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Report No: PAD5268

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED IDA CREDIT

IN THE AMOUNT OF SDR 141.40 MILLION  
(US\$187.6 MILLION EQUIVALENT)

AND

PROPOSED IDA CREDIT ON SHORT MATURITY LOAN TERMS  
IN THE AMOUNT OF SDR 39.5 MILLION  
(US\$52.4 MILLION EQUIVALENT)

AND

PROPOSED IDA SCALE-UP WINDOW CREDIT  
IN THE AMOUNT OF US\$60 MILLION

TO THE

PEOPLE'S REPUBLIC OF BANGLADESH

FOR THE

GAS SECTOR EFFICIENCY IMPROVEMENT AND CARBON ABATEMENT PROJECT

June 28, 2023

Energy and Extractives Global Practice  
South Asia Region

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## CURRENCY EQUIVALENTS

(Exchange Rate Effective May 31, 2023)

Currency Unit = Bangladeshi Taka (BDT)

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BDT 107.25 = US\$1

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US\$1.33 = SDR 1

FISCAL YEAR

July 1 – June 30

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## ABBREVIATIONS AND ACRONYMS

BERC	Bangladesh Energy Regulatory Commission
BCM	Billion Cubic Meters
BoP	Balance of Payment
CCB	Climate Co-Benefit
CCS	Carbon Capture and Storage
CHS	Community and Worker Health and Safety
CPF	Country Partnership Framework
DA	Designated Account
EIRR	Economic Internal Rate of Return
EMRD	Energy and Mineral Resources Division
EPA	US Environmental Protection Agency
ERD	Economic Relations Division
ESCoP	Environment and Social Code of Practices
ESCP	Environmental and Social Commitment Plan
ESF	Environmental and Social Framework
FAPAD	Foreign Aided Projects Audit Department
FM	Financial Management
GBV	Gender-Based Violence
GCRF	Global Crisis Response Framework
GDF	Gas Development Fund
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIS	Geographic Information System
GoB	Government of Bangladesh
GRM	Grievance Redress Mechanism
GRS	Grievance Redress Service
GTCL	Gas Transmission Company Limited
IA	Implementing Agency
IBAS-PMAP	Integrated Budget and Accounting System Project Management Accounting Portal
IEA	International Energy Agency
IPF	Investment Project Financing
IT	Information Technology
IUFR	Interim Unaudited Financial Report
JICA	Japan International Cooperation Agency
LDAR	Leak Detection and Repair
LMP	Labor Management Procedures
LNG	Liquefied Natural Gas
MACC	Marginal Abatement Cost Curve
MDB	Multilateral Development Bank
MEFCC	Ministry of Environment, Forest and Climate Change
MPEMR	Ministry of Power, Energy, and Mineral Resources
MRV	Monitoring, Reporting, and Verification

NDC	Nationally Determined Contribution
NFC	Near Field Communication
NPV	Net Present Value
O&G	Oil and Gas
O&M	Operation and Maintenance
OHS	Occupational Health and Safety
PDO	Project Development Objective
PGCL	Pashchimanchal Gas Company Limited
PIU	Project Implementing Unit
PPSD	Project Procurement Strategy for Development
PSC	Production-Sharing Agreement
SCADA	Supervisory Control and Data Acquisition
SEA/SH	Sexual Exploitation and Abuse/Sexual Harassment
SEP	Stakeholder Engagement Plan
SOE	State-Owned Enterprise
SPC	Shadow Price of Carbon
STEP	Systematic Tracking of Exchanges in Procurement
SUW	Scale-up Window
TA	Technical Assistance
TGTDCL	Titas Gas Transmission and Distribution Company Limited
TOR	Terms of Reference
WBG	World Bank Group



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DATASHEET

**BASIC INFORMATION**

Country(ies)	Project Name	
Bangladesh	GAS SECTOR EFFICIENCY IMPROVEMENT AND CARBON ABATEMENT PROJECT	
Project ID	Financing Instrument	Environmental and Social Risk Classification
P179009	Investment Project Financing	Moderate

**Financing & Implementation Modalities**

<input type="checkbox"/> Multiphase Programmatic Approach (MPA)	<input type="checkbox"/> Contingent Emergency Response Component (CERC)
<input type="checkbox"/> Series of Projects (SOP)	<input type="checkbox"/> Fragile State(s)
<input type="checkbox"/> Performance-Based Conditions (PBCs)	<input type="checkbox"/> Small State(s)
<input type="checkbox"/> Financial Intermediaries (FI)	<input type="checkbox"/> Fragile within a non-fragile Country
<input type="checkbox"/> Project-Based Guarantee	<input type="checkbox"/> Conflict
<input type="checkbox"/> Deferred Drawdown	<input type="checkbox"/> Responding to Natural or Man-made Disaster
<input type="checkbox"/> Alternate Procurement Arrangements (APA)	<input type="checkbox"/> Hands-on Enhanced Implementation Support (HEIS)

Expected Approval Date	Expected Closing Date
21-Jul-2023	31-Dec-2028

Bank/IFC Collaboration

No

**Proposed Development Objective(s)**

To improve efficiency of gas distribution and end-use, and support carbon abatement in the gas sector

**Components**

Component Name	Cost (US\$, millions)
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Strengthening the gas sector downstream monitoring and control capabilities	433.73
Technical assistance for carbon abatement of the oil and gas value chain	4.01

**Organizations**

Borrower:	Peoples Republic of Bangladesh
Implementing Agency:	Pashchimanchal Gas Company Limited (PGCL) Petrobangla Titas Gas Transmission and Distribution Company Limited

**PROJECT FINANCING DATA (US\$, Millions)****SUMMARY**

<b>Total Project Cost</b>	437.89
<b>Total Financing</b>	437.89
<b>of which IBRD/IDA</b>	300.00
<b>Financing Gap</b>	0.00

**DETAILS****World Bank Group Financing**

International Development Association (IDA)	300.00
IDA Credit	247.60
IDA Shorter Maturity Loan (SML)	52.40

**Non-World Bank Group Financing**

Counterpart Funding	137.89
Borrower/Recipient	137.89

**IDA Resources (in US\$, Millions)**

	Credit Amount	Grant Amount	SML Amount	Guarantee Amount	Total Amount
<b>Bangladesh</b>	247.60	0.00	52.40	0.00	300.00



National Performance-Based Allocations (PBA)	187.60	0.00	52.40	0.00	240.00
Scale-Up Window (SUW)	60.00	0.00	0.00	0.00	60.00
<b>Total</b>	<b>247.60</b>	<b>0.00</b>	<b>52.40</b>	<b>0.00</b>	<b>300.00</b>

**Expected Disbursements (in US\$, Millions)**

WB Fiscal Year	2024	2025	2026	2027	2028	2029
Annual	10.00	45.00	75.00	75.00	75.00	19.85
Cumulative	10.00	55.00	130.00	205.00	280.00	299.85

**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

10. Overall

● Substantial

**COMPLIANCE**

**Policy**

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

Yes  No

Does the project require any waivers of Bank policies?

Yes  No

**Environmental and Social Standards Relevance Given its Context at the Time of Appraisal**

E & S Standards	Relevance
Assessment and Management of Environmental and Social Risks and Impacts	Relevant
Stakeholder Engagement and Information Disclosure	Relevant
Labor and Working Conditions	Relevant
Resource Efficiency and Pollution Prevention and Management	Relevant
Community Health and Safety	Relevant
Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Not Currently Relevant
Biodiversity Conservation and Sustainable Management of Living Natural Resources	Not Currently Relevant
Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities	Not Currently Relevant
Cultural Heritage	Not Currently Relevant
Financial Intermediaries	Not Currently Relevant

**NOTE:** For further information regarding the World Bank’s due diligence assessment of the Project’s potential environmental and social risks and impacts, please refer to the Project’s Appraisal Environmental and Social Review Summary (ESRS).



## Legal Covenants

### Sections and Description

Section I.A.2 of Schedule 2 of the Financing Agreement, Institutional Arrangements:

“By no later than one (1) month after the Effective Date, the Recipient shall, through the MPEMR, establish and thereafter maintain throughout the course of Project implementation, a Project steering committee (“Project Steering Committee”) with a mandate, functions, composition and resources satisfactory to the Association. Without limitation to the immediately foregoing provision, said Project Steering Committee shall (a) be chaired by Senior Secretary or Secretary of Energy and Mineral Resources Division and comprise representatives from the relevant ministries/agencies involved in Project implementation; and (b) meet at least every three (3) months to: (i) provide strategic and policy direction on all Project activities; (ii) review progress in Project implementation; and (iii) address any obstacle during Project implementation.”

### Sections and Description

Section I.A.3(a) of Schedule 2 of the Financing Agreement, Institutional Arrangements:

“By no later than one (1) month after the Effective Date, the Recipient shall cause each of Petrobangla, TGTDC and PGCL to establish and thereafter maintain throughout the course of Project implementation: (a) a project implementation unit within each of Petrobangla, TGTDC and PGCL — respectively PIU-Petrobangla, PIU-TGTDC and PIU-PGCL - with a mandate, functions, and resources satisfactory to the Association, and with staff in adequate numbers and with qualifications, experience and terms of reference satisfactory to the Association. Without limitation on the foregoing, each of PIU-Petrobangla, PIU-TGTDC and PIU-PGCL shall: (a) be headed by a Project director, and (b) be staffed with technical experts and specialists in, inter alia, procurement, financial management, and monitoring and evaluation and reporting, all with qualifications, experience and terms of reference satisfactory to the Association; and (c) be responsible for, inter alia: (i) planning, coordination, implementation and monitoring and evaluation of their Respective Parts of the Project activities; (ii) procurement and financial management; (iii) social and environmental safeguards; (iv) reporting on Project progress, for their Respective Parts of the Project; and, with regards to the PIU- Petrobangla, preparation of consolidated progress reports.”

### Sections and Description

Section 7.01 of the Financing Agreement:

“The Additional Condition of Effectiveness consists of the following: the Subsidiary Agreements have been executed on behalf of the Recipient and each of Petrobangla, TGTDC and PGCL and all the conditions precedent to their effectiveness or to the right of each of Petrobangla, TGTDC and PGCL to make withdrawals under each of their respective Subsidiary Agreements (other than the effectiveness of this Agreement) have been fulfilled.”

### Sections and Description

Section II of Schedule 2 of the Financing Agreement, Project Monitoring, Reporting and Evaluation:

“The Recipient shall furnish to the Association each Project Report not later than one (1) month after the end of each calendar semester, covering the calendar semester. Except as may otherwise be explicitly required or permitted under this Agreement or as may be explicitly requested by the Association, in sharing any information, report or document related to the activities described in Schedule 1 to this Agreement, the Recipient shall ensure that such information, report or document does not include Personal Data.”

### Sections and Description



Section IV of Schedule 2 of the Financing Agreement, Procurement and Use of Drones:

- "1. Prior to procurement and/or use of drones under their Respective Parts of the Project, the Recipient shall, and shall cause each of Petrobangla, TGTDCI and PGCL to:
- (a) notify the Association of such proposed procurement and/or use, and afford the Association a reasonable opportunity to assess any risks related to such procurement and/or use, including operational, legal and regulatory, institutional, technical, social and environmental, and fiduciary risks, and to recommend appropriate mitigation measures; and
  - (b) develop a risk mitigation plan for the procurement and use of drones, in form and substance acceptable to the Association.
2. No drones shall be procured and/or used under their Respective Parts of the Project unless the Recipient has, and shall cause each of Petrobangla, TGTDCI and PGCL to have, implemented the risk mitigation measures in accordance with paragraph 1 above, in form and manner satisfactory to the Association.
3. No drones procured under their Respective Parts of the Project shall be used for any purpose other than those set out in Schedule 1 of this Agreement and for which the risk mitigation plan referred to in paragraph 1(b) above has been developed and implemented, except where the Association has provided its prior approval in writing for such use based on: (a) assessment of the risks involved; and (b) implementation of appropriate risk mitigation measures.
- "

**Conditions**

Type	Financing source	Description
Disbursement	IBRD/IDA	<p>Section I.F.1 of Schedule 2 of the Financing Agreement – Expenditures to be financed with counterpart funds.</p> <p>"1. The Recipient shall: (a) ensure that the following expenditures are financed exclusively out of its own resources or the resources of Petrobangla, and not out of the proceeds of the Financing; and (b) provide, promptly as needed, the resources needed for this purpose:</p> <ul style="list-style-type: none"> <li>(i) all costs associated with land and land use rights required for the purposes of the Project;</li> <li>(ii) Incremental Operating Costs;</li> <li>(iii) procurement of vehicles, recurrent expenditures for the purpose of attending meetings, conferences, seminars, workshops and for all other purposes (sitting allowances/ cash per diems / honoraria), notwithstanding eligible expenditures under Incremental Operating Costs and Training, and recurrent expenditures for fuel, under the Project; and</li> </ul>



		(iv) Taxes exceeding fifteen (15) percent of the total amount of the Financing.”
Type Disbursement	Financing source IBRD/IDA	<p>Description</p> <p>Section I.F.2 of Schedule 2 of the Financing Agreement – Expenditures to be financed with counterpart funds:          “The Recipient shall: (a) ensure that the following expenditures are financed exclusively out of its own resources or the resources of TGTDCI and not out of the proceeds of the Financing; and (b) provide, promptly as needed, the resources needed for this purpose:</p> <ul style="list-style-type: none"> <li>(i) all costs associated with land and land use rights required for the purposes of the Project;</li> <li>(ii) civil works;</li> <li>(iii) Incremental Operating Costs and Training;</li> <li>(iv) procurement of vehicles, recurrent expenditures for the purpose of attending meetings, conferences, seminars, workshops and for all other purposes (sitting allowances/ cash per diems / honoraria), and recurrent expenditures for fuel, under the Project;</li> <li>(v) Taxes; and</li> <li>(vi) goods relating to installation and commissioning of prepaid gas meter that are identified in the Annual Work Plan as being borne by TGTDCI, if any.”</li> </ul>
Type Disbursement	Financing source IBRD/IDA	<p>Description</p> <p>Section I.F.3 of Schedule 2 of the Financing Agreement – Expenditures to be financed with counterpart funds:          “The Recipient shall: (a) ensure that the following expenditures are financed exclusively out of its own resources or the resources of PGCL and not out of the proceeds of the Financing; and (b) provide, promptly as needed, the resources needed for this purpose:</p> <ul style="list-style-type: none"> <li>(i) all costs associated with land and land use rights required for the purposes of the Project;</li> <li>(ii) civil works;</li> <li>(iii) Incremental Operating Costs and Training;</li> <li>(iv) procurement of vehicles, recurrent expenditures for the purpose of attending meetings, conferences, seminars, workshops and for all other purposes (sitting allowances/ cash per diems / honoraria), and recurrent expenditures for fuel, under the Project;</li> <li>(v) Taxes; and</li> <li>(vi) capital goods and consulting services that are identified in</li> </ul>



		the Annual Work Plan as being borne by PGCL, if any.”
Type Disbursement	Financing source IBRD/IDA	<p>Description</p> <p>Section III.B.1(b) –(d) of Schedule 2 of the Financing Agreement – Withdrawal Conditions; Withdrawal Period:</p> <p>“Notwithstanding the provisions of Part A of this Section, no withdrawal shall be made:</p> <p>...</p> <p>(b) under Categories (1) to (2) from the Concessional Credit and the Non-Concessional Credit until the Project Operations Manual is prepared by PIU-TGTDCL and adopted by TGTDCL.</p> <p>(c) under Categories (3) to (4) from the Concessional Credit and the Non-Concessional Credit until the Project Operations Manual is prepared by PIU-PGCL and adopted by PGCL.</p> <p>(d) under Categories (5) from the Non-Concessional Credit until the Project Operations Manual is prepared by PIU-Petrobangla and adopted by Petrobangla.”</p>
Type Disbursement	Financing source IBRD/IDA	<p>Description</p> <p>Section I.B.1 of Schedule 2 of the Financing Agreement – Subsidiary Agreements:</p> <p>“To facilitate the carrying out of Petrobangla, TGTDCL and PGCL’s Respective Parts of the Project, the Recipient shall make part of the proceeds of the Financing allocated from time to time to:</p> <p>(a) Categories 1 and 2 of the table set forth in Section III.A of this Schedule available to TGTDCL from the Concessional Credit and the Non-Concessional Credit;</p> <p>(b) Categories 3 and 4 of the table set forth in Section III.A of this Schedule available to PGCL from the Concessional Credit and the Non-Concessional Credit; and</p> <p>(c) Category 5 of the table set forth in Section III.A of this Schedule available to Petrobangla from the Non-Concessional Credit, under subsidiary agreements entered into between the Recipient and each of the Petrobangla, TGTDCL and PGCL (“Subsidiary Agreements”), under terms and conditions approved by the Association, which shall include inter alia the obligations of each of Petrobangla, TGTDCL and PGCL set out in this Schedule 2.”</p>



## I. STRATEGIC CONTEXT

### A. Country Context

- 1. Bangladesh made rapid social and economic progress in recent decades and reached lower middle-income status in 2015.** Stable macroeconomic conditions supported average annual real Gross Domestic Product (GDP) growth of 6.7 percent between 2010 and 2019. 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. However, the pace of poverty reduction slowed in recent years even as growth accelerated, particularly in urban areas and in the west of the country.<sup>1</sup> Annual consumption growth of the bottom 40 percent (1.2 percent) trailed that of the overall population (1.6 percent) from 2010 to 2016.
- 2. A strong post-pandemic recovery was disrupted by rising global commodity prices and synchronous global policy tightening.** Bangladesh navigated the COVID-19 pandemic with prudent macroeconomic policies, maintaining positive real GDP growth. An effective stimulus program supported a rapid economic recovery in FY21, as movement restrictions ended. However, worsening external conditions led to a surge in imports in mid-FY22. Inflation accelerated, driven by rising commodity prices and an upward adjustment in administered prices of petroleum products. In the first half of FY23, high inflation weighed on private consumption and fiscal consolidation measures slowed government consumption and investment growth. Merchandise exports remained resilient, growing by 7.1 percent in the first eleven months (July-May) of FY23.
- 3.** On the supply side, strong industrial growth in FY22 slowed in the first half of FY23 due to energy shortages, rising input costs, and limited issuance of letters of credit (LC) for key imports. Services growth also slowed from a FY22 post-pandemic rebound as consumer purchasing power declined with rising inflation in the first half of FY23. Modest agricultural growth was sustained, although increases in the diesel price impacted production. Monetary policy was tightened through higher policy rates, although transmission was impaired by a cap on lending interest rates. Tight liquidity conditions and narrow net interest margins weighed on private sector credit growth. A contractionary monetary policy was announced for FY24, and fixed interest rate caps will transition to a reference lending rate and margin cap.
- 4. The Balance of Payments (BoP) deficit widened in FY22 with rising imports.** The current account (CAD) surged in the second half of FY22 amidst rising commodity and intermediate goods prices. Import price moderation and limited LC issuance narrowed the CAD in the first half of FY23, supported by resilient export growth. However, a sharp contraction in trade credit and lower medium- and long-term lending contributed to a financial account deficit, resulting in a US\$8.8 billion BoP deficit in the first ten months of FY23 and a 15.9 percent depreciation of the interbank exchange rate over the same period. Gross FX reserves declined by US\$12.2 billion over a one-year period to US\$27.9 billion at the end of May 2023, as authorities requested additional external financing from development partners. An IMF program was approved by the Executive Board in January 2023.

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<sup>1</sup> World Bank, 2021. Bangladesh Systematic Country Diagnostic Update.



5. **The fiscal deficit widened to 4.3 percent of GDP in FY22 from 3.7 percent in FY21 but remained below the 5 percent of GDP target.** Tax revenue remained among the lowest in the world at 7.6 percent of GDP in FY22. Expenditure growth accelerated with higher subsidy spending as a result of elevated commodity prices. Capital expenditure rose in FY22 led by infrastructure megaprojects, before being rationalized in the first half of FY23 to slow growth of the budget deficit.

6. **Real GDP growth is expected to decelerate to 5.2 percent in FY23 before returning to its long-term trend.** Growth is expected to accelerate in FY24, as inflationary pressure eases and reform implementation accelerates, converging to around 6.5 percent over the medium term depending on the depth of economic reforms implemented. The fiscal deficit is projected to widen to 4.4 percent of GDP in FY23 as lower imports weigh on tax revenues. Over the medium term, the fiscal deficit is expected to gradually narrow with accelerating trade and economic activity, higher incomes, and tax administration reform implementation. The CAD will narrow as imports normalize with moderating commodity prices. Remittance inflows are expected to rise with a higher outflow of workers and resilient demand for workers in the gulf region. A financial account deficit is projected to contribute to external sector pressure in FY23 is expected to moderate in FY24.

7. **Structural reforms are needed to support a faster pace of growth over the medium term.** To achieve the vision of attaining upper middle-income status by 2031, Bangladesh needs to create jobs and employment opportunities by creating a competitive business environment, diversifying exports, increasing human capital, building efficient infrastructure, deepening the financial sector, and establishing a policy environment that attracts private investment. At the same time, Bangladesh will need to implement coordinated policies and investments to address rising climate vulnerabilities.<sup>2</sup> These reforms will support international competitiveness as Bangladesh prepares for graduation from the United Nations Least Developed Country (LDC) status in 2026, which will gradually result in reduced access to concessional financing and preferential external market access for its exports. To achieve the vision of attaining upper-middle-income status by 2031, Bangladesh needs to focus on creating jobs and employment opportunities by fostering a competitive business environment, diversifying exports, increasing human capital, building efficient infrastructure, deepening the financial sector, and establishing a policy environment that attracts private investment.

8. **Bangladesh is at low risk of overall and external debt distress in the January 2023 joint IMF-World Bank Debt Sustainability Assessment (DSA).** Bangladesh is not currently subject to Debt Limits Conditionality under the Sustainable Development Finance Policy (SDFP). In its most recent Staff Report, the IMF stressed the need for Bangladesh to accelerate its ambitious reform agenda to achieve a more resilient, inclusive, and sustainable growth, requiring substantial investments in human capital and infrastructure. The proposed use of IDA's Scale-up Window (SUW) does not alter the debt sustainability risk ratings under the most recent DSA.<sup>3</sup>

9. **Bangladesh faces a high level of vulnerability to the effects of climate change.** The Global Climate Risk Index ranks it as the world's seventh most-affected country in 2000-2019,<sup>4</sup> with high susceptibility to

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<sup>2</sup> World Bank, 2022. Country Climate and Development Report.

<sup>3</sup> The proposed US\$ 60 million SUW component of the operation is a modest component of the US\$ 166.1 billion stock of public and publicly guaranteed debt in Bangladesh at the end of FY22.

<sup>4</sup> German watch (2021) Global Climate Risk Index 2021.





extreme weather events such as cyclones, floods, and storm surges. Rising temperatures lead to intensified and unpredictable rainfall patterns during the monsoon season. This, coupled with the already high probability of cyclones, is expected to further increase, resulting in increased tidal inundation. Recurring flooding in Bangladesh affects a greater population than any other natural hazard, impacting about 1 million or more people annually. Once every three to five years, up to two-thirds of the country is inundated by floods. Addressing these climate risks will support sustainable economic development and prevent vulnerable populations from being left behind.

## B. Sectoral and Institutional Context

10. **Bangladesh's upstream energy supply chain weighs heavily on its greenhouse gas (GHG) emissions.** The bulk of the country's emissions stem from production and use of oil and natural gas (O&G). Natural gas plays a dominant role as the primary energy source in Bangladesh, comprising 68 percent of the country's primary energy consumption in 2021. Oil follows with a share of 23 percent and, increasingly, coal (8 percent) comprises most of the balance. Hydropower and renewable energy contribute minimally at 0.4 and 0.3 percent, respectively. Over half (52 percent) of the power generation capacity in 2021 was gas-fired.<sup>5</sup> Currently, the national gas grid is supplied by approximately 25.2 billion cubic meters (bcm) of natural gas from 20 domestic gas fields and approximately 7 bcm of imported liquified natural gas (LNG). Consumption of coal, driven by growing power generation needs, also increased at an average of 11 percent annually in the last decade, significantly contributing to the rapid growth of total CO<sub>2</sub> emissions from energy, which doubled from 50.6 million tons of CO<sub>2</sub> (tCO<sub>2</sub>) in 2010 to 100.9 million tCO<sub>2</sub> in 2021.<sup>6</sup>

11. Methane (CH<sub>4</sub> or natural gas) emissions from venting and leakages in the O&G value chain were estimated at 257 kilotons (kT), roughly equivalent to 7.7 million tCO<sub>2</sub>. These emissions were mainly from upstream and midstream links of the value chain.<sup>7</sup> Methane, the primary component of natural gas, is a potent GHG with a climate warming potential more than 25 times that of carbon dioxide (CO<sub>2</sub>), but its effects are more short-lived. It remains in the atmosphere for approximately 12 years, compared to centuries for CO<sub>2</sub>, making its rapid reduction one of the most important, cost-effective climate actions in the short- to medium-term. Indeed, the International Energy Agency calls for reducing 75 percent of global methane emissions by 2030 as part of its "Net Zero by 2050" scenario. This is particularly relevant in the gas sector, where it may be possible to avoid more than 70 percent of methane emissions with existing technology, approximately 45 percent of which can be avoided at no—or negative—net cost.

12. **Conscious of both its increasing GHG emissions levels and exposure to climate risks, the Government of Bangladesh (GoB) committed to achieving an ambitious climate change agenda.** The GoB revised its NDC in August 2021, calling for actions, such as improving energy efficiency in the industrial sector and reducing fugitive methane emissions, which include leakages from gas production, processing, transmission, and distribution pipeline networks, to contribute more to achieving Bangladesh's NDC than all actions in the transport, agriculture, and commercial sectors combined. The GoB's climate strategy also targets reduction of downstream gas and electricity use by households, as current consumption levels represent the fourth largest source of GHG emissions in the country. Implementing such a strategy would

<sup>5</sup> Bangladesh Power Development Board, 2021.

<sup>6</sup> BP Statistical Review of World Energy, 2022.

<sup>7</sup> IEA Methane Tracker, 2021.





also benefit the country's economic and fiscal position, given that improving gas demand efficiency would reduce the need for LNG imports, relieving the country's energy import dependence.

13. **However, addressing gas sector GHG emissions will be challenging without adopting better monitoring systems and pricing strategies.** First, there are gaps in the gas metering infrastructure on the distribution network, particularly for residential consumers. As a result, there is little incentive for efficient use of this resource, and there is an increased risk of overbilling the most vulnerable consumer groups. Likely fraud, pilferage, and suspected unauthorized connections are likely present in the residential and commercial areas. Second, monitoring of gas flows in the distribution network is lacking as the existing Supervisory Control and Data Acquisition (SCADA) system<sup>8</sup> is limited only to the transmission network, hampering a comprehensive and efficient supervision of gas leakages at critical points on the distribution system. Third, gas pricing strategies are not optimal as gas prices in the country are among the lowest in the South Asia region, despite recent price hikes.

14. **Bangladesh's relevant institutions are keen to answer these challenges, with support from the World Bank and other development institutions.** The gas sector is regulated by the Bangladesh Energy Regulatory Commission (BERC). Domestic natural gas exploration, production, transmission, and distribution are mainly managed by public companies owned by Bangladesh Oil, Gas, and Mineral Corporation (Petrobangla), a state-owned company under the authority of the Energy and Mineral Resources Division (EMRD) of the Ministry of Power, Energy and Mineral Resources (MPEMR). Petrobangla is the main public company in the O&G sector, owning 12 companies that cover the entire O&G value chain—exploration and production, transmission, distribution, compressed natural gas, liquified petroleum gas, and mining. Petrobangla is the delegated state authority to conclude production-sharing contracts (PSCs) with international oil companies (IOCs) for the exploration and development of O&G resources in Bangladesh. Exploration and production rights are granted under these PSCs, which in effect rely on a regulation-by-contract approach to enable operators in the upstream link to carry out their activities.

15. Moreover, under Petrobangla's authority, the transmission network is managed by the Gas Transmission Company Limited (GTCL), while the distribution network is managed by six other companies. Among these companies, Titas Gas Transmission and Distribution Company Limited (TGTDCCL) is the largest gas distributor, supplying 55 percent of the total gas consumed in the country, with a 13,238.09 km gas pipeline network, including 46.93 km built during the FY20-21<sup>9</sup>. Pashchimanchal Gas Company Limited (PGCL) is another smaller gas distribution subsidiary of Petrobangla that owns and operates a 1,671 km pipeline network to meet its residential, commercial, and industrial demand.

16. It is within this context that the GoB requested World Bank support to (a) install 1,100,000 prepaid gas meters in TGTDCCL's Dhaka service territory and 128,000 meters in PGCL's, which would cover PGCL's entire residential customer base; (b) install a SCADA system on PGCL's network; (c) undertake a small pilot program to test the impact of using smart meters at select industrial customers to improve efficiency and

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<sup>8</sup> The SCADA system offers the opportunity for operators to monitor in real time pressures and flows in the distribution network. This requires installing suitable instruments such as pressure transducers and flow meters at strategic locations within the network (such as pressure reducing stations).

<sup>9</sup> Source: TGTDCCL and Petrobangla FY2021 annual report



monitoring of their gas consumption; and (d) provide Petrobangla with technical assistance (TA) to assess and prioritize carbon abatement opportunities in the O&G sector.

### C. Relevance to Higher Level Objectives

17. **The proposed operation is aligned with the World Bank Group (WBG) Bangladesh Country Partnership Framework (CPF) FY23-27 (No. 181003-BD), discussed by the World Bank Group Board of Executive Directors on April 27, 2023.** It supports the Government's priority for the "development and improvement of critical institutions necessary to lead the economy to [Upper Middle Income] status." One of the High-Level Outcomes expected to achieve this priority is enhancing the economy's climate resilience, which directly relates to the CPF's Objective 8 (Enhanced sustainability and productivity in the use of natural capital for climate-smart green growth). In particular, the CPF notes that "reducing emissions by 2030 will require greater deployment of domestic and imported renewable energy; deeper action on energy efficiency investment in transmission and distribution, including private sector participation; and climate-resilient grids." The proposed operation is in line with the CPF's commitment to "help the country enhance efficiency and accountability in the overall power supply and gas network." The proposed operation is also fully aligned with the World Bank strategy to support clean energy transitions in the South Asia Region, particularly by promoting demand-side efficiency in the gas sector.

18. **The Project is consistent with the country's Nationally Determined Contribution (NDC).** While Bangladesh accounts for less than 0.35 percent of global GHG (IMF 2019),<sup>10</sup> the country became one of the most active proponents of planning and action on climate change. It revised its August 2021 NDCs<sup>11</sup> to include 6.73 percent unconditional and 15.12 percent conditional reductions in GHG emissions by 2030, both primarily from action taken in the energy sector (95.4 percent in the case of unconditional commitments and 96.46 percent in the case of conditional commitments). Its conditional commitment requires a 51 percent reduction of gas leakages along the entire energy value chain. The GoB's Energy Efficiency and Conservation Master Plan up to 2030 also calls for lowering energy intensity (national primary energy consumption per unit of GDP) in 2030 by 20 percent to 2013 levels. The Project is designed to support these objectives by encouraging conservation in residential gas consumption through proper metering and improving network monitoring to help identify and remedy leakages in the gas distribution network. It also provides technical assistance, as an initial step, to help detect GHG emission sources; identify and prioritize opportunities to reduce these emissions in existing infrastructure along the energy value chain; and develop regulatory frameworks for monitoring, reporting and verifying (MRV) protocols for sustained carbon abatement that can be implemented through policy initiatives and with public and private climate financing. The proposed operation also supports IDA20's policy commitments to increase climate co-benefits by facilitating development of low-carbon strategies in the energy sector and improve Bangladesh's capacity to respond to natural hazards.

19. **Furthermore, the operation is consistent with Bangladesh's Country Climate and Development Report (Oct. 2022) (CCDR).** The CCDR noted that "[m]ost of the country's CO<sub>2</sub> emissions stem from oil and gas production and use, which generated close to 84 percent of the country's total emissions (76.6 MtCO<sub>2</sub>e) in 2020." These emissions were "predominately from venting (55 percent) and fugitive gases

<sup>10</sup> Bangladesh Staff Report for the 2019 Article IV Consultations, International Monetary Fund, p. 19 (Box 2) (2019).

<sup>11</sup> Bangladesh. NDC (Updated). August 26, 2021. [https://unfccc.int/sites/default/files/NDC/2022-06/NDC\\_submission\\_20210826revised.pdf](https://unfccc.int/sites/default/files/NDC/2022-06/NDC_submission_20210826revised.pdf)



(45.5 percent).” Abatement of these emissions “along the oil and gas value chain is possible with upstream (supply) and downstream (demand) measures to improve efficiency.” In the upstream space, “[p]olicy and regulatory development for decarbonizing the natural gas value chain hinges on the prioritization of decarbonization opportunities in the sector’s upstream and midstream operations.” Downstream, “good monitoring systems (e.g., supervisory control and data acquisition systems for the gas distribution network) and pricing strategies on the demand side” are needed. The report emphasized that “[u]ntil all gas consumption in the country is properly metered, it will be difficult to determine, much less control, how and where gas losses and leakages occur in the system.” These issues form the basis for the proposed Project’s design, as discussed further below.

20. **Lastly, all components of the proposed operation support the Bank’s Pillar 4 commitments in its Global Crisis Response Framework (GCRF), which focuses on long-term policies and actions to advance the Green, Resilient, and Inclusive Development (GRID) agenda.** It continues the Bank’s commitment to “scale-up efforts to support clean energy, energy efficiency, and transport technologies, both through investments and reforms to the enabling policy environment, while working to catalyze associated private investments.” It also furthers the Bank’s focus on supporting “clients working on the just transition to help in the reduction of carbon intensity in the economy.”

## II. PROJECT DESCRIPTION

### A. Project Development Objective

#### PDO Statement

21. To improve efficiency of gas distribution and end-use, and support carbon abatement in the gas sector.

#### PDO Level Indicators

22. The Project Development Objective (PDO) level indicators proposed for this Project are

- Total GHG emissions avoided as a result of the Project (kT of CO<sub>2</sub> equivalent);
- Projected gas savings: average amount of gas saved per meter (cubic meters);
- Endorsement of an action plan for carbon abatement of sector operations (Yes/No); and
- Endorsement of a Roadmap for the development and implementation of a sector policy, legal, institutional, regulatory, and contractual framework for sustained sector carbon abatement (Yes/No).



## B. Project Components

23. The proposed US\$437.89 million operation (financed by IDA (US\$300 million including US\$150,000 capitalized front-end fee) and the GoB (US\$137.89 million equivalent)) is divided into the following components:

### **Component 1 (US\$296.67 million from IDA and US\$137.06 million equivalent from the GoB) - Strengthening the gas sector downstream monitoring and control capabilities**

*Subcomponent 1.1 (US\$283.42 million from IDA and US\$133.37 million from the GoB) - Enhancing efficiency of the gas distribution network and end-use through metering systems for residential and industrial consumers*

24. This subcomponent will contribute to reducing natural gas demand by residential and industrial end users and contribute to strengthening the monitoring capabilities of the gas sector. It will focus on installing and commissioning metering solutions (including related testing and calibration benches) as follows:

- (a) **For residential consumers (US\$282.92 million from IDA and US\$133.37 million GoB financing)**, 1.1 million prepaid gas meters would be installed by TGTDCI in the greater Dhaka area and 128,000 by PGCL. TGTDCI expects these meters to cover approximately 54 percent of its residential customers, an increase from the current level of 15 percent completed in an earlier project funded by Japan International Cooperation Agency (JICA). PGCL's meters are expected to cover 100 percent of its residential consumers. IDA financing will largely focus on procurement of the prepaid meters and related systems and consulting and non-consulting services, while GoB funding will primarily cover meter installation costs, which mostly involve local services.
- (b) **For industrial consumers (US\$0.5 million from IDA)**, a limited pilot for rolling out smart meters to a select number (a maximum of 60) of TGTDCI and PGCL's larger customers. This pilot is expected to demonstrate viability of smart meters to better monitor and manage gas use by industrial customers. The pilot includes installing optimal smart gas meter models (based on cost constraints, localization, and structure of current meters at targeted industrial consumers) to improve the network's monitoring capabilities and its operational and commercial efficiency. Generally, industrial customers involved in this pilot will be selected based on their average daily gas consumption (4,000 Cubic Feet per Hour (CFH) or more).

*Subcomponent 1.2 (US\$12.41 million from IDA) - Reducing gas leakages on PGCL's distribution network through reinforced monitoring and upgraded distribution infrastructure*

25. This subcomponent will focus on reducing gas leaks by installing a SCADA system to monitor PGCL's major distribution lines. As a result, PGCL is expected to have better monitoring and operation capabilities on its network, resulting in more secure and efficient gas distribution operation. This new SCADA system (including at least 10 Customer Metering Stations (CMS), providing regulated and metered gas at 150 pounds per square in gauge (psig) from inlet gas pressure 350 psig in accordance with customer



requirements; Town Bordering Stations (TBS), providing regulated and metered gas at 40-60 psig from inlet gas pressure 150 psig to the different customers of a town; and District Regulating Stations (DRS), providing regulated and metered gas at 150-60 psig from inlet gas pressure 350 psig to the different customers of a district, as required) is also expected to enable a more transparent accounting of gas use.

26. Moreover, this subcomponent will support developing and operationalizing a Geographic Information System (GIS) database framework for at least 10 CMS/TBS/DRS. The GIS database will capture, store, check, and display data related to positions on Earth's surface, creating a database framework for the gas pipelines in PGCL's service territory. The combined SCADA/GIS interface will connect to the metering systems installed under Subcomponent 1.1, combining key data on gas flow volumes and operating pressures in the network with regular physical leakage surveys (functional independence measure, infrared, and so on) and other leak detection methods (combustible gas indicator, pinpointing, etc.). It will also provide a strong data-based analytical foundation to determine efficiency of gas equipment as well as support future network planning, contributing to the overall increased efficiency of the country's gas sector.

27. In addition, considering climate hazards and risks of extreme weather in the country, this monitoring system is expected to include climate and weather conditions sensors and associated assets and system performance capabilities to help develop appropriate Operation and Maintenance (O&M) plans and standardized protocols for mitigating climate risk. Since the SCADA system is designed to monitor changes in pressure throughout the monitored network, it is expected to increase resilience of PGCL's grid in response to climate events, such as flooding, landslides, etc. PGCL should be able to quickly detect any resulting impacts on the network and initiate either protective or repair actions.

28. Any personal data collected or processed under Subcomponents 1.1 and 1.2 through the installed metering systems will be subject to an appropriate data protection framework, in line with the World Bank policy on data privacy.

*Subcomponent 1.3 (US\$0.84 million from IDA and US\$3.69 million counterpart financing) - Implementation support for TGTDC and PGCL to supplement their institutional capacity to adequately deliver the Project and comply with applicable World Bank policies.*

29. This subcomponent is designed to support TGTDC and PGCL's Project implementation activities and improve their institutional capacity to comply with applicable World Bank policies. TGTDC and PGCL have limited experience with World Bank Investment Project Financing (IPF) projects and limited organizational capabilities using information technology (IT) for automated management activities. As such, this subcomponent is intended to supplement the utilities' project management resources and support training and capacity building. It is also expected to support training and capacity building of the utilities' Project Implementation Unit (PIU) staff on relevant World Bank policies and procedures. This would cover procurement, contract administration, internal controls, billing and payment, documentation, communication, addressing complaints, safeguards, gender policies, etc.



**Component 2 (US\$3.18 million from IDA and US\$0.83 million counterpart financing) - Technical assistance for carbon abatement of the oil and gas value chain**

30. This subcomponent will focus on developing a policy, legal, institutional, regulatory, and contractual framework for carbon abatement of the O&G value chain. The framework will hinge on a granular assessment of carbon abatement options in the sector's upstream, midstream, and downstream operations.

*Subcomponent 2.1 (US\$2.18 million from IDA and US\$0.83 million counterpart financing) - Action Plan for carbon abatement of sector operations*

31. This subcomponent will involve:

- (a) Detecting and inventorying CO<sub>2</sub> and methane emissions, their volume, intensity, concentration, and location along the O&G value chain, in order to identify and prioritize interventions to address energy efficiency gaps; eliminate routine gas flaring; abate methane venting and leakages; adopt low-carbon power, heat, and combustion processes in operations; integrate grid and/or on-site renewable energy sources in operations; and assess sector-specific carbon capture and storage (CCS) opportunities.
- (b) Assessing the technical, economic, and commercial feasibility of these interventions and developing a marginal abatement cost curve (MACC)<sup>12</sup>.
- (c) Developing an Action Plan for the phased implementation of carbon abatement measures in O&G value chain operations.

*Subcomponent 2.2 (US\$1 million) – Roadmap for a Carbon Abatement Framework*

32. Support and advisory services will be provided to MPEMR; the Ministry of Environment, Forest and Climate Change (MEFCC), BEREC, and Petrobangla to develop a sector carbon abatement framework including enabling policy, legal, institutional, contractual, and regulatory instruments. These will include:

- (a) Identifying gaps in the existing policy, legal, institutional, regulatory, and contractual framework for carbon abatement of sector operations and presenting recommendations to address them.
- (b) Assessing hurdles for private capital mobilization for targeted investments in carbon abatement and developing a framework to enable private investment in commercially viable intervention options identified in Subcomponent 2.1.
- (d) Developing a roadmap for the phased introduction policy, legal, institutional, regulatory, and contractual instruments for sustained carbon abatement in sector operations.

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<sup>12</sup> A marginal abatement cost curve—MACC—presents the costs or savings expected from different opportunities, alongside the potential volume of emissions that could be reduced if implemented. MACCs measure, compare, and prioritize the financial cost and abatement benefit of individual actions. They use the metric of dollars per ton of carbon dioxide equivalent abated—usually represented as US\$/tCO<sub>2</sub>e.



- (d) Enhancing capacity and providing advisory support to sector institutions for the initial phase of implementation of the proposed roadmap.

C. Project Beneficiaries.

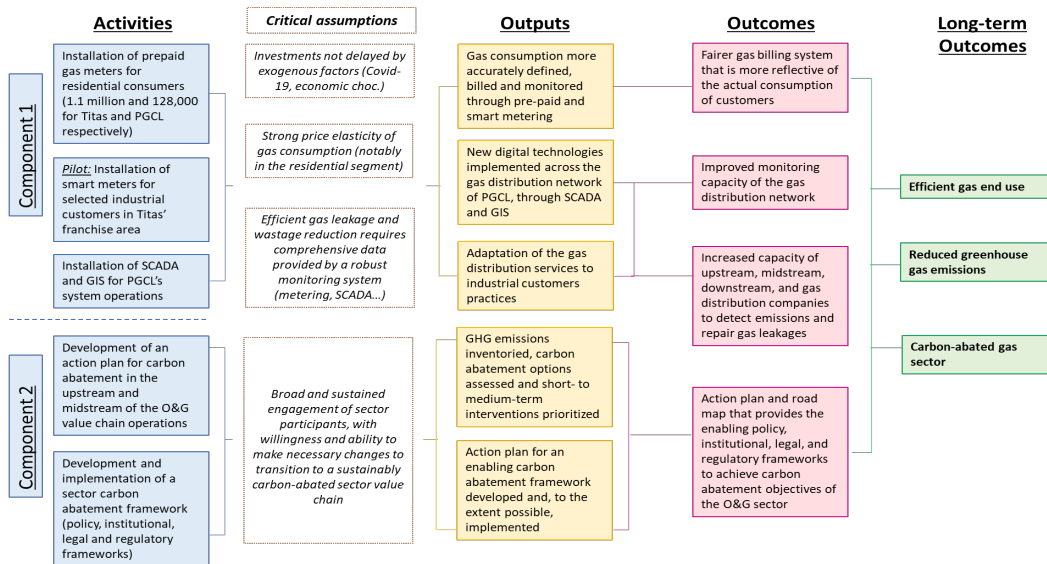
33. Beneficiaries of the proposed Project can be divided into two categories: (a) institutional beneficiaries and (b) final customer beneficiaries:

- (a) **Institutional beneficiaries.** This category encompasses the IAs that will benefit from the positive impact of the proposed improvements under the Project. Under Component 1, the beneficiaries include TGTDCI and PGCL because of the financial benefits, efficiency gains, and technical benefits expected to accrue from the proposed investments. Under Component 2, the beneficiaries include MPEMR, BERC, Petrobangla, and sector operators that will benefit from development of a carbon abatement pathways and investment action plan to achieve them.
- (b) **Final consumer beneficiaries.** This category encompasses targeted residential customers in TGTDCI and PGCL service territories who will benefit from the new prepaid meters. Under Component 1, these customers are expected to benefit from lower gas bills and overall network costs and from positive environmental impacts from reduced methane leakages.

E. Results Chain

34. Project’s results chain is summarized in Figure 1 below.

Figure 1. Expected Results Chain under the Proposed Project







## **F. Rationale for Bank Involvement and Role of Partners**

35. **Through this operation, the World Bank will support the GoB's climate change mitigation efforts using modern gas distribution monitoring technologies.** It will also help the GoB access global knowledge and experience in carbon abatement opportunities of the gas sector. Bangladesh's revised NDCs indicate actions such as improving energy efficiency in the industrial sector and reducing fugitive methane emissions, which include leakages from gas production, processing, transmission, and distribution pipeline networks, to contribute more to achieving Bangladesh's NDC than all actions in the transport, agriculture, and commercial sectors combined.

36. **By financing upgrades of gas distribution networks through concessional resources, the World Bank will help reduce technical and commercial losses at a lower cost, which will benefit both end users and IAs.** Moreover, the anticipated economic returns from reduced gas demand in the targeted networks and the transformational nature of the Government's plans to rationalize gas use by improving sector metering and gas flow monitoring also provide strong rationale for using public resources.

## **G. Lessons Learned and Reflected in the Project Design**

37. **Relevant precedents provide lessons that were reflected in the Project design.** On Component 1, the positive impact of a similar project confirms the results chain expected under this proposed Project. In 2015, JICA, the GoB, and TGTDCCL co-financed a project titled "Installation of Prepaid Gas Meter for TGTDCCL", under the 'Natural Gas Efficiency Project (BD-P78)' of Japan's 35th Official Development Aid loan package. This project targeted "conservation of energy, ensuring its efficient, safe and sustainable use, reduction of system loss, introducing customer-friendly modern management system, and improving customer service." Under this JICA-funded project, installation of 200,000 prepaid meters were completed in January 2020. The main lesson learned from this precedent is that the prepaid metering system seems to have successfully increased consumer awareness in combating waste of natural gas, thus creating the potential for gas savings in residential consumption.

38. **Lessons to be applied during implementation of Component 2 are drawn from recent analytical work and the currently ongoing TA support on carbon abatement of O&G operations** (Supporting Egypt's Decarbonization of the O&G Value Chain - P176321). This support is provided to Egypt's Ministry of Petroleum and Mineral Resources and the East Mediterranean Gas Forum. Analytical focus has extended to Israel, Jordan, and Cyprus, including satellite-based detection of methane emissions; identifying CO<sub>2</sub> emission sources and concentrations; assessing strategic, technical, economic, and financial aspects of solutions to address them; developing national and asset-based MACCs and short- to medium-term action plans defining carbon intensity targets; fixing policy objectives and addressing institutional and regulatory gaps; and supporting the introduction of investment-enabling frameworks for carbon abatement of sector operations. Each country and asset class has its own intrinsic emissions profile, substantially influencing the starting point for any carbon abatement efforts.





### III. IMPLEMENTATION ARRANGEMENTS

#### A. Institutional and Implementation Arrangements

39. Figure 2 below summarizes the Project’s institutional and implementation arrangements, while Annex 1 discusses them in more details. An Inter-ministerial Project Steering Committee with focal persons from all relevant agencies will provide coordination among all stakeholders. The committee will have at least once every 3 months for the Project and can have more meetings, as required. The composition of the committee is outlined in Figure 3.

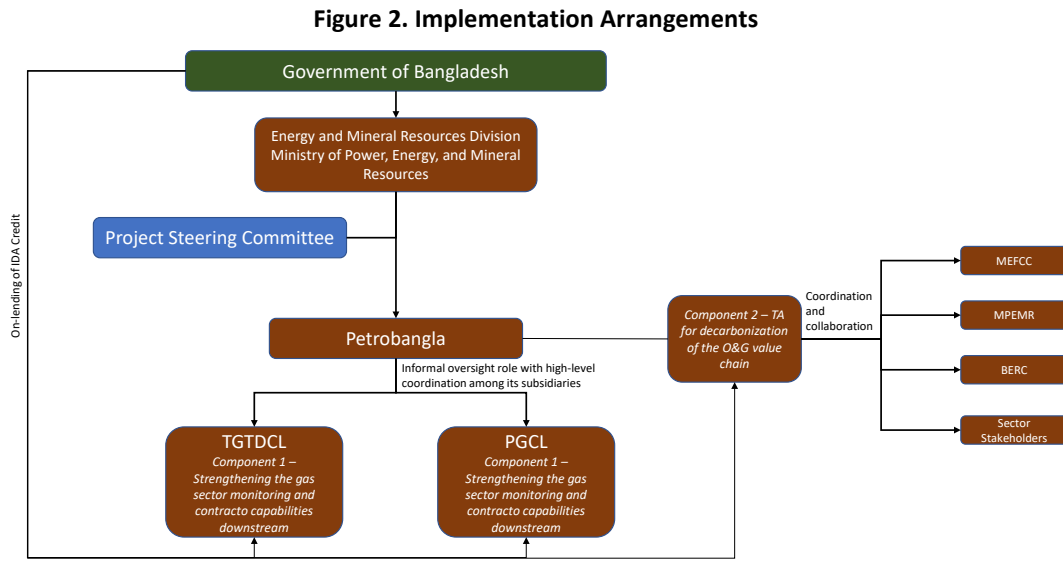


Figure 3: Project Steering Committee





## **B. Results Monitoring and Evaluation Arrangements**

40. Monitoring and evaluation mechanisms will be established at the Project and entity levels. The PIUs will provide quarterly physical progress reports, audited financial statements (within six months of the end of each financial year), and other such information as the World Bank may reasonably require.

41. The PIUs will also prepare a Project Operations Manual, where a set of monitoring indicators will be put in place to track Project progress with information on (a) results indicators and (b) additional monitoring indicators that track Project implementation according to detailed schedules. The indicators comprise a mix of outcome and output indicators, with clearly defined annual targets to be achieved. Additional data on Project progress across various functional areas, such as environment, social, technical, and financial indicators, will also be collected and reported on a periodic basis. Section VII presents the Project's Results Framework that defines specific results to be monitored.

## **C. Sustainability**

42. There is strong ownership of the Project at the level of the Government through the EMRD of the MPEMR, the Economic Relations Division (ERD) of the Ministry of Finance and Petrobangla, TGTDC, and PGCL. The Project furthers the Government's plans to increase sector efficiency, reduce gas consumption, and further national climate ambitions. It supports activities that contribute to carbon abatement of the gas sector, as identified in the 8th Five Year Plan. The Project facilitates the sector's environmental and social sustainability, and helps provide a model for future project implementation through the IAs' adoption and implementation of an Environmental and Social Management Framework for the Project that guides the handling of related issues.

## **IV. PROJECT APPRAISAL SUMMARY**

### **A. Technical and Economic Analysis**

#### **Technical**

43. TGTDC and PGCL prepared high-level feasibility studies covering work under Subcomponents 1.1 and 1.2. Two different types of meters are being considered. The first is the card-based near-field communication (NFC) meters, as was installed during the now-completed JICA-funded project. There are two versions of this type of meter: one that uses traditional positive displacement diaphragm measurement and the second uses more modern ultrasonic measurement system. The second type of meter is an online based 'smart' meter using ultrasonic measurement.

44. There are advantages and disadvantages to both systems. The card-based type has a relatively low purchase and operating cost while the smart meters have a higher purchase cost. From customers' perspective, the card type is slightly less convenient. The card can be recharged (that is, credit added) through either online systems or by visiting a vendor (point of sale, banks, or other agents) outlet. The smart meters, however, are connected to the internet through a dedicated communications network and a central server, and payment is made directly online through the banking systems. Customers can also get gas usage and cost information in real time unless internet service is disrupted. Both types of meters



are battery operated, but the smart meter uses more power because of its permanent internet connection so battery life is significantly shorter. Internet disruption does not affect the gas flow with either meter. The Government is currently favoring the card-based type, but the final determination will be made during implementation as the specifications of the meters are finalized for the bidding documents to procure them.

45. Both types of meters will be fitted with an excess flow valve. Both fittings automatically shut off the gas supply in the case where the rate of flow through the meter exceeds a preset value, mitigating a probable leakage problem. TGTDCCL states that it wants to have both types of meters available for the project. Because they both have their own dedicated web-based central data recording and processing systems, TGTDCCL proposes to purchase a separate software package that takes data from both systems and integrates it into a central customer records and billing system.

46. Project costs have been estimated on the basis that TGTDCCL/PGCL will bear all costs from the riser or service pipe up to and including the meter set, assuming all costs downstream of the meter will be borne by the customer. TGTDCCL's unit cost per meter is US\$221 plus installation cost of around US\$55, based on TGTDCCL's estimates. TGTDCCL included pressure sensors in approximately 20 percent of its anticipated installations. Moreover, TGTDCCL's existing customers are between 30-50 years old, implying some modification maybe required in at least 20 percent of its installations. PGCL's per unit meter cost is US\$194 plus installation cost of US\$50 based on PGCL's estimates.

47. Because PGCL is proposing to install meters for all its residential customers, it will have better visibility on the flows of gas in its networks and report gas losses more accurately, thus better target leakage reduction. TGTDCCL plans to install the proposed 1.1 million new meters, which, as previously noted, represents 54 percent of its residential customers. As such, its ability to reduce gas losses over its entire network will be naturally more limited, though would improve over time as the utility completes rollout of prepaid meters to all its residential customers under subsequent projects/investments.

48. In conjunction with Subcomponent 1.1, PGCL's proposed SCADA/GIS system is expected to be part of a broader, interconnected system. Petrobangla has commissioned consultants (the UAE-based ILF Consulting Engineers (ILF) and the Bangladesh-based, government-owned Infrastructure Investment Facilitation Company (IIFC)) to prepare designs to install SCADA systems on a nationwide basis for all its subsidiary gas transmission and distribution companies. This work will also encompass installing GIS systems, network hydraulic modelling, and surveying of pipeline systems. The terms of reference (TOR) for this work confirm that it covers the systems envisaged by PGCL under this Project.

49. **The operation is aligned with the goals of the Paris Agreement on both mitigation and adaptation.**

50. **Assessment and reduction of mitigation risks.** In 2020, Bangladesh's oil and gas production contributed 82 percent of CO<sub>2</sub> emissions. Furthermore, oil and gas combustion, venting and leakages in extraction, gathering, storage, processing, transport, and distribution operations accounted for 72 percent of energy sector methane emissions. The operation is expected to help improve the gas network's energy efficiency, thus contributing to mitigating some of these issues, and is not designed to invest in increasing network capacity or gas supply. Its technical assistance component, which focuses on assessing and prioritizing carbon abatement opportunities in the O&G value chain, is expected to support



developing the enabling environment for subsequent investments in abating carbon emissions throughout this value chain. It is also expected to enable investments to integrate low carbon heat and power in processes, adopt carbon abatement regulations and standards, and introduce monitoring, reporting and verification (MRV) protocols. Consequently, the Project is expected to have a low mitigation risk.

51. **Assessment and reduction of adaptation risks:** Bangladesh's gas network system is highly vulnerable to climate change impacts due to its location in a low-lying delta region, where extreme weather events, sea-level rise, and flooding are becoming more frequent and severe. Inundation of gas pipelines and compressor stations from floods and storm surges can cause gas leaks, damage to infrastructure, and even explosions. Furthermore, salinity intrusion into the gas network systems can cause corrosion and reduce the lifespan of the infrastructure. The prepaid meters proposed for this Project have built-in protective systems that monitor and automatically shut-off the gas connection to the property in case of climate-related events resulting in damage to the downstream pipelines and increasing risk of major gas leakage and venting of methane to atmosphere. Additionally, the meters are installed in weather-protected locations within buildings and at an elevated level (above flood level) to enable customer access to the prepayment features, when necessary, which provides protection against flood risk. The proposed SCADA system for PGCL is expected to monitor the critical operational parameters of the utility's gas network, including pressures and flows. The system also incorporates alarms which identify unusual or unexpected changes to normal operations to the operational control rooms. The telemetered sensors that will be installed in network equipment will be housed in appropriate, weather-protected cabinets (elevated in locations susceptible to flooding) and the sensors themselves are expected to be individually sealed to ensure that their electrical supply cannot, under any failure condition, cause conflagration through contact with leaking gas. These measures increase the system's resilience and its operators' flexibility to respond to climate-related events and lower the adaptation risk to an acceptable level.

52. Moreover, the Project is expected to generate climate co-benefits through prepaid meters, which are expected to help reduce inefficient gas consumption and reduce CO<sub>2</sub> emissions in gas distribution network. This investment is an eligible Category 2.1 climate financing activity, as outlined in the *Joint Multilateral Development Bank (MDB) Methodology for Climate Finance*, and Category 4 and 5 activities of the *Revised MDB Mitigation Finance Tracking Methodology*. The Project is also expected to contribute to reducing commercial or collection losses resulting in increasing effective prices paid by consumers, which is also an eligible Category 13 activity of the *Revised MDB Mitigation Finance Tracking Methodology*.

### Economic Analysis

53. **The proposed Project will yield economic benefits to residential gas users in areas served by the participating utilities by allowing them to better manage their monthly gas bills.** In most instances, their costs will decline, although for those whose current consumption is higher than that covered by the flat regulatory rate, costs will likely initially increase. Over the longer term, however, the Project is expected to alleviate the need to import LNG to meet domestic needs, thereby lowering costs for all users. The environment will also benefit from an expected reduction in emissions of CO<sub>2</sub> associated with gas burned by households and reductions in CH<sub>4</sub> emissions as leaks in the network are identified and repaired. Initially, the utilities are likely to suffer to a degree as they will be obliged to recognize the cost of losses in the



system, but consumers will reap a corresponding benefit as they are no longer required to pay for technical and nontechnical losses in the gas distribution system, as they currently do based on regulated, not actual, amount of consumption assumed for billing purposes.

54. **Results.** The net present value (NPV) of subcomponent 1.1 was positive (at a 6 percent discount rate) even without accounting for environmental benefits. NPV was estimated at US\$605 million for the base case and ranged from US\$332 million to US\$878 million for the 35 percent and 65 percent consumption reduction scenarios respectively. The economic internal rate of return (EIRR) for the base case was 25.8 percent overall, 26.4 percent for PGCL, and 25.7 percent for TGTDC. When the value of avoided carbon emissions was included (at an average of the low and high SPCs), the Project NPVs virtually doubled to US\$1.197 billion under the base case, ranging from US\$746 million to US\$1.647 billion under the low and high consumption cases, and the base case EIRR rises to 42 percent. For subcomponent 1.2, the 'break even' NPV was zero and the EIRR was 6 percent. When the benefits of avoided CH<sub>4</sub> emissions were included, NPV rises to US\$68 million and the EIRR to 74 percent.

55. **Sensitivities.** Project NPVs were positive for each of the three scenarios with respect to the reductions in consumption achieved as a result of metering. A switching analysis was also carried out to examine changes in key variables that could be accommodated before the Project EIRR dropped below 6 percent. Capital costs for subcomponent 1.1 could rise by more than 3 times for both companies, while the marginal cost of LNG could fall to approximately 40 percent of the base case forecast. Note that the sensitivity analysis did not consider the value of avoided GHG emissions, so the economic projections should be more robust than suggested.

56. **Conclusions.** In the base case, the results show its returns highly robust under a range of assumptions. Furthermore, even if reductions in household gas consumption are less than anticipated, the installation of a cordon of meters around deliveries to residential customers, together with installing SCADA and GIS, will make it easier for the utilities to locate and repair technical and nontechnical leakages from the system, with associated benefits in terms of both avoided gas purchases and reductions in GHG emissions. Moreover, the operation does not present risks to Bangladesh's energy transition, given the timeframe needed for this transition and the anticipated economic life of the equipment financed under this proposed Project.

## B. Fiduciary

57. Once the PIUs are established, mitigation measures derived from the fiduciary assessment of their procurement and financial management (FM) capabilities will be rolled out to further tailor some of the following fiduciary arrangements agreed to be adopted at this stage.

### (i) Financial Management

58. **A detailed FM assessment, according to the World Bank Directives for IPFs, was carried out for all the PIUs.** The IAs, namely TGTDC, PGCL, and Petrobangla, have limited experience in managing World Bank-financed or similar externally aided projects. The FM assessment identified weaknesses and areas where the IAs will need external support. From an FM perspective, the Project design is complex, using multiple cost centers and mixed nature of expenditure such as goods, consultancy, and training.



Moreover, a qualified audit opinion for inadequate disclosure in the audited financial statements of IAs also highlights some additional challenges. Specific actions, discussed in more details in Annex 1, to improve capacity and internal controls, thereby mitigating risks to the Project’s FM, will need to be undertaken by the IAs. The results of the residual FM risk is summarized in the Key Risks section below.

**(ii) Procurement**

59. The main procurement activities under the Project will be for (a) supply and installation of prepaid gas meters, (b) building up of the SCADA/GIS system, including their software and hardware requirements, (c) minor works for the data center and office, and (d) TA consultancies in sector development, Project management, and other similar activities needed during implementation. All goods, works, non-consulting services, and consulting services required for this Project and financed from the proceeds of the IDA credit will be procured in accordance with the World Bank Procurement Regulations for IPF Borrowers, fourth edition, November 2020 (‘Procurement Regulations’) and the provisions of the Financing Agreement and Procurement Plan. Procurement will also be subject to the World Bank’s Anticorruption Guidelines. The Project will use the Systematic Tracking of Exchanges in Procurement (STEP) tool to plan, record, and track procurement transactions and complaints.

60. **All Project IAs—Petrobangla, PGCL, and TGTDCI—have limited experience in implementing similar procurement activities, including high-value contracts, and lack experience in managing procurement under World Bank procurement rules.** Thus, the PIUs to be established in all agencies are expected to have dedicated procurement staff for handling the Project’s procurement activities. They will be assisted by procurement consultants who will also provide capacity building to relevant PIU staff. A Project Procurement Strategy for Development (PPSD) has been submitted by both TGTDCI and PGCL that details the procurement arrangements for large contracts and contract management plan, including the related risks and mitigation measures.

61. **The results of the World Bank’s procurement capacity/risk assessment of the IAs are summarized in the Key Risks section below.** Further details on procurement arrangements are provided in Annex 1.

**C. Legal Operational Policies**

	Triggered?
Projects on International Waterways OP 7.50	No
Projects in Disputed Areas OP 7.60	No

**D. Environmental and Social**

62. **The proposed Project follows the Environmental and Social Framework (ESF).** From the proposed activities, the Project environment and social risk is rated Moderate. The key relevant environmental and social standards are ESS1 - Assessment and Management of Environmental and Social Risks and Impacts, ESS2 - Labor



and Working Conditions, ESS4 - Community Health and Safety, and ESS10 - Stakeholder Engagement and Information Disclosure.

63. **Summary of interventions.** Based on the anticipated scope of Components 1 and 2, it is expected that the E&S impacts will be localized and minor, entailing primarily added noise and dust associated with installing meters.

64. **Environmental risks and impacts.** The Project's overall environmental impacts will be vastly positive and contribute to improving the environment, and the minor negative impacts can be managed with appropriate measures. As previously noted, the Project's overall environmental benefits are reducing GHG emission and air pollution. Environmental risks and impacts of Project investments related to installing the meters are minor air pollution, gas leakage, and noise pollution. Also, during installation of the meters and the SCADA system, some minor occupational health and safety (OHS) related risks are anticipated. Adequate safety measures will be adopted to avoid accidents from gas leakage, the risk of which is expected to be negligible. These risks and impacts will be addressed through adequate mitigation measures, as incorporated in the Environment and Social Code of Practices (ESCoP).

65. **Social risks and impacts.** The overall social risk is rated Moderate, considering the risks related to the potential exclusion of residential and industrial customers, as the Project will install 1,228,000 meters under Component 1 while TGTDC and PGCL's customer base exceeds that number; community and worker health and safety (CHS) and OHS; sexual exploitation and abuse/sexual harassment (SEA/SH) risks; and novelty of ESF to the IAs. Project activities do not pose adverse livelihood impacts for residential and industrial customers. The Project will not require land acquisition, resettlement, or restrictions to land use. To manage the labor and worker OHS risks related to meter installations, Labor Management Procedures (LMP) have been prepared by TGTDC and PGCL. CHS concerns such as incidents and accidents associated with gas connections, SEA/SH, COVID-19, and so on among project workers and communities will be managed by adopting OHS and CHS measures (including SEA/SH and COVID-19 provisions) incorporated in the LMP and ESCoP, respectively. The LMP also outline the grievance redress mechanism (GRM) for project workers. TGTDC and PGCL have prepared their respective Stakeholder Engagement Plans (SEPs). As part of the SEP, a local and Project-level GRM, which is accessible to all stakeholders (including vulnerable groups), has been incorporated. Moreover, SEA/SH risk is rated low using civil works tools. SEA/SH mitigation measures will be adopted proportionally.

66. **Environmental and social assessment modalities and disclosure.** The required instruments, including the draft ESCoP, LMP, SEP for each IA, and Environmental and Social Commitment Plan (ESCP), have been prepared and disclosed on January 10, 2023, in the IAs' and the World Bank websites.<sup>13</sup> Hard copies of the document have also been made available in all field offices related to the Project's implementation. The draft ESCP sets out the appropriate timeframe for plans and actions required for the Project to meet the ESF requirements.

67. The capacities of TGTDC, PGCL, Petrobangla, and EMRD have been assessed as part of the environmental and social capacity assessment. There is a need for training and deployment of adequate staffing and resources in the agencies to mitigate the related risks (for TGTDC: permanent environmental and social focal points and publicly available phone number dedicated to receiving complaints and for PGCL: central and local office-based grievance management system).

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<sup>13</sup> <http://documents.worldbank.org/curated/en/099510101102371886/P1790090683fc0040b45f0a095dcbc416e>





68. **Citizen Engagement:** The Project will have robust citizen engagement approach to contribute to the achievement of the PDO. The approach includes: (a) consulting key stakeholders (i.e., local communities, residential and commercial customers etc.) during selection, design and implementation of the Project, through field visits, focus groups and round table discussions; (b) establishing a two-tier Grievance Redressal Mechanism (GRM) to process complaints or grievances related to project activities, including Gender-Based Violence (GBV) and personal safety-related complaints that are received in-person, via email/letter, and/or telephone calls; and (c) pursuing beneficiary feedback mechanisms, such as satisfaction surveys to: (i) track beneficiaries' perception of Project progress and improved gas usage; and (ii) assess the impact of training and capacity building carried out under the Project. The Project's citizen engagement intermediate results indicators include: (1) the number of consultations with community people and customers, (2) the number of grievances addressed related to delivery of Project benefits, and (3) percentage of Project-related grievances satisfactorily addressed within two months of receipt.

69. **Gender.** The Project will contribute to closing gender gaps in employment through its activities and ensure greater opportunities for women in the gas sector workforce. Women have less representation in the energy sector, especially in technical roles. Women make up approximately 9 percent of total staff employed in TGTDC and only 3 percent in PGCL. In TGTDC, women are mostly found in manager, deputy, and assistant manager positions. Some of the major barriers to greater female representation include (a) lack of training opportunities that are field based and practical; (b) negative preconceptions surrounding careers in the power sector (including that it is male dominated), which discourages female applicants; (c) low awareness, enrollment, and retention of girls in STEM<sup>14</sup> subjects; and (d) lack of facilities and policies to benefit women (day care, prayer rooms, separate toilets/resting rooms and safe transportation, and flexible work options).

70. The Project aims to reduce the gender gap in employment within the utilities and create an enabling institutional environment for increasing women's representation in the sector. The Project includes a gender assessment to identify the challenges and opportunities to expand women's representation. The Project will carry out a set of activities targeted at existing and new female employees. To recruit more women in the utilities, the Project will strengthen outreach and recruitment efforts. The actions will include developing a paid internship program targeting female candidates. Employment at the utilities is carried out based on passing an entrance exam. However, the lack of women employed in the utilities is reflective of a wider systemic issue related to the limited female candidates in the pool of applicants that take this exam. The internship program will address this gap by recruiting at least 40 percent female interns in both PGCL and TGTDC. The internship will give female interns the necessary practical training and exposure to better prepare them to pass the entrance exam, should they qualify for and elect to take them, and subsequently gain employment in the utilities. The utilities will also conduct outreach with academic institutions and technical and vocational education and training (TVET) institutions that generate a pipeline of potential employees and targeted outreach for women in job fairs. Training delivery approaches will be tailored to meet the learning needs of female interns.

71. Beyond the internship program, employment will also be generated within the PIU as staff and community mobilizers, to the extent needed. The Project will carry out activities aimed at sensitizing senior management and staff of the utility companies on the need to improve gender diversity. For the existing female employees, tailored training, on-the-job training, and mentorships will be provided. These actions will help retain women employees in the utilities. In addition, the Project will promote infrastructure that addresses women's specific needs, for instance, separate toilets, restroom/prayer rooms, childcare/day care, and transport service or stipend to

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<sup>14</sup> STEM = Science, technology, engineering, and mathematics





encourage more female job applications and increase women’s overall participation in the gas sector. The Project will also strengthen capacity to establish and maintain a human resource monitoring system that is gender disaggregated. The institutional approaches will help ensure that employment opportunities for women are sustained and will enhance IA’s capacity to address gender inequalities as it reengages with World Bank after a ten-year hiatus in the relationship and sector engagement.

## V. GRIEVANCE REDRESS SERVICES

72. **Grievance Redress.** Communities and individuals who believe that they are adversely affected by a project supported by the World Bank may submit complaints to existing project-level grievance mechanisms or the Bank’s Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the Bank’s independent Accountability Mechanism (AM). The AM houses the Inspection Panel, which determines whether harm occurred, or could occur, as a result of Bank non-compliance with its policies and procedures, and the Dispute Resolution Service, which provides communities and borrowers with the opportunity to address complaints through dispute resolution. Complaints may be submitted to the AM at any time after concerns have been brought directly to the attention of Bank Management and after Management has been given an opportunity to respond. For information on how to submit complaints to the Bank’s Grievance Redress Service (GRS), please visit <http://www.worldbank.org/GRS>. For information on how to submit complaints to the Bank’s Accountability Mechanism, please visit <https://accountability.worldbank.org>.

## VI. KEY RISKS

73. **The overall risk of the proposed operation is rated Substantial.** This is mainly due to institutional, sustainability, and fiduciary risks.

74. **Residual institutional capacity for implementation and sustainability are rated Substantial.** The Project involves multiple PIUs within IAs without much experience implementing Bank-financed projects. Moreover, the IAs will likely need to apply to BERC to request adjusting the gas tariff rate base to include the contemplated investments under this Project to ensure recovery of the investment costs through tariff revenue. This request cannot be submitted until completion of the procurement process during Project implementation, which will provide the information needed by BERC to consider the application as part of a regulatory filing. In this respect, there are some uncertainties as to the outcome of this regulatory process, which could potentially negative implications on the IAs’ financial sustainability. To mitigate these risks, the Project will provide training and capacity building to bolster the IAs’ implementation capacity. The Bank will also work with the IAs and BERC to facilitate the regulatory process, once the necessary data for an application become available.

75. **Residual fiduciary risks are rated Substantial.** Procurement risks including lack of experience with the Bank’s Procurement Regulations, the anticipated high-value contracts to be procured, and systemic delays in procurement processes in the country caused by, among other reasons, delays in the GoB’s required internal approvals. The PPSD has been prepared and appropriate procurement risk mitigation measures are outlined in Annex-1. Similarly, FM risks include the IAs’ lack of experience in managing IDA financing, multiple PIUs/cost centers for the Project, and inadequate capacity to prepared consolidated project financial statement and



complete timely audit reports. To mitigate these risks, a mitigation plan is agreed that includes; (a) appointing experienced FM consultants at the PIUs based on TORs acceptable to the World Bank along with adequate staff to support relevant functions, (b) undertaking risk-based internal audit on terms acceptable to the World Bank, (c) developing and using web-based computerized systems for all accounting and record-keeping functions in all the PIUs with real-time accounting entries, and (d) separating ledger code for each source of financing, such as IDA, and counterpart funding to track the budget and record project expenditure as per the source of financing.



**VII. RESULTS FRAMEWORK AND MONITORING**

**Results Framework**

COUNTRY: Bangladesh

**GAS SECTOR EFFICIENCY IMPROVEMENT AND CARBON ABATEMENT PROJECT**

**Project Development Objectives(s)**

To improve efficiency of gas distribution and end-use, and support carbon abatement in the gas sector

**Project Development Objective Indicators**

Indicator Name	PBC	Baseline	Intermediate Targets				End Target
			1	2	3	4	
<b>Total greenhouse gas emissions avoided as a result of the Project (kT of CO2 equivalent)</b>							
Total greenhouse gas emissions avoided as a result of the Project (Metric ton)		0.00	650.00	1,300.00	1,950.00	2,600.00	3,250.00
<b>Projected gas savings: average amount of gas saved per meter</b>							
Projected gas savings: average amount of gas saved per meter (cubic meters) (Cubic Meter(m3))		0.00	1.00	5.00	10.00	20.00	26.01
<b>Action Plan for carbon abatement of sector operations</b>							
Endorsement of Action Plan for carbon abatement of sector operations (Yes/No)		No	No	No	No	No	Yes
<b>Roadmap for the development and implementation of a sector policy carbon abatement framework</b>							



Indicator Name	PBC	Baseline	Intermediate Targets				End Target
			1	2	3	4	
Endorsement of Roadmap for the development and implementation of a sector carbon abatement framework (Yes/No)		No	No	No	No	No	Yes

**Intermediate Results Indicators by Components**

Indicator Name	PBC	Baseline	Intermediate Targets				End Target
			1	2	3	4	
<b>Component 1 - Strengthening the gas sector monitoring and control capabilities downstream</b>							
Annual CO2 emission reduction supported by the investments under the Project (Metric ton)		0.00	130.00	260.00	390.00	520.00	650.00
Number of prepaid meters installed for residential consumers (Number)		0.00	245,600.00	491,200.00	736,800.00	982,400.00	1,228,000.00
Number of smart meters installed for industrial customers (Number)		0.00	10.00	20.00	30.00	40.00	50.00
Number of distribution companies provided with SCADA/GIS systems (Number)		0.00	0.00	0.00	0.00	0.00	1.00
Person-Days of Training Provided to TGTDC and PGCL staff (Days)		0.00	400.00	800.00	1,200.00	1,600.00	2,000.00
Person-Days of Training Provided to TGTDC and PGCL female staff (Days)		0.00					800.00



Indicator Name	PBC	Baseline	Intermediate Targets				End Target
			1	2	3	4	
Share of female university and polytechnic graduates recruited by TGTDC and PGCL for 6-month paid internships (Percentage)		0.00	8.00	16.00	24.00	32.00	40.00
Percentage of grievances related to the facility satisfactorily addressed within two months of receipt (Percentage)		0.00	10.00	20.00	40.00	60.00	80.00
<b>Component 2 - Technical assistance for the carbon abatement of the oil and gas value chain</b>							
Person days of training on carbon abatement in Oil and Gas operations (Days)		0.00	15.00	30.00	45.00	60.00	60.00
Person-days of training on legal and regulatory frameworks for carbon abatement in Oil and Gas operations (Days)		0.00	4.00	8.00	12.00	16.00	20.00

**Monitoring & Evaluation Plan: PDO Indicators**

Indicator Name	Definition/Description	Frequency	Datasource	Methodology for Data Collection	Responsibility for Data Collection
Total greenhouse gas emissions avoided as a result of the Project	This will measure the total amount of avoided CO2 emissions because of the reduction in gas	Annual	Report commissioned by TGTDC and PGCL	Report commissioned by TGTDC and PGCL that will use an internationally	TGTDC and PGCL



	consumption from the installation of prepaid meters and reduction in non-technical losses from advanced monitoring infrastructure		that will use an internationally recognized methodology to estimate GHG emission reduction	recognized methodology to estimate GHG emission reduction	
Projected gas savings: average amount of gas saved per meter (cubic meters)	This will measure the average amount of monthly gas saved per meter in a kitchen with one double-burner kitchen as a result of the prepaid metering infrastructure.	Semi-annual	Survey commissioned by TGTDCI and PGCL to estimate the average amount of gas per meter saved as a result of the prepaid meter installation among residential consumers	Report commissioned by TGTDCI and PGCL to estimate the change in the average amount of gas per meter saved as a result of the prepaid meter installation among residential consumers on a representative sample basis	TGTDCI and PGCL
Endorsement of Action Plan for carbon abatement of sector operations	This will track the endorsement of an Action Plan for carbon abatement of sector operations by the MPEMR, the sector's main	One-time at the end of the Project	MPEMR	Completed action plan	Petrobangla



	authority				
Endorsement of Roadmap for the development and implementation of a sector carbon abatement framework	This will track the endorsement of a Roadmap for the development and implementation of a sector policy, legal, institutional, regulatory and contractual framework for sector carbon abatement by the MPEMR	One-time at the end of the Project	MPEMR	Completed roadmap	Petrobangla

**Monitoring & Evaluation Plan: Intermediate Results Indicators**

Indicator Name	Definition/Description	Frequency	Datasource	Methodology for Data Collection	Responsibility for Data Collection
Annual CO2 emission reduction supported by the investments under the Project	This will measure the total amount of CO2 emissions reduced because of the reduction in gas consumption from the installation of prepaid meters and reduction in non-technical losses from advanced monitoring infrastructure	Annual	Report commissioned by TGTDC and PGCL that will use an internationally recognized methodology to estimate GHG emission reduction	Report commissioned by TGTDC and PGCL that will use an internationally recognized methodology to estimate GHG emission reduction	TGTDC and PGCL



Number of prepaid meters installed for residential consumers	Number of pre-paid meters (card-based NFC type diaphragm meters and online- based “smart” meters using ultrasonic measurement) installed for residential consumers in TGTDCL and PGCL service territories (Number)	Semi-annual	Progress report submitted by TGTDCL and PGCL	TGTDCL and PGCL will track the number of smart meters installed for residential consumers within their business area	TGTDCL and PGCL
Number of smart meters installed for industrial customers	Number of smart meters installed for industrial customers to undertake the pilot program	Semi-annual	Progress report submitted by TGTDCL and PGCL	Titas will track the number of prepaid meters installed for residential consumers in the greater Dhaka area	TGTDCL and PGCL
Number of distribution companies provided with SCADA/GIS systems	Number of regulating and metering stations provided with SCADA systems	One-time at the end of the Project	Progress report submitted by PGCL	Certificate of installation	PGCL
Person-Days of Training Provided to TGTDCL and PGCL staff	This will measure the person-days of TGTDCL and PGCL staff (males and females) trained across different areas under the institutional and capacity-building component of the project.	Semi-annual	Progress report submitted by TGTDCL and PGCL	Progress reports by TGTDCL and PGCL will provide details on the person-days of relevant training received by their respective staff (males and females) trained across different areas under the institutional and capacity-building	TGTDCL and PGCL





				component of the project.	
Person-Days of Training Provided to TGDCL and PGCL female staff	This sub-indicator will measure the person-days of TGDCL and PGCL staff (females) trained across different areas under the institutional and capacity-building component of the project.	Semi-annual	Progress report submitted by TGDCL and PGCL	Progress reports by TGDCL and PGCL will provide details on the person-days of relevant training received by their respective staff (females) trained across different areas under the institutional and capacity-building component of the project.	TGDCL and PGCL
Share of female university and polytechnic graduates recruited by TGDCL and PGCL for 6-month paid internships	TGDCL and PGCL will establish new or expand existing internship programs to recruit female university and polytechnic institute graduates for 6-month paid internships to increase the pool of potential female applicants for permanent positions at both utilities	Semi-annual	Progress report submitted by TGDCL and PGCL	TGDCL and PGCL will collate data on the number of intern graduates who are female	TGDCL and PGCL
Percentage of grievances related to the facility satisfactorily addressed within two months of receipt	This will measure the percentage of grievances/complaints received on the activities related to the project that are satisfactorily addressed	Semi-annual	Progress report submitted by TGDCL and PGCL	TGDCL and PGCL shall share the details of grievances related to the meter rollout program as well as evidence of satisfactory	TGDCL and PGCL



	within a period of two months from date of receipt.			redressal	
Person days of training on carbon abatement in Oil and Gas operations	This will measure the Person-days of training on carbon abatement in O&G operations for staff of MPEMR, BERC, Petrobangla, and other subject-matter-relevant GoB personnel under component 2 of the project. It will target at least 60 person-days (20 participants x 3 1-day workshops)	One-time at the end of the project	Progress report submitted by Petrobangla	Progress report by Petrobangla will provide details on the person-days of relevant training on carbon abatement in O&G operations for staff of MPEMR, BERC, Petrobangla and other subject-matter-relevant GoB personnel.	Petrobangla
Person-days of training on legal and regulatory frameworks for carbon abatement in Oil and Gas operations	This will measure the Person-days of training on carbon abatement in O&G operations for staff of MPEMR, BERC, Petrobangla and other subject-matter-relevant GoB personnel under component 2 of the project. It will target at least 20 person-days (10 participants x 2 1-day workshops)	One-time at the end of the project	Progress report submitted by Petrobangla	Progress report by Petrobangla will provide details on the person-days of relevant training on carbon abatement in O&G operations for staff of MPEMR, BERC, Petrobangla and other subject-matter-relevant GoB personnel.	Petrobangla





## ANNEX 1: Implementation Arrangements and Support Plan

### COUNTRY: Bangladesh

#### Gas Sector Efficiency Improvement and Carbon Abatement Project

1. The strategy for implementation support has been developed based on the nature of activities involved in the Project and their commensurate risk profile in accordance with the Systematic Operations Risk-Rating Tool. Implementation support will be provided through regular implementation support missions and continuous exchange of correspondence and regular communication and thematic implementation support missions, if required. Implementation support to the utilities will cover technical and institutional development aspects. Petrobangla, TGTDC, and PGCL will form dedicated PIUs that will be responsible for the day-to-day coordination and execution of the Project relevant to each company. These units will need to include technical, financial management, procurement, environmental and social safeguards, and legal specialists focused on administering the loan and completing its financed activities.
2. Each PIU will provide the Bank with quarterly and annual progress reports. Each progress report will include, at a minimum, an account of activities implemented and results achieved during the reporting period, issues and corrective actions, planned and actual details of the work program, capacity-building activities for Project implementation, critical issues for attention, and any other relevant information. An outline of the progress report will be included in the Project Operations Manual.
3. **Technical.** The first key action during implementation will involve TGTDC, PGCL, and Petrobangla's staffing the PIUs with technical specialists (consultants) that will be responsible preparing relevant procurement documents, including related estimates of meters needed. The technical consultants will help TGTDC and PGCL develop the meter specifications, system requirements, and procurement documents, as well as assist in evaluating proposals submitted in the procurement process and supervising implementation.
4. The risks associated with the potential use of drones under Component 2 is negligible, given the location-circumscribed use of drones for detection purposes in selected facilities and their long-established use practice. Risk mitigation measures have been addressed in the Financing Agreement, covering the risk assessment and risk mitigation measures prior to procurement. However, it is important to note that Bangladesh has some regulatory requirements (e.g., clearance from the Civil Aviation Authority of Bangladesh (CAAB)) and other restrictions on the use of drones. This may cause delays in implementing some of Component 2's scope that will have to be taken into consideration during implementation. All the required regulatory clearances will need to be secured before using drones and the Bank's policies on data protection and privacy will need to be adhered to.
5. **Procurement.** Procurement under the Project will be carried out in accordance with the World Bank Procurement Regulations and provisions stipulated in the PPSD and Procurement Plan that may be updated from time to time with the World Bank's approval. The Project will be subject to the World Bank's Anticorruption Guidelines, dated October 15, 2006, revised in January 2011, and as of July 1, 2016



(‘Anticorruption Guidelines’). The project will use the STEP tool to plan, record, and track procurement transactions and complaints.

6. A detailed procurement analysis was carried out during Project preparation. The major procurement risks identified from the analysis, with suggested mitigating measures for minimizing its impact on the project, are summarized in Table 1.1. below.

**Table 1.1. Procurement Risks and Mitigating Measures**

Sl. No.	Risk Description	Risk Ranking		Overall Rating (A × B)	Description of Proposed Mitigation through Procurement Process
		Likelihood Rating (A)	Impact Rating (B)		
1	Availability of supply of meters as huge quantities are required	H	H	H	<ul style="list-style-type: none"> <li>• Early market mobilization efforts will be made among all major vendors.</li> <li>• Consultants working on the project design will focus on developing specifications that allow supplies by multiple vendors.</li> <li>• Drawing up an appropriate timeline and scheduling will ensure uninterrupted supply through the project period.</li> <li>• Ensuring regular monitoring of procurement activities through STEP, focusing on consultancies with high downstream effect.</li> <li>• Contracts with price adjustment based on price indexes for durations &gt; 18 months.</li> </ul>
2	Delay in procurement process	H	H	H	<ul style="list-style-type: none"> <li>• Establishing the PIU early in the implementation phase and quickly recruiting consultants</li> <li>• Commencing the procurement process early</li> <li>• Agreeing on a detailed timeline for all procurement activities and strictly following the timeline</li> <li>• Ensuring regular monitoring of procurement activities through STEP, focusing on consultancies with high downstream effect</li> </ul>
3	Insufficient experience of officials in the World Bank’s Procurement Regulations, SPD, and STEP	H	H	H	<ul style="list-style-type: none"> <li>• Establishing a strong PIU with skilled procurement staff</li> <li>• Providing adequate training on Procurement Regulations, SPD, and STEP to relevant officials of PGCL and TGTDC.</li> </ul>



Sl. No.	Risk Description	Risk Ranking		Overall Rating (A × B)	Description of Proposed Mitigation through Procurement Process
		Likelihood Rating (A)	Impact Rating (B)		
7	Inadequate supervision and quality control of contracts and poor contract management	M	H	S	<ul style="list-style-type: none"> <li>• Developing and following a contract management plan.</li> <li>• Providing training to the PGCL and TGTDCCL officials on contract management.</li> <li>• Engaging a consulting firm for supervision and monitoring of each package; the selected firm should be exposed to international good practices in construction supervision and contract management (selection criteria to address this aspect).</li> <li>• Making on-time payments and addressing claims/variations/documentary requests without undue delays.</li> </ul>
8	Lack of coordination among the stakeholders	M	H	S	<ul style="list-style-type: none"> <li>• Assigning a focal person from the PIU for coordination among the agencies involved in project implementation such as PGCL, TGTDCCL, Petrobangla, EMRD, Planning Commission, ERD, Ministry of Finance, and so on</li> <li>• Forming an inter-ministerial Project Steering Committee.</li> <li>• Forming a Project Implementation Committee.</li> </ul>
9	Sustainability	M	M	M	<ul style="list-style-type: none"> <li>• Procurement documents will address environmental, health, safety, social aspects (including COVID-19 prevention measures).</li> <li>• Wherever relevant (for example, construction supervision and contract management consultant), the contracts/TORs should include provisions for training and capacity building.</li> </ul>
10	Lack of experience of PGCL and TGTDCCL officials in World Bank's procurement of web/IT/systems	M	H	S	<ul style="list-style-type: none"> <li>• Providing adequate training on procurement of IT/web system and web/IT-specific SPD to relevant officials of PGCL and TGTDCCL</li> <li>• Engaging consultants to assist with procurement of IT/web system packages (including contract management and monitoring)</li> </ul>



Sl. No.	Risk Description	Risk Ranking		Overall Rating (A × B)	Description of Proposed Mitigation through Procurement Process
		Likelihood Rating (A)	Impact Rating (B)		
11	Supply shortage of GI/MS material in local markets for internal line modification by customers	H	H	H	<ul style="list-style-type: none"> <li>• Making information of real need for GI/MS materials available to local suppliers from the beginning of the project and if necessary fiscal benefits to importers may be considered.</li> </ul>

Note: SPD = Standard procurement document.

H= High; M= Moderate; S = Satisfactory.

7. The World Bank’s procurement implementation support will include prior reviews and post reviews and provision of training and guidance as needed to the PIUs. The prior review contracts will be those that are relatively complex, high-value contracts and will be agreed in the Procurement Plan following a risk-based approach. For the post review contracts, the TORs of the consulting services and technical specifications/bills of quantities of some of the goods/works packages may require technical review by the World Bank. Procurement post review will be conducted by the World Bank on a representative sample of contracts selected based on associated risks, at least on an annual basis or more frequently based on need.

8. **Financial Management.** The IAs’ audit reports indicates material weaknesses in FM reflected by inappropriate/inadequate disclosure on costs and liabilities, incomplete record and disclosure for intercompany fund transfers, weaknesses in fixed asset management and recording, inadequate practice to identify nonperforming assets, etc. Combined with complexity of the Project’s design from an FM perspective, these gaps will be mitigated through the following actions:

- (a) Appointment of a qualified accountant, preferably with accreditation from the International Federation of Accountants in each of the IAs, with adequate experience in Project FM (with TORs acceptable to the World Bank, and the package must be included under prior review contract irrespective of value) along with a dedicated accounts associate/junior consultant to support such functions in cost centers.
- (b) Using the Integrated Budget and Accounting System Project Management Accounting Portal (IBAS-PMAP) to record, report, and manage the Project’s FM activities, thereby mainstreaming iBAS++, once rolled out, for accounting and preparing Project financial statements. The PIUs, with real-time accounting entries, will generate quarterly interim unaudited financial reports (IUFRs) disaggregated to financing source, preferably from the iBAS++.
- (c) Adopting an approved Project Operations Manual, including FM procedures, in place as a disbursement condition for the respective disbursement category, which will detail an expenditure plan, eligibility criteria of Project expenditure, advance ceiling, prerequisites for expenditure of each component and disbursement category disaggregated by financing source, and reporting and accountability mechanism for eligible Project expenditure. Each PIU will incur the respective Project expenditures from the special account and direct payment/SC



from their allocation without any inter-PIU transfer of IDA funds from the special account. The Manual will also cover the overall accounting with financing sources, such as IDA and GoB, detail work plan with financing source, auditing, reporting, financial, and disbursement of the Project, which will be adopted by TGTDC, PGCL, and Petrobangla before disbursement.

- (d) Risk-based internal audit with TORs acceptable to the World Bank (subject to the World Bank’s prior review contract irrespective of value)

9. Intensive support, including field visits and desk reviews, in the initial years by World Bank staff is envisaged to ensure implementation of agreed FM arrangements. The support will cover timeliness of release of funds to the project, quality of financial reports, reconciliation of financial data, capacity building of FM staff, review of IUFs/audit reports, and follow-up for mitigation of issues and implementation of recommendations.

10. The Project will be included in the organizational code of the Budget and Accounting Classification System of the budget of the EMRD (Grant Code-142) under the MPEMR, to be determined under the operational segment (scheme of the Project) for release of the allocated annual budgets to the PIUs. The Government will reach on-lending agreements with IAs to ensure fund flow to Project spending centers and reporting arrangements of related expenditure.

11. The Project will finance all expenses agreed to achieve its objectives at 100 percent (with no co-financing) except for salaries and allowance of civil servants, vehicle and fuel, land acquisition (to the extent required), resettlement (to the extent required), taxes exceeding 15 percent of the total amount of financing, and other recurrent operating expenses that are ineligible for IDA financing according to current country financing parameters. GoB funding, which is accounted for in the IAs’ approved Development Project Proposals (DPPs) covering the Project’s Component 1, will provide for these and related expenditures in the form of parallel financing. Table 1.2 summaries the Project costs and funding sources.

Table 1.2: Project Costs Disaggregated by PIU and Financing Sources

Cost Item/Category	PGCL		TGTDC		Petrobangla		Project Aggregate		Total
	Amount in US\$ Million								
	IDA	Counterpart	IDA	Counterpart	IDA	Counterpart	IDA	Counterpart	IDA+Gov
Good, Consultancy and non-Consultancy Service	40.44	20.62	256.23	112.75	3.18	0.83	299.85	133.37	433.22
Motor Vehicles	0.00	0.14	0.00	0.31	0.00	0.00	0.00	0.45	0.45
Works	0.00	0.44	0.00	0.00	0.00	0.00	0.00	0.44	0.44
Incremental Operating Costs	0.00	0.74	0.00	2.06	0.00	0.83	0.00	3.63	3.63
TOTAL	40.44	21.94	256.23	115.12	3.18	1.66	299.85	137.89	437.74
IDA+Gov	62.38		371.35		4.84				437.74

Note: Total IDA Project Aggregate of US\$ 299.85 million excludes capitalized front-end fee of US\$150,000, which, when combined, bring total IDA funding to US\$300 million

12. GOB contributions under the Project for PGCL includes incremental operating cost, part of earmarked consultancy and whole training at 100 percent, vehicle, taxes, works (buildings for Server & Meter prover installation), and certain capital goods which will be identifiably separated in the annual work plan, if any. Similarly, GOB financing for TGTDC includes, incremental operating cost, vehicle, taxes, training, supply, certain part of goods (Installation & Commissioning of Prepaid Gas meter), if any. The allocation for the activities financed by the GOB are earmarked in the respective DPPs covering





Component 1's scope, and disaggregated to economic code of budget line. Lastly, GOB contributions for Petrobangla will be focused on the incremental operating costs. During implementation, the PIUs will have a separate ledger code for each source of financing, i.e., IDA and GOB, to track budget and record Project expenditure as per the source of financing so that expenditure under each source of financing can be identified, recorded, and accounted separately for State-Owned Enterprises, withdrawal application IUFs, and audited project financial statements.

13. A Designated Account (DA), in the form of Convertible Taka Special Account, will be opened by all IAs with a national commercial bank to receive IDA funds. The funds flow to the DA will be based on submission of a withdrawal application, in Client Connection, by authorized signatories for the project upon confirmation by ERD. An alternative signatory arrangement will be made for submission of the withdrawal application to ensure unhindered flow of funds for project execution. Disbursement would initially be made on an advance and replenishment, based on regular Statements of Expenditure. PIUs may have the option of direct payment for large value contracts as referenced in the Annual Work Plan.

14. Annual audits will be conducted by the Foreign Aided Projects Audit Department (FAPAD) under the Office of the Comptroller and Auditor General. FAPAD will express an opinion on the Project financial statement in accordance with international auditing standards and submit the report within six months of the fiscal year's end. The auditor is required to provide a detailed management letter containing the auditor's observations on internal controls and compliance with financial covenants in the Financing Agreement. A risk-based internal audit by an independent audit firm will be performed each year over the project term. Currently, there is no overdue audit report for any on-going or closed project by any of the PIUs.

15. After two years of implementation, the World Bank will review the quality of FM performance and may convert the disbursement modality to relying on interim unaudited financial reports (IUFs), including a six-monthly forecast of fund requirements. The PIUs will provide cash flow projections by June 30 of each year, which will be updated quarterly. All IAs will prepare separate IUFs from their accounting system in the quarterly format agreed upon with the World Bank and submit them to the World Bank for review and clearance within 45 days from the end of each quarter.

16. **Environmental and social safeguards.** The support will cover monitoring of various activities to ensure full compliance with the World Bank's ESF and the agreed readiness criteria for subprojects related to environment and social safeguards aspects.

17. The related environmental and social risks will be included in the TORs of the detailed assessment of decarbonization opportunities under Component 2. Although there are low/minor environmental risks associated with Project activities, the Project's environmental risks are rated Moderate because the IAs are new to the Bank's ESF. Capacity enhancement of the IAs will be developed to manage the environmental and social risks.