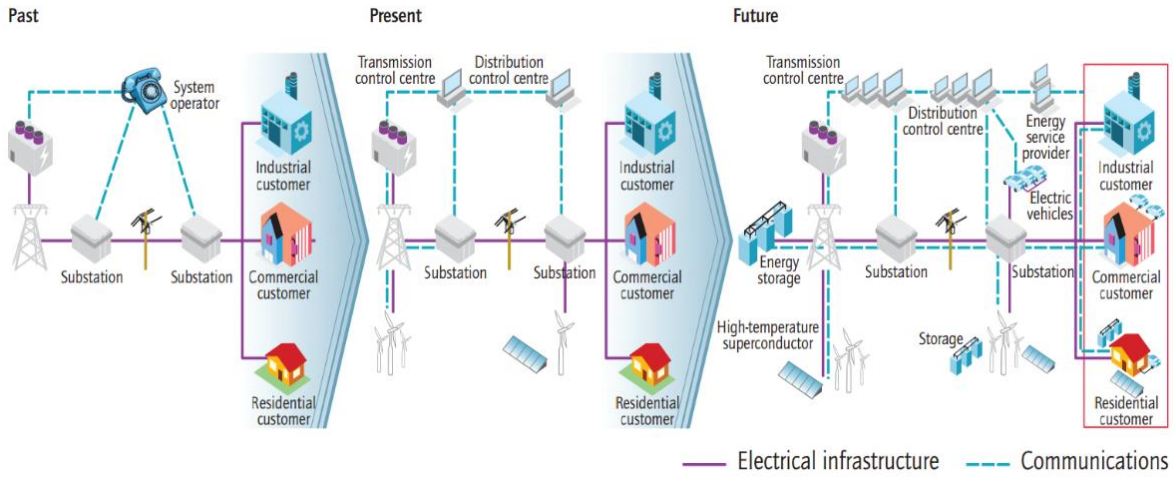
### B. Theory of Change

22. **The electricity sector is undergoing rapid change and transformation.** The traditional grid architecture that was based on large-scale generation, centralized, one-way control and passive loads is evolving into one

with the ability to support two-way flow of electricity and information, growing numbers of distributed energy resources, and customers as both power suppliers and demand managers (figure 1).

23. **Bangladesh faces constraints in improving electricity supply and achieving sustainable transformation of its electricity system.** The key binding constraints include (a) insufficient investments in network capacity, (b) lack of prioritization of climate-resilience measures in its distribution network, (c) lack of utilization of state-of-the-art technologies and distributed energy resources, and (d) inadequate institutional and regulatory capacity and know-how in new technologies and business models.

**Figure 1. Evolution of the Electric Power Grid**

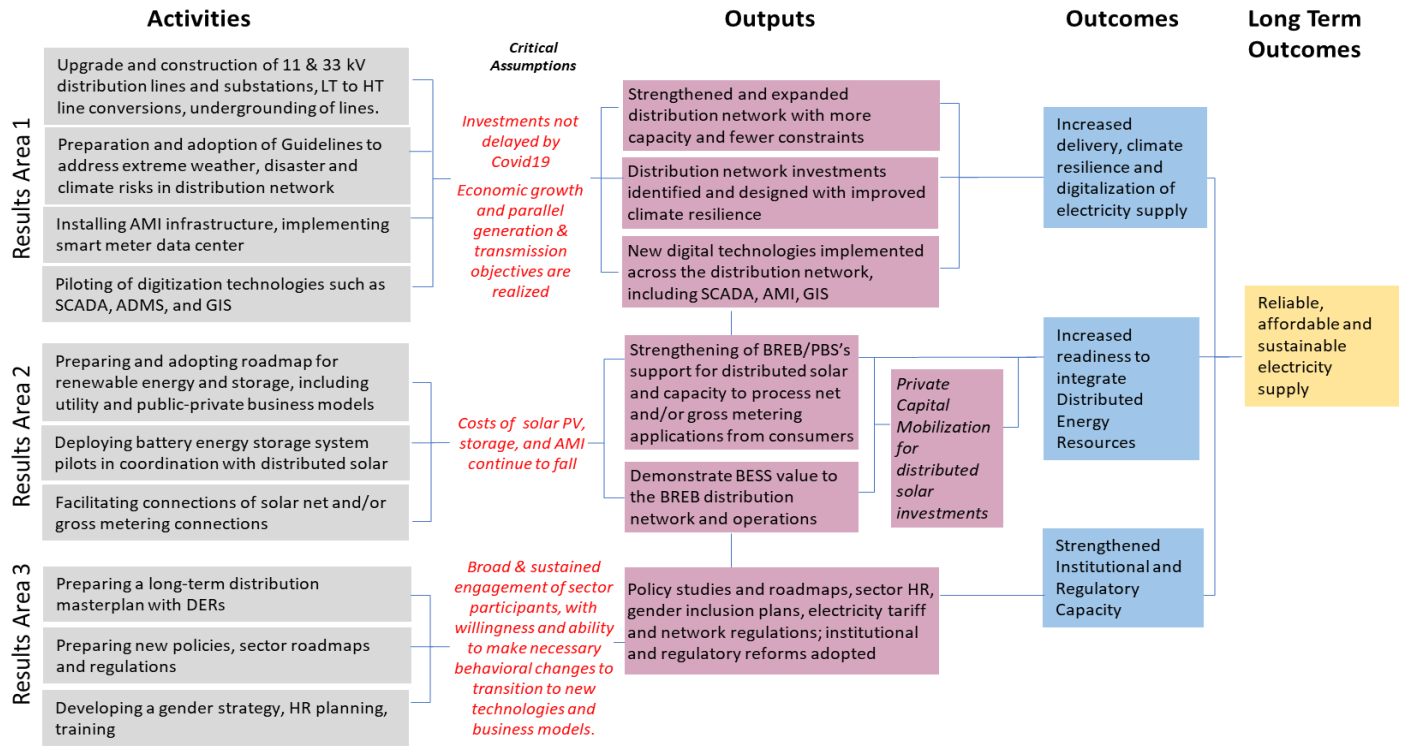



*Source:* International Energy Agency (2011), *Technology Roadmap: Smart Grids,* OECD/IEA, Paris

24. **Electricity distribution network transformation is essential for decarbonizing the electricity system.** A modern grid that is flexible and capable of monitoring and optimizing its resources will be able to integrate variable renewable energy and electric mobility solutions, while also being able to minimize and recover more quickly from climate and cyber threats. The growing affordability and ubiquity of ICTs means that digitalization can save costs for utilities, even in developing countries. This transformation is a complex undertaking for utilities, regulators, policy makers, and other electric power industry stakeholders and will need to be supported by a substantial technical assistance and capacity-building program.

25. **The proposed operation will strengthen BREB ability to capitalize on the energy transition and prepare for future climate conditions.** The theory of change (figure 2) is based on three results areas for the achievement of outcomes: (a) increased delivery, climate resilience, and digitalization of electricity supply; (b) increased readiness to integrate distributed energy resources; and (c) strengthened institutional and regulatory capacity.

**Figure 2. Theory of Change**




## C. PforR Program Scope

26. **The proposed PforR operation (Program) will support part of the overall Government program** focused on network strengthening, expansion, and rehabilitation to ease existing constraints and meet the rapidly growing demand in 25 PBSs within BREB's Dhaka-Mymensingh Division (Table 3.1 in Annex 3 contains PBS details). These network investments will be paired with new and transformative elements such as Supervisory Control and Data Acquisition (SCADA), Advanced Distribution Management System (ADMS), and AMI and distributed energy resources such as rooftop solar and BESS to improve reliability, efficiency, and sustainability of electricity supply. Institutional and regulatory strengthening to implement new and emerging technologies will be undertaken in BREB and MPEMR. Given the need to build capacity and readiness to implement new and, in some cases, still evolving technologies, the Government and BREB are planning a gradual rollout of new technologies, with deployment across all PBSs expected to extend beyond the current Program timeline.

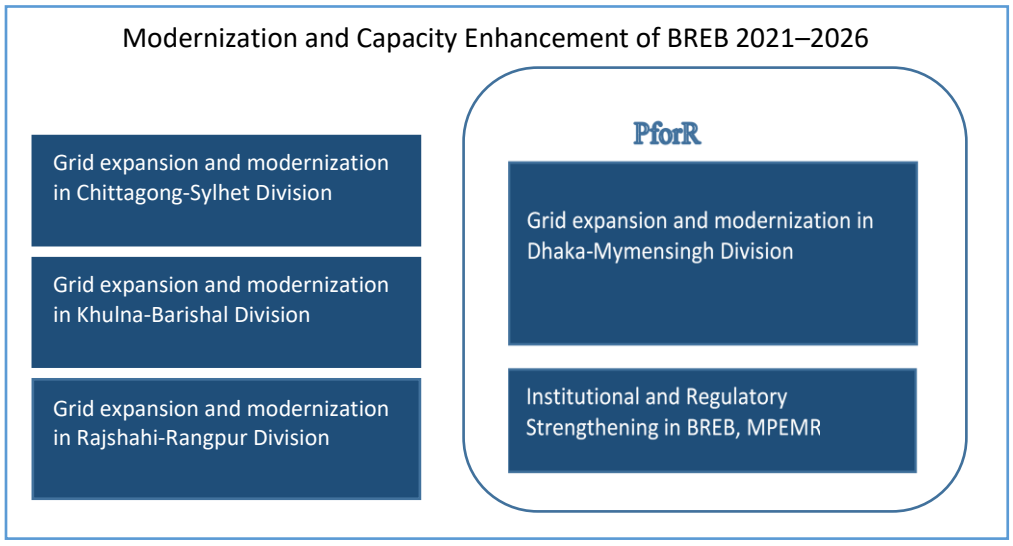
**Table 1. Proposed Program Scope**

| Item | Government of Bangladesh (GOB) program | Program supported by PforR |
|---|---|---|
| ***Title*** | Modernization and Capacity Enhancement of BREB Network | Electricity Distribution Modernization |
| ***Objective*** | Increase delivery, reliability, and efficiency of electricity services | Increase delivery, reliability and efficiency of electricity supply and strengthen institutional capacity and readiness for its |

| | | |
|---|---|---|
| | | sustainable transformation |
| ***Duration*** | 2021-2026 | 2021 -2026 |
| ***Result Areas*** | • Increased delivery, climate resilience and digitalization of electricity supply<br>• Increased readiness to integrate distributed energy resources<br>• Strengthened institutional and regulatory capacity | Results areas will be the same as the GOB program |
| ***Geographical Scope*** | • Dhaka-Mymensingh Division<br>• Chittagong-Sylhet Division<br>• Khulna-Barishal Division<br>• Rajshahi-Rangpur Division | Dhaka-Mymensingh Division |
| ***Financial Envelope*** | **US$ 3,213 million** of which GOB/BREB: US$ 902 million and Development Partners: $2,311 million | **US$ 902 million** of which GOB/BREB: US$250 million; World Bank: US$500 million; Climate Investment Fund: US$15 million; Korea Institute of Advanced Technology: US$ 13 million; Private Capital Mobilization: US$124 million. |

*Note:* Except for support provided under Results Area 3 for institutional and regulatory strengthening at the national level.

**Figure 3. Government Program and PforR Linkage**




27. The following results areas will be supported under the Program.

***Results Area 1: Increased delivery, climate resilience and digitalization of electricity supply***

28. Strengthening and expanding the network to increase the capacity of the distribution network and address network constraints through investment in upgrade and construction of more than 31,000 km of distribution lines, 157 distribution substations and related infrastructure in 25 PBSs in BREB's Dhaka and Mymensingh Division.

29. Increasing the climate resilience of BREB's distribution network through the adoption of guidelines to address extreme weather, disaster, and climate risks to inform network investments under the Program.

30. Supporting the digital transformation of BREB's network operations through the introduction of SCADA/ ADMS, Geographic Information System (GIS), and smart prepaid meters/AMI.

***Results Area 2: Increased readiness to integrate Distributed Energy Resources***

31. Supporting the integration of distributed solar through the preparation of a roadmap for integration of renewable energy and storage in BREB distribution network and strengthening of BREB/PBS's capacity to process and approving net and/or gross metering applications from consumers, developing distributed solar using utility-owned and/or public-private partnership models, and assessing and managing their impact on BREB/PBS financial sustainability.

32. Supporting battery energy storage system pilots in coordination with distributed solar to demonstrate their value to the BREB distribution network and operations.

33. *Private Capital Mobilization***.** Up to 150 MW of distributed solar capacity is expected to be developed in Program areas[12] with private capital mobilization potentially of about US$ 124 million.

***Results Area 3: Strengthened Institutional and Regulatory Capacity***

34. Providing technical assistance and capacity building to BREB and Power Cell to facilitate the energy transition and effectively respond to challenges and opportunities in the sector.

**Program Financing**

| Source | Amount (USD Million) | Percent of Total |
|---|---|---|
| **Counterpart Funding** | **250.00** | **27.72** |
| Borrowing Agency | 250.00 | 27.72 |

[12] As of September 2021, 54 MW of distributed rooftop solar projects were in different stages of development at an estimated cost of US$38 million in the Program areas.

| | | |
|---|---|---|
| **International Development Association (IDA)** | **500.00** | **55.43** |
| IDA Credit | 500.00 | 55.43 |
| **Trust Funds** | **15.00** | **1.66** |
| Climate Investment Funds | 15.00 | 1.66 |
| **Commercial Financing** | 124.00 | **13.75** |
| Unguaranteed Commercial Financing | 35.00 | 3.88 |
| **Cofinancing - Other Sources (IFIs, Bilaterals, Foundations)** | **13.00** | **1.44** |
| KOREA, Govt. of | 13.00 | 1.44 |
| **Total Program Financing** | **902.00** | |

## D. Program Development Objective(s) (PDO) and PDO Level Results Indicators

35. The PDO is to increase the delivery, reliability and efficiency of electricity supply and strengthen institutional capacity and readiness for its sustainable transformation[13]. The PDO-level results indicators are

- Electricity delivery to BREB customers increased (Gigawatt-hour [GWh]);
- Electricity system losses reduced (percent);
- People provided improved electricity service, including female (Number); and
- SCADA and BESS pilot completed in BREB's distribution network[14].

## E. Disbursement Linked Indicators and Verification Protocols

36. **The disbursement under the proposed Program will be governed by a set of seven DLIs across the three results areas**. The DLI's articulate actions necessary to meet the projected growth in electricity demand reliably and efficiently in the Program areas while enabling BREB/PBSs to capitalize on disruptive developments in digitalization and distributed energy resources to support energy transition. The DLIs balance traditional elements of network of development that are familiar to BREB and where BREB already has significant in-house capacity (DLIs 1 and 2) with elements that are new to BREB (DLIs 3, 4, 5, and 6) and would require technical assistance and capacity building and will need to be adopted gradually. DLI 7 focuses on technical assistance and capacity building activities for BREB and Power Cell. DLI selection was guided by: (a) transformational potential to support the energy transition in the BREB network; (b) feasibility and practicality of measuring, monitoring, and verifying the indicators; and (c) capacity of BREB to achieve DLIs during the implementation period of the

[13] The second part of the PDO relates to the readiness and capacity of institutions to support sustainable transformation of electricity supply through greater digitalization of networks, integration of BESS and distributed solar, and climate resilience
[14] SCADA and BESS pilots will be undertaken together with associated training and capacity building and as such are used to measure improved readiness and capacity for sustainable transformation in implementing agencies.

PforR. All DLIs except DLI 6.2 will be funded with IDA Scale-up Facility (SUF) resources; US$15 million CIF grants will be disbursed upon the achievement of results in DLI 6.2 - BESS connections to BREB distribution network increased.

**Table 2. Summary of DLIs**

| Results Area | Summary of DLIs | Financial Allocation (US$, million) | Recipient |
|---|---|---|---|
| Results Area 1: Increased delivery, climate resilience, and digitalization of electricity supply | DLI 1. Electricity delivery to BREB customers increased | 112 | BREB |
| | DLI 2. Climate resilient electricity distribution network infrastructure developed | 271 | BREB |
| | DLI 3. Advanced Metering Infrastructure implemented | 23 | BREB |
| | DLI 4. SCADA pilot completed | 15 | BREB |
| Results Area 2: Increased readiness to integrate distributed energy resources | DLI 5. Integration of renewable energy in BREB distribution network increased | 30 | BREB |
| | DLI 6. BESS connected to BREB distribution network | 30 | BREB |
| Results Area 3: Strengthened institutional and regulatory capacity | DLI 7. Sector institutional and regulatory capacity and gender consideration increased | 34 | |
| | DLI 7.1 Annual institutional strengthening and gender activities of BREB completed | 21 | BREB |
| | DLI 7.2 Annual institutional strengthening and technical assistance activities of Power Cell completed | 13 | Power Cell |
| | **Total** | **515** | |

37. **The DLIs will be annually reviewed and verified by an independent verification agency (IVA) to be contracted by BREB and Power Cell using terms of reference satisfactory to the World Bank.** The implementing agencies are drafting these terms for the IVA and will seek inputs from the World Bank before finalization. The DLIs will be verified based on review of official data and reports supplementing evidence-based methods such as field verification through a customer survey. The periodic IVA reports will serve as the basis for assessing progress toward achievement of the DLI targets and for disbursement authorization by the World Bank. The IVA reports will also form the basis for BREB to present DLI claims to the World Bank and to release funds.

## III. PROGRAM IMPLEMENTATION

### A. Institutional and Implementation Arrangements

38. **BREB, under the oversight and coordination of MPEMR, will be the lead implementing agency for the Program.** Power Cell will be responsible for implementing its TA component. The Program will use the Government and BREB systems for program implementation, oversight, financial management, procurement, safeguards, monitoring and evaluation, and reporting arrangements. The Program will be implemented over five years between 2021 and 2026. Activities under Results Areas 1 and 2 will be implemented by BREB, while activities under Results Area 3 will be implemented by BREB and Power Cell. Two Steering Committees, headed by MPEMR and comprising of BREB, Power Cell and other relevant government agencies will provide oversight for the implementation of the BREB investment program and Power Cell technical assistance program, respectively.

39. **BREB will be responsible for planning, financing, and installation of Program investments in Results Areas 1 and 2.** Once constructed, responsibility for the distribution system will be transferred to PBSs which provide retail service, as well as operation and maintenance, and are overseen by BREB. A Program Operations Manual will be developed setting out detailed institutional, administrative, financial, technical, and operational guidelines and procedures for the implementation of the Program and Program Action Plan (PAP), including (a) detailed safeguards, (b) financial management (including fund flow and budgeting) and procurement arrangements, and (c) a monitoring and verification system for the Program. In addition, the Ministry of Finance will sign a subsidiary agreement with the implementing agencies, which will include terms of proceeds of the financing made available to them and their responsibility in carrying out activities under the Program. The detailed institutional and implementation arrangements are provided in annex 3.

### B. Results Monitoring and Evaluation

40. **As Program implementing agencies, BREB and Power Cell will be responsible for the results monitoring and reporting of the PforR Program** and recruitment of a third-party agency for verification of the achievement of the DLIs. BREB has a well-established monitoring and reporting system that tracks progress on a monthly, quarterly, and annual basis and feeds into its management information system (MIS). This system also forms the basis for BREB reporting on its Results Framework and Annual Performance Agreement with MPEMR. Program monitoring and reporting is aligned with BREB's systems and will be led and managed by BREB's Office of Chief Engineer (Project) in coordination with its Finance and Accounts Directorate and Systems Operations Directorate.

41. **A Multi-Tier Framework (MTF) survey will be carried out prior to Program effectiveness to establish a baseline for the PDO indicator on people provided improved electricity supply.** Follow up MTF surveys will be carried out at the mid-term review and upon Program completion. The Program's impact evaluations are the responsibility of the BREB and will be undertaken for selected areas of the Program in consultation with the World Bank. PBSs provide quarterly reports on their technical, operational, and financial parameters to BREB, which are consolidated and monitored as part of BREB's MIS.

42. **Power Cell has a monitoring and reporting system that enables it to track its work program and Annual Performance Agreements.** However, the Technical Assessment highlights gaps in these systems and the need to improve the systems' capacity. Power Cell's monitoring and reporting system will be further strengthened under the Program through additional staffing and consulting support, to enable it to meet reporting requirements.

### C. Disbursement Arrangements

43. **The CTF grant and IDA credit proceeds will be disbursed against submission, to the World Bank, of the IVAs' Program Results Verification Report on the achievement of the DLIs to Government treasury in BDT.** The implementing agencies will present the Program Results Verification Report to the World Bank within three months of the end of each fiscal year. The World Bank will use the Program Report to determine the amount of the eligible disbursements to be made based on the results achieved. The CTF grant will be applied to the against the BESS DLI installation in the Program. The counterpart agencies understand that if after the IDA credit and CTF grant closing date, the World Bank establishes that the withdrawn financing balance exceeds the total amount paid for Program expenditures, exclusive of any such amounts financed by any other financier or by the World Bank under any credit or grant, the borrower shall promptly, upon notice from the World Bank, refund such excess amount of the withdrawn financing balance. Reconciliation between disbursement and program

expenditures would be done after considering both financing sources – IDA and CTF and both implementing agencies and if disbursement exceeds program expenditures, refund would be requested.

44. **Most of the DLIs are scalable, with funds being disbursed in proportion to the achievement of the DLI.** Where actions are not achieved in any particular year, the allocated amount will be carried over to the subsequent year. Conversely, if targets are reached before deadlines, disbursements may be made earlier, after clearance from the World Bank. BREB and Power Cell will submit separate withdrawal applications for their parts of the Program. The implementing agencies are likely to withdraw advance funds up to US$119 million from the loan amount and up to US$3.75 million from the CTF Grant as provided in the disbursement and financial information letter, upon declaration of effectiveness and payment of front-end fee, given the upfront funding needs of the Program based on the expenditure framework[15]. The DLIs for the PforR are provided in annex 2, together with the disbursement amounts for each of the DLIs and the protocols for their verification.

45. **Prior results.** An amount of up to US$30,779,382 will be allocated for achievement of prior results in DLI1 – Delivery of electricity to BREB customers increased from the IDA credit, covering the period from 1 December 2020 to 30 June 2021. Disbursements for prior results will be made against the verification of the results following the effectiveness of the credit.

### D. Capacity Building

46. **Capacity building and institutional strengthening is a key priority of the Program.** It will enable sector agencies to successfully transition to new technologies and business models in the sector. Advice, training, and capacity building to BREB and Power Cell are included in Results Area 3 of the Program and will help address gaps identified in the technical assessment. Funds from the World Bank-executed trust funds—ESMAP, GFDRR, and Climate Support Facility (CSF)—will complement the Program resources[16]. Specific areas of support to BREB under the Program include:

a) **Rural distribution masterplan.** With the changing landscape of the power sector in Bangladesh, BREB's distribution network planning for a future power system needs to consider integrated generation and network planning, incorporate demand-side resources, distributed energy resources and their associated flexibility requirements, and linkages of power to other sectors such as transport. Capacity building for BREB to prepare a rural distribution masterplan will coordinate with preparation of the Bangladesh Integrated Energy and Power Sector Masterplan.

b) **Digital transformation of distribution networks.** BREB will be supported through capacity building to implement digital transformation initiatives including SCADA, ADMS, GIS. and AMI. This will include (a) an institutional diagnostic to assess gaps in organization structure, institutional processes, organizational information technology systems, HR, business models, and training programs; (b) a capacity development plan to build BREB's ability to adopt and effectively use new technologies; and (c) training and sharing of international experience.

c) **Distributed energy resources.** The Program support BREB to develop a road map to increase the integration of renewables, battery storage, electric vehicles, and demand response in its network including

[15] Prior results and advances together will be subject to cap of 30 percent of the IDA credit and CTF grant amounts.
[16] Trust fund resources are Bank executed resources and will not be included in Program Expenditures.

(a) gap analysis, consultations with stakeholders, and preparation of action plans; (b) preparation of assessments and business models and review of feasibility studies to support their adoption; and (c) training and sharing of international experience.

d) **Resilience in distribution network.** GFDRR grants will be used to help BREB incorporate climate resilience considerations in its planning process and build institutional understanding of good practices, with strengthened capabilities to employ evidence-based approaches to risk-informed resilience policies and procedures. This support will leverage global knowledge from Japan and other countries facing similar risks.

**Gender in BREB and PBSs.**

47. **Bangladesh's power sector is aiming to increase female representation in technical roles.** In BREB, Women account for 8.2 percent of total employees and 2.8 percent of total technical staff. Some of the major barriers to greater female representation include (a) low awareness and enrollment of girls in Science, Technology, Engineering, and Mathematics (STEM) subjects; (b) lack of practical field-based training opportunities; (c) negative preconceptions of careers in the power sector (that is, male-dominated), which discourages women applicants; and (d) lack of women-friendly policies and facilities (flexi-work options, daycare, and safe transportation). Please see Annex 3 for more details from the BREB gender assessment.

48. **The Program will help advance gender equity in BREB and PBSs.** BREB is committed to improving its organizational gender diversity and equity. In 2020, BREB became a South Asia Women in the Power Sector Professional Network (WePOWER) partner and is already implementing quarterly gender activities.[17] BREB will adopt a Gender Strategy and Action Plan and establish a Gender-Responsive Human Resource Monitoring System. BREB will look to scale up WePOWER gender activities, including strengthening outreach and recruitment efforts for female STEM students and engineers, and training and job placement of women into technical positions.[18]

49. **To measure the outcome, the Program will monitor the total percentage of female employees in technical roles (Baseline: 2.8%, Target: 10%) under DLI 7.** In addition, the total percentage of female staff at BREB and PBS, percentage of female staff in management/officer positions, and percentage of female staff in project technical trainings will be monitored and reported annually by BREB.

**Climate Co-Benefits**

50. **The Climate Co-Benefits of this operation amount to US$336.6 million (67.3%),** as per the appraisal stage assessment from the Bank's Climate Co-Benefits team received on 17 November 2021. Climate Co-Benefits are expected from the integration of renewable energy and BESS, adoption of climate resilience measures, reduction of system losses and technical assistance and capacity building. Additional information on the Program climate co-benefits is provided in the standalone Technical Assessment.

[17] Blog on BREB's participation in WePOWER: https://blogs.worldbank.org/endpovertyinsouthasia/wepower-helps-bangladeshs-largest-power-distribution-company-boost-its-female.

[18] Other gender activities include: i) adopt gender-responsive human resource policies to attract and retain female staff; ii) job placement of women into technical positions as part of its modernization efforts for network digitization/smart infrastructures – such as managing SCADA systems and electric vehicle charging stations; iii) ensure at least 40 percent of women beneficiaries, such as entrepreneurs, participate in BREB awareness and engagement activities; and iv) internalize gender awareness training and guidance on gender-responsive communication, including stakeholder interaction, community events, and promotional campaigns.

## IV. ASSESSMENT SUMMARY

### A. Technical (including program economic evaluation)[19]

51. **The proposed Program is consistent with the Government's commitment to build a low carbon electricity system**. The Program's focus on meeting electricity demand reliably and efficiently is aligned with the Government's five-year plan and energy sector strategy paper. The Program is consistent with World Bank Group's Bangladesh CPF, CCAP (2021–2025), and GRID framework.

52. **The Program is timely and designed to increase the delivery of electricity reliably and efficientl**y. It strikes a balance between network investments that are urgently needed to meet the increase in the electricity demand and investments in technologies and capacity that are essential for setting the sector on a more efficient and sustainable path while improving affordability and reliability.

53. **BREB has agreed to implement measures to address gaps and improve effectiveness of the Program** including: (a) implement measures to increase resilience of the distribution network to extreme weather events and climate change; (b) prepare a long-term distribution masterplan; (c) capacity building and technical assistance in network planning and new technologies such as SCADA, AMI, distributed solar, BESS, and electric mobility infrastructure; and (d) capacity building and technical assistance on gender and social inclusion.

54. **The Program will rely on the government's relatively well-established structure of planning and budgeting.** There is a medium-term budgeting framework (MTBF) and an annual budget process that help fiscal policy formulation and management. The planned expenditures for grid expansion and strengthening, digitalization, distributed energy resources, and institutional and regulatory strengthening are estimated at about US$902 million.

55. **The emphasis on cost effectiveness and efficiency that characterized past BREB programs is expected to be maintained in this Program.** Program expenditures under BREB's rural electrification programs were efficient and delivered electricity connection to large number of beneficiaries cost effectively. BREB previously got competitive prices through international competitive bidding. BREB is expected to maintain the emphasis on cost-effectiveness and efficiency with its investments in SCADA, AMI, and BESS in the Program.

56. **The Program is economically viable.** Program investments will bring substantial economic benefits to Bangladesh's economy by helping displace expensive diesel based self-generation and fossil fuel generation, meet growing demand, and improve the efficiency and reliability of the power system. The economic rate of return of the Program is 34.3 percent (NPV US$6.3 billion). Sensitivity analysis shows that the Program economic rate of return is robust to unfavorable outcomes of variables such as Program costs, additional electricity supplied, and average willingness to pay.

57. **The Proposed Program is consistent with the World Bank's Cascade and Maximizing Finance for Development approach to development finance**, as network investments will removes binding constraints to private investment in the sector and rest of the economy and help lower investment risk. The Program also supports the indirect mobilization of private capital through the net and/or gross metering solutions under

[19] Additional information on the Technical Assessment of the Program is provided in Annex 3. The full Technical Assessment will be disclosed as a separate document.

Results Area 2 described above. The World Bank is adding value in the Program by supporting capacity building; sharing global knowledge and experience in climate resilience and technologies such as SCADA, AMI, and BESS; and mobilizing concessional resources to support distribution network transformation and the energy transition.

58. **The financial sustainability of PBSs is expected to improve with the implementation of the Program, as universal access is achieved, and annual capital investments are reduced.** PBSs' revenues increase at a faster pace and expenses level off resulting in improved margins and increased equity. Given the wholesale power supply cross-subsidy mechanism, PBSs will not require significant subsidies increases to avoid negative cash balances during the evaluation period.

59. **BREB's current electricity tariff are only three-fourths of the tariff level that would be needed to ensure profitability for all PBSs and enable access to private and commercial financing**. At the establishment of BREB, PBSs were expected to ultimately graduate into fully autonomous utilities empowered to raise their own financing. However, the need to cross-subsidize PBSs that serve the poor and marginal consumers with the profits of PBSs that serve high paying consumers has meant that this policy has not been implemented until now. However, as the financial health of the poorly performing PBSs improves, it will be possible to allow PBSs to evolve into fully empowered utilities able to raise private and commercial financing. Improved financial viability of BREB and PBSs will be helpful to the government in reducing its subsidies to the sector.

## B. Fiduciary[20]

60. **The fiduciary systems that are in place for the Program are adequate.** The Fiduciary System Assessment (FSA) followed the World Bank's Policy for PforR and the related Directive and concluded that Program fiduciary systems for Procurement, financial Management, and Governance and Anti-Corruption provide reasonable assurance that the financing proceeds would be used for intended purposes with due attention to the principles of economy, efficiency, effectiveness, transparency, and accountability.

61. **The Program implementing agencies have a strong budget execution and implementation track record and adequate auditing arrangements are in place.** The GOB's Budget and Accounts Classification System is robust and will enable reporting of Program expenditures, which will be reflected in the Government's budget. Budget allocations to BREB and Power Cell will fall under the oversight of Power Division in MPEMR. The Program audit will be carried out by the Office of the Comptroller and Auditor General (OC&AG).

62. **The implementing agencies will strengthen their fiduciary systems in the Program.** BREB will strengthen its capacity to undertake risk-based internal audit. BREB will prepare and implement an internal audit modernization plan under the Program. Similarly, BREB and other implementing agencies will be responsible for carrying out a list of actions which have been incorporated in the PAP.

63. **The Program will conform to the World Bank's 'Guidelines on Preventing and Combating Fraud and Corruption in Program-for-Results Financing'.** To strengthen compliance with the World Bank's guidelines, BREB will (a) strengthen its complaint monitoring and management system and (b) identify and strengthen the focal office and key officials responsible for ensuring that the Program activities are implemented in accordance with the provisions of the World Bank's Anti-Corruption Guidelines and agreed protocols.

[20] Key findings are summarized in annex 4. The full FSA will be disclosed as a separate document.

64. **The Program is not expected to procure any large contracts valued at or above the OPRC thresholds for a "Substantial" risk rating** i.e. US$75 million for works, US$50 million for goods and non-consulting services, and US$20 million for consultant services. The IAs shall report to the World Bank if any large contracts appear during Program implementation. The World Bank will also monitor fiduciary systems and contract management reports to identify any large value contracts throughout the Program implementation.

### C. Environmental and Social[21]

65. **An Environmental and Social Systems Assessment (ESSA) was carried out to meet the requirements of the Program for Results Financing Policy and Directive.** The ESSA (a) assesses the environmental and social benefits, risks, and impacts of the Program; (b) reviews systems and procedures that would apply to environmental and social issues associated with the Program; (c) assesses the extent to which they confirm to the six 'core principles of World Bank PforR guidance'; and (d) recommends actions to address the gaps and enhance performance during Program implementation.

66. **The anticipated environmental and social risks of the Program are not significant and can be mitigated.** Measures for improvement of the environmental and social management system have been discussed with the implementing agency, BREB. There will be minimal to no land acquisition as BREB will use own or Government-owned lands to the extent possible, and no resettlement is anticipated at this stage.[22] The Program will exclude any Category A type activity that may have significant adverse environmental and social impacts that are sensitive, diverse, or unprecedented. The expected environmental and social impacts are moderate with known mitigation measures available in the industry and can be mitigated through implementation of Environmental Code of Practice and Environmental and Social Management Plans. For BESS, contractual arrangements with solar panel suppliers will include buying back or taking back used batteries for safe disposal.

67. **The legal, regulatory, and institutional framework for managing environmental and social impacts of the Program is adequate.** The ESSA reviewed the existing regulations and policies, their legal and practical applicability at the Program level as well as the institutional capacity, and the effectiveness of implementation in practice. The Government's relevant laws, policies, instruments, and so on are deemed adequate for both protection, safety and social security, and inclusiveness of the populace and conservation of environmental resources, although enforcement capacity needs to be improved.

**Citizen Engagement**

68. **The ESSA preparation involved extensive stakeholder consultations and disclosure of the ESSA report following the guidelines of the World Bank's Access to Information Policy.** In addition to these meetings and consultations, a virtual stakeholder consultation workshop was organized by the World Bank and BREB on June 10, 2021 with different stakeholders, PBS officials, Samity Board members, Department of Environment, representatives from the Ministry of Labor, Union Porishod Chairmen and members, local government

[21] The summary of identified gaps and recommendations, aligned to the core principles, are presented annex 5. The full ESSA has been disclosed as a separate document.

[22] If Government land is not available, BREB normally purchases land through a willing buyer and willing seller process as purchasing the land is an easier and effective alternative compared to land acquisition. So BREB will use this option as a primary land procurement method. As a result, land acquisition is not expected to take place in this Program.

leadership, rural entrepreneurs, teachers, print and electronic media journalists, and tribal representatives from the Garo community.

69. **Communities and individuals who believe that they are adversely affected as a result of a Bank supported PforR operation, as defined by the applicable policy and procedures, may submit complaints to the existing program grievance redress mechanism or the WB's Grievance Redress Service (GRS).** The GRS ensures that complaints received are promptly reviewed in order to address pertinent concerns. Affected communities and individuals may submit their complaint to the Bank's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of the Bank's non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit http://www.worldbank.org/GRS. For information on how to submit complaints to the World Bank Inspection Panel, please visit http://www.inspectionpanel.org.

## V. RISKS

70. The overall risk of the Program at the time of appraisal is **Substantial**.

71. **Implementation capacity risk is rated Substantial.** Although BREB is deemed to possess a comparatively strong institutional capacity, the implementation of new technologies and complex interventions and reform actions envisioned in the Program would require a higher level of institutional and regulatory sophistication than has been demonstrated by BREB and other sector participants so far. There is also risk of a drop in performance of BREB whenever there are changes in BREB's leadership, such as those expected at the end of 2021. To facilitate the transition to new technologies as well as institutional and regulatory models, the Program includes substantial technical assistance and capacity-building. The risk of weaker BREB leadership can be mitigated through World Bank policy dialogue with GOB and through support for HR modernization initiatives in the sector.

72. **Fiduciary risk is rated Substantial** on account of the shortcomings observed in BREB in areas such as procurement, warehouse, contract management, integrated financial management, and information system management during implementation of the World Bank's Rural Electricity Transmission and Distribution Project. These risks were assessed as part of the FSA and measures to address them are included in the PAP and in the technical assistance and capacity-building component of the Program.

73. **Other (COVID-19) risk is rated Substantial.** The continuation of COVID-19 disruptions into the Program implementation period would pose a risk for the Program implementation. The Program will implement many institution-level activities for infrastructure development and institutional and regulatory modernization. Restrictions on people's movement and office closures would inevitably disrupt both the preparation and implementation of such activities and slow down progress. The risk will be mitigated to the extent possible by adopting modalities such as online meetings while the expected increase in vaccination rate and other safety and precaution measures in the country should also allow normalcy to return in the coming months.

## ANNEX 1. RESULTS FRAMEWORK MATRIX

**Results Framework**
**COUNTRY: Bangladesh**
**Electricity Distribution Modernization Program**

### Program Development Objective(s)

The PDO is to increase the delivery, reliability and efficiency of electricity supply and strengthen institutional capacity and readiness for its sustainable transformation.

### Program Development Objective Indicators by Objectives/Outcomes

| Indicator Name | DLI | Baseline | End Target |
|---|---|---|---|
| **Electricity delivery to BREB customers increased** | | | |
| Electricity delivery to BREB customers increased (Gigawatt-hour (GWh)) | DLI 1 | 0.00 | 6,790.00 |
| **Efficiency of electricity supply increased** | | | |
| Electricity system losses reduced (Percentage) | | 9.10 | 7.00 |
| **Reliability of electricity supply increased** | | | |
| People provided with new or improved electricity service (CRI, Number) | | 0.00 | 9,000,000.00 |
| People provided with new or improved electricity service - Female (CRI, Number) | | 0.00 | 4,500,000.00 |
| **Strengthened institutional capacity and readiness for sustainable transformation** | | | |

| Indicator Name | DLI | Baseline | End Target |
|---|---|---|---|
| BESS pilot completed in BREB's distribution network (Text) | DLI 6.1 | BREB has not implemented Battery Energy Storage System (BESS) in its distribution network | BREB has completed the commissioning of BESS in at least one substation in the Dhaka and Mymensingh Division |
| SCADA pilot completed in BREB's distribution network (Text) | DLI 4 | BREB has not implemented SCADA in its distribution network | BREB has completed the commissioning of Supervisory Control and Data Acquisition (SCADA) / Advanced Distribution Management System (ADMS) at Narsingdi PBS-1 in the Dhaka Mymensingh Division and backup display at BREB Head Quarters with introduction of Substation Automation System and data collection of at least one 33/11 kV substation. |

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## Intermediate Results Indicator by Results Areas

| Indicator Name | DLI | Baseline | End Target |
|---|---|---|---|
| **Increased delivery, climate resilience, and digitalization of electricity supply** | | | |
| Guidelines to address extreme weather, disaster and climate risks in distribution network infrastructure adopted by BREB (Yes/No) | DLI 2.1 | No | Yes |
| Distribution network capacity increased (Kilovolt-Amphere(KVA)) | DLI 2.2 | 0.00 | 2,150,000.00 |
| Distribution lines constructed or upgraded (Kilometers) | DLI 2.3 | 0.00 | 31,000.00 |
| Distribution substations constructed or upgraded (Number) | | 0.00 | 157.00 |
| Distribution lines constructed underground (Kilometers) | | 0.00 | 400.00 |
| Advanced Metering Infrastructure implemented (Number) | DLI 3 | 0.00 | 200,000.00 |
| Smart Meter Data Center implemented (Yes/No) | DLI 3.1 | No | Yes |
| Smart meters installed (Number) | DLI 3.2 | 0.00 | 200,000.00 |
| Digital systems and processes to track System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) established in selected areas under the program (Yes/No) | | No | Yes |
| **Increased readiness to integrate distributed energy resources** | | | |
| Renewable Energy and BESS roadmap adopted by BREB (Yes/No) | DLI 5.1 | No | Yes |
| Solar net and/or gross metering connections provided to industrial and commercial customers by BREB (Number) | DLI 5.2 | 0.00 | 100.00 |
| Distributed solar generation capacity developed in Program Areas (Megawatt) | | 0.00 | 150.00 |
| BESS connections to the BREB distribution network increased | DLI 6.2 | 0.00 | 40.00 |

| Indicator Name | DLI | Baseline | End Target |
|---|---|---|---|
| (Megawatt hour(MWh)) | | | |
| GHG emission reductions from solar and BESS investments in Program (Metric tons/year) | | 0.00 | 41,400.00 |
| **Strengthened institutional and regulatory capacity** | | | |
| Sector institutional, regulatory capacity and gender consideration increased (Yes/No) | DLI 7 | No | Yes |
| Share of BREB and PBS female staff in technical roles (Percentage) | | 2.80 | 10.00 |

| Monitoring & Evaluation Plan: PDO Indicators | | | | | |
|---|---|---|---|---|---|
| **Indicator Name** | **Definition/Description** | **Frequency** | **Datasource** | **Methodology for Data Collection** | **Responsibility for Data Collection** |
| Electricity delivery to BREB customers increased | This indicator measures the increase in electricity supply in BREB's Dhaka and Mymensingh Division. Data on electricity supply and sales is compiled by BREB's Finance and Accounts Directorate in its Monthly Financial and Statistical report (Form 550) and tracked as part of BREB's MIS report. | Quarterly | MIS/Monthly Financial and Statistical report (Form 550) | Desk review of the data on electricity supply and sales in BREB's Monthly Financial and Statistical Report and MIS report. Field verification through a customer survey in Dhaka and Mymensingh Division to assess the increase in electricity supply and confirm the findings of the reports. | BREB |
| Electricity system losses reduced | This indicator measures distribution losses in BREB's Dhaka and Mymensingh division. It is calculated by dividing total electricity losses (i.e. the sum of technical and nontechnical losses) with the total net injected generation in the Program area. The baseline is the 12 month average of actual electricity losses in the program area as of end June 2021. Data on system | Quarterly | MIS/Monthly Financial and Statistical report (Form 550) | Desk review of the data electricity distribution losses in BREB's Monthly Financial and Statistical Report and MIS report. | BREB |

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|---|---|---|---|---|---|
| | losses is compiled by BREB's Finance and Accounts Directorate in its Monthly Financial and Statistical report (Form 550) and tracked as part of BREB's MIS report. | | | | |
| People provided with new or improved electricity service | | Upon Program approval, at mid-term review and upon Program completion. | Multi-Tier Framework Survey | A Multi-Tier Framework (MTF) survey will carried out at the outset of Program implementation to establish a baseline for the tier of electricity access of customers (which includes measurement of reliability, availability and quality) in BREB's Dhaka and Mymensingh division. The target indicates that about a quarter of people in Dhaka and Mymensingh division would see an improvement in the tier of access as per the MTF over the Program implementation period. The end target for the indicator may be revised based on the baseline | BREB/World Bank |

| | | | | | |
|---|---|---|---|---|---|
| | | | | survey. Follow up MTF surveys will be carried out at the mid-term review and upon Program completion to track progress on this indicator including by gender. | |
| People provided with new or improved electricity service - Female | | Upon Program approval, at mid-term review and upon Program completion. | Multi-Tier Framework Survey | A Multi-Tier Framework (MTF) survey will carried out at the outset of Program implementation to establish a baseline for the tier of electricity access of customers (which includes measurement of reliability, availability and quality) in BREB's Dhaka and Mymensingh division. Follow up MTF surveys will be carried out at the mid-term review and upon Program completion to track progress on this indicator including by gender. The target indicates that about a quarter of the female population living in | BREB/World Bank |

| | | | | | |
|---|---|---|---|---|---|
| | | | | Dhaka and Mymensingh division would see an improvement in the tier of access as per the MTF over the Program implementation period. The end target for the indicator may be revised based on the baseline survey. | |
| BESS pilot completed in BREB's distribution network | The indicator measures the completion of BESS pilot in BREB's Dhaka and Mymensingh Division as well as associated technical assistance and capacity building activities. Data on implementation of BESS will be compiled by BREB's Office of Chief Engineer (Project) on a quarterly basis in its implementation progress report. | Quarterly | Progress Report | Desk review of the data BESS pilot implementation in the quarterly progress report from BREB's Office of Chief Engineer. Field verification through a representative sample of locations in Dhaka and Mymensingh Division to assess the BESS capacity (MwH) connected to BREB's distribution network and confirm the findings of the reports. | BREB |
| SCADA pilot completed in BREB's distribution network | The indicator measures the implementation of a SCADA pilot and associated technical assistance and capacity building activities in BREB's Dhaka and | Quarterly | Progress Report | Desk review of the data on SCADA pilot implementation in the quarterly progress report from BREB's Office of Chief | BREB |

| | | | | | |
|---|---|---|---|---|---|
| | Mymensingh Division. Data on implementation of SCADA will be compiled by BREB's Office of Chief Engineer on a quarterly basis. | | | Engineer. Spot checks to confirm the findings of the reports. | |

| Monitoring & Evaluation Plan: Intermediate Results Indicators | | | | | |
|---|---|---|---|---|---|
| **Indicator Name** | **Definition/Description** | **Frequency** | **Datasource** | **Methodology for Data Collection** | **Responsibility for Data Collection** |
| Guidelines to address extreme weather, disaster and climate risks in distribution network infrastructure adopted by BREB | This indicator measures the adoption of guidelines on addressing extreme weather, disaster and climate risks in distribution network infrastructure by BREB. | Annual | Progress Report | Desk review of minutes from BREB's Board of Directors' meeting and official correspondence with PBSs to confirm the adoption of guidelines to address extreme weather, disaster, and climate risks. | BREB |
| Distribution network capacity increased | The indicator measures the increase in transformation capacity at 33/11 kV in BREB's Dhaka and Mymensingh Division. Data on substation construction and capacity is compiled by BREB's Office of Chief Engineer on a monthly basis and monitored and published as part of BREB's Annual Performance Agreement with MPEMR. | Quarterly | Progress Report | Desk review of the data on substation construction and capacity in the monthly report from BREB's Office of Chief Engineer. | BREB |
| Distribution lines constructed or upgraded | This indicator measures the length of 33 and 11kV distribution lines constructed or rehabilitated/upgraded in BREB's Dhaka and | Quarterly | Progress Report | Desk review of the data on distribution lines construction and upgrade in the monthly report from BREB's Office of Chief Engineer. | BREB |

| | | | | | |
|---|---|---|---|---|---|
| | Mymensingh Division. Data construction and upgrade of distribution lines is compiled by BREB's Office of Chief Engineer (Project) on a monthly basis and monitored and published as part of BREB's Annual Performance Agreement with MPEMR. | | | | |
| Distribution substations constructed or upgraded | The indicator measures the number of 33/11 kV substations constructed or upgraded in BREB's Dhaka and Mymensingh Division. Data on substation construction and capacity is compiled by BREB's Office of Chief Engineer on a monthly basis and monitored and published as part of BREB's Annual Performance Agreement with MPEMR. | Quarterly | Progress Report | Desk review of the data on substation construction and upgrade in the monthly report from BREB's Office of Chief Engineer. | BREB |
| Distribution lines constructed underground | This indicators measures the number of Kilometers of distribution lines constructed underground in BREB's Dhaka and Mymensingh Division. Data on construction and upgrade of distribution | Quarterly | Progress Report | Desk review of the data on distribution lines construction and upgrade in the monthly report from BREB's Office of Chief Engineer. | BREB |

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|---|---|---|---|---|---|
| | lines is compiled by BREB's Office of Chief Engineer (Project) on a monthly basis and monitored and published as part of BREB's Annual Performance Agreement with MPEMR. | | | | |
| Advanced Metering Infrastructure implemented | The indicator measures the implementation of Advanced Metering Infrastructure in BREB's Dhaka and Mymensingh Division. Data on smart meters and associated infrastructure is compiled by BREB's System Operation Directorate and the relevant PBSs on a monthly basis and monitored and published as part of BREB's Annual Performance Agreement with MPEMR. | Quarterly | Progress Report | Desk review of the data on smart meters and associated infrastructure in the monthly report from BREB's System Operation Directorate and the relevant PBSs. | BREB |
| Smart Meter Data Center implemented | This indicator measures the implementation of smart meter Data Center in BREB's Dhaka and Mymensingh Division. Data on smart meters and associated infrastructure is compiled by BREB's System Operation Directorate and | Quarterly | Progress Report | Desk review of the data on smart meters and associated infrastructure in the monthly report from BREB's System Operation Directorate and the relevant PBSs. | BREB |

| | | | | | |
|---|---|---|---|---|---|
| | the relevant PBSs on a monthly basis and monitored and published as part of BREB's Annual Performance Agreement with MPEMR. | | | | |
| Smart meters installed | This indicator measures the installation of smart meters in BREB's Dhaka and Mymensingh Division. Data on smart meters and associated infrastructure is compiled by BREB's System Operation Directorate and the relevant PBSs on a monthly basis and monitored and published as part of BREB's Annual Performance Agreement with MPEMR. | Quarterly | Progress Report | Desk review of the data on smart meters and associated infrastructure in the monthly report from BREB's System Operation Directorate and the relevant PBSs. | BREB |
| Digital systems and processes to track System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) established in selected areas under the program | The indicator measures the establishment of digital systems and processes to track SAIDI and SAIFI in selected areas in BREB's Dhaka and Mymensingh Division. Data on progress with the implementation of these systems will be compiled by BREB's Office of Chief Engineer and is monitored and published | Quarterly | Progress Report | Desk review of the data on SAIDI and SAIFI implementation in the quarterly report from BREB's Office of Chief Engineer. | BREB |

| | | | | | |
|---|---|---|---|---|---|
| | as part of BREB's Annual Performance Agreement with MPEMR. | | | | |
| Renewable Energy and BESS roadmap adopted by BREB | This indicator measures the approval of a BESS and renewable energy roadmap by BREB. | Annual | Progress Report | Desk review of the renewable energy and BESS roadmap to ensure that prior consultations have been conducted, recommendations have been included, and that the final version has been approved by BREB's Board of Directors and is available on BREB's official website. | BREB |
| Solar net and/or gross metering connections provided to industrial and commercial customers by BREB | The indicator measures the additional number of solar PV connections provided to industrial and commercial customers in BREB's distribution network in the Dhaka and Mymensingh Division. Data on solar connections is compiled by BREB's Renewable Energy Directorate on a monthly basis and monitored and published as part of BREB's Annual Performance Agreement with MPEMR. | Quarterly | Progress Report | Desk review of the data on solar connections in the monthly progress report from BREB's Renewable Energy Directorate. | BREB |

| | | | | | |
|---|---|---|---|---|---|
| Distributed solar generation capacity developed in Program Areas | This indicator measures the additional number of MWs of distributed solar PV developed in BREB's Dhaka and Mymensingh Division. Data on solar connections and capacity is compiled by BREB's Renewable Energy Directorate on a monthly basis and monitored and published as part of BREB's Annual Performance Agreement with MPEMR. | Quarterly | Progress Report | Desk review of the data on solar capacity and connections in the monthly report from BREB's Renewable Energy Directorate. | BREB |
| BESS connections to the BREB distribution network increased | The indicator measures the BESS capacity (MwH) connected to the distribution network in Dhaka and Mymensingh Division. Data on implementation of BESS will be compiled by BREB's Office of Chief Engineer (Project) on a quarterly basis in its implementation progress report. | Quarterly | Progress Report | Desk review of the data on BESS implementation in the quarterly progress report from BREB's Office of Chief Engineer. | BREB |
| GHG emission reductions from solar and BESS investments in Program | This indicator measures the reductions in GHG emission resulting from Program solar and BESS investments | Annual | Progress Report | GHG emission reduction to be calculated based on data on BESS and distributed solar implementation against a grid-counterfactual in the | BREB |

| | | | | | |
|---|---|---|---|---|---|
| | | | | quarterly report from BREB's Office of Chief Engineer. | |
| Sector institutional, regulatory capacity and gender consideration increased | The indicator measures progress toward the achievements of sector institutional strengthening and capacity building and gender milestones. Data on implementation of milestone will be compiled by BREB's Office of Chief Engineer (Project) and Power Cell in their implementation progress reports. | Quarterly | Progress Report | Desk review of the information on TA and capacity building milestones in the quarterly report from BREB's Office of Chief Engineer and Power Cell. | BREB and Power Cell |
| Share of BREB and PBS female staff in technical roles | This indicator measures the share of female staff in technical roles in BREB and PBSs. Data on share of female staff will be compiled by BREB's Human Resource Directorate on an annual basis in implementation progress reports. | Annual | Progress Report | Desk review of gender based human resource data from BREB's Human Resource division. | BREB |

## ANNEX 2. DISBURSEMENT LINKED INDICATORS, DISBURSEMENT ARRANGEMENTS AND VERIFICATION PROTOCOLS

| Disbursement Linked Indicators Matrix | | | | |
|---|---|---|---|---|
| **DLI 1** | Electricity delivery to BREB customers increased | | | |
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Outcome | Yes | Gigawatt-hour (GWh) | 112.00 | 21.75 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |
| Baseline | 0.00 | | | |
| Prior Results | 1,866.00 | | 30.78 | US$16494.85 per GwH of increase in electricity supply |
| 2022 | 891.00 | | 14.70 | US$16494.85 per GwH of increase in electricity supply |
| 2023 | 936.00 | | 15.44 | US$16494.85 per GwH of increase in electricity supply |
| 2024 | 982.00 | | 16.20 | US$16494.85 per GwH of increase in electricity supply |
| 2025 | 1,032.00 | | 17.02 | US$16494.85 per GwH of increase in electricity supply |
| 2026 | 1,083.00 | | 17.86 | US$16494.85 per GwH of increase in |

| | | | | |
|---|---|---|---|---|
| | | | | electricity supply |
| **DLI 2** | Climate resilient electricity distribution network infrastructure developed | | | |
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Intermediate Outcome | Yes | Text | 271.00 | 52.43 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |
| Baseline | NA | | | |
| Prior Results | NA | | 0.00 | NA |
| 2022 | NA | | 17.46 | NA |
| 2023 | NA | | 37.19 | NA |
| 2024 | NA | | 94.51 | NA |
| 2025 | NA | | 121.84 | NA |
| 2026 | NA | | 0.00 | NA |
| **DLI 2.1** | Guidelines to address extreme weather, disaster and climate risks in distribution network infrastructure adopted by BREB | | | |
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Intermediate Outcome | No | Yes/No | 15.00 | 2.91 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |
| Baseline | No | | | |
| Prior Results | No | | 0.00 | N/A |

| | | | |
|---|---|---|---|
| 2022 | Yes | 15.00 | US$15 million for adoption of guidelines. |
| 2023 | Yes | 0.00 | N/A |
| 2024 | Yes | 0.00 | N/A |
| 2025 | Yes | 0.00 | N/A |
| 2026 | Yes | 0.00 | N/A |

| **DLI 2.2** | Distribution network capacity increased | | | |
|---|---|---|---|---|
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Intermediate Outcome | Yes | Kilovolt-Amphere(KVA) | 106.00 | 20.39 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |
| Baseline | 0.00 | | | |
| Prior Results | 0.00 | | 0.00 | N/A |
| 2022 | 50,000.00 | | 2.47 | US$49.30 per KVA of substation capacity |
| 2023 | 450,000.00 | | 22.18 | US$49.30 per KVA of substation capacity |
| 2024 | 700,000.00 | | 34.51 | US$49.30 per KVA of substation capacity |

| | | | | |
|---|---|---|---|---|
| 2025 | 950,000.00 | | 46.84 | US$49.30 per KVA of substation capacity |
| 2026 | 0.00 | | 0.00 | US$49.30 per KVA of substation capacity |

| **DLI 2.3** | Distribution lines constructed or upgraded | | | |
|---|---|---|---|---|
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Output | Yes | Kilometers | 150.00 | 29.13 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |
| Baseline | 0.00 | | | |
| Prior Results | 0.00 | | 0.00 | US$4838.71 per km of distribution lines upgraded or constructed |
| 2022 | 0.00 | | 0.00 | US$4838.71 per km of distribution lines upgraded or constructed |
| 2023 | 3,100.00 | | 15.00 | US$4838.71 per km of distribution lines upgraded or constructed |
| 2024 | 12,400.00 | | 60.00 | US$4838.71 per km of distribution lines upgraded or constructed |
| 2025 | 15,500.00 | | 75.00 | US$4838.71 per km of distribution lines upgraded or constructed |
| 2026 | 0.00 | | 0.00 | US$4838.71 per km of distribution lines upgraded or constructed |

| DLI 3 | Advanced Metering Infrastructure implemented | | | |
|---|---|---|---|---|
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Output | Yes | Text | 23.00 | 4.47 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |
| Baseline | NA | | | |
| Prior Results | NA | | 0.00 | NA |
| 2022 | NA | | 7.50 | NA |
| 2023 | NA | | 15.50 | NA |
| 2024 | NA | | 0.00 | NA |
| 2025 | NA | | 0.00 | NA |
| 2026 | NA | | 0.00 | NA |

| DLI 3.1 | Smart meter Data Center implemented | | | |
|---|---|---|---|---|
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Output | No | Yes/No | 8.00 | 1.55 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |
| Baseline | No | | | |
| Prior Results | No | | 0.00 | NA |
| 2022 | No | | 0.00 | NA |

| | | | |
|---|---|---|---|
| 2023 | Yes | 8.00 | US$ 8 million for implementation of smart meter Data Center in BREB's Dhaka and Mymensingh division |
| 2024 | Yes | 0.00 | NA |
| 2025 | Yes | 0.00 | NA |
| 2026 | Yes | 0.00 | NA |

| **DLI 3.2** | Smart meters installed | | | |
|---|---|---|---|---|
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Output | Yes | Number | 15.00 | 2.91 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |
| Baseline | 0.00 | | | |
| Prior Results | 0.00 | | 0.00 | NA |
| 2022 | 100,000.00 | | 7.50 | US$ 75 per unit of smart meter installed |
| 2023 | 100,000.00 | | 7.50 | UUS$ 75 per unit of smart meter installed |
| 2024 | 0.00 | | 0.00 | UUS$ 75 per unit of smart meter installed |
| 2025 | 0.00 | | 0.00 | US$ 75 per unit of smart meter installed |

| | | | | |
|---|---|---|---|---|
| 2026 | 0.00 | | 0.00 | NA |

| **DLI 4** | SCADA pilot completed | | | |
|---|---|---|---|---|
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Outcome | No | Text | 15.00 | 2.91 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |
| Baseline | BREB has not implemented Supervisory Control and Data Acquisition (SCADA) / Advanced Distribution Management System (ADMS) in its distribution network. | | | |
| Prior Results | NA | | 0.00 | NA |
| 2022 | BREB has completed the commissioning of Supervisory Control and Data Acquisition (SCADA) / Advanced Distribution Management System (ADMS) at Narsingdi PBS-1 in the Dhaka Mymensingh Division and backup display at BREB Head Quarters with introduction of Substation Automation System and data collection of at least one 33/11 kV substation. | | 15.00 | US$15 million for completion of the pilot |
| 2023 | NA | | 0.00 | NA |
| 2024 | NA | | 0.00 | NA |
| 2025 | NA | | 0.00 | NA |
| 2026 | 0.00 | | 0.00 | NA |

| DLI 5 | Integration of renewable energy in BREB distribution network increased | | | |
|---|---|---|---|---|
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Output | Yes | Text | 30.00 | 5.83 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |
| Baseline | NA | | | |
| Prior Results | NA | | 0.00 | NA |
| 2022 | NA | | 0.00 | NA |
| 2023 | NA | | 22.50 | NA |
| 2024 | NA | | 7.50 | NA |
| 2025 | NA | | 0.00 | NA |
| 2026 | NA | | 0.00 | NA |

| DLI 5.1 | Renewable energy and BESS roadmap adopted by BREB | | | |
|---|---|---|---|---|
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Intermediate Outcome | No | Yes/No | 15.00 | 2.91 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |
| Baseline | No | | | |
| Prior Results | No | | 0.00 | NA |
| 2022 | No | | 0.00 | NA |

| | | | |
|---|---|---|---|
| 2023 | Yes | 15.00 | US$ 15 million for adoption of roadmap. |
| 2024 | Yes | 0.00 | NA |
| 2025 | Yes | 0.00 | NA |
| 2026 | Yes | 0.00 | NA |

| **DLI 5.2** | Solar net and/or gross metering connections to industrial and commercial customers | | | |
|---|---|---|---|---|
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Intermediate Outcome | Yes | Number | 15.00 | 2.91 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |
| Baseline | 0.00 | | | |
| Prior Results | 0.00 | | 0.00 | US$150,000 per solar net metering connections provided to industrial and commercial customers |
| 2022 | 0.00 | | 0.00 | US$150,000 per solar net metering connections provided to industrial and commercial customers |
| 2023 | 50.00 | | 7.50 | US$150,000 per solar net metering connections provided to industrial and commercial customers |
| 2024 | 50.00 | | 7.50 | US$150,000 per solar net metering connections provided to industrial |

| | | | and commercial customers |
|---|---|---|---|
| 2025 | 0.00 | 0.00 | US$150,000 per solar net metering connections provided to industrial and commercial customers |
| 2026 | 0.00 | 0.00 | US$150,000 per solar net metering connections provided to industrial and commercial customers |

| **DLI 6** | BESS connected to the BREB distribution network | | | |
|---|---|---|---|---|
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Output | Yes | Text | 30.00 | 5.83 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |
| Baseline | NA | | | |
| Prior Results | NA | | 0.00 | NA |
| 2022 | NA | | 0.00 | NA |
| 2023 | NA | | 22.50 | NA |
| 2024 | NA | | 3.75 | NA |
| 2025 | NA | | 3.75 | NA |
| 2026 | NA | | 0.00 | NA |

| DLI 6.1 | BESS pilot completed in BREB network | | | |
|---|---|---|---|---|
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Outcome | No | Text | 15.00 | 2.91 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |
| Baseline | BREB has not implemented BESS in its distribution network | | | |
| Prior Results | | | 0.00 | NA |
| 2022 | NA | | 0.00 | NA |
| 2023 | BREB has completed the commissioning of BESS in at least one substation in the Dhaka and Mymensingh Division. | | 15.00 | US$ 15 million for completion of BESS pilot in BREB network |
| 2024 | NA | | 0.00 | NA |
| 2025 | NA | | 0.00 | NA |
| 2026 | NA | | 0.00 | NA |

| DLI 6.2 | BESS connections to BREB distribution network increased | | | |
|---|---|---|---|---|
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Output | Yes | Megawatt hour(MWh) | 15.00 | 2.91 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |

| | | | |
|---|---|---|---|
| Baseline | 0.00 | | |
| Prior Results | 0.00 | 0.00 | NA |
| 2022 | 0.00 | 0.00 | NA |
| 2023 | 20.00 | 7.50 | US$0.375 million of CIF per MWH of BESS connected to BREB distribution network |
| 2024 | 10.00 | 3.75 | US$0.375 million of CIF per MWH of BESS connected to BREB distribution network |
| 2025 | 10.00 | 3.75 | US$0.375 million of CIF per MWH of BESS connected to BREB distribution network |
| 2026 | 0.00 | 0.00 | US$0.375 million of CIF per MWH of BESS connected to BREB distribution network |

| **DLI 7** | Sector institutional, regulatory capacity and gender consideration increased | | | |
|---|---|---|---|---|
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Output | No | Yes/No | 34.00 | 6.80 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |
| Baseline | No | | | |
| Prior Results | No | | 0.00 | NA |

| | | | |
|---|---|---|---|
| 2022 | Yes | 8.25 | NA |
| 2023 | Yes | 16.25 | NA |
| 2024 | Yes | 5.25 | NA |
| 2025 | Yes | 4.25 | NA |
| 2026 | Yes | 0.00 | NA |

| **DLI 7.1** | Annual institutional strengthening and gender activities of BREB completed | | | |
|---|---|---|---|---|
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Output | No | Yes/No | 21.00 | 4.27 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |
| Baseline | No | | | |
| Prior Results | No | | 0.00 | NA |
| 2022 | Yes | | 5.00 | US $5 million for Gender Strategy and Action Plan. |
| 2023 | Yes | | 13.00 | US$13 million for approval of Technical Assistance Project Proposal |
| 2024 | Yes | | 2.00 | US$1.0 million for approval of long term rural distribution masterplan;US$1 million for establishment of three model |

| | | | daycare centers |
|---|---|---|---|
| 2025 | Yes | 1.00 | US$1.0 million for establishment of gender based HR monitoring system in BREB |
| 2026 | Yes | 0.00 | NA |

| **DLI 7.2** | Annual institutional strengthening and technical assistance activities of Power Cell completed | | | |
|---|---|---|---|---|
| **Type of DLI** | **Scalability** | **Unit of Measure** | **Total Allocated Amount (USD)** | **As % of Total Financing Amount** |
| Output | No | Yes/No | 13.00 | 2.52 |
| **Period** | **Value** | | **Allocated Amount (USD)** | **Formula** |
| Baseline | No | | | |
| Prior Results | No | | 0.00 | NA |
| 2022 | Yes | | 3.25 | US$3.25 for preparing a capacity building plan for Year 2. |
| 2023 | Yes | | 3.25 | US$3.25 million for completing Year 2 activities and approving a TA and capacity building plan for Year 3. |
| 2024 | Yes | | 3.25 | US$3.25 million US$3.25 million for completing Year 3 activities and approving a TA and capacity building plan for Year 4.. |
| 2025 | Yes | | 3.25 | US$3.25 million US$3.25 million for completing Year 4 activities and |

| | | | |
|---|---|---|---|
| | | | approving a TA and capacity building plan for Year 5. |
| 2026 | Yes | 0.00 | NA |

| Verification Protocol Table: Disbursement Linked Indicators | |
|---|---|
| **DLI 1** | Electricity delivery to BREB customers increased |
| **Description** | This indicator measures the increase in electricity supply in BREB's Dhaka and Mymensingh Division. Data on electricity supply and sales is compiled by BREB's Finance and Accounts Directorate in its Monthly Financial and Statistical report (Form 550) and tracked as part of BREB's MIS report. Prior results are for increase in electricity supply between December 2020 to June 2021 period compared to December 2019 to June 2020. |
| **Data source/ Agency** | BREB |
| **Verification Entity** | Independent Verification Agent |
| **Procedure** | - Desk review of the data on electricity supply and sales in BREB's Monthly Financial and Statistical Report and MIS report<br>- Field verification through a customer survey in Dhaka and Mymensingh Division to assess the increase in electricity supply and confirm the findings of the reports |
| **DLI 2** | Climate resilient electricity distribution network infrastructure developed |
| **Description** | This indicator measures the development of climate resilient distribution network infrastructure in BREB's Dhaka and Mymensingh Division. Data on substation construction and capacity and distribution lines construction and upgrade is compiled by BREB's Office of Chief Engineer on a monthly basis and monitored and published as part of BREB's Annual Performance Agreement with MPEMR. |
| **Data source/ Agency** | BREB |
| **Verification Entity** | Independent Verification Agent |
| **Procedure** | - Desk review of the data on substation construction and capacity and distribution lines construction and upgrade in the monthly report from BREB's Office of Chief Engineer<br>- Desk review of minutes from BREB's Board of Directors' meeting and official correspondence with PBSs to confirm the adoption of guidelines to address extreme weather, disaster, and climate risks |
| **DLI 2.1** | Guidelines to address extreme weather, disaster and climate risks in distribution network infrastructure adopted by BREB |
| **Description** | The indicator measures the adoption of guidelines to address extreme weather, disaster and climate risks in development of distribution network infrastructure. |

| | |
|---|---|
| **Data source/ Agency** | Progress Report/BREB |
| **Verification Entity** | Independent Verification Agent |
| **Procedure** | Desk review of minutes from BREB's Board of Directors' meeting and official correspondence with PBSs to confirm the adoption of guidelines to address extreme weather, disaster, and climate risks. The guidelines will be prepared in co-ordination with the Bank's Technical Assistance and will be based on the following; (i) stock taking of BREB's current approach extreme weather, disaster and climate risk and gap analysis; (ii) review of international best practice and experience relevant to BREB; (iii) review of national policy and regulatory requirements; (iv) assessment of extreme weather, disaster and climate risk in BREB areas.. |
| **DLI 2.2** | Distribution network capacity increased |
| **Description** | The indicator measures the increase in transformation capacity at 33/11 kV in BREB's Dhaka and Mymensingh Division. Data on substation construction and capacity is compiled by BREB's Office of Chief Engineer on a monthly basis and monitored and published as part of BREB's Annual Performance Agreement with MPEMR. |
| **Data source/ Agency** | Progress Report/BREB |
| **Verification Entity** | Independent Verification Agent |
| **Procedure** | Desk review of the data on substation construction and capacity in the monthly report from BREB's Office of Chief Engineer. Field verification through visit to representative sample of locations in Dhaka and Mymensingh Division to confirm the findings of the reports. |
| **DLI 2.3** | Distribution lines constructed or upgraded |
| **Description** | This indicator measures the length of the distribution lines constructed or upgraded in BREB's Dhaka and Mymensingh Division. Data on construction and upgrade of distribution lines is compiled by BREB's Office of Chief Engineer (Project) on a monthly, basis and monitored and published as part of BREB's Annual Performance Agreement with the Ministry of Power, Energy and Mineral Resources. |
| **Data source/ Agency** | BREB |
| **Verification Entity** | Independent Verification Agent |

| | |
|---|---|
| **Procedure** | Desk review of the data on distribution line construction and upgrade in the monthly report from BREB's Office of Chief Engineer. Field verification through visit to representative sample of locations in Dhaka and Mymensingh Division to confirm the findings of the reports. |
| **DLI 3** | Advanced Metering Infrastructure implemented |
| **Description** | This indicator measures the implementation of Advanced Metering Infrastructure in BREB's Dhaka and Mymensingh Division. Data on smart meters and associated infrastructure is compiled by BREB's System Operation Directorate and the relevant PBSs on a monthly basis and monitored and published as part of BREB's Annual Performance Agreement with MPEMR. |
| **Data source/ Agency** | BREB |
| **Verification Entity** | Independent Verification Agent |
| **Procedure** | See sub-DLI procedures |
| **DLI 3.1** | Smart meter Data Center implemented |
| **Description** | This indicator measures the implementation of a Master Information Center in BREB's Dhaka and Mymensingh division. Data on smart meters and associated infrastructure is compiled by BREB's System Operation Directorate and the relevant PBSs on a monthly basis and monitored and published as part of BREB's Annual Performance Agreement with MPEMR. |
| **Data source/ Agency** | BREB |
| **Verification Entity** | Independent Verification Agent |
| **Procedure** | Desk review of the data on smart meters and associated infrastructure in the monthly report from BREB's System Operation Directorate and the relevant PBSs. Visit of the smart meter Data Center to check implementation. |
| **DLI 3.2** | Smart meters installed |
| **Description** | This indicator measures the number of smart meters installed in BREB's Dhaka and Mymensingh Division. Data on smart meters and associated infrastructure is compiled by BREB's System Operation Directorate and the relevant PBSs on a monthly basis and monitored and published as part of BREB's Annual Performance Agreement with MPEMR. |
| **Data source/ Agency** | BREB |

| | |
|---|---|
| **Verification Entity** | Independent Verification Agent |
| **Procedure** | Desk review of the data on smart meters and associated infrastructure in the monthly report from BREB's System Operation Directorate and the relevant PBSs. Field verification through a representative sample of locations in Dhaka and Mymensingh Division to assess the number of smart meters installed and confirm the findings of the reports. |
| **DLI 4** | SCADA pilot completed |
| **Description** | This indicator measures the implementation of SCADA pilot and associated technical assistance and capacity building in BREB's Dhaka and Mymensingh Division. Data on implementation of SCADA will be compiled by BREB's Office of Chief Engineer (Project) on a quarterly basis. |
| **Data source/ Agency** | BREB |
| **Verification Entity** | Independent Verification Agent |
| **Procedure** | Desk review of the data on SCADA pilot implementation in the quarterly report from BREB's Office of Chief Engineer. Spot checks to confirm the findings of the reports |
| **DLI 5** | Integration of renewable energy in BREB distribution network increased |
| **Description** | The indicator measures the additional number of solar PV net metering connection provided to industrial and commercial customers in BREB's distribution network in the Dhaka and Mymensingh Division. Data on solar connections is compiled by BREB's Renewable Energy Directorate on a monthly basis and monitored and published as part of BREB's Annual Performance Agreement with MPEMR. |
| **Data source/ Agency** | BREB |
| **Verification Entity** | Independent Verification Agent |
| **Procedure** | See sub-DLIs |
| **DLI 5.1** | Renewable energy and BESS roadmap adopted by BREB |
| **Description** | This indicator measures the adoption of a renewable energy and BESS roadmap by BREB. |

| | |
|---|---|
| **Data source/ Agency** | BREB |
| **Verification Entity** | Independent Verification Agent |
| **Procedure** | Desk review of the renewable energy and BESS roadmap to ensure that prior consultations have been conducted, recommendations have been incorporated and that the final version has been approved by BREB's Board of Directors and is available on BREB's official website. The roadmap will prepared in consultation with the Bank team and is expected to incorporate i) gap analysis, consultations with stakeholders and action plan to increase the integration distributed solar, BESS and other distributed energy resources in Bangladesh's electricity distribution network; ii) business models to support the adoption of distributed solar, Battery Energy Storage Systems and other distributed energy resources. |
| **DLI 5.2** | Solar net and/or gross metering connections to industrial and commercial customers |
| **Description** | The indicator measures the additional number of solar PV net metering connection provided to industrial and commercial customers in BREB's distribution network in the Dhaka and Mymensingh Division. Data on solar connections is compiled by BREB's Renewable Energy Directorate on a monthly basis and monitored and published as part of BREB's Annual Performance Agreement with MPEMR. |
| **Data source/ Agency** | BREB |
| **Verification Entity** | Independent Verification Agent |
| **Procedure** | Desk review of the data on solar connections in the monthly report from BREB's Renewable Energy Directorate. Field verification through a representative sample of locations in Dhaka and Mymensingh Division to assess the number of solar PV net metering connection provided to industrial and commercial customers in BREB's distribution network and confirm the findings of the reports. |
| **DLI 6** | BESS connected to the BREB distribution network |
| **Description** | This will measure the BESS capacity (MwH) connected to the distribution network in Dhaka and Mymensingh Division. Data on implementation of BESS will be compiled by BREB's Office of Chief Engineer (Project) on a quarterly basis in its implementation progress report. |
| **Data source/ Agency** | BREB |

| | |
|---|---|
| **Verification Entity** | Independent Verification Agent |
| **Procedure** | See sub-DLIs |
| **DLI 6.1** | BESS pilot completed in BREB network |
| **Description** | The indicator measures the completion of BESS pilot and associated technical assistance and capacity building in BREB's Dhaka and Mymensingh Division. Data on implementation of BESS will be compiled by BREB's Office of Chief Engineer (Project) on a quarterly basis in its implementation progress report. |
| **Data source/ Agency** | BREB |
| **Verification Entity** | Independent Verification Agent |
| **Procedure** | Desk review of the data on BESS pilot implementation in the quarterly report from BREB's Office of Chief Engineer. Field verification through visit to pilot location in Dhaka and Mymensingh Division. |
| **DLI 6.2** | BESS connections to BREB distribution network increased |
| **Description** | This indicator measures the BESS capacity (MwH) connected to the distribution network in Dhaka and Mymensingh Division. US$ 15 million of CIF grants will be disbursed against this DLI. Data on implementation of BESS will be compiled by BREB's Office of Chief Engineer (Project) on a quarterly basis in its implementation progress report. |
| **Data source/ Agency** | BREB |
| **Verification Entity** | Independent Verification Agent |
| **Procedure** | Desk review of the data BESS pilot implementation in the quarterly report from BREB's Office of Chief Engineer. Field verification through a representative sample of locations in Dhaka and Mymensingh Division to assess the BESS capacity (MwH) connected to BREB's distribution network and confirm the findings of the reports. |
| **DLI 7** | Sector institutional, regulatory capacity and gender consideration increased |
| **Description** | The indicator measures progress toward the achievement of technical assistance and capacity building milestones. Data on implementation of milestone will be compiled by BREB's Office of Chief Engineer (Project) and Power Cell in their implementation progress reports. |

| | |
|---|---|
| **Data source/ Agency** | BREB, Power Cell |
| **Verification Entity** | Independent Verification Agent |
| **Procedure** | See sub-DLIs |
| **DLI 7.1** | Annual institutional strengthening and gender activities of BREB completed |
| **Description** | This indicator will measure (i) adoption of a Gender Strategy and Action Plan by BREB; (ii) preparation and approval the government for a Technical Assistance Project Proposal consisting of a program of activities to strengthen power system planning in BREB/PBSs and facilitate the integration of new technologies such as SCADA, AMI, rooftop solar, BESS and electric vehicles; (iii) preparation and approval of a long-term Rural Distribution Master Plan consistent with the Integrated Energy and Power Master Plan by BREB Board and (iv) establishment of gender informed human resource monitoring system by BREB. Data on the implementation of these milestones will be reported by BREB's Office of Chief Engineer (Project) in its implementation progress report. |
| **Data source/ Agency** | BREB |
| **Verification Entity** | Independent Verification Agent |
| **Procedure** | Desk review of the Gender Strategy and Action Plan to ensure that prior consultations have been conducted, recommendations have been included, and that the final version has been approved by BREB's Board of Directors and is available on BREB's official website. Desk review of the Technical Assistance Project Proposal to ensure that prior consultations have been conducted, recommendations have been included, and that the final version has been endorsed by the Ministry of Power, Energy, and Mineral Resources and by the Planning Commission. Field verification of model day care centers through visits. |
| **DLI 7.2** | Annual institutional strengthening and technical assistance activities of Power Cell completed |
| **Description** | This indicator measures the progress toward achieving the milestones as well as the submission of the annual TA and capacity building plan. The plan will be prepared by Power Cell at the end of each FY for the following FY and include an action plan, procurement plan, and annual budget and financing for implementing each year's capacity development and project preparatory activities. Power Cell will also prepare an implementation status report for each year. |

| | |
|---|---|
| **Data source/ Agency** | Power Cell |
| **Verification Entity** | Independent Verification Agent |
| **Procedure** | Annual review of Power Cells' TA and capacity building plans to confirm their adoption and verify the findings of their implementation status reports against the initial action plan, procurement plan, and annual budget for capacity development and project preparatory activities. |

## ANNEX 3. Summary Technical Assessment

1. **This annex summarizes the assessment of the Program's technical and institutional soundness, drawing on the Program's Technical Assessment**. The summary focuses on technical soundness and viability of Program initiatives and on institutional soundness in terms of Program implementation arrangements, institutional practices, capacity, and resources of implementing agencies. Details are available in the stand-alone Program Technical Assessment.

### Technical Soundness

2. **The technical soundness of the Program is assessed across the three results areas.** The assessment (a) reviews whether the system expansion plan used in the Program makes use of reasonable electricity demand projections, is complete and will produce adequate service to consumers at reasonable cost, and would be robust and resilient in the face of potential future changes; (b) evaluates the incentives in place for Program stakeholders to effectively contribute to the Program's success; and (c) makes recommendations to improve the Program including through incorporation of alternative technologies and institutional and regulatory strengthening activities that might lead to more sustainable and efficient outputs.

### Results Area 1: Increased delivery, climate resilience, and digitalization of electricity supply

(a) **Distribution network expansion and strengthening**

3. **A power flow analysis of the network expansion plan proposed by BREB was carried out to review and validate the investment plan.**[23] A sample of 10 PBSs were selected as representative of the entire program. All the existing 33 kV feeders and a sample of 11 kV feeders in the selected 10 PBSs were included in power flow models.

4. **The results of the analysis indicate that the performance of BREB's existing network under 2019 loading is constrained with serious issues with the power flow performance.** As might be expected for a system in which many feeders suffer overloads and voltage problems, average demand losses are 8.3 percent for these PBSs, and some have loss levels as high as 26 percent. However, the modeling indicates that network improvements proposed in the Program would address these issues and reduce system losses by more than 50 percent.

5. **The review confirms the urgent need to strengthen and expand BREB's rural distribution network to meet the projected increase in electricity demand.** It confirms the approach to electricity demand projections and network expansion proposed in the Program by BREB and recommends strategies to address voltage and loading issues: (a) use of a line voltage regulator to resolve voltage issues, (b) use of line in - line out design and use switches on T-Off circuits and (c) enablement of auto recloser feature along with sectionalizer.

[23] The review of BREB's plan was carried out with the assistance of NRECA International under the ESMAP-funded BREB Financial Sustainability Review Study.

6. **BREB/PBS network planning approach and capacity must be strengthened.** The importance of network planning will increase as the complexity of distribution networks increases with greater digitalization and integration of distributed energy resources, and demand response. BREB is advised to prepare a long-term distribution masterplan and develop capacity of its staff in planning.

7. **The Program will undertake investments to address network constraints and improve flexibility.** This will facilitate the integration of renewable energy. Approximately 13000 out of 31000 km of distribution lines constructed or upgraded will result in increased voltage levels; 5400 out 31000 km of lines will be new lines while the remaining will be upgrade of distribution lines including conversion to higher voltage levels. Approximately 1600 MVA out of 2150 MVA of increased capacity will result from construction of new substations while the remaining will result from upgrade.

(b) **Climate Resilience**

8. **It is critically important that BREB investments in the Program are resilient to the significant risks from climate change and extreme weather events.** The resilience of Program investments was assessed through: (a) review of BREB equipment specification, network design, and planning approaches; (b) wind risk analysis and simulations for high-risk PBSs; and (c) assessment of the impact of implementation of conventional network solutions and distributed generation sources (solar rooftop and energy storage) on mitigating climate risks. This is described further in the standalone Program Technical Assessment.

9. **BREB is advised to mainstream key measures to make its distribution network more resilient.** These include (a) use of a composite approach consisting of underground cabling, alternate feeding arrangements, and feeder augmentation in high-risk areas; (b) maintenance of a pole top insulation level of 300 kV; (c) integration of distributed solar and BESS solutions; (d) use of wind load specifications for network equipment that are consistent with the Bangladesh Building Code; (e) establishment of a vegetation management program to manage impact on network lines; (f) elevated substations and drainage to reduce risk of flooding; and (g) adoption of guidelines to address extreme weather, disaster, and climate risks to inform network investments under the Program.

10. **The guidelines to address extreme weather, disaster, and climate risks will be adopted by BREB in the Program and applied to Program investments.** The Global Fund for Disaster Risk Reduction (GFDRR) technical assistance grants will support BREB and other agencies to adopt guidelines, operational procedures, and robust decision-making tools to prepare future network expansion investments considering latest available extreme weather, natural hazard, and climate risks.

(c) **Digitalization**

11. **Greater digitalization of BREB's distribution network will enable BREB to deliver electricity more efficiently and reliably while improving the climate resilience of the network.** Implementation of SCADA, ADMS, and GIS will allow remote monitoring of the distribution network and provide the information required by the PBS to (a) improve operational performance both during outages and for system optimization, (b) facilitate the integration of variable renewable energy, and (c) enable BREB to assess damages from extreme weather and climate events sooner and more accurately and minimize power

outages. With the deployment of SCADA, BREB would be able to remotely de-energize critical equipment during flooding to prevent catastrophic damage that could require weeks to repair or replace. Similarly, the introduction of AMI in PBSs will enable capabilities with significant advantages for BREB/PBS commercial and technical operations as described in the Program Technical Assessment.

12. **BREB's approach to implementation of AMI and SCADA/ADMS is robust and well adapted to local context and conditions.** BREB is planning to roll out these technologies gradually and incrementally in its network under the Program, to enable implementation capacity and readiness to be built in PBSs and to allow opportunities for learning and course corrections. BREB will start implementation of both AMI and SCADA under the Program in some high-growth PBSs in the Dhaka Mymensingh Division; deployment across all PBSs will extend beyond the current Program's timeline. BREB's vision and decisions regarding AMI and SCADA/ADMS implementation is further described in the standalone Program Technical Assessment.

13. **Stakeholder incentives are well aligned and supportive of Results Area 1 of the Program.** There is support at the management level for the digitalization of the BREB network and operations. However, it is possible that BREB staff and rural consumers may not fully understand the benefits of these technologies. Furthermore, BREB employees in manual roles such as meter readers could be concerned about the potential loss of employment on account of digitalization. It will be important for BREB to communicate clearly about the transformative potential of digital technologies and their benefits to consumers and prepare a capacity-building and training plan to transition manual employees into new roles.

**Results Area 2: Increased readiness to integrate Distributed Energy Resources**

14. **Distributed energy resources have an important role to play in the distribution network transformation in Bangladesh.** They can help Bangladesh meet electricity demand, reduce distribution losses, improve reliability, and make distribution networks more efficient.

15. **Technical studies undertaken by the World Bank confirm the potential and role of distributed solar and BESS.** The following conclusions on integration of BESS in the BREB networks can be reached from the assessment: (a) integration of solar and BESS lowers the peak load of the substation and provides opportunities to defer network investments; (b) solar and BESS lead to greater reduction in technical loss than is possible from only solar; (c) BESS provides voltage support to the system, thereby reducing system technical loss and improving the utilization of solar generation and solar penetration in the network; (c) solar and BESS in the network will help reduce ENS; and (e) a combined solar and BESS provides operational flexibility to the network and can make it resilient to climate and extreme weather events.

16. **BREB's capacity to integrate distributed energy resources such as solar, BESS, demand response and electric mobility in its network must be strengthened.** Despite the adoption of net metering regulations in 2018 and significant technical and economic potential, there has so far been limited uptake of distributed solar in BREB-served areas. BREB has only seen the development of 25 MW of solar in its area as of June 2020. BREB will adopt a renewable energy and storage road map, provide at least 100 net and/gross metering connections to industrial and commercial customers and could see the development

of an additional 150 MW of distributed solar in the Dhaka Mymensingh Division under this Program through private investments.

17. **The implementation of BESS pilots in the Program has the potential to catalyze a market that can have a transformative impact on Bangladesh's power sector**, BREB intends to implement 40 MWh of battery storage in its distribution network through Climate Technology Fund grants mobilized under this Program. KIAT's parallel support for BESS pilots has not been confirmed but would be expected to give BREB complementary experience with additional use cases.

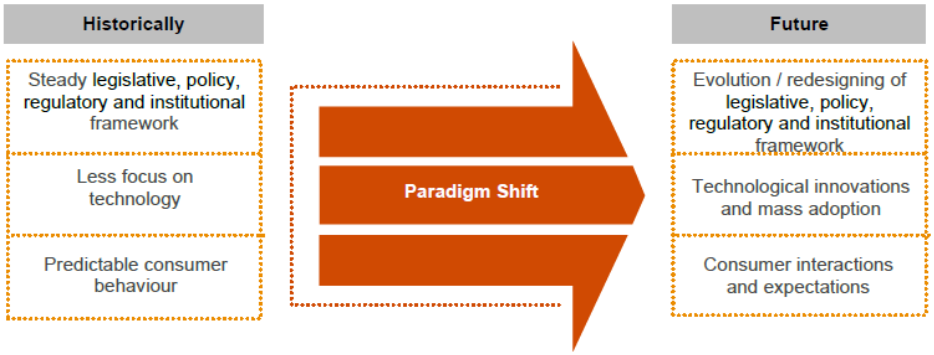
18. **The relationships with and expectations of stakeholders in Results Area 2 will need to be managed carefully by the Government and BREB.** BREB consumers are supportive of the Program because net metering will enable them to lower the cost of electricity. BREB and PBSs may be ambivalent about distributed solar and net metering given the potential for reduced electricity demand from high-paying industrial and commercial customers, Furthermore, there could be opposition to distributed solar and BESS from private thermal generators in Bangladesh that may see the increased penetration of renewable energy as a threat to their financial interests. These risks will need to be managed by mobilizing civil society groups and communicating clearly about the benefits of distributed solar with stakeholders.

**Results Area 3: Strengthened Institutional and Regulatory Capacity**

19. **Bangladesh's institutional and regulatory system needs to evolve to fully meet the emerging needs of Bangladesh's electricity sector.** The old regulatory paradigm is unlikely to unleash the real-time flexibility that new technologies promise and that the emerging power system will require. New approaches to policy and regulation must be fashioned, as described in the Program Technical Assessment and in figure 3.1.

20. **The capacity of policy and regulatory institutions such as Power Cell has not kept pace with demands of the sector.** The Government has approved a Technical Assistance Project Proposal for Power Cell to address this situation. A review of the Technical Assistance Project Proposal of Power Cell was undertaken and highlighted the need to incorporate several elements in the Program to identify gaps and potential areas of improvement, as described in the Program Technical Assessment.

**Figure 3.1. Paradigm Shift in the Regulatory Framework**




21. **Furthermore, Results Area 3 includes support to BREB to address gaps identified in the Technical Assessment**. BREB will prepare and receive approval from the Government for Technical Assistance

Project Proposals incorporating these elements and implement the Technical Assistance Project Proposal under the Program.

a. **Areas of support to BREB** include (a) distribution network planning to increase integration of renewable energy, demand response and electric mobility; (b) preparation of a long-term distribution masterplan with options to increase renewable energy, demand response and electric mobility; (c) capacity building and technical assistance in network planning and new technologies such as SCADA, AMI, distributed solar, BESS, and electric mobility infrastructure; and (d) capacity building on climate and disaster risks. BREB will prepare and receive approval from the Government for a Technical Assistance Project Proposal incorporating these elements and will implement the Technical Assistance Project Proposal under the Program.

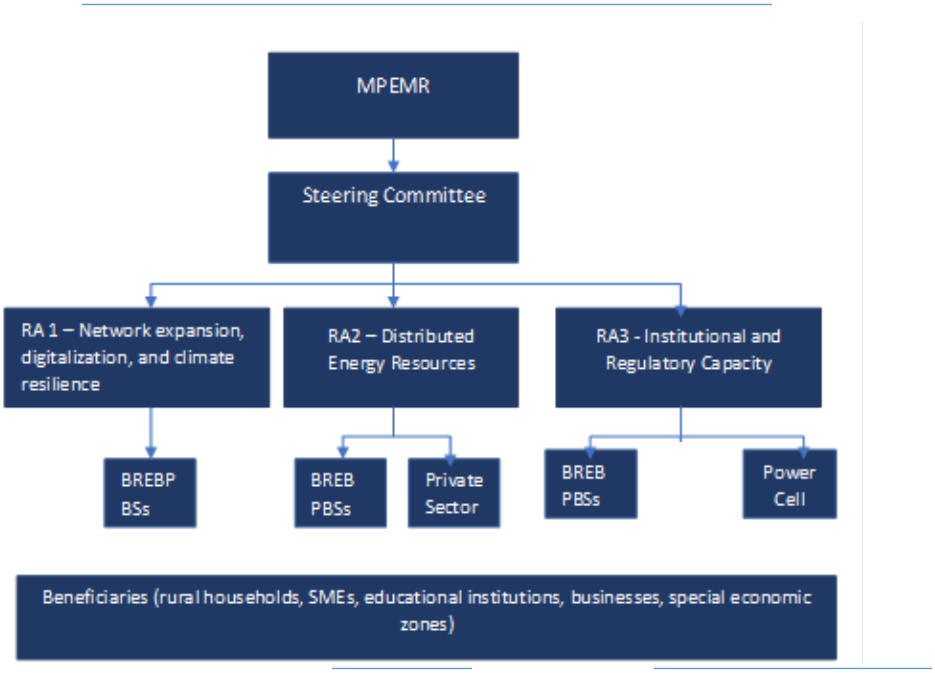
b. **Areas of support to Power Cell** included in its Technical Assistance Project Proposal approved by the Government, comprise (a) preparation of new policies, sector road maps and regulations on smart grid development, renewable energy, energy efficiency, storage, digitization, electricity trade, and electric mobility; (b) HR planning, training, and upgrade to facilitate increased integration of renewable energy and energy efficiency in the sector; (c) development of innovative financing mechanisms for renewable energy; and (d) electricity cost and tariff assessment and design. Building on their Technical Assistance Project Proposals that have been approved by the Government, Power Cell will prepare and implement an annual technical assistance and capacity-building plan, including an action plan, a procurement plan, and an annual budget and financing plan for implementing each year's technical assistance and capacity-building activities.

22. **Stakeholder incentives for Results Area 3 will need to be managed carefully by the Government and BREB.** The proposed transition to new and updated policies and regulation could be opposed by stakeholders that benefit from the status quo, slowing the adoption of these policies and regulation and limiting economic and environmental gains likely to result from a more rapid scale-up of these technologies. Nevertheless, the implementation of activities in Results Area 3 is supported at high levels of the Government and will be positively viewed by the consumers and civil society groups given its positive impact on electricity supply.

**Institutional Arrangements**

23. **BREB, under the oversight and coordination of MPEMR, is the lead implementing agency for the Program (figure 3.2).** The Program implementation, which will take place over five years between 2021 and 2026, is further described in the Program Technical Assessment.

**Figure 3.2. Implementation Arrangements**




*Note:* RA = Results area; SMEs = Small and medium enterprises.

24. **BREB will be responsible for planning, financing, and installation of Program investments in Results Area 1 and Results Area 2.** Once it is constructed, responsibility for the distribution system will be transferred to 25 rural electricity cooperatives (PBSs) in the Dhaka Mymensingh Division (see table 3.1). BREB benefits from a strong track record of implementing large grid investment programs with funding from the GoB and development partners including the World Bank. Since 2009, as part of the Government's push to achieve universal electrification by 2021, BREB has been implementing a large investment program to achieve universal electrification with Government funding.

25. **BREB and PBSs have built robust capacity and acquired qualified staffing in technical and management positions to implement large and complex programs.** They have adequate capacity across different implementation stages. In the last decade, BREB implemented a reform action plan to strengthen its institutional capacity, reinforce its management staff and promote organizational efficiency. These actions enabled BREB to obtain ISO 9001:2008 certification in August 2013.

**Table 3.1. Overview of PBSs in the Dhaka and Mymensingh Division (June 2021)**

| PBS | System Loss | Number of Consumers | Sales | Sales | Margin |
|---|---|---|---|---|---|
| | Percent | # | US$, million | GWh | US$, million |
| Dhaka PBS-1 | 5.34 | 512,380 | 161.67 | 1,960.12 | 7.43 |
| Tangail PBS | 10.00 | 534,265 | 41.54 | 618.46 | −0.52 |
| Mymensingh PBS-1 | 14.99 | 491,113 | 30.65 | 433.48 | −1.52 |

| PBS | System Loss | Number of Consumers | Sales | Sales | Margin |
|---|---|---|---|---|---|
| Jamalpur PBS | 15.57 | 489,318 | 23.47 | 346.20 | −2.78 |
| Madaripur PBS | 11.50 | 325,479 | 19.25 | 275.80 | −0.86 |
| Narsingdi PBS-1 | 4.01 | 178,129 | 75.79 | 925.84 | 3.94 |
| Kishoreganj PBS | 18.75 | 522,904 | 27.75 | 398.89 | −2.09 |
| Narsingdi PBS-2 | 9.35 | 497,962 | 61.48 | 822.39 | 0.61 |
| Manikgonj PBS | 7.42 | 420,377 | 39.09 | 519.62 | 0.73 |
| Netrokona PBS | 12.61 | 471,265 | 22.43 | 315.95 | −1.44 |
| Faridpur PBS | 11.97 | 366,621 | 21.20 | 303.44 | −2.25 |
| Mymensingh PBS-2 | 6.24 | 344,574 | 102.97 | 1,193.16 | 4.18 |
| Gopalgonj PBS | 11.01 | 327,867 | 18.25 | 263.89 | −1.25 |
| Rajbari PBS | 12.99 | 202,814 | 7.85 | 114.67 | −0.49 |
| Sherpur PBS | 7.42 | 251,607 | 20.32 | 341.29 | −1.14 |
| Shariatpur PBS | 11.02 | 276,124 | 15.19 | 214.75 | −0.73 |
| Mymensingh PBS-3 | 10.79 | 291,848 | 14.67 | 211.55 | −0.99 |
| Munshigonj PBS | 9.44 | 378,257 | 54.81 | 61.12 | 0.51 |
| Dhaka PBS-2 | 8.90 | 184,792 | 18.25 | 261.91 | −0.40 |
| Gazipur PBS-1 | 3.22 | 469,529 | 203.53 | 2,804.29 | 5.82 |
| Narayangonj PBS-1 | 3.20 | 287,094 | 137.06 | 1,642.98 | 5.42 |
| Dhaka PBS-3 | 4.04 | 380,876 | 100.11 | 1,282.81 | 3.40 |
| Gazipur PBS-2 | 7.78 | 182,765 | 50.19 | 589.04 | 1.60 |
| Narayangonj PBS-2 | 4.79 | 238,078 | 74.27 | 953.55 | 2.63 |
| Dhaka PBS-4 | 5.37 | 326,092 | 61.62 | 782.22 | 1.67 |
| Total | 9.11 | 8,952,130.37 | 1,403.43 | 17,637.42 | |

*Source:* BREB.

26. **BREB programs in the past have been able to access adequate predictable flow of resources to meet both recurrent and capital expenditures on time and transparently.** The Program has also been able to mobilize external expertise to support the design and implementation of programs. BREB makes use of the services of consulting firms to carry out design, cost estimate preparation, supervision of contracts, and verification of the quality of the completed civil works. BREB is required to regularly report on its program and results to MPEMR and in some instances to the Ministry of Finance and Planning Commission and has established adequate monitoring and reporting capacity to undertake this function.

27. **Program oversight is provided by the BREB Board, which consists of a Chairman and five full-time members.** The internal organization of BREB and its Board are further detailed in the Program Technical Assessment.

28. **The accountability structure in BREB and PBSs is effective and able to support the achievement of targeted outcomes.** BREB has clear guidelines for recruitment, transfers, and other service-related issues, which are implemented by its Personnel Administration Directorate. The Enquiry and Discipline Directorate is responsible for conducting enquiries on allegations against BREB and PBS officials and taking

enforcement action. BREB and PBS staff have access to regular training that are carried out by the Training Directorate.

29. **BREB and PBSs must strengthen their capacity to effectively implement new and transformative technologies proposed in the Program.** Capacity, organizational, and manpower gaps must be addressed in areas such as network planning, SCADA/ADMS, AMI, distributed solar, BESS, electric mobility, and demand response.

30. **Power Cell has adequate capacity to implement the technical assistance and capacity-building activities under Results Area 3.** Power Cell was established in 1995 to be the technical arm of MPEMR and serve as the think tank for the sector. It supports sector reform, restructuring, and strengthening efforts and will be responsible for preparing policy assessments and road maps on new technologies as well as HR upgrade and training plans for sector entities. Power Cell will engage consulting firms to undertake various technical studies and plans under the Program.

**Program Expenditure Framework**

**Program Budget Structure and Classification**

31. **Bangladesh has a relatively well-established structure of planning and budgeting both at the central and local levels.** There is an MTBF and an annual budget process that helps fiscal policy formulation and management, where the Ministry of Finance, line ministries, the Finance Division, the Planning Commission and the Parliament play a clear role, as described in the Program Technical Assessment.

32. **MPEMR and BREB prepare their plans and budget in accordance with this process.** Based on planning, feasibility, and costing studies, BREB prepares Development Project Proposals (DPPs) for expenditures in its program that are reviewed by MPEMR, the Planning Commission, and Ministry of Finance before being approved by the Executive Committee of the National Economic Council (ECNEC). Similarly, Power Cell prepares Technical Assistance Project Proposals (TAPPs) for its technical assistance and capacity-building activities under the Program that is reviewed by MPEMR and Ministry of Finance and approved by the Planning Commission. The Government's contribution to BREB and Power Cell program is included as part of the MPEMR budget.

33. **The planned expenditures for grid expansion and strengthening, digitalization, distributed energy resources as well as institutional and regulatory strengthening are estimated at about US$902 million.** Table 3.2 provides the detailed list of expenditures eligible under the Program. Expenditure categories are aligned to the Government's Budget and Accounts Classification System. The Program is expected to mobilize US$124 million of private capital for distributed energy resources; however expenditures related to private capital mobilization is not an eligible expenditure. The below codes would be used for the reconciliation process along with the main program code, which will be finalized after the approval of Detailed Project Proposal associated with BREB Program.

**Table 3.2. Estimated Program Expenditure under the Electricity Distribution Modernization Program**

| Item | Amount (US$, millions) |
|---|---|
| **Capital expenditure** | 733 |

| | |
|---|---|
| Distribution lines, substations and associated capital expenditure (41112, 41113, 41121–41123, 41411, 49411) | 683 |
| Smart meters and associated capital expenditures (41112, 41113, 41121–41123, 41411, 49411) | 20 |
| SCADA and associated capital expenditures | 5 |
| BESS and associated capital expenditures | 24 |
| Computer, software, equipment, and other capital expenditures (411122–411123) | 1 |
| **Operating expenditure** | **45** |
| Salary and Allowances (31111–31113) | 2 |
| Consulting expenses (32571) | 31 |
| Other operating expenditure (32111, 32211, 32312,32421,32561, 32431, 32411, 32551, 32572, 32581, 38211, 39111) | 12 |
| **Total** | **778** |
| Distributed solar PV installations (through private capital mobilization) | 124 |
| **Total including private capital mobilization** | **902** |

**Funding Predictability**

34. **The power sector, and particularly BREB, have benefited from a large and steady flow of funds from the Government, that is expected to be maintained.** Investments in power and energy infrastructure as part of the Government's Annual Development Program totaled more than US$12.6 billion over the last five years, equal to about 15 percent of total public investments. The Government allocated close to one-third of the sector allocations (US$4.3 billion) in this period to BREB. In the Eighth Five Year Plan, 15 percent of the ADP and 1 percent of GDP are expected for the power and energy sectors. The Government's share of financing of the proposed Government program is expected to be maintained at about US$0.9 billion.

**Adherence to Budgeted Program Expenditure and Execution of Program Priorities**

35. **Overall, the planning and budgeting arrangements of MPEMR and BREB are adequate and satisfactory for the implementation of the new program,** as further described in the Program Technical Assessment.

36. **The budget execution of BREB in the last five years has been satisfactory as it has pursued the Government's universal electrification target.** Based on this track record, the annual budget of BREB's investment program can be expected to be prepared based on the realistic absorption capacity. The annual Program budget will be prepared by the implementing agencies and consolidated by MPEMR. MPEMR and implementing agencies will ensure that there is recording, accounting, and reporting on the proposed Program's sources of funding and expenditures.

**Efficiency of Program Expenditures**

37. **Program expenditures under BREB's rural electrification program were efficient and delivered electricity connections to several beneficiaries cost-effectively.** This emphasis on cost-effectiveness and efficiency is expected to be maintained under the proposed Program.

38. **BREB will be undertaking investments in SCADA, AMI, and BESS for the first time.** There is a well-established international market for these technologies and in the case of SCADA and AMI, other electricity utilities in Bangladesh have undertaken these investments. The estimated costs of these technologies in the Program expenditure framework are based on the cost incurred for these technologies by other utilities in Bangladesh (AMI and SCADA) and the region (BESS).

39. **Power Cell has a long track record of undertaking technical assistance and capacity-building activities.** MPEMR, Ministry of Finance, and Planning Commission provide oversight and can be expected to leverage their experience to ensure the efficiency of Program expenditures. The World Bank team will also engage closely with both these entities as part of implementation support missions.

**Results Framework and Monitoring and Evaluation**

40. **Program implementing agencies have a well-established monitoring and reporting system and will recruit a third-party agency for verification of the achievement of the DLIs**, as further described in the Program Technical Assessment. PforR reporting and monitoring is fully aligned with BREB's monitoring and reporting system and will be coordinated by BREB's Office of Chief Engineer (Project). Power Cell also has a monitoring and reporting system that enables it to track its work program and Annual Performance Agreement.

41. **Program impact evaluations are the responsibility of BREB Program Planning Directorate and will be undertaken for selected areas of the Program in consultation with the World Bank.** The process of consolidation and monitoring of PBSs monthly reporting is further described in the Program Technical Assessment.

**Program Economic Justification**

42. **An economic assessment of the proposed Program was undertaken through a quantitative and qualitative assessment.** The assessment covers (a) the rationale for public sector financing, (b) World Bank value added, and (c) development impact of operation.

(a) **Rationale for public provision and financing.** BREB and PBSs have undertaken high levels of debt to finance investments to meet the Government's universal electrification target and serve rural lifeline consumers. Long-term debt grew from 94 percent to 97 percent of total asset value between 2016 and 2019. Some PBSs have negative equity. With some exceptions for those PBSs that serve significant industrial and large commercial loads, most PBSs are significantly dependent on public financing to meet capital expansion requirements as well as support achievement of positive financial results and cash flow support. With the current level of indebtedness, most PBSs would not qualify for private or commercial loan resources in the near term. Public financing is hence needed to ensure that BREB and PBSs can undertake investments in the rural distribution network and meet the growing electricity demand in the country.

(b) **World Bank added value.** Bangladesh and BREB currently lack the experience and capacity to implement automation, digitalization, and distributed energy resources. The World Bank can add value by supporting capacity building; sharing global knowledge and experience in technologies

such as SCADA, AMI, and BESS; and mobilizing concessional resources to support distribution network transformation and energy transition.

(c) **Development impact.** An economic model was prepared to assess the economic benefits of BREB's program in Dhaka-Mymensingh Division. The economic analysis considers the scenario where Bangladesh would significantly increase the share of renewable energy in its generation mix consistent with National Solar Energy Action Plan; the share of renewable energy in the generation mic in Program areas would increase from 3 percent in 2020 to 29 percent in 2031 and reach 50 percent in 2050. System losses are estimated to come down from 9 percent in 2020 to 6 percent in 2031 and stay at that level from there on. The costs and benefits of the 'with-Program' scenario consisting of (i) increased network capacity and reliability; (ii) more efficient utilization of power system resources; and (iii) increased integration of distributed energy resources such as rooftop solar and BESS were compared with a counterfactual consisting of the status quo in terms of network capacity and reliability, digitalization, and penetration of distributed energy resources to calculate NPV and economic rate of return. The costs considered in the economic evaluation include capital and operation and maintenance costs of (i) network expansion and strengthening, (ii) SCADA and AMI, (iii) distributed solar, (iv) BESS, and (v) associated investments in generation and transmission. The benefits considered include the economic value of (i) displacement of diesel self-generation and fossil fuel generation and (ii) additional electricity demand met measured using willingness to pay for electricity of BREB consumers.

43. **Economic analysis results.** The Program investments will bring substantial economic benefits to Bangladesh's economy by helping displace expensive diesel-based self-generation and fossil fuel generation, meet growing demand, and improve the efficiency and reliability of the power system. The baseline economic rate of return of the 'with-Program' scenario over a 30-year period is 34.2 percent (NPV US$6.3 billion) (table 3.3). The levelized economic costs of electricity served in the 'with-Program' scenario is US¢7 compared to US¢10 in the 'without-Program' scenario. GHG accounting indicates that the Program contributes to reduction in emissions of 48.5 million tons of $CO_2e$ over the life of the Program in the decarbonization scenario considered in the analysis. The reduction in GHG emissions is on account of displacement of diesel self-generation and fossil fuel generation and reduction in technical losses from the implementation of the Program.

44. **Sensitivity analysis.** A sensitivity analysis is performed to test the robustness of economic returns to the changes in underlying parameters. Sensitivity analysis shows that the economic rate of return is robust to unfavorable outcomes of some variables such as Program costs, additional electricity supply, and average willingness to pay. The Program cost would have to be one-and-half times higher than the base value and average willingness to pay and energy wheeled two-fifths lower for the economic rate of return to fall below the hurdle rate.

**Table 3.3. Summary of Economic Analysis of Electricity Distribution Modernization Program**

| | Item | Unit | Base Case | Sensitivity |
|---|---|---|---|---|
| [1] | Discount rate | | 6.0 percent | 10.0 percent |
| [2] | | | | |
| [3] | **Economic rate of return** | | | |
| [4] | ERR | [ ] | 33.7 percent | 33.7 percent |
| [6] | ERR+local+GHG@BankGuidanceValues | [ ] | 34.2 percent | 34.2 percent |

| | | | | |
|---|---|---|---|---|
| [7] | Levelized cost of elec. with EDMP | US$/kWh | 0.07 | 0.07 |
| [8] | Levelized cost of elec without EDMP | US$/kWh | 0.10 | 0.10 |
| [9] | | | | |
| [10] | **Composition of NPV** | | | |
| [11] | *Electricity Distribution Modernization Program* | | | |
| [12] | Network investment costs | [$USm] | 580 | 530 |
| [13] | SCADA/ADMS costs | [$USm] | 4 | 4 |
| [14] | Advanced Metering Infrastructure costs | [$USm] | 17 | 16 |
| [15] | BESS costs | [$USm] | 13 | 12 |
| [16] | Incremental Generation Costs | [$USm] | 1560 | 1429 |
| [17] | Incremental Network O&M Costs | [$USm] | 397 | 260 |
| [18] | Incremental Transmission cost | [$USm] | 497 | 454 |
| [19] | **Total costs** | **[$USm]** | **3069** | **2704** |
| [20] | *Benefits* | | | |
| [21] | Avoided self-generation | [$USm] | 3867 | 2549 |
| [22] | Additional elec supplied | [$USm] | 4320 | 2848 |
| [23] | of which technical losses reduced | [$USm] | 180 | 119 |
| [24] | **Total benefits** | **[$USm]** | **8187** | **5396** |
| [25] | | | | |
| [26] | **NPV (before environmental benefits)** | **[$USm]** | **5119** | **2692** |
| [27] | local env. benefits: avoided grid gen. | [$USm] | 321 | 192 |
| [28] | NPV (incl. local environmental benefits) | [$USm] | **5440** | **2884** |
| [29] | value of avoided GHG emissions | [$USm] | 872 | 385 |
| [30] | **NPV (including environment)** | **[$USm]** | **6312** | **3269** |
| [31] | Lifetime GHG emissions, undiscounted | mtons CO2 | -48.5 | -48.5 |
| [32] | Marginal abatement cost | $/ton | -105.5 | -55.5 |

**Program Financial Sustainability**

45. **A financial sustainability assessment of the BREB program over 2021–28 was undertaken.** The assessment makes use of a financial model of the BREB program including all PBSs.[24] The model projects consumer growth, electricity sales, operating and maintenance costs, consumer and administrative and general expenditure requirements, power requirements, and capital requirements and assesses the impact of program implementation on financial sustainability of BREB and PBSs.

46. **Most PBSs are significantly dependent on BREB to finance capital expansion requirements as well as to cover their costs.** BREB PBSs have achieved remarkable growth in recent years, nearly doubling the number of consumers connected from 16 million in 2016 to 29 million in FY2020 (table 3.5). The efforts and costs associated with this expansion took a toll on financial performance, with only 27 out of 80 PBSs achieving profitability in FY2019 and nearly half of all PBSs experiencing cash flow deficits. There has been a further deterioration in PBS financial performance during FY2020 due to adverse impacts of the COVID-

[24] The model was shared with BREB followed by multiple meetings during which the assumptions and analyses were reviewed by all parties. BREB team members had significant and substantial input to the modeling assumptions, methodology, and rationale that is described herein.

19 pandemic. The revenues to cost of service ratio dropped to 96 percent in FY2020 from 98 percent in FY2019 (table 3.4). The number of profitable PBSs has declined from 27 in 2019 to 16 in FY2020.

47. **BREB's current electricity tariff is only three-fourths of the tariff level needed to ensure profitability for all PBSs** and enables access to private and commercial financing. PBSs are highly indebted to BREB due to the accelerated growth of rural lifeline consumers. Long-term debt grew from 94 percent to 97 percent of the total asset value between 2016 and 2019. Some PBSs have negative equity.

**Table 3.4. BREB/PBS Recent Financial Performance**

| | Unit | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| Revenues/cost of service ratio | percent | 94 | 93 | 97 | 98 | 96 |
| EBITDA over revenues | percent | 4 | 3 | 9 | 10 | 11 |
| Margin over revenues | percent | −4 | −6 | −1 | 0 | −1 |
| Debt-to-equity ratio | # | 15.1 | 26.7 | 31.4 | 35.9 | 25.5 |

**Table 3.5. BREB/PBS 2021–28 Demand Forecast**

| | | 2020 - Actual | 2021 | 2028 |
|---|---|---|---|---|
| Consumers | Million | 28.9 | 33.8 | 38.2 |
| Electricity sales | GWh | 35,902 | 44,267 | 67,830 |
| Peak demand | MW | 9,022 | 9,720 | 14,990 |

48. **The financial sustainability analysis indicates that the financial performance of PBSs can be expected to improve following the implementation of the Program**, as universal access is achieved, and annual capital investments are reduced. PBS increased profitability, equity and subsidy requirements are further described in the Program Technical Assessment.

**Table 3.6. BREB/PBS Projection of Key Financial Performance Indicators through 2028**

| | Unit | 2020 - Actual | 2021 | 2025 | 2028 |
|---|---|---|---|---|---|
| Revenues/cost of service ratio | percent | 96 | 97 | 103 | 107 |
| EBITDA over revenues | percent | 11 | 6 | 12 | 15 |
| Margin over revenues | percent | −1 | −2 | 4 | 6 |
| Debt-to-equity ratio | # | 25.5 | 107 | 25 | 9.4 |

49. **Private and commercial financing will become an option for PBSs only when their financial performance improves.** Table 3.7 presents a summary of the three PBS financial performance indicators evaluated to determine how many PBSs might qualify for commercial loans in the future. The extremely high debt-to-equity ratios that characterize PBSs in this segment of BREB development of aggressive expansion are the single most important financial limitation preventing PBSs from qualifying for commercial loans. Given the continued need for aggressive investment in system expansion to strengthen grid reliability for the next five years, there will be little potential to build significant equity in the short term.

**Table 3.7. Number of PBSs Qualified to Seek Commercial Financing by Performance Year**

| Number of PBSs | Actual | Projections | |
|---|---|---|---|
| | 2020 | 2021 | 2028 |
| Below maximum debt-to-equity ratio | 6 | 4 | 9 |

| Number of PBSs | Actual | Projections | |
|---|---|---|---|
| | 2020 | 2021 | 2028 |
| 3 or more years of profitability | 10 | 13 | 44 |
| Positive cash flow | 28 | 24 | 58 |
| PBS fulfilling 3 requirements | 3 | 2 | 9 |

**Gender Assessment Summary**

50. **BREB is already demonstrating a strong commitment toward improving gender outcomes.** BREB became a WePOWER (South Asia Women in Power Sector Professional Network) Partner in 2021 and is implementing activities to recruit and retain women professionals. At the institutional level, BREB is ensuring the engagement and participation of women employees in all technical assignments, committee meetings, and capacity development opportunities. Female employees have been deliberately encouraged to express their needs and suggestions in quarterly staff meetings.[25]

51. **There is underrepresentation of women among BREB, and PBS employees and they seem to have fewer career progression opportunities, mostly concentrated in non-technical administrative positions,** as further described in table 3.8 and in the Program Technical Assessment.

**Table 3.8. Gender-Disaggregated Employment at BREB and PBSs (as of June 30, 2021)**

| Employment | Total No. of Employees | Female | Male | Percent of Women |
|---|---|---|---|---|
| Total for BREB | 1,447 | 119 | 1,328 | 8.22 |
| Total for All PBSs | 40,188 | 5,594 | 34,594 | 13.91 |
| Total BREB and PBS | 41,635 | 5,713 | 35,922 | 13.72 |
| **Officer-level positions** | | | | |
| BREB | 801 | 80 | 721 | 10.00 |
| PBSs | 1,315 | 42 | 1,273 | 3.19 |

52. **Employee perception surveys point to a generally positive and supportive work environment for women employees at BREB and PBSs.** Women respondents generally have a higher job satisfaction rate than men (89 percent versus 84 percent) and more of them feel that they have fair and equal promotion/career growth opportunities (79 percent versus 63 percent). More women (93 percent) than men (82 percent) felt that BREB/PBS supports a good work-life balance. Overall, women were more satisfied than men with the general office facilities (88 percent versus 77 percent) but felt women-friendly facilities are lacking. Specifically, women did not feel comfortable bringing babies to work because the PBS offices lack on-site day care centers or even lactation rooms.

53. **The gender assessment points to the following areas of intervention to improve gender equity in BREB/PBS**: i) Science, technology, engineering and mathematics education; ii) recruitment; (iii) retention; (iv) development; and (v) policy and institutional change. Additional details on proposed actions in these areas are provided in the standalone full Technical Assessment.

[25] More information can be found at this blog with the link: https://blogs.worldbank.org/endpovertyinsouthasia/wepower-helps-bangladeshs-largest-power-distribution-company-boost-its-female.

## ANNEX 4. FIDUCIARY SYSTEM ASSESSMENT

### Section 1: Conclusions

*1.1 Reasonable Assurance*

1. **The FSA was undertaken to ascertain the adequacy of Program financial management and procurement arrangements** and provide reasonable assurance that Program funds will be used for the intended purposes with due attention to the principles of economy, efficiency, effectiveness, transparency, and accountability.

*1.2 Risk Assessment*

2. **The overall fiduciary risk for the Program is rated Substantial.** Program implementing agencies have agreed to implement mitigation measures to address these risks, to be monitored during implementation through the PAP (Table 4.9).

*1.3 Procurement Exclusions*

3. **The Program is not expected to procure any large contracts valued at or above the OPRC thresholds for a "Substantial" risk rating** i.e. US$75 million for works, US$50 million for goods and non-consulting services, and US$20 million for consultant services. The IAs shall report to the World Bank if any large contracts appear during Program implementation. The World Bank will also monitor fiduciary systems and contract management reports to identify any large value contracts throughout the Program implementation.

### Section 2: Scope of FSA

4. **The FSA[26] covers BREB, which is the main implementing agency, as well as Power Cell.** This assessment reviews the adequacy of the systems, processes, and procedures underlying Program activities in implementing agencies. The FSA is based on the Program Expenditure Framework identified in the Technical Assessment of US$902 million, of which World Bank financing will be US$515 million over 2021–26.

### Section 3: Review of Country Public Financial Management Cycle

**3.1 Planning and Budgeting**

*Adequacy of Budgets*

5. **The GOB's Budget and Accounts Classification System is robust and will enable reporting of Program expenditures.** Budget allocations to BREB fall under the oversight of the Power Division in MPEMR. The Program budget will be reflected in the Government's budget. The counterpart financing from BREB and the Government will also be included in the unique nine-digit task/scheme/program code that will be used by all implementing entities. The inclusion of all program activities undertaken by BREB

[26] The approach and methodology for the FSA is based on the Program-for-Results Fiduciary Systems Assessment Guidance Note issued and effective June 30, 2017, to assist task teams in conducting the FSA for PforR operations.

and Power Cell in the unique program code will enable effective monitoring of utilization of program budget by each Program implementing agency.

6. **The Finance Departments of implementing agencies will consider implementing subordinate office and organizational unit dimensions of the Budget and Accounts Classification System under the Program.** Deepening the organizational segment from Power Division to the responsible implementing agencies (BREB and Power Cell) will enhance managerial accountability of funds allocated to deliver on the specific allocation at the lowest organizational unit level, as shown in table 4.1, to minimize the risk of delay in distribution of Program funds to the front-line units responsible for the DLIs.

**Table 4.1. Finance Division Organizational Codes**

| Public Sector | Ministry/Division | Directorate/ Department | Subordinate Office/Organizational Unit Group | Organizational Unit |
|---|---|---|---|---|
| L-1 | L-2 | L-3 | L-4 | L-5 |
| Digit-1 | Digit-2 | Digit-2 | Digit-2 | Digit-6 |
| **1** | 1-**09** | 1-09-XX | 1-09-XX | 1-09-01-01-XX |
| Budgetary Central Government | Secretariat, Power Division | Secretariat, Power Division | Secretariat, Power Division | Secretariat, Power Division/BREB/Power Cell |

7. **The operating segment of the Budget and Accounts Classification System supports tracking of Program activities.** This will facilitate budget management and reporting arrangements and ensure external scrutiny of the PAP. The PforR will be included in the budget using the code: 'Electricity Distribution Modernization Program: Continuation of Priority Ongoing Activities Programme', as shown in table 4.2.

**Table 4.2. Power Division Operational Code**

| Type | Sub-Type | Task/Scheme/Project Group | Task/Scheme/Project |
|---|---|---|---|
| **Level 1** | **Level 2** | **Level 3** | **Level 4** |
| **1 Digit** | **1 Digit** | **5 Digit** | **2 Digit** |
| 2 | 2-**XX** | 2-XXX | 2-XXX |
| Developme nt Activities | Annual Development Program | Electricity Distribution Modernization Program Ongoing Activities Program | Electricity Distribution Modernization Program Ongoing Activities Program |

8. **Power Division and BREB have a strong budget execution and implementation track record.** There has been only a minor deviation in the approved and expected expenditures in recent years (tables 4.3 and 4.4), indicating that the risk of Program funds not being utilized for intended purposes is low. Nevertheless, if there is an underutilization of total Program budget that results in the total Program expenditure being less than IDA allocation of US$515 million, the counterpart will have to refund that shortfall amount at the end of the Program period.

**Table 4.3. ADP Utilization of Ongoing Development Program under Power Division**

| Financial Year (FY) | Approved | Actual | Variance | Variance percent |
|---|---|---|---|---|
| FY2019/20 | 2,920 | 2,730 | 190 | 6.50 |

| Financial Year (FY) | Approved | Actual | Variance | Variance percent |
|---|---|---|---|---|
| FY2018/19 | 2,921 | 2,720 | 201 | 6.90 |
| FY2017/18 | 2,935 | 3,036 | (101) | −3.44 |

*Note:* Variance: Approved budget less actual.

**Table 4.4. Development Budget Utilization by BREB Programs**

| Financial Year | 2017–2018 | 2018–2019 | 2019–2020 | 2020–2021 |
|---|---|---|---|---|
| Budget (amount allocated) | 991.8 | 1,116.9 | 813.7 | 499.6 |
| Utilization/actual expenditure | 1,032.6 | 1,131.3 | 798.6 | 487.5 |
| Total number of projects | 16.0 | 17.0 | 14.0 | 11.0 |
| Number of projects - GOB finance | 16.0 | 17.0 | 14.0 | 11.0 |
| Amount allocated - GoB and BREB finance projects | 717.4 | 859.4 | 665.0 | 425.0 |
| Utilization/Actual expenditure - (GOB Finance Project and BREB) | 717.0 | 859.0 | 649.2 | 415.7 |
| Number of projects - donor finance | 5.0 | 6.0 | 8.0 | 7.0 |
| Amount allocated - donor finance projects | 274.4 | 257.5 | 148.7 | 74.7 |
| Utilization/actual expenditure -(donor finance projects) | 315.5 | 272.4 | 148.7 | 71.8 |

9. **The current budget of the PforR program for 2021–26 is US$902 million, of which GOB/BREB: US$250 million, World Bank: US$500 million, and Clean Technology Fund (CTF): US$15 million.** Given the past utilization track of Power Division, BREB, and strengthening of fiduciary capacity proposed under the Program, the risk associated with budget adequacy is moderate.

*Program's Expenditure Framework*

54. **The Program will be implemented over five years, at an estimated total cost of US$902 million, out of which IDA will finance US$515 million including CTF: US$15 million (see Table 4.5 for breakdown of Program costs).** The Program is expected to mobilize at least US$124 million of private capital for distributed energy resources, which is included in the financial envelope of the Program; however private capital mobilized for distributed solar is not an eligible expenditure under the Program. The IDA funds will be disbursed to the Government Single Treasury Account (Consolidated Fund) upon submission of withdrawal applications for DLI advances and results on verification of achievement of disbursement-linked results. The Government will reach on-lend/on-grant agreements with implementing agencies—BREB and Power Cell—to ensure fund flow to Program spending centers and reporting arrangement of Program expenditure.

**Table 4.5. Program Cost Estimates (US$, millions)**

| | Cost Head | BREB Modernization | BREB-SM | Power Cell | Total | Percentage |
|---|---|---|---|---|---|---|
| Economic Code | | | | | | |
| | Operating Cost | 5.6 | | 3.8 | 9.3 | 1 |
| 32571 | Consultancy | 20.0 | | 11.4 | 31.4 | 3 |
| | Capital Expenditure | | | | — | |
| 41121 | Transport Equipment | 0.4 | | | 0.4 | 0 |

| | Cost Head | BREB Modernization | BREB-SM | Power Cell | Total | Percentage |
|---|---|---|---|---|---|---|
| 41122 | Computer and Accessories | 0.0 | 0.0 | 0.8 | 0.8 | 0 |
| 41123 | Electrical Equipment | 712.2 | 20.0 | | 732.2 | 81 |
| | Private Capital Mobilization for distributed solar | 124 | 0 | 0 | 124 | 14 |
| | Others | 3.9 | | | 3.9 | 0 |
| | **Total** | **866.0** | **20.0** | **16.0** | **902.0** | **100** |

**Procurement Planning**

10. **The approach to procurement planning in the Program is adequate.** BREB prepares annual procurement plans and updates them regularly. Power Cell will also undertake of procurement goods and consulting services of relatively small value under the Program. The annual procurement plan is published on the notice board of the agencies and where applicable on their websites and through e-GP systems.

**Procurement Profile of the Program**

11. The following goods and services will be procured under the Program.

**Table 4.6. Procurement Profile**

| Type of Procurement | Category of Items | Total Value (US$, millions) | Range of Larger Expected Contract Size (US$, millions) | Expected Number of Large Contracts |
|---|---|---|---|---|
| Goods | Transformer | 11.4 | 1.5–5.6 | 4 |
| | Conductor | 135.0 | 1.5–40 | 6 |
| | Line hardware | 9.3 | 1.8–5.9 | 3 |
| | Insulator | 5.8 | 2.3–3.5 | 2 |
| | Grounding wire | 5.1 | 1.5–1.8 | 3 |
| | Pole | 114.0 | 5-30 | 2 |
| Work | Substation | 148.0 | 25-45 | 3 |
| | New line and upgradation | 3.8 | 3.8 | 1 |
| | LT to HT conversion, insulated conductor line | 29.0 | 29 | 1 |
| | SCADA establishment | 2.5 | 2.5 | 1 |
| | Energy storage system establishment | 7.5 | 7.5 | 1 |
| | Fault locator installation | 2.1 | 2.1 | 1 |
| | River crossing | 6.1 | 6.1 | 1 |
| | Supervision and management consultant | 7.0 | 7 | 1 |
| | PSI agent | 0.42 | 0.4 | 1 |
| Consultancy | Electrical works design, | 9.4 | 9.4 | 1 |

| Type of Procurement | Category of Items | Total Value (US$, millions) | Range of Larger Expected Contract Size (US$, millions) | Expected Number of Large Contracts |
|---|---|---|---|---|
| firm | implementation and supervision consultant along with GIS data collection | | | |
| Individual consultants | International procurement consultant | 0.224 | 0.2 | 1 |
| | International technical consultant | 0.525 | 0.5 | 1 |

**3.2. Budget Execution**

*Treasury Management and Funds Flow: The Funds Flow Arrangements for Program Implementation*

12. **Technical information on each DLI with time-wise activities and verification protocol of results will be used to prepare funds allocation against each results area.** The fund flow outlined in the Treasury Rules and Supplementary Rules will apply. Generally, development fund release is sought by the implementing agencies based on an Annual Operational Plan approved by the line ministry and funds are released in four equal instalments. BREB and Power Cell would submit the withdrawal application for their respective part upon achievement of DLI or prior result and advance. An amount of up to US$30.8 million will be allocated for prior results from the IDA credit against DLI-1. Disbursements for prior results will be made against the verification of the results following the effectiveness of the credit.

13. **With the Power Division providing oversight to the Program implementing agencies and the Secretary, Power Division, as the principal accounting officer, the risk of unavailability of funds for Program implementation is not envisaged.** Further information on direct payment requests protocol is provided in the Program Fiduciary Systems Assessment.

*Accounting and Financial Reporting*

14. **The financial reporting obligations are specified in the Public Money and Budget Management Act 2009.** All Principal Accounting Officers are required to maintain accounts of their agencies and reconcile regularly with the accounts maintained by the concerned accounts office. Further information on preparation, review and publication of financial reports is provided in the Program FIduciary Systems Assessment.

15. **The chief accounts officer, Power Division, currently uses iBAS for payment processing, accounting, and reporting.** To improve budget monitoring and management under the Program, Budget Execution Reports should show spending against approved and released budget disaggregated by department, scheme, sector/sub-sector, fund, and other of the Budget and Accounts Classification System elements supplemented with output data for release to decision-makers and service delivery managers and published in user-friendly format.

16. **iBAS++, together with the Budget and Accounts Classification System, will be used to prepare the Annual Program Financial Statements.** Program expenditure financed by IDA, CTF and GoB will be channeled through TSA using iBAS for initial recording of expenditure under the unique program code

with separate organizational code for BREB and Power Cell. There will also be fund code for each source of financing. In parallel, BREB will also record the program expenditure in its FMIS along with the program activities funded by its own source. The program financial statements will be comprised of iBAS generated expenditure report and the BREB's expenditure statement financed by BREB's own fund. In parallel, BREB will include its program expenditure in its annual financial statement. Economic codes would be used for the reconciliation process along with the main program code, which will be finalized after the approval of Detailed Project Proposal associated with BREB Program.

*Procurement processes and procedures*

17. **Based on the Public Procurement Act (2006) and the Public Procurement Rules (2008), the procurement systems and processes that are in place for the Program are adequate.** BREB forms the evaluation committee for Program, comprising officials from BREB and other government agencies. The quality of tender and proposal evaluation is also found to be generally acceptable. The Tender and Proposal Evaluation Committees should consult the World Bank's Debarment List prior to finalizing the contract award decision in order to avoid having a debarred firm or entity being awarded a contract under the WB-financed Program.

*Procurement Performance*

18. **The procurement performance of BREB has been found acceptable.** For the large value and complex contracts (awarded between July 1$^{sts}$ 2019 and June 30$^{th}$, 2021), the time taken to complete the procurement process was higher than expected. The indicators of procurement performance are provided in the full standalone FSA. Almost all of the goods and works contracts which are procured through open competition were processed through eGP system.

*Access to Complaint Handling Mechanism*

19. **The complaint handling mechanism for procurement will be strengthened to meet Program requirements.** Complaints related to procurement processes are handled under the Public Procurement Rules (2008), which is acceptable to the World Bank. BREB has agreed to put in place a formal structure to record and address complaints according to Public Procurement Rules (2008). Further information regarding complaints registering and treatment is provided in the Program Fiduciary Systems Assessment.

*Contract Administration*

20. **Program contract administration and management arrangements are acceptable.** However, given the large number of contracts under the Program, the Finance Department may consider reinforcing their contract management dedicated staff, as described in the Program Fiduciary Systems Assessment.

**3.3 Internal Controls**

*Internal Controls*

21. **The Secretary of Power Division as the Principal Accounting Officer (PAO) will ensure that the total expenditure is kept within the limits of the authorized appropriation and that the funds allotted to the Program are spent for the intended purpose.** The PAOr will notably be responsible for observance

and compliance of all relevant financial rules and regulations of the Program through the Program Director. The Secretary of the Power Division is the head of the Procuring Entity .

*Internal Audit*

22. **BREB will strengthen its capacity to undertake risk-based internal audit.** BREB currently has a traditional transaction-based internal audit wing in its Financial Management Unit. BREB will prepare and implement an internal audit modernization plan under the Program including by strengthening Audit Committees to enhance effectiveness of internal audit and institute risk-based internal audit.

*Program Governance and Anticorruption Arrangements.*

23. **Arrangements to deal with issues of fraud and corruption will follow the requirements of the Anti-Corruption Guidelines on Preventing and Combating Fraud and Corruption in PforR lending.** The Administration Wing of the Finance Division handles corruption and other disciplinary cases against employees of the Division. Fraud and corruption issues arising out of statutory audit are handled within the existing mandate of the OC&AG. Three public finance-related committees in Bangladesh—the Public Accounts Committee, Estimates Committee, and Public Undertakings Committee—provide the legislature's oversight of public accounts in the form of 'ex post' reviews of audit reports. The Public Accounts Committee plays a principal role in resolving audit objections as per applicable laws.

24. **The complaint handling mechanism in procurement has two levels: the administrative process and the independent process.** The administrative process involves the handling of complaints by the implementing agency. Where not satisfied with the outcome of the administrative process, the complainant may take recourse in the independent process. The review panel is responsible for the independent process. In August 2005, the Government constituted a Review Panel for Complaints and Appeals to address bidders' complaints and appeals and increased the number of such panels to three in April 2006. Each review panel is in the Central Procurement Technical Unit and consists of three experts (selected from a list of qualified personnel) having experience in handling procurement matters. According to Rule 60(5) of Public Procurement Rules (2008), the decision of a review panel is binding upon the concerned parties.

**Table 4.7. Procurement Review Panel Decisions**

| Year | No of Cases Handled by the Review Panel | Decisions in Favour of | |
|---|---|---|---|
| | | Procuring Entity | Tenderer |
| 2005 | 1 | 0 | 1 |
| 2006 | 10 | 6 | 4 |
| 2007 | 7 | 3 | 4 |
| 2008 | 11 | 7 | 4 |
| 2009 | 26 | 13 | 13 |
| 2010 | 25 | 13 | 12 |
| 2011 | 28 | 14 | 14 |
| 2012 | 41 | 20 | 21 |
| 2013 | 33 | 23 | 10 |
| 2014 | 45 | 27 | 18 |
| 2015 | 20 | 9 | 11 |
| Total | 247 | 135 (54.66 percent) | 112 (45.34 percent) |

25. **The manner of operationalization of the Anti-Corruption Guidelines under the Program has been agreed with the Finance Department.** Key commitments under the Program in this area and how these commitments would be implemented are as follows:

a) All appropriate measures will be undertaken to ensure that the Program is carried out in accordance with the PforR Anti-Corruption Guidelines.
b) Given the Program design, there will be no distinction between Government-financed activities and World Bank-financed activities within the Program; thus, BREB agrees that the Anti-Corruption Guidelines shall be applied in an unrestricted manner for all activities within the Program boundary and all appropriate measures to prevent fraud and corruption in connection with the Program, including (but not limited to) adopting and implementing appropriate fiduciary and administrative practices and institutional arrangements.
c) BREB will identify focal office and key officials responsible for ensuring that the Program activities are implemented in accordance with the provisions of the World Bank's Anti- Corruption Guidelines and agreed protocols. This focal office will promptly inform the World Bank of all credible and material allegations or other indications of fraud and corruption in connection with the Program that come to its attention.
d) Timely and appropriate action will be undertakne to investigate fraud and corruption allegations and indications; report to the World Bank on the actions taken in any such investigation, every six months; and promptly update upon the completion of any such investigation by reporting its findings to the World Bank.
e) In line with the above, for purposes of Section 6 of the Anti-Corruption Guidelines, the BREB's focal office and officials who are responsible will collect, consolidate, and provide to the World Bank, on a semi-annual basis, a report on (i) any material and credible allegations and other indications of fraud and corruption under the Program that come to the attention of implementing agencies during the reporting period, (ii) any investigations launched into such allegations, and (iii) the progress of and outcomes from such investigations and any remedial or corrective actions taken or planned in response to such allegations or the findings of such investigations.
f) Timely and appropriate action will be taken, satisfactory to the World Bank, to remedy or otherwise address the situation and prevent its recurrence if the borrower or the World Bank determines that fraud and corruption has occurred in connection with the Program.
g) For the purposes of Sections 6(f) and 7(b) of the Anti-Corruption Guidelines, BREB confirms that if the World Bank decides to conduct its own inquiry into allegations or other indications of fraud and corruption in connection with the Program, BREB and other entities implementing the Program will cooperate fully with the World Bank's representatives and take all appropriate measures to ensure the full cooperation of relevant persons and entities, including in each case, allowing the World Bank to access sites and facilities, meet with relevant persons and/or entities,

and to inspect all of their relevant accounts, records, and other documents and have them audited by, or on behalf of, the World Bank.

h) BREB and Power Cell will ensure that any person or entity debarred or suspended by the World Bank will not be awarded a contract under the Program or otherwise allowed to participate in the Program during the period of such debarment or suspension.

i) BREB and Power Cell will report to the World Bank on actions taken in any investigation into fraud and corruption allegation or other indications. BREB will use a template for reporting that has been agreed between the Economic Relations Division (Ministry of Finance and World Bank.

(j) If there are reported allegations, which might constitute a serious risk to the implementation of the Program, the reputation of the borrower or the World Bank, or to the proper use of the proceeds of IDA financing, BREB will immediately inform the World Bank.

**3.4 Auditing**

*Program Audit*

1. **The Program audit will be carried out by the OC&AG through the entity financial statement of the Finance Department that will include the Program transactions that will be tracked using the operating segment of the Budget and Accounts Classification System.** Currently, the OC&AG is undergoing reform whereby it is moving to an entity audit model by combining revenue and development expenditure in a single financial statement and will be audited by a single Audit Directorate. The independent auditor will pay special attention to the risks of material misstatement of the financial statements due to fraud, in line with International Standards on Auditing 240: "The auditor's responsibilities relating to fraud in an audit of financial statements." There is no pending audit report by BREB and Power Cell under any on-going or closed Bank Financed operation. The audit report is to be submitted before nine months of the end of the Fiscal Year.

**3.5 Procurement and Financial Management Capacity**

26. **The Program implementing agencies are advised to strengthen their procurement and financial management capacity.** This is the first PforR to be implemented by the implementing agencies. The Chief Accounts Officer, Finance Department, will need to assign staff in each agency who will focus on processing and reporting on the Program expenses. It will also be important to ensure that staff dedicated to the Program receive formal training on procurement and financial management including the PforR instrument and its requirements.

## Section 4: Program Systems and Capacity Improvements

**Table 4.9. FSA Inputs to the PAP**

| Risk | Mitigation Measures | Timing | Type of Action (PAP, DLI) |
|---|---|---|---|
| 1. **Planning and Budgeting**<br>Risk of inefficient allocation of budget due to lack of timely budget allocation to implementing agencies and inadequate coordination between budgeting processes and procurement planning | Institute arrangements in implementing agencies to ensure coordination between budget and procurement planning. | 2022 | PAP |
| 2. **Budget Execution**<br>Risk of delayed implementation of Program due to inefficient budget execution and duplicative institutional reporting arrangements where separate financial accounts are being maintained by DDO and Chief Accounts Officers | Mainstream IBAS for recording and reporting Program expenditure for all implementing agencies.<br><br>Ensure on-lending/granting arrangements with BREB for its downstream fund flow and release to ensure funding is available on time at the spending center. | 2021<br><br>2022 | PAP<br><br>PAP |
| 3. **Internal Controls**<br>Risk of weak oversight of processes and quality due to weak Internal Audit capacity and practice in BREB | Develop and implement an internal audit modernization plan for BREB that includes (a) issuance of a Model Internal Audit Charter and risk-based internal audit manual and (b) establishment of a system for annual procurement planning and procurement post review and associated training. | 2023 | PAP |
| 4. **Auditing**<br>Risk of non-compliance with the financial covenants and inability to identify and take remedial measures due to delays in resolution of audit observation | Strengthen the audit committee and establish processes and mechanisms for completing annual audit, including procurement audit and resolving audit observations. | 2024 | PAP |
| 5. **FM Capacity**<br>Risk of inefficient and ineffective financial management due to absence of experienced and qualified FM staff to meet the needs of its growing investment program | Focused Training on FM for staff in BREB, and Power Cell.<br><br>Prepare guidance notes on use of iBAS++ for the IDA component of the Program. Develop Information and Communication Technology -based internal control systems at BREB linking procurement, payments, and asset register in the Financial Management Information System of BREB; and update FM operations manual.<br><br>Prepare an updated FM operation manual and risk management manual. | 2022<br><br>2022 | PAP |

| Risk | Mitigation Measures | Timing | Type of Action (PAP, DLI) |
|---|---|---|---|
| 6. Inadequate public confidence in procurement processes carried out by the implementing agencies resulting in low participation of bidders | BREB and Power Cell to establish and maintain a separate publicly accessible website dedicated for the overall program where all disclosable procurement data including annual procurement plans, procurement notices, complaints/resolution, contract award information, quarterly procurement performance progress reports under the overall Program will be available and regularly updated. | Within three months of project effectiveness | PAP |
| 7. Inefficiencies in procurement process due to e-GP system not being used for International Competitive Bidding method | BREB and Power Cell will use the e-GP system for at least one-third of their contracts procured through the ICB method under the overall program. | Within three months of the availability of e-GP system's ICB module | PAP |

**Section 5: Implementation Support**

27. The fiduciary team will work with the borrower to monitor implementation progress and address underperforming areas identified in the PAP.

## ANNEX 5. Summary Environmental and Social Systems Assessment

1. **This annex provides a summary of the disclosed ESSA of the PforR Program**. The ESSA was carried out to meet the requirements of the Program for Results Financing Policy and Directive.

2. **The ESSA finds that the expected environmental and social impacts of the Program are moderate.** Adequate legal, regulatory, and institutional arrangements are in place to manage them to ensure consistency with the six core principles outlined in the World Bank's Policy on PforR Financing. The ESSA proposes measures to address gaps and strengthen capacity of the Program to manage environmental and social impacts.

**Program Environmental and Social Risk and Opportunity Assessment**

3. **The anticipated environmental and social risks of the Program are not significant.** There will be minimal to no land acquisition as BREB will use own or Government-owned lands to the extent possible, and no resettlement is anticipated at this stage. The Program will exclude any activity that may have significant adverse environmental and social impacts that are sensitive, diverse, or unprecedented. No permanent adverse impacts are expected for augmentation of the existing facilities and extension/strengthening the existing distribution network.

4. **The expected environmental and social impacts of the Program can be mitigated.** There will be construction-related impacts such as air pollution, noise emissions, waste generation, health and safety of workers and communities, and exposures to electrical hazards from the use of tools and machinery. However, the expected environmental and social impacts are moderate with known mitigation measures available in the industry and can be mitigated through implementation of Environmental Code of Practice and Environmental and Social Management Plans. For BESS, contractual arrangements with solar panel suppliers will include buying back or taking back used batteries for safe disposal. This should ensure proper recycling and reduce risk of lead pollution from unplanned disposal of solar batteries.

**Program Environmental and Social Management System Assessment**

5. **The legal, regulatory, and institutional framework for managing environmental and social impacts of the Program is adequate.** The relevant laws, policies, instruments, and so on in Bangladesh are deemed adequate for both protection, safety and social security, and inclusiveness of the populace and conservation of environmental resources although enforcement capacity needs to be improved.

6. **BREB has a track record of managing environmental and social risk of similar activities satisfactorily**BREB has an Environmental and Social Management Office set up in its permanent organogram with eight regular staff headed by Director-level staff. They implemented the World Bank-financed Rural Electricity Transmission and Distribution Project, which was classified as Category B under the safeguards operational policies based on the associated environmental and social issues. It is reported that overall compliance status of the Environmental Management Plan and implementation of the Resettlement Action Plan at various subproject sites is satisfactory.

**Recommendations and Actions**

7. **The ESSA recommends addressing institutional capacity constraints and gaps across a range of environmental and social areas.** These measures for improvement of the environmental and social management system have been discussed with the implementing agency, BREB. The summary of identified gaps and recommendations, aligned to the core principles, are presented in table 5.1.

**Table 5.1. Identified Gaps and Recommendations**

| Objectives and Issues | Recommended Measures/Actions |
|---|---|
| Environmental and social systems management | |
| Environmental and social management instruments | • BREB to adapt and develop Standard Operating Procedure (SOP) for the Program based on the Environmental and Social Management Framework used by BREB for the World Bank's Rural Electricity Transmission and Distribution Project. The SOP will include i) review of the latest legal regulatory framework; ii) frameworks for Labor Management Plan, Gender and Gender-Based Violence (GBV) Prevention Plan, and Tribal Peoples Plan (TPP), wherever necessary; (iii) a description of the market, including possible suppliers of solar panels, where the solar panels are manufactured, and where the components are sourced; (iv) whether possible suppliers of solar panels are likely to be subject to regulations on preventing forced labor and what these regulations may require them to have in place (e.g. policy on forced labor, code of conduct); and (v) typical terms and conditions in a sale/purchase agreement for solar panels, and whether it might be possible (based on the fiduciary system assessment for the PforR) to consider the feasibility of including contractual requirements on forced labor in national procurement contracts |
| Strengthen institutional capacity for safeguards management at the central level | • BREB to carry out training and capacity building for management and staff in the BREB Environmental and Social Management Unit on environmental and social management.<br>• BREB to recruit a dedicated social and environmental specialist or consultants in its Environmental and Social Management Unit for this Program. |
| Training of PBS staff and contractor/subcontractors on environmental and social risk and impact mitigation, labor management, GBV issues, stakeholder engagement, and GRS issues | • BREB to arrange for training and capacity building on environmental and social management for staff engaged in supervision at the PBS level, their contractors, and subcontractors. |
| Measures to increase accountability for the ESMP compliance at the field level | • BREB to arrange for training for subcontractors and labor contractors on their ESMP obligations related to ESMP compliance.<br>• BREB to incorporate the ESMP compliance requirements in its contractual agreements with contractors and contractors and subcontractors.<br>• BREB to ensure that daily records of site supervision by the safety officer are maintained. |
| Child and forced labor management and third-party monitoring | • BREB to ensure that requirements for minimum legal age for employment according to Bangladesh's labor law are incorporated in the contractual documents with civil works contractors and to arrange third-party monitoring |

| Objectives and Issues | Recommended Measures/Actions |
|---|---|
| | under the Program, as needed, to monitor compliance of child labor-related laws and convention and environmental and social compliance. BREB will take necessary action to the prevent the import of products that were produced with child/forced labor. |
| Land acquisition and resettlement | • BREB to ensure that Program financing is not used to support investments that, in the World Bank's opinion, involve land acquisition and/or resettlement of a scale or nature that will have significant adverse impacts on affected people or the use of forced evictions.<br>• BREB will use its own or Government-owned land to the extent possible. Whenever needed, BREB will purchase land using a willing buyer and willing seller approach. Program SOP on environmental and social management under preparation by BREB must include detailed procedures of negotiated settlement and voluntary land donation.<br>• The Program SOP developed by BREB will include detailed procedures of negotiated settlement and voluntary land donation. |
| Labor influx management and GBV | • BREB to ensure, as needed, that contractors develop site-specific measures and working plan for labor management in consultation with local community including specific clauses on labor influx management, child labor restrictions, and minimizing GBV.<br>• BREB to arrange third-party monitoring and establish a grievance redress mechanism for settlement of labor-related complaints and grievances including GBV. |
| Stakeholder engagement and grievance redress mechanism | • BREB to include detailed guidelines for stakeholder engagement in the Program Environmental and Social Management Framework that is under preparation.<br>• BREB to ensure recording and disclosure of grievances need to be ensured at field and project level. |
| Integrating local community and grassroot leadership in the project | • BREB to ensure that community-based PBS Boards are consulted on important Program decisions. |
| TPP | • BREB to, if necessary, prepare a TPP according to the World Bank's latest guidelines if Program activities are undertaken in the tribal Garo community areas to maximize benefits to the tribal peoples. |

**Consultations and Disclosure**

8. The ESSA preparation involved extensive stakeholder consultations and disclosure of the ESSA report following the guidelines of the World Bank's Access to Information Policy, including a virtual stakeholder consultation workshop on June 10, 2021.

9. The draft ESSA has been disclosed on June 10, 2021 before stakeholders' consultations. The World Bank disclosed the final ESSA on the World Bank's external website on October 25, 2021.\

## ANNEX 6. PROGRAM ACTION PLAN

| Action Description | Source | DLI# | Responsibility | Timing | | Completion Measurement |
|---|---|---|---|---|---|---|
| BREB to recruit dedicated social and environment specialist or consultant | Environmental and Social Systems | | BREB | Due Date | 31-Mar-2022 | The Bank team will monitor this action as part of its implementation support missions. |
| BREB to prepare and adopt a Program Standard Operating Procedures (SOP) for environment and social management. | Environmental and Social Systems | | BREB | Due Date | 30-Jun-2022 | The Program SOP will be adapted from the ESMF developed for the Rural Electricity Transmission and Distribution project including the framework for environment and social screening, impact assessment, management, and monitoring for the Program. |
| BREB to arrange training on environmental and social management to BREB/PBS staff, contractors and subcontractors | Environmental and Social Systems | | BREB | Due Date | 30-Sep-2022 | The Bank team will advise BREB/PBS on training curriculum and support the completion of this action as part of its implementation support missions. |
| BREB to prepare and implement a internal audit modernization plan including training of relevant Financial Management staff and consultants | Fiduciary Systems | | BREB | Recurrent | Yearly | As per the FSA, the plan include i) issuance of a model internal audit charter and risk based internal audit manual; ii) annual procurement planning and, procurement post review and (iii) issuance of internal audit reports. |
| BREB and Power Cell to strengthen planning, budgeting and budget execution by i) improving co-ordination between budgeting and procurement planning; ii) mainstreaming IBAS-PMAP and iii) completing certified training on | Fiduciary Systems | | BREB and Power Cell | Recurrent | Yearly | The completion of this actions will be tracked as part of Program implementation support missions. |

| | | | | | | |
|---|---|---|---|---|---|---|
| FM and procurement. | | | | | | |
| BREB to (i) strengthen it's complaint monitoring and management system and (ii) Identify and strengthen the focal office and key officials responsible for ensuring compliance with the Bank's Anti Corruption Guidelines and agreed protocols. | Fiduciary Systems | | BREB | Recurrent | Yearly | The completion of this actions will monitored as part of Program implementation support missions. |
| BREB to i)maintain a publicly accessible website with information on Program procurement; ii)maintain an electronic complain register following PPR-2008; and iii)adopt the national e-GP to process and retain all procurement records for auditors. | Fiduciary Systems | | BREB | Recurrent | Semi-Annually | The completion of this action will be tracked as part of implementation support missions. |
| BREB has established digital systems and processes to track System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) established in selected areas under the program | Technical | | BREB | Recurrent | Yearly | Completion of this action will tracked as part of World Bank implementation support sytems. |
| BREB to complete activities in its Gender Strategy and Action Plan, WePOWER | Technical | | BREB | Recurrent | Yearly | The completion of this action will be tracked as part of World Bank implementation support missions. |

| | | | | | | |
|---|---|---|---|---|---|---|
| partnership and publish an Annual Gender Report on its website. | | | | | | |

## ANNEX 7. Implementation Support Plan

### Focus of Implementation Support

1. Implementation support will include (a) reviewing implementation progress and achievement of Program results and DLIs; (b) supporting the client in resolving implementation issues; (c) carrying out institutional capacity-building activities; (d) monitoring performance of the Program system and implementation of the actions agreed in the PAP; and (d) monitoring changes in Program risks and compliance with the provisions of the legal covenants, as required.

2. The proposed implementation plan is consistent with the PforR operational guidelines. Program implementation rests under the responsibility of BREB, with targeted and continuous implementation support and technical advice from the World Bank and development partners.

**Table 7.1. Main Focus of Implementation Support**

| Time | Focus | Skills Needed | Resources Estimate | Partner Role |
|---|---|---|---|---|
| First 12 months | Institutional capacity enhancement to strengthen country systems<br><br>Technical advice to support Program implementation | Technical, fiduciary, environment, and social | • Three implementation support visits by technical specialists focused on capacity building, regulatory strengthening, continued technical assistance, and monitoring<br>• Two implementation support visits by fiduciary specialists focused on capacity building<br>• One implementation support visit by environmental and social specialists focused on capacity building and reviewing/strengthening effectiveness of redress mechanism | Not applicable |
| 12–48 months | • Institutional capacity enhancement to strengthen implementation capacity<br>• Implementation monitoring<br>• Technical advice to support Program implementation | Technical (including monitoring and evaluation), fiduciary, environment, and social | • Two implementation support visits by technical and fiduciary specialists focused on fiduciary support and implementation support<br>• One implementation support visit by social and environmental specialists focused on strengthening local capacity and implementation support | |
| Midterm review | Implementation progress review and identification of necessary midcourse adjustments | Technical (including monitoring and evaluation), | • One implementation support visit, including technical, fiduciary, social, environment, M&E, and operational specialists | |

| Time | Focus | Skills Needed | Resources Estimate | Partner Role |
|---|---|---|---|---|
| | | fiduciary, environment, social, and operational | | |

**Table 7.2. Task Team Skills Mix Requirements for Implementation Support**

| Skills Needed | Number of Staff Weeks | Number of Trips | Comments |
|---|---|---|---|
| Project management (Task team leader) | 12 | 12 | Singapore/Washington |
| Project management (Task team leader) | 24 | Ongoing | Dhaka |
| Technical specialists | 24 | 12 | Dhaka, Singapore, Washington |
| FM specialist | 12 | 6 | Dhaka |
| Procurement specialist | 12 | 6 | Dhaka |
| Environmental specialist | 12 | 6 | Dhaka |
| Social specialist | 12 | 6 | Dhaka |
| Administrative support | Ongoing | n.a. | Dhaka |

## ANNEX 8. CLEAN TECHNOLOGY FUND

### BANGLADESH: ELECTRICITY DISTRIBUTION MODERNIZATION PROGRAM

**Table A8.1: Indicators of the Project**

| Indicator | CTF/IDA-funded Project | | Scaled-up* Phase |
|---|---|---|---|
| Installed capacity of BESS [MW/MWh] | 10 MW/40 MWh | | 1250 MW / 5000 MWh |
| Installed capacity of VRE supported [MW] | 50 MW (rooftop solar) | | 12,500 MW |
| Tons of GHG emissions reduced or avoided<br>-Tons per year [$tCO_{2eq}$/yr]<br>-Tons over lifetime of the project [$tCO_{2eq}$] | 41,800 $tCO_2eq$/yr<br><br>0.63 $MtCO_2eq$ over lifetime of the Project | | 9,960,000 $tCO_2eq$/yr<br><br>200 $MtCO_2eq$ |
| Financing leveraged through CTF funding [US$ million] | CTF US$15m | US$902m<br>• CTF US$15m<br>• IDA SUF US$500m<br>• Korea Institute for Advanced Technology US$13m<br>• Commercial US$124m<br>• BREB/Bangladesh Government US$250m | US$12,628m<br>• Public US$3,525m<br>• Private US$8,225m<br>• WB RE operations US$750m<br>• KIAT $13m<br>• CTF US$15m |
| CTF leverage ratio [1:X] | 1:54 | | 1: 842 |
| CTF Investment cost effectiveness [US$$_{CTF}$/$tCO_{2eq}$ avoided] | US$24 $_{CTF}$/$tCO_{2eq}$ | | US$0.1 $_{CTF}$/$tCO_{2eq}$ |
| Other co-benefits | • Improved power quality through voltage control.<br>• Improved climate resilience of the power system, including BESS and PV ability to serve critical loads.<br>• Potential for BESS to offer energy-time shifting to reduce capital investment in distribution and transmission networks to accommodate variability of RE supply and peak demands.<br>• Environmental and health co-benefits associated with reduced local pollution ($SO_2$, NOx, soot) resulting from displaced diesel and HFO generation.<br>• Improved energy security through reliance on locally abundant solar electricity.<br>• Improved reliability of the power system by cutting operating reserve cost nearly in half. | | |

*The scaled-up phase (through 2030) assumes full implementation of the IDA Program and CTF investment, which in turn supports achievement of goals set out in the Mujib Climate Prosperity Plan. The Mujib Plan calls for an Energy Storage Action Plan and implementation of the Bangladesh Draft Solar Action Plan. While the requirements for BESS are not laid out, external analyses from NREL (2021) indicate the potential role for BESS and VRE in a least cost power system plan using recent price trends.

## I. Introduction

### (a) Country and sector context

1. **Bangladesh has made considerable headway in increasing access to electricity and power generation capacity.** Access to grid electricity increased from a third of the population in 2000 to 97 percent by 2020. Installed generation capacity quadrupled from 5 GW to 24 GW in the same period. Growth of private sector participation in generation has been significant and now accounts for more than half of the total installed capacity. Improvements in electricity supply have helped underpin economic growth rates of more than 6 percent in the last decade.

2. **The country nonetheless faces significant challenges in securing reliable electricity to support its rapidly growing economy.** Electricity demand in Bangladesh is projected to more than double to 32 GW by 2030 to meet its economic growth targets and per capita electricity consumption, which remain at just 1/7$^{th}$ the average for middle-income countries. Bangladesh transmission and distribution networks and utilities need to be strengthened and modernized to enable them to meet growing demand efficiently and reliably. The Government's efforts to increase generation and electrification have not been accompanied by adequate investment in augmentation and modernization of transmission and distribution networks, leaving them congested and weakened. Furthermore, the power sector is highly vulnerable to natural hazards in Bangladesh, with storms accounting for over 40 percent of outages in some areas. A cyclone in 2007 left 75 million people without electricity[27]. Climate change is expected to make the electricity reliability challenge worse with cyclones interacting with higher sea levels that risk inundating over 10 percent of the Bangladesh population by mid-century[28,29].

3. **The Proposed Program would support the Bangladesh Rural Electrification Board (BREB)'s US$3.2 billion distribution capacity enhancement and modernization program, implemented over 2021-2026.** BREB can capitalize on innovative technologies – digitalization, battery electricity storage systems (BESS), distributed renewables, geospatial information systems (GIS), electric mobility, and flexible demand response – to transform the way electricity is delivered to consumers while supporting the decarbonization and improved climate resilience of the electricity system.

### (b) **Bangladesh CTF Investment Plan**:

4. **The CTF Global Energy Storage Program (GESP) was established by the CTF Trust Fund Committee in June 2019 to make concessional climate finance available for all Climate Investment Funds (CIF) countries**, working through partner MDBs, to support them in accelerating the deployment of a range of energy storage solutions to scale up renewable energy development. GESP was established as a separate thematic window under the CTF focused on energy storage, along the lines of the Dedicated Private Sector Program (DPSP). GESP focuses on energy storage, which likely will play a critical role in moving the world toward a clean energy transformation by smoothly integrating renewable energy into

[27] Nicholas, C. et al. (2019). *Stronger Power: Improving Power Sector Resilience to Natural Hazards. Background paper for Lifelines. World Bank.*

[28] Becker, M, et al. (2020). "Water level changes, subsidence, and sea level rise in the Ganges–Brahmaputra–Meghna delta." *Proceedings of the National Academy of Sciences* 117.4: 1867-1876.

[29] See Annex 1 of Kulp, S.A., Strauss, B.H. (2019) New elevation data triple estimates of global vulnerability to sea-level rise and coastal flooding. *Nat Commun* **10,** 4844.

existing and developing power grids, increasing the share of renewable energy in power systems, creating a more flexible and reliable grid system, improving energy access, and promoting the electrification of different economic sectors.

5. **Bangladesh has three investment plans agreed with the Climate Investment Funds, with the proposed CTF investment and associated Program fitting under the Scaling Up Renewable Energy in Low Income Countries (SREP) Investment Plan**. Other investment plans include the Forest Investment Programme (FIP), Pilot Program for Climate Resilience (PPCR).

6. **SREP is seeking to overcome barriers to transformational energy sector technologies that are scalable, have substantial resource availability, unrealized market development, and which are investment ready.** The Government of Bangladesh has been supported through SREP to focus on grid-connected renewable energy, including 200 MW of utility-scale solar and grid-connected rooftop solar. Off-grid solar PV and waste-to-energy projects are also supported by SREP in Bangladesh, with the potential for wind if the resource proves sufficient (See Table 8.2 below). The World Bank's support for SREP is enabling development of utility scale projects, identification of land for RE development, facilitation of competitive RE procurement, and provision of financing for private sector project developers.

7. **The proposed CTF investment under the GESP and the associated World Bank Program supports SREP by enabling the demonstration of battery energy storage technologies in Bangladesh, through financing of related DLIs.** Experience gained through the CTF investment will build technical and institutional capacity at BREB and across the Bangladesh Power Division regarding planning, commissioning, and operating energy storage in the Bangladesh power system. Without the concessional funding for battery storage, the ability of the Government to undertake this type of first-of-a-kind investment for the Bangladesh market could cripple the prospects for BESS, because the appetite of the private sector is weak to undertake investment in innovative technologies without a supportive policy enabling environment or track record. These first CTF-supported BESS investments in Bangladesh will inform the development of an associated regulatory/market environment. Through provision of market information the CTF investment will help to mobilize commercial capital to the energy storage sector and realize a least cost and low-carbon development path.

**Table 8.2: Indicative Financing under the Scaling Up Renewable Energy in Low Income Countries (SREP) Investment Plan for Bangladesh, Million US$**

| | | | Grid connected renewables | Off-grid Solar PV | Development support for Waste-to-Energy | Total |
|---|---|---|---|---|---|---|
| Phase 1 | **CTF** | ADB | | 29.95 | | **29.95** |
| | | WB | 28.95 | | 0.3 | **29.25** |
| | | IFC | 15.5 | | | **15.5** |
| | **MDB** | ADB | | 140 | | **140** |
| | | WB | 200 | | | **200** |
| | | IFC | 30 | | | **30** |

| | | | | | |
|---|---|---|---|---|---|
| | **Bangladesh counterpart** | 69.45 | 25.35 | | **94.8** |
| | **Other donors** | | | | **0** |
| | **Private Sector** | 190 | | | **190** |
| | **Sub-Total** | **533.9** | **195.3** | **0.3** | **729.5** |
| Phase 2 | **CTF** | | | | **0** |
| | **MDBs** | 1517.5 | 101 | 100 | **1718.5** |
| | **Bangladesh counterpart** | 523.4 | 79.2 | 31.7 | **634.3** |
| | **GCF** | 150 | 25 | 30 | **205** |
| | **Private Sector** | 1375 | 414 | 46 | **1835** |
| | **Sub-Total** | **3565.9** | **619.2** | **207.7** | **4392.8** |
| | TOTAL | ***4099.8*** | ***814.5*** | ***208*** | ***5122.3*** |

(c) **Project description**: summarize project, including proposed transformation and rationale for CTF financing (2-3 paragraphs).

8. **The proposed operation will help BREB shift from a traditional grid architecture to one with the ability to support two-way flow of electricity and information, growing numbers of low-carbon distributed energy resources, and customers as both power suppliers and demand managers**. This will be achieved through greater digitalization of network operations - SCADA, ADMS and AMI and integration of distributed energy resources such as rooftop solar, BESS and Electric Vehicle infrastructure. These investments will be mobilized alongside a broader buildout of distribution network capacity informed by planning assessments of future climate and natural hazard risks. Collectively the proposed operation will strengthen BREB's ability to meet rapidly growing electricity demand reliably, efficiently, and sustainably.

9. **CTF financing is crucial to overcome several barriers to uptake of BESS, which is an enabler of the power system's progressive transition to solar power.** Pilot BESS projects supported by the program will: 1) enable demonstration of battery energy storage technology, operation and maintenance in Bangladesh, which is a frontier market with heightened perception of risk around safety, functionality, and profitability; 2) build technical and institutional capacity at BREB and across the Bangladesh Power Division through experience and training; and 3) inform the approach of an energy storage roadmap for Bangladesh including regulatory/market environment for future planning, commissioning and maximizing system value from energy storage and helping to mobilize commercial capital.

10. **By enabling investment in BESS, CTF support improves the flexibility of the BREB network and accelerates uptake of the program's distributed solar components**. There is significant grid-connected distributed solar potential in BREB's service areas. Integration of distributed solar in co-ordination with BESS can amplify the benefits of each technology. This includes for reducing distribution losses (by moving supply closer to demand centers), improve reliability through islanding and voltage control, make distribution networks more efficient and resilient to extreme weather events, help defer network investments and augmentation through peak shifting, and displace diesel generation used for backup

power. The proposed operation will support BREB in implementing net metering connections for accelerated uptake of distributed solar, to implement business models for BREB to be invested in the scale up of solar and BESS such as through utility-ownership models and public private partnerships (including at special industrial zones). CTF's support for BESS will enable an additional 50 MW of grid-connected distributed solar to be connected in the BREB distribution network, complemented by the other modernization elements of broader investment Program. CTF support will enable the Government to undertake a faster scale-up of proposed solar energy investments – leveraged by flexibility from BESS – than would be possible with non-concessional financing by financing the program expenditures .

## II. Assessment of Proposed Project with CTF Investment Criteria[30]

### A. Potential for GHG Emissions Savings

*Emissions Reduction Potential of Investment:*

**The CTF supported elements of the Program would be expected to reduce emissions by 41.8 $ktCO_2eq/yr$, or 0.63 $MtCO_2eq$ over the lifetime of the investments.** These estimated savings/ emission reductions are based on 10 MW/40 MWh of battery energy storage systems located within the BREB distribution network that enables 50 MW of rooftop solar generation. In this project case, solar generation exceeding the storage capacity of the batteries is assumed to integrate directly into the grid where it displaces gas generation. When the BESS discharges in the evening (with a roundtrip efficiency of 90 percent), it is displacing a mix of HFO and diesel generation that constitutes a third of installed capacity and commonly provides peak load and reserves in Bangladesh. Therefore, the emissions benefits originate from two sources: the gas displaced by solar generation, and the HFO/diesel displaced by the stored solar energy discharged from the battery. Two counterfactuals may be considered. The primary counterfactual assumes that battery storage enables integration of solar power into the distribution network, given peaking constraints, so the solar and battery benefits are considered together against a counterfactual of electricity service from gas, and peaking power from HFO/diesel. A second counterfactual can assume that rooftop solar is built and generates without the CTF-supported program and energy storage assets. The solar would displace only gas generation but not the HFO/diesel in the evening. This counterfactual still reduces emissions (by 38 kt CO2/yr) which is 8 percent lower than the proposed CTF investment.

11. **A higher fidelity model simulation of two prospective BESS and distributed PV investments in the BREB network produced similar estimates regarding the emissions abatement potential of the CTF investment**. Two distribution feeders were selected in districts with high susceptibility to storm outages (Jessore and Brahman Baria) which may be candidates for investments to improve resilience. The solar rooftop potential was estimated using satellite imagery for each of the 33/11 kV sub-stations in the respective feeders. Probabilistic outage events were simulated using Monte Carlo simulations to approximate the performance of alternative investment options in terms of reductions in unserved energy, reductions in power purchase requirements, more efficient peak load management, minimized voltage deviation, loss reduction, and minimization of outages. The results for Jessore and Brahman Baria

[30] For reference: *CTF Investment Criteria for Public Sector Operations*, *https://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/CTF_Investment_Criteria_Public_Sector_final.pdf*

are presented in Table 8.3. The available solar PV potential was a limiting factor in these feeders and the BESS sizing was approximated as 10 percent of the sub-station transformation capacity (larger capacities of BESS were possible, but with decreasing returns for outage mitigation). While not optimal investments – as reflected in the higher abatement cost (cost effectiveness), the sample investments reveal that while the majority of the emissions abatement comes from the ability of solar to displace power purchases from the power grid, there are substantial benefits for outage mitigation, peak management, and voltage control. Eighty-six percent of the BESS value comes for voltage support, which is critical in distribution systems as the share of solar power increases. The remaining BESS value is in serving to reduce unserved energy during outages and periods of peak demand.

**Table 8.3: Summary of proposed CTF investment, alongside comparable investments analyzed in the BREB network, and the scaled up phase.**

| | ***Proposed CTF investment*** | | | **Jessore** (sample investment in BREB network) | | | **Brahman Baria** (sample investment in BREB network) | | | ***Scaled-Up Phase (to 2030)*** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Solar PV* | *BESS* | *total* | *Solar PV* | *BESS* | *total* | *Solar PV* | *BESS* | *total* | *Solar PV* | *BESS* | *total* |
| Capacity [MW] | 50 | 10 | | 47 | 16 | | 39 | 15 | | 12500 | 1250 | |
| Solar PV annual generation [GWh] | | | 100.7 | | | | | | | | | 25185 |
| BESS charging @ 1 cycle/day and 90 percent efficiency [GWh] | | | 16.2 | | | | | | | | | 2027.8 |
| Remaining PV for displacing gas [GWh] | | | 84.5 | | | | | | | | | 23157 |
| *Annual icremental benefits associated with Solar or BESS* Reduction in Un-Served Energy due to Roof-top Solar [GWh] | | | | 0.21 | 0.26 | 0.47 | 0.23 | 0.09 | 0.32 | | | |
| Reduction in power purchase [Gwh] | | | | 66 | | 66 | 55 | | 55 | | | |
| Loss reduction due to peak management [GWh] | | | | 0.67 | 0.73 | 1.40 | 0.62 | 0.15 | 0.77 | | | |
| Avoided gas emissions (@ 0.380 kgCO2/kWh) [MtCO2] | | | 0.0321 | | | 0.025 | | | 0.021 | | | 8.7997 |
| Avoided HFO/diesel emissions (@ 0.66 kgCO2/kWh) [MtCO2] | | | 0.0096 | | | 0.001 | | | 0.001 | | | 1.2045 |
| ***Total annual emissions displaced [MtCO2]*** | | | ***0.0418*** | | | ***0.0262*** | | | ***0.0217*** | | | ***10.0*** |
| Lifetime emissions [MtCO2] | | | 0.63 | | | 0.39 | | | 0.33 | | | 200.08 |
| CTF cost effectiveness [US$CTF/tCO2eq avoided] | | | 24.0 | | | 38.1 | | | 46.0 | | | 0.1 |

*Technology Development Status:*

12. **Battery energy storage systems – particularly lithium-ion chemistries – are considered to be mature and commercial technologies in many global market contexts**, particularly advanced economies. Perceptions of technological risk are higher in developing countries, where inadequate demonstration of performance increases risks for safety, functionality, and profitability of BESS deployments and could hobble market development. Many technologies on the global market tend not to be designed specifically for the full range of operational needs in developing countries which has slowed market uptake as project developers, utilities, and financiers look to early experience. Early BESS development in Bangladesh will yield important market knowledge regarding performance under Bangladesh's temperature, dust, and power quality conditions, as well as operational requirements.

B. Cost-effectiveness[31]

13. **Pairing distributed PV and battery storage under the CTF-funded program has a low cost of CO2 emissions abatement, in the range of US$24$_{CTF}$/tCO2.** This cost for avoided emissions is significantly below the social cost of carbon (which starts at US$41-52/tCO2 in 2021 and rises to US$56-88 by the end of the investment lifetime). This implies that the CTF investment is already an efficient mitigation investment. The cost of emissions abatement using energy storage is likely to further improve in Bangladesh as energy storage costs decline with domestic experience and following international trends. The economic analysis further considers the catalytic role of the CTF investment in the Bangladesh power system's sustainable transformation. Bangladesh's Mujib Climate Prosperity Plan calls for both an Energy Storage Action Plan and implementation of the Bangladesh Draft Solar Action Plan representing a step change for solar power in Bangladesh. Enabled by BESS as a critical flexibility resource and coupled with this solar growth, the initial CTF funds achieve emissions reductions for ~US$0.1/tCO2 in the scaled-up phase.

C. Demonstration Potential at Scale

*Scope and strategy for replication, and potential barriers*

14. **The Government of Bangladesh recently cancelled plans to construct ten additional coal-fired power plants totaling 7.4 GW.** What had been planned as a new coal backbone of the power system to supplement the place of gas and diesel generation will instead require substantial renewable energy and flexible resources such as energy storage. Estimates from National Renewable Energy Laboratory (2021) indicate that Bangladesh could optimally deploy 5000 MW of BESS in 2030 with a consequent 8.3 percent reduction in production cost of the power system, resulting mainly from a 34 percent reduction in HFO requirement. BESS would improve reliability by cutting the cost of operating reserve by 46 percent. BESS would largely discharge during the evening peak, which further helps to save on transmission and distribution augmentation costs.

15. **Potential barriers to the uptake of BESS include inadequate performance demonstration at scale and the political economy of HFO.** There is a complex political economy surrounding HFO rental

[31] For reference: CTF Co-Chairs Summary, Agenda Item 8, Cost-Effectiveness of CTF Projects, pp.4-5, October 2013. *https://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/Summary_of_Co_Chairs_CTF_TFC_October_2013_final.pdf*

power plants in Bangladesh, which has resulted in these units being re-authorized for continued use despite their high cost and burden of pollution. The substantial potential for BESS coupled with solar power to outcompete HFO and diesel could be compromised if utilities such as BREB do not internalize the value proposition and push for realization of these technologies' potential. Utilities have not traditionally been seen as proponents of distributed generation such as solar rooftops, however the EDMP program helps BREB to construct business models where both the utility and consumers gain.

*Transformation potential*

16. **The Proposed Program – by improving the capability of the power system to integrate distributed energy resources and strengthening sector institutional capacity – is expected to be instrumental in scaling up solar energy in Bangladesh.** The Bangladesh Government is actively considering a Draft National Solar Energy Action Plan that indicates scenarios for solar growth by 2041, as follows: BAU (8 GW, 62 percent is utility or IPP, 25 percent rooftop), Medium (25 GW, 61 percent is utility or IPP, 30 percent rooftop), high (40 GW, 62.5 percent is utility or IPP, 30 percent rooftop). The Scale Up phase of the Proposed Program is assumed to support achievement of at least the Medium scenario, with half attainment by 2030.

17. **NREL's estimate for BESS needs in 2030 represents a 500-fold increase in the capacity of installed batteries beyond the CTF-supported program target of 10 MW, starting from a base of zero today[32].** The CTF-supported catalytic investment will demonstrate the system value of energy storage, provide BREB with experience planning, commissioning and operating energy storage for power system optimization, and signal to the market that energy storage is bankable particularly as costs continue to fall.

D. Development Impact

18. **The Program is expected to increase BREB's capacity to integrate variable renewable energy, particularly grid-connected solar rooftops, battery storage and manage its peak load and capital expenditure in the Dhaka-Mymensingh Division**. The Program is closely aligned with the GoB's plans for the Modernization and Capacity Enhancement of BREB's network to increase distribution network capacity, digitalization, and climate resilience. The Program will also enable BREB to integrate customers as both power suppliers and demand managers and strengthen BREB's ability to meet the projected increase in electricity demand. The Program investments will also improve the quality of service experienced by BREB's customers, reduce electricity distribution losses that weigh on the finances of BREB, and improve the resilience of the power system to extreme weather and natural hazards.

19. **Economic analysis by the Bank finds that the Program's investments will bring substantial economic benefits to Bangladesh's economy**, by helping to displace expensive diesel-based self-generation and fossil fuel generation, meet growing demand, and improve the efficiency and reliability of the power system. The Program's economic rate of return is 34.2 percent (NPV US$6.3 billion) over a 30-year period. The levelized economic costs of electricity served with the Program is estimated at US$ 7 cents compared to US$ 10 cents without the Program. The Program will also lead to improved reliability and climate resilience of the power system, including by cutting operating reserve costs nearly in half.

[32] NREL (2021) "Energy Storage in South Asia: Understanding the Role of Grid-Connected Energy Storage in South Asia's Power Sector Transformation". *https://www.nrel.gov/docs/fy21osti/79915.pdf*

20. **Environmentally, the CTF-funded Program is expected to reduce emissions by 41.8 ktCO2eq/yr, or 0.63 MtCO2eq over the life of the Program, based on the decarbonization scenario considered in the Green House Gas (GHG) accounting analysis**[33]. The reduction in GHG emissions is on account of displacement of diesel self-generation and fossil fuel generation with renewable energy and reduction in technical losses from the implementation of the Program. The Program will also have environmental and health co-benefits through the reduced local pollutants such as sulfur dioxide ($SO_2$) and nitrogen oxide (NOx) from generating electricity with inefficient diesel and HFO generators.

21. **The Program will help advance gender equity in BREB and across its PBSs.** BREB is committed to improving its organizational gender diversity and equity, and it became a WePOWER (South Asia Women in the Power Sector Professional Network) partner in 2020. Under the Program, BREB will develop a Gender Strategy and Action Plan to increase the number and quality of jobs for women at BREB and PBS. BREB will i) strengthen outreach and recruitment efforts for Science Technology Engineering and Mathematics students and female engineers; ii) adopt gender-friendly human resource policies to attract and retain female staff; iii) ensure training and job placement of women into technical positions as part of its modernization efforts for network digitization and smart infrastructures - such as on SCADA systems and electric vehicle charging stations; iv) ensure the participation of at least 40 percent of women beneficiaries such as women's groups and women entrepreneurs, in BREB awareness and engagement activities; and v) internalize gender awareness training and guidance on gender-responsive communication, including stakeholder interaction, community events, and promotional campaigns.

### E. Implementation Potential

22. **The implementation potential of the program is high as it is aligned with the Government's plans for the sector and there is strong ownership within the GoB.** The Government adopted net metering regulations in 2018 to facilitate the adoption of distributed solar and is currently updating its power sector development plan to establish a carbon-neutral energy system by 2050. The Integrated Energy and Power Sector Masterplan, currently under preparation, will provide a roadmap for the introduction of low carbon policies and technologies to facilitate Bangladesh's transition towards a low or zero carbon society. The Program also benefits from a complimentary World Bank Scaling Up Renewable Energy Project which provides financing and technical assistance for rooftop PV projects. Assessments carried out by the Bank show that there is significant distributed solar potential in BREB areas and integration of distributed solar can reduce distribution losses, improve reliability[34], and make distribution networks more efficient and they could also help defer distribution investments. BREB's commitment to piloting BESS is evident in its efforts underway to work with the World Bank and Korean Institute for Advanced Technology (KIAT) to identify substations for distribution-level BESS for voltage control and peak shifting services. The advanced client dialogue has also enabled the World Bank to engage the KIAT to mobilize over $10 m in grant support to analyze and pilot BESS in the BREB network.

## III. CTF Additionality

23. **CTF funding will help to overcome the viability gap for energy storage in BREB's network while**

[33] This decarbonization scenario assumes that share of renewable energy in electricity mix increases to 50 percent by 2050.
[34] When distributed solar was modelled near a 33/11 kV substation in Jessore PBS using power flow software, it reduced technical losses by 65 percent and substations loading by more than 50 percent.

**BESS costs remain higher than prevailing international prices. CTF support will also help mitigate perceptions of technology risk given undemonstrated performance in Bangladesh, and commercial risk given the uncertain value streams as the market and regulatory environment for energy storage matures.** The CTF funds will enable application of new use cases for pilots in the Bangladesh network, including potentially alongside solar for special economic zones, for islanding capability to critical loads in event of extreme weather, and for capital investment deferral in the distribution network. On basis of the CTF-supported pilots under the Program, the World Bank plans to apply for additional scale up funds – as a second phase operation with BREB – from the Green Climate Fund on the order of US$200 million.

## IV. Implementation Readiness

24. **The level of readiness for implementing the Program is high given BREB's strong track record as a capable implementing agency.** The Bank has had a long engagement with BREB going back to 1981 and seven operations to support the Government's electrification and access programs. During this period, BREB has with the Bank's assistance strengthened its organizational systems and implementation capacity and emerged as a capable implementing agency. In the last decade, BREB successfully implemented large Government programs using its own systems and processes. BREB has a well-established monitoring and reporting system that tracks progress of the implementation of all BREB energy projects on a monthly, quarterly, and annual basis and feeds into its Management Information System. This system also forms the basis for BREB reporting on its results framework and Annual Performance Agreement with the MPEMR. Program Steering Committees, consisting of relevant Government ministries and agencies, will ensure coordinated implementation of the Program.

25. **The World Bank is supporting BREB with technical assistance to prepare for deployment of the CTF's resources once the investment program is approved.** This technical assistance incorporates energy storage and distributed solar power in two components, first on business models and investment identification for distributed energy resources, and second on building capacity for integrating extreme weather and natural hazard risks into asset and system level planning. In addition to informing the proposed investment program, this technical assistance will assist in preparation of the action plans for scaling up implementation of energy storage and solar as part of the sustainable transformation of the Bangladesh power system.