Report and Recommendation of the President to the Board of Directors

Project Number: 50161-003
May 2018

Proposed Loan and Administration of Grant People's Republic of Bangladesh: Rupsha 800-Megawatt Combined Cycle Power Plant Project

This is the version of the document approved by ADB's Board of Directors that excludes information that is subject to exceptions to disclosure set forth in ADB's Public Communications Policy 2011.

Asian Development Bank

CURRENCY EQUIVALENTS
(as of 1 May 2018)

Currency unit	–	taka (Tk)
Tk1.00	=	$0.011
$1.00	=	Tk84.0127

ABBREVIATIONS

ADB	–	Asian Development Bank
EIA	–	environmental impact assessment
ERP	–	enterprise resource planning
HSD	–	high-speed diesel
IDB	–	Islamic Development Bank
km	–	kilometer
kWh	–	kilowatt-hour
LNG	–	liquefied natural gas
MW	–	megawatt
NWPGCL	–	North-West Power Generation Company Limited
PAM	–	project administration manual

NOTES

(i) The fiscal year (FY) of the Government of Bangladesh and its agencies ends on 30 June. "FY" before a calendar year denotes the year in which the fiscal year ends, e.g., FY2016 ends on 30 June 2016.
(ii) In this report, "$" refers to United States dollars.

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PROJECT AT A GLANCE

1. Basic Data — **Project Number:** 50161-003

Project Name	Rupsha 800-Megawatt Combined Cycle Power Plant Project	**Department /Division**	SARD/SAEN
Country	BAN	**Executing Agency**	North-West Power Generation Co. Ltd.(NWPGCL)
Borrower	Bangladesh		

2. Sector

	Subsector(s)	ADB Financing ($ million)
✓ **Energy**	Conventional energy generation	445.00
	Electricity transmission and distribution	37.00
	Oil and gas transmission and distribution	11.00
Information and communication technology	ICT industries and ICT-enabled services	7.00
	Total	**500.00**

3. Strategic Agenda

	Subcomponents
Inclusive economic growth (IEG)	Pillar 2: Access to economic opportunities, including jobs, made more inclusive
Environmentally sustainable growth (ESG)	Disaster risk management Global and regional transboundary environmental concerns

Climate Change Information

CO_2 reduction (tons per annum)	1,278,206
Climate Change impact on the Project	Medium

ADB Financing

Adaptation ($ million)	25.08
Mitigation ($ million)	14.28

4. Drivers of Change

	Components
Governance and capacity development (GCD)	Client relations, network, and partnership development to partnership driver of change Institutional development Organizational development
Knowledge solutions (KNS)	Pilot-testing innovation and learning
Partnerships (PAR)	International finance institutions (IFI) Official cofinancing

Gender Equity and Mainstreaming

Effective gender mainstreaming (EGM)	✓

5. Poverty and SDG Targeting

Geographic Targeting	No
Household Targeting	No
SDG Targeting	Yes
SDG Goals	SDG7, SDG13

Location Impact

Nation-wide	High

6. Risk Categorization: Complex

7. Safeguard Categorization **Environment:** A **Involuntary Resettlement:** B **Indigenous Peoples:** C

8. Financing

Modality and Sources	Amount ($ million)
ADB	**500.00**
Sovereign Project (Regular Loan): Ordinary capital resources	500.00
Cofinancing	**301.50**
Islamic Development Bank - Project loan (Not ADB Administered)	300.00
Japan Fund for Poverty Reduction - Project grant (Full ADB Administration)	1.50
Counterpart	**338.50**
Government	338.50
Total	**1,140.00**

Source: Asian Development Bank

I. THE PROPOSAL

1. I submit for your approval the following report and recommendation on a proposed loan to the People's Republic of Bangladesh for the Rupsha 800-Megawatt Combined Cycle Power Plant Project. The report also describes the proposed administration of a grant to be provided by Japan Fund for Poverty Reduction (JFPR) for the financing of the Rupsha 800-Megawatt Combined Cycle Power Plant Project, and if the Board approves the proposed loan, I, acting under the authority delegated to me by the Board, approve the administration of the grant.

2. The project targets improving energy security in Bangladesh. It will increase availability of efficient and cleaner energy by developing a state-of-the-art power plant with 800-megawatt (MW) generation capacity using cleaner and highly efficient power generation technology. The project also envisages the construction of associated natural gas supply and power transmission infrastructure facilities, as well as strengthening of the institutional capacity and overall business process of the project's executing agency, North-West Power Generation Company Limited (NWPGCL), to efficiently plan and operate power plants.[1]

II. THE PROJECT

A. Rationale

3. Bangladesh has the eighth largest population and is the 10th most densely populated country in the world.[2] The country has achieved consistent and steady economic growth, with real gross domestic product estimated at 6.1% in fiscal year (FY) 2014, 6.6% in FY2015, and 7.1% in FY2016.[3] The structure of the Bangladesh economy is gradually shifting from agriculture to manufacturing and services. The government's strategy for development in the medium to long term focuses on four priorities: (i) accelerating growth to 7.5% per year; (ii) making this growth more inclusive, pro-poor, and environmentally sustainable; (iii) reducing the poverty rate from 24.8% to 18.6% and the extreme poverty from 12.9% to about 8.9%; and (iv) providing productive jobs for all new entrants to the labor force by 2021.[4]

4. Despite the economic success, the country faces major challenges in its effort to maintain the growth trend and move closer to upper middle-income status because of infrastructure deficiencies. Bangladesh ranks low in infrastructure quality (behind India, Pakistan, and Sri Lanka), and as such, addressing infrastructure deficiencies is a top priority for the government.[5] A major challenge is to provide modern and affordable energy services to those who lack access. Inadequate energy could result in a loss of productivity and competitiveness and become a constraint to faster growth and greater investment in the short to medium term. To mitigate this constraint and sustain Bangladesh's economic momentum, the government has prepared an investment plan to increase power generation capacity, as well as improve and extend the power transmission and distribution network, with the aim of achieving universal access to grid-connected electricity by 2021.

5. **Sector overview.** The power sector in Bangladesh is characterized by recurring shortages of electricity generating capacity in the face of ever-rising demand in a growing economy. In

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[1] The project is included in ADB. 2017. *Country Operations Business Plan: Bangladesh, 2018–2020.* Manila.

[2] World Bank. https://data.worldbank.org/country/bangladesh (accessed 1 March 2018). As of 2016, Bangladesh had an estimated population of 162 million people and a population density of 1,252 people per square kilometer.

[3] Bangladesh Bureau of Statistics. http://www.bbs.gov.bd/ (accessed 1 March 2018).

[4] Government of Bangladesh, Planning Commission. 2015. *Seventh Five Year Plan FY2016–FY2020: Accelerating Growth and Empowering Citizens.* Dhaka.

[5] World Economic Forum. 2017. *The Global Competitiveness Report, 2017–2018.* Geneva. Bangladesh was ranked 111th of 137 countries.

FY2015, per capita electricity consumption was 310 kilowatt-hours (kWh); this was lower than most of the other countries in South Asia, indicating that power sector infrastructure facilities in Bangladesh require significant capacity additions.[6] In FY2017, peak demand was estimated at 10,400 MW while available generation capacity was 9,479 MW. Net peak demand is expected to exceed 13,300 MW by 2020 and 19,900 MW by 2025 while existing generation capacity will gradually retire and need replacement. Bangladesh's power generation expansion plan intends to provide (i) the required generation capacity to meet this increasing demand at least cost; and (ii) sufficient generation capacity to meet the government's electrification goals, including delivering services to segments of the population currently not connected to grid electricity, and required reserve margins.[7] In tandem with increased power generation capacity, investments in the transmission network are required to address transmission bottlenecks for the evacuation of bulk power from power stations to major load centers. Therefore, at the government's request, the proposed Southwest Transmission Grid Expansion Project (footnote 1) will be submitted for consideration by ADB in July 2018.

6. **Energy security.** Domestic natural gas is the dominant fuel in power generation in Bangladesh. In 2016, 62% of the country's electricity was generated by gas-fired power stations while the remainder was based on furnace oil (21.3%), diesel (8.2%), power imports (4.9%), hydropower (1.9%), and coal (1.6%). However, domestic gas reserves are rapidly declining and the growth in gas production has not kept up with increasing demand for power generation and other industrial, commercial, and household consumption. Current reserves are likely to be fully depleted by 2030, and domestic gas exploration efforts are yet to yield any promising results.

7. To address the problem of declining domestic gas reserves and ensure energy security, importing liquefied natural gas (LNG) will play a pivotal role. LNG is a cleaner fuel that burns at a higher efficiency in modern combined cycle power plants, leading to lower environmental emissions, including carbon dioxide. Additionally, production costs of electricity using LNG are now more competitive compared with many conventional fuels. The Power System Master Plan 2016 (footnote 7) indicates that equal proportions of coal-fired and gas-fired generation result in least economic cost on a per kWh basis in the long term. Accordingly, the project is designed to use dual fuel gas-fired combined cycle power plant technology.[8]

8. The government has executed two separate terminal use and implementation agreements with Excelerate Energy L.P. and Summit Power International Ltd. for the construction and operation of Bangladesh's first and second LNG import terminals near Maheshkhali Island in the Bay of Bengal. These terminals will enable the government to procure LNG from international gas markets, which will supplement the country's declining domestic natural gas reserves. The government has already signed a long-term contract with RasGas Company (Qatar) to supply 2.5 million tons of LNG per annum over 15 years, commencing in 2018. The LNG terminals will be constructed in time to receive the first LNG delivery within 2018. Given that the government has provided written assurance to supply gas to the Rupsha power plant from the Maheshkhali LNG terminals, the project will significantly contribute to reducing the gap between electricity demand and supply in Bangladesh.

9. **Weak institutional capacity.** Technical and financial management of electricity utilities is largely based on traditional practices, with limited use of modern management techniques

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[6] Annual per capita consumption levels reported in 2015 by other countries in the region were as follows: Bhutan 3,039 kWh, India 800 kWh, Maldives 558 kWh, Sri Lanka 530 kWh, and Nepal 140 kWh.

[7] Government of Bangladesh; Ministry of Power, Energy and Mineral Resources; Power Division. 2016. *Power System Master Plan 2016.* Dhaka.

[8] The Rupsha power plant is designed as dual fuel plant. It will operate on natural gas as the primary fuel, and high-speed diesel as an emergency backup fuel.

supported by information management systems. This leads to poor resource allocation and inefficient reporting. Power generation, which accounts for the highest share of the cost of electricity, needs to be managed by specialists with hands-on training in controlling the process flow in each power plant, including the use of modern power plant operations simulators. Otherwise, power plant operator training is limited to classroom sessions and to trainings provided by power plant contractors during commissioning of new power plants.

10. **Asian Development Bank sector experience and assistance program.** The Asian Development Bank (ADB) is a key development partner in the energy sector of Bangladesh and has been actively supporting investments in seven broad thematic areas: (i) promoting a commercial orientation for power sector entities, (ii) promoting investments in power generation, (iii) removing transmission constraints, (iv) expanding access to electricity, (v) increasing gas production capacity and mobilizing investments to gas production, (vi) improving the gas transmission and distribution network, and (vii) improving the governance and regulatory framework. ADB has strongly contributed to promoting far-reaching energy sector reforms, especially in the power sector and private sector participation. Through a series of reform-linked projects, ADB helped the government vertically unbundle the power sector entities and set of new companies with firm commercial bases for power distribution, transmission, and generation. Financing was also provided for the newly set up companies to increase generation capacity, augment transmission systems, and rehabilitate distribution networks. Also, ADB interventions have resulted in issuance of gas and electricity tariff regulations.

11. Per covenants stipulated in the draft loan agreement for this project, ADB will continue its policy dialogue with the government to pursue further reform actions to strengthen the gas pricing policy and regular electricity tariff revisions with the active involvement of the Bangladesh Energy Regulatory Commission. The project is in line with ADB's country partnership strategy for Bangladesh, 2016–2020,[9] supporting the government's vision of higher, more inclusive, and sustainable economic growth and investments to address infrastructure constraints. The country partnership strategy recognizes that achieving energy security through policy reforms is the key to achieving accelerated growth. The project also complements activities of other major development partners in Bangladesh.[10]

12. **Value added by ADB assistance.** The project builds upon ADB's strong and sustained presence in the power sector of Bangladesh and embraces ADB's sector knowledge and synergistic approach in developing all energy subsectors. Complementing ongoing massive investments in transmission and distribution infrastructure, this project is an integral part of the government's plan to ensure energy security for its population.

13. ADB is a pioneer in harnessing clean and efficient power generation technology; the ADB-financed project design will ensure that the Rupsha power plant will use the latest proven combined cycle technology, which offers the highest efficiency to convert gas to electricity. Further, the power plant is designed to use the latest zero liquid discharge technology making it the first of its kind in Bangladesh.[11] ADB will also add value through capacity building. This project will facilitate operator training and will finance a high-level technology power plant operations training simulator to be installed at NWPGCL. The project will also finance the

[9] ADB. 2016. *Country Partnership Strategy: Bangladesh, 2016–2020.* Manila.

[10] ADB coordinates and cofinances projects in the energy sector with major development partners, including Agence Française de Développement, the European Investment Bank, the Islamic Development Bank (IDB), the Japan International Cooperation Agency, German development cooperation through KfW, and the World Bank. Development Coordination (accessible from the list of linked documents in Appendix 2).

[11] Zero liquid discharge wastewater technology utilizes the most advanced technological water treatment processes to purify and recycle liquid waste at the end of the industrial process, leaving zero discharge.

implementation of a modern enterprise resource planning (ERP) system to facilitate improved information flow, financial control, and decision-making. In addition, the proposed JFPR grant under the project will pilot test innovative socially inclusive and gender-sensitive development programs for communities in the project area (para. 18). Activities to be financed by the grant will focus on vulnerable households and women, with a view to improving living standards.

B. Impact and Outcome

14. The project is aligned with the following impact: energy security improved, and electricity supply increased.[12] The project will have the following outcome: availability of efficient and cleaner energy increased.[13]

C. Outputs

15. **Output 1: Efficient gas-fired power generation increased.** This will be achieved through the design, supply, installation, and commissioning of the new Rupsha 800 MW combined cycle power plant. Combined cycle technology provides the best efficiency among all power-generating technologies. It enables the power plant to be built in stages, with the ability to commission the gas turbines in 2 years, which is useful to meet the ongoing capacity deficit in Bangladesh's power system. Khulna city, where the Rupsha power plant will be based, is served by the national gas transmission network, enabling domestic or imported gas to be readily supplied.

16. **Output 2: Energy transfer systems upgraded.** For gas supply to the Rupsha power plant, the project will construct (i) a 10-kilometer (km), 24-inch gas distribution pipeline to connect the Khulna city gas station to the Rupsha power plant; and (ii) an additional 2 km, 20-inch gas pipeline (offtake) from the Rupsha power plant to NWPGCL's existing 225 MW power plant at Khulna, which is currently operating on high-speed diesel (HSD). The project will replace the HSD at the Khulna power plant and provide a stable gas supply for its operation, resulting in significant environmental, economic, and financial benefits. To transfer generated electricity from the Rupsha power plant to the existing Khulna south grid substation, the project will finance construction of a 230-kilovolt switchyard at the Rupsha power plant site and 29 km of 230-kilovolt high-capacity double-circuit transmission lines.

17. **Output 3: Institutional capacity of North-West Power Generation Company Limited strengthened.** This will be achieved through (i) implementation and operation of an ERP system; (ii) supply and installation of a universal power plant operations training simulator; and (iii) on-the-job training for NWPGCL staff in (a) project management, implementation, and supervision; (b) monitoring and evaluation; (c) operation and maintenance; (d) environment and social safeguards; (e) gender equity; and (f) effective project communications.

18. **Output 4: Socially inclusive development of communities neighboring the project site pilot tested.** The project will provide grant financing to improve living standards of communities in the project area by (i) increasing awareness on safe and efficient use of electricity; (ii) delivering capacity building trainings on livelihood activities and employment opportunities; and (iii) installing a 10-kilowatt solar system, two information technology laboratories, and two science laboratories in schools near the Rupsha power plant.[14]

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[12] Government of Bangladesh, Ministry of Planning, Planning Commission. 2012. *Perspective Plan of Bangladesh, 2010–2021: Making Vision 2021 a Reality.* Dhaka.

[13] The design and monitoring framework is in Appendix 1.

[14] Japan Fund for Poverty Reduction Grant (accessible from the list of linked documents in Appendix 2).

D. Summary Cost Estimates and Financing Plan

19. The project is estimated to cost $1,140 million (Table 1).

20. Detailed cost estimates by expenditure category and by financier are in the project administration manual (PAM).[15] Major expenditure items to be financed by the project are turnkey contracts, consulting services, and information technology hardware and software for ERP system.

Table 1: Summary Cost Estimates
($ million)

Item		Amount[a]
A.	**Base Cost**[b]	
	1. Efficient gas-fired power generation increased	880.6
	2. Energy transfer systems upgraded	35.7
	3. Institutional capacity of North-West Power Generation Company Limited strengthened	31.5
	4. Socially inclusive development of communities neighboring the project site pilot tested	1.4
	Subtotal (A)	**949.2**
B.	**Contingencies**[c]	**95.2**
C.	**Financial Charges During Implementation**[d]	**95.6**
	Total (A+B+C)	**1,140.0**

[a] Includes taxes and duties of $152.9 million to be financed by the government from the project's counterpart funding by cash contribution. Taxes and duties under the JFPR grant will be financed by the JFPR.
[b] In October 2017 prices, based on the development project proposal prepared by the executing agency.
[c] Physical contingencies were computed at 4% of base costs. Price contingencies with respect to costs in foreign currency were computed at 1.4% for 2017 and 1.5% for 2018 onwards. Price contingencies with respect to costs in local currency are computed at 6.1% for 2017 and 6.3% for 2018 onwards. This also includes provision for potential exchange rate fluctuation under the assumption of a purchasing power parity exchange rate.
[d] Includes interest and commitment charges. Interest during construction has been computed at the government's onlending rate. Commitment charges for the OCR loan are 0.15% per year to be charged on the undisbursed loan amount.
Sources: North-West Power Generation Company Limited and Asian Development Bank estimates.

21. The government has requested a regular loan of $500 million from ADB's ordinary capital resources to help finance the project. The loan will have a 25-year term, including a grace period of 5 years; an annual interest rate determined in accordance with ADB's London interbank offered rate-based lending facility; a commitment charge of 0.15% per year; and such other terms and conditions set forth in the draft loan and project agreements. Based on the straight-line repayment method, the average loan maturity is 15.25 years, and the maturity premium payable to ADB is 0.10% per year.[16]

22. The government has also requested a loan of $300 million from the Islamic Development Bank (IDB) to cofinance output 1. Cofinancing will be on a collaborative basis following a joint financing structure. IDB will administer its own funds. ADB and IDB agreed on the cofinancing amount and structure, as well as the procurement and safeguard arrangements.[17] JFPR will provide grant cofinancing of $1.5 million to be fully administered by ADB.

23. The summary financing plan is in Table 2. ADB will finance eligible expenditures in relation to the turnkey contracts, supply of equipment, consulting services, and contingencies. The JFPR grant will finance equipment and consulting services in relation to socially inclusive development of communities. The government will finance taxes and duties, small civil works, recurrent costs,

[15] Project Administration Manual (accessible from the list of linked documents in Appendix 2).
[16] The Government of Bangladesh will onlend ADB's loan proceeds to the executing agency at a rate of 4% per annum.
[17] Details of the cofinancing arrangements are reflected in the Minutes of the Meeting for Cooperation, Coordination, and Exchange of Information between ADB and IDB for Rupsha 800-Megawatt Combined Cycle Power Plant Project (accessible from the list of linked documents in Appendix 2). A memorandum of understanding will be signed after the approval of the project by ADB and IDB.

interest during implementation, land transfer, environmental and social mitigation, project management, and remuneration of counterpart staff. The government has assured ADB that it will cover any shortfall in financing required to meet the agreed outputs.

Table 2: Summary Financing Plan

Source	Amount ($ million)	Share of Total (%)
Asian Development Bank		
Ordinary capital resources (regular loan)	500.0	43.9
Islamic Development Bank	300.0	26.3
Japan Fund for Poverty Reduction (grant)	1.5	0.1
Government of Bangladesh	338.5	29.7
Total	**1,140.0**	**100.0**

Source: Asian Development Bank estimates.

24. The proportion of the cost attributable to climate mitigation is estimated to be $29.34 million, while it is $41.13 million for climate adaptation.[18] ADB will finance 49% ($14.28 million) of mitigation costs and 61% ($25.08 million) of adaptation costs. Details are in the project climate risk assessment and management report.[19]

E. Implementation Arrangements

25. Universal procurement shall apply to output 1, as the contract package will be jointly financed by ADB and IDB. Procurement of all remaining packages will follow ADB's Procurement Guidelines (2015, as amended from time to time). Recruitment of consultants will follow ADB's Guidelines on the Use of Consultants (2013, as amended from time to time). An oversight role by ADB will help NWPGCL meet integrity requirements during the bidding process and project implementation. NWPGCL maintains a website that will be updated regularly and include information with respect to (i) procurement progress and contract awards, and (ii) physical and financial progress of the project.

26. The implementation arrangements are summarized in Table 3 and described in detail in the PAM (footnote 15). Sundarban Gas Company Limited will provide technical support to implement the gas supply component of the project while Power Grid Company of Bangladesh will provide technical support to implement the power transmission component.

Table 3: Implementation Arrangements

Aspects	Arrangements		
Implementation period	September 2018–June 2022		
Estimated completion date	30 June 2022		
Estimated loan and grant closing date	31 December 2022		
Management			
(i) Oversight body	Steering committee Secretary, Power Division, MPEMR (chair) Representatives of MOF; Ministry of Planning, Planning Commission; Energy Division, MPEMR; Petrobangla; BPDB; PGCB;[a] GTCL; and SGCL[b] (members)		
(ii) Executing agency	NWPGCL		
(iii) Implementation unit	Project management unit established in NWPGCL		
Procurement	ICB	4 contracts	$698.5 million
Consulting services	QCBS (80:20)	1 contract	$13.7 million
	ICS	2 contracts	$0.7 million

[18] Economic analysis of the climate-proofing investment was conducted to prove that adaptation is desirable from an economic efficiency point of view. Economic Analysis (accessible from the list of linked documents in Appendix 2).
[19] Climate Risk Assessment and Management Report (accessible from the list of linked documents in Appendix 2).

Aspects	Arrangements
Retroactive financing and/or advance contracting	At the request of the government, advance contracting has commenced, and retroactive financing is permissible for up to 20% of the loan and grant amount for expenditures incurred prior to loan effectiveness, but no more than 12 months before the signing of the loan agreement.
Disbursement	The loan and grant proceeds will be disbursed following ADB's *Loan Disbursement Handbook* (2017, as amended from time to time) and detailed arrangements agreed between the government and ADB.

ADB = Asian Development Bank, BPDB = Bangladesh Power Development Board, GTCL = Gas Transmission Company Limited, ICB = international competitive bidding, ICS = individual consultant selection, MOF = Ministry of Finance, MPEMR = Ministry of Power, Energy and Mineral Resources, NWPGCL = North-West Power Generation Company Limited, Petrobangla = Bangladesh Oil, Gas and Mineral Corporation, PGCB = Power Grid Company of Bangladesh, QCBS = quality- and cost-based selection, SGCL= Sundarban Gas Company Limited.
[a] After commissioning all assets with respect to power transmission project, facilities will be duly transferred to PGCB.
[b] After commissioning all assets with respect to gas supply project, facilities will be duly transferred to SGCL.
Source: ADB.

III. DUE DILIGENCE

A. Technical

27. The ADB project team and project preparatory consultants visited the project sites, reviewed all available reports on file (including the project feasibility study), and undertook comprehensive assessments to determine that the proposed investment is technically sound.[20] The project will utilize best available and proven technologies suitable to local conditions and the capacity of NWPGCL staff. The Rupsha power plant will be located 271 km southwest of Dhaka in Khulna city. The power plant will use combined cycle gas turbine technology, comprising two identical generating units, each nominally rated at 400 MW. Combined cycle gas turbine technology is the most efficient (the conversion efficiency of the power plant's two generating units is estimated to be 57% or higher) and the cleanest fossil fuel power generation option currently available in the market. The power plant is designed to have two blocks of multi-shaft 1:1:1 configuration comprising one gas turbine, one heat recovery steam generator, and one steam turbine.

28. The Rupsha power plant is designed to operate on natural gas as the primary fuel and HSD as an emergency backup fuel. A net efficiency of 57% would require a gas flow rate of 113 million cubic feet per day. Allowing provision for power plant sizing above 800 MW (depending on the successful bidder's offered configuration), a provision of 125 million cubic feet per day (0.9 million tons per annum) is expected to be allowed for gas supply infrastructure. The government has provided written assurance to supply natural gas for Rupsha power plant operation. ADB's due diligence confirmed that the government will commence LNG imports within 2018 and assessed that the existing gas transmission network is adequate to deliver gas from LNG receiving facilities to the Rupsha power plant.[21]

[20] Consulting services to prepare a comprehensive project feasibility study were financed by ADB. 2012. *Report and Recommendation of the President to the Board of Directors: Multitranche Financing Facility to the People's Republic of Bangladesh for the Power System Expansion and Efficiency Improvement Program.* Manila (Loan 2966-BAN). In addition, the following technical assistance was approved on 1 September 2016 to help the government with additional project due diligence: ADB. 2016. *Small-Scale Technical Assistance to the People's Republic of Bangladesh for the Khulna 800 MW LNG Based Power Plant Project.* Manila (TA 9164-BAN).

[21] Assessment of Gas Demand, Gas Supply, and Gas Transmission System Capability to Ensure Sustainable Gas Supply to the Proposed Rupsha 800-Megawatt Combined Power Plant (accessible from the list of linked documents in Appendix 2).

B. Economic and Financial

29. **Economic viability.** An economic analysis was carried out in accordance with ADB's Guidelines for the Economic Analysis of Projects.[22] Results indicate an economic internal rate of return of 17.8%, in constant 2017 prices. Given a hurdle rate of 9%, the project is deemed economically viable. Without the Rupsha power plant, Bangladesh Power Development Board will have to continue with ongoing contracts using oil-fired generation to meet growing demand. However, the proposed power plant running at 800 MW full capacity will generate 4,906 gigawatt-hours of electricity every year, and an estimated 320 MW of oil-fired generating capacity will be displaced. The non-incremental benefit of avoided fuel costs and the environmental benefit of avoided carbon dioxide emissions were calculated based on fuel type of displaced power plants. The remaining capacity (480 MW) will produce incremental outputs, valued using the willingness-to-pay methodology, and non-incremental outputs, valued at resource cost savings.

30. **Financial viability.** Following ADB's Guidelines on the Financial Management and Analysis of Projects, a financial cost–benefit analysis was carried out separately for outputs 1, 2, and 3.[23] Financial viability was assessed by comparing the incremental costs and revenues over the life of each output. The electricity produced by the Rupsha power plant will be priced based on the power purchase agreement between NWPGCL and Bangladesh Power Development Board, which allows full cost recovery through a tariff. The financial internal rate of return for the Rupsha power plant was calculated in real terms on an after-tax basis using 2017 constant prices. Results (confirmed through sensitivity analysis) show a rate of return of 6.0%, which is above the weighted average cost of capital of 1.8%; the project is therefore deemed financially viable.[24]

C. Governance

31. NWPGCL, an enterprise of Bangladesh Power Development Board, is one of five public power generation utilities in the country. NWPGCL was created in 2007 under the provision of the Companies Act, 1994 and the framework of the Government Power Sector Reforms Policy supported by ADB's sector development program loan.[25] NWPGCL is one of the fastest-growing power companies in Bangladesh, with a current installed generation capacity of 722 MW and an aim to increase generation capacity by an additional 2,590 MW by 2022.

32. NWPGCL has substantial capacity to undertake the project, as it has been the executing and implementing agency for past ADB-financed projects. NWPGCL has significant capability in public procurement, as well as extensive knowledge of ADB's procurement processes and regulations. Procurement capacity risk is rated low.[26] The financial management assessment of NWPGCL concluded that it can fulfill ADB's fiduciary requirements, and financial management risk is moderate. However, the assessment noted that NWPGCL has room to strengthen its overall financial management capacity considering the future development agenda of the company. NWPGCL currently uses a manual information reporting system and accounting; financing and fixed asset records are kept manually using spreadsheets. To upgrade NWPGCL's business processes, ADB will support implementation of the ERP system, and help NWPGCL build additional financial management capacity. ADB's Anticorruption Policy (1998, as amended to date) was explained to and discussed with the government and NWPGCL. The specific policy requirements and supplementary measures are described in the PAM (footnote 15).

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[22] ADB. 2017. *Guidelines for the Economic Analysis of Projects*. Manila.
[23] ADB. 2005. *Guidelines on the Financial Management and Analysis of Projects*. Manila.
[24] Economic Analysis and Financial Analysis (accessible from the list of linked documents in Appendix 2).
[25] ADB. 2007. *Report and Recommendation of the President to the Board of Directors: Proposed Sector Development Program Loan to the People's Republic of Bangladesh for the Sustainable Power Sector Development Program.* Manila (Loan 2334-BAN).
[26] Procurement Capacity Assessment Report (accessible from the list of linked documents in Appendix 2).

D. Poverty, Social, and Gender

33. **Poverty and social.** The major benefit of the project is additional electricity supply to about 300,000 consumers, which will promote business expansion and create employment opportunities for local communities, including poor and socially disadvantaged people. The project will also contribute to poverty reduction by bringing economic and livelihood opportunities to the area around the project site, and directly provide electricity in the project area. During construction, the project is expected to generate jobs for skilled and unskilled laborers, including the poor, vulnerable groups, and women.

34. **Gender.** The project is categorized as effective gender mainstreaming, and a gender action plan has been prepared. Key design features are (i) providing a safe and inclusive educational environment, (ii) providing training for safe and efficient use of electricity for school teachers and students, (iii) providing technical and skills training to expand employment and livelihood opportunities, and (iv) supporting improved social and gender awareness in the energy sector. These activities, supported by targets, will be undertaken with a focus on women. ADB will encourage NWPGCL to enhance women's recruitment in the energy sector.

E. Safeguards

35. In compliance with ADB's Safeguard Policy Statement (2009),[27] the project's safeguard categories are as follows.[28]

36. **Environment (category A).** The project is a "greenfield" investment in fossil fuel-based power generation, and the power plant is adjacent to the Bhairab River, which supports the globally endangered Ganges River dolphin. The Rupsha power plant will run annually for 5,632 hours using natural gas and 500 hours using HSD. Following ADB's Safeguard Policy Statement and national regulations, an environmental impact assessment (EIA) (including biodiversity assessment and surveys) was undertaken and is presented in three volumes, one for each component of the project.[29] Mitigation measures are proposed in the EIA and the environmental management plan to minimize environmental, health, and safety impacts resulting from air emission, effluent, noise, and waste from the project. A draft EIA was disclosed on ADB's website on 23 February 2018. NWPGCL has previously implemented ADB projects and has adequate institutional capacity to manage environmental risks. External monitoring will verify the information submitted to ADB by NWPGCL. A grievance redress mechanism has been established. The project management unit in NWPGCL will be responsible for environmental management plan implementation, retaining one permanent safeguard staff member supported by national and international experts to strengthen the capacity of NWPGCL.

37. **Involuntary resettlement (category B).** Land acquisition for the project is not envisaged, and the impacts are therefore not considered significant. The Rupsha power plant will be located in the abandoned Khulna Newsprint Mill complex, from which 20 hectares of government land will be purchased and transferred to NWPGCL. The construction of the 12 km gas pipeline will follow the existing right-of-way of highways and roads, while the construction of the 29 km transmission line will temporarily require land under right-of-way. The project is expected to affect 145 households with 640 people, but the impacts are mostly temporary and not considered significant. Mitigation measures and budgetary provisions are in place to provide compensation at replacement cost and

[27] ADB and IDB agreed to follow ADB's Safeguard Policy Statement.
[28] ADB. Safeguard Categories. https://www.adb.org/site/safeguards/safeguard-categories.
[29] The consultant's terms of reference for the biodiversity assessment were prepared with assistance from the Wildlife Conservation Society and from staff and consultants of ADB's Sustainable Development and Climate Change Department. NWPGCL has contracted the International Union for Conservation of Nature to undertake biodiversity assessment in the project area.

restore livelihoods commensurate to the impacts. The resettlement plan was prepared in compliance with the relevant government regulations and ADB's Safeguard Policy Statement and was disclosed on ADB's website on 5 March 2018. Given its experience, NWPGCL can properly implement the resettlement plan.

38. **Indigenous peoples (category C).** Relevant due diligence confirmed that no indigenous peoples, as defined by ADB's Safeguards Policy Statement, are located in the project area.

F. Summary of Risk Assessment and Risk Management Plan

39. Significant risks and mitigating measures are summarized in Table 4 and described in detail in the risk assessment and risk management plan.[30]

Table 4: Summary of Risks and Mitigating Measures

Risks	Mitigation Measures
Non-availability of natural gas to operate the Rupsha power plant due to delays in liquefied natural gas imports.	Infrastructure to import liquefied natural gas is under construction, and the government has given written assurance to allocate gas for the Rupsha power plant. The government has already signed an agreement to import gas, which is expected to be available within 2018, 2 years ahead of commissioning of the first gas turbines of the Rupsha power plant.
Power transmission system constraints will cause the Rupsha power plant to underutilize its capacity.	The required infrastructure to evacuate power to the existing substation will be financed by the project. The remaining transmission system strengthening is included in the power grid company's development plans, and it is being financed by development partners, including the Asian Development Bank, through regular lending programs.
Increases in prices of commodities and raw materials in the international market above projections and contingencies could result in cost overrun and delay project completion.	The capital expenditure estimates are benchmarked to recent similar projects in Bangladesh. Additionally, adequate physical and price contingencies have been provisioned in the project cost.

Source: Asian Development Bank.

IV. ASSURANCES

40. The government and NWPGCL have assured ADB that implementation of the project shall conform to all applicable ADB policies, including those concerning anticorruption measures, safeguards, gender, procurement, consulting services, and disbursement as described in detail in the PAM and loan documents.

41. The government and NWPGCL have agreed with ADB on certain covenants for the project, which are set forth in the draft loan agreement and project agreement.

V. RECOMMENDATION

42. I am satisfied that the proposed loan would comply with the Articles of Agreement of the Asian Development Bank (ADB) and recommend that the Board approve the loan of $500,000,000 to the People's Republic of Bangladesh for the Rupsha 800-Megawatt Combined Cycle Power Plant Project, from ADB's ordinary capital resources, in regular terms, with interest to be determined in accordance with ADB's London interbank offered rate (LIBOR)-based lending facility; for a term of 25 years, including a grace period of 5 years; and such other terms and conditions as are substantially in accordance with those set forth in the draft loan and project agreements presented to the Board.

Takehiko Nakao
President

31 May 2018

[30] Risk Assessment and Risk Management Plan (accessible from the list of linked documents in Appendix 2).

DESIGN AND MONITORING FRAMEWORK

Impact the Project is Aligned with Energy security improved, and electricity supply increased (Perspective Plan of Bangladesh, 2010–2021: Making Vision 2021 a Reality)[a]			
Results Chain	**Performance Indicators with Targets and Baselines**	**Data Sources and Reporting Mechanisms**	**Risks**
Outcome Availability of efficient and cleaner energy increased	By 2023: a. Annual power generation in Bangladesh increased by 4,900 GWh (2017 baseline: 52,620 GWh) b. 1,278,206 tons of carbon dioxide emissions per annum avoided (2017 baseline: 0 tons)	a–b. Bangladesh Power Development Board annual reports	Non-availability of natural gas to operate the Rupsha power plant due to delays in liquefied natural gas imports.
Outputs 1. Efficient gas-fired power generation increased	By 2022: 1. Two 400-megawatt combined cycle gas turbine units commissioned at the Rupsha power plant (2017 baseline: 0)	1. Annual reports of NWPGCL and quarterly project progress reports	Increases in prices of commodities and raw materials in the international market above projections and contingencies could result in cost overrun and delay project completion.
2. Energy transfer systems upgraded	By 2021: 2a. 10 km of 24-inch and 2 km of 20-inch gas distribution pipelines built (2017 baseline: 0 km) 2b. One gas regulating, and metering station constructed (2017 baseline: 0) 2c. One 230 kV substation constructed at power plant site (2017 baseline: 0) 2d. 29 km of 230 kV double circuit transmission line constructed (2017 baseline: 0)	2a–b. Annual reports of SGCL and quarterly project progress reports of the joint project implementation unit between NWPGCL and SGCL established for the project 2c–d. Annual reports of Power Grid Company of Bangladesh Limited and quarterly project progress reports	
3. Institutional capacity of NWPGCL strengthened	By 2022: 3a. Universal power plant operations training simulator installed (2017 baseline: 0) 3b. Enterprise resource planning system for NWPGCL implemented and	3a–3b. Quarterly project progress reports, ADB mission's aide memoires, and back-to-office reports	

Results Chain	Performance Indicators with Targets and Baselines	Data Sources and Reporting Mechanisms	Risks
	operational (2017 baseline: 0) 3c. At least 30 NWPGCL staff reported knowledge on (i) project management, (ii) monitoring and evaluation, (iii) operation and maintenance, (iv) safeguards, and (v) project communications (2017 baseline: 0) 3d. At least 50 NWPGCL staff reported knowledge on adopting gender equity features in company's future project designs and operations (2017 baseline: 0) 3e. Socially and gender-inclusive community development strategy for NWPGCL prepared[b] (2017 baseline: NA)	3c–d. Participant feedback surveys 3e. Quarterly project progress reports, ADB mission's aide memoires, and back-to-office reports	
4. Socially inclusive development of communities neighboring the project site pilot tested[c]	By 2021: 4a. At least 200 students and teachers (of which 30% are women) increased awareness on safe and efficient use of electricity (2017 baseline: 0) 4b. At least 200 people (of whom 90% are from vulnerable households[d] and 30% are women) reported increased knowledge and skills on establishing livelihood activities and employment opportunities (2017 baseline: 0) 4c. 10-kilowatt solar photovoltaic system,[e] two IT laboratories, and two science laboratories installed in two schools in the vicinity of the Rupsha power plant (2017 baseline: 0)	4a–b. Participant feedback surveys; project progress reports; and final reports of consultants 4c. Project progress reports; and final reports of consultants	

Key Activities with Milestones

1. Efficient gas-fired power generation increased
- 1.1 Issue prequalification documents in Q2 2017
- 1.2 Issue bid documents in Q1 2018
- 1.3 Award contract in Q3 2018
- 1.4 Construct power plant by Q1 2022
- 1.5 Commission power plant by Q2 2022

2. Energy transfer systems upgraded
- 2.1 Issue bid document for gas supply contract in Q4 2017
- 2.2 Award gas supply contract in Q3 2018
- 2.3 Construct gas distribution pipelines by Q4 2020
- 2.4 Issue bid document for power transmission in Q1 2018
- 2.5 Award power transmission contract in Q3 2018
- 2.6 Construct transmission line by Q4 2020

3. Institutional capacity of NWPGCL strengthened
- 3.1 Supply and install power plant operation training simulator by Q2 2022
- 3.2 Implement and operate enterprise resource planning system by Q2 2022
- 3.3 Provide on-the-job training to NWPGCL staff by Q2 2022

4. Socially inclusive development of communities neighboring the project site pilot tested
- 4.1 Recruit implementation consulting firm by Q2 2019
- 4.2 Deliver training to increase awareness on safe and efficient use of electricity by Q4 2019
- 4.3 Deliver technical and skills training by Q2 2021
- 4.4 Issue bid documents in Q4 2018
- 4.5 Award the contracts in Q1 2019
- 4.6 Install solar photovoltaic system and equip school with IT and science laboratories by Q4 2021

Project Management Activities

Recruit project management and construction supervision consultants for Rupsha power plant
Recruit external experts to validate safeguards monitoring reports and implementation of environmental management plan and resettlement plan
Deliver operational training for NWPGCL staff
Conduct review missions

Inputs

ADB: $500.0 million (regular OCR loan)
IDB: $300.0 million (loan)
Government: $338.5 million
JFPR: $1.5 million (grant)

Assumptions for Partner Financing

ADB and IDB will jointly finance one contract package under output 1 on collaborative basis. ADB will finance 60% of the contract amount.

ADB = Asian Development Bank, GWh = gigawatt-hour, IDB = Islamic Development Bank, IT = information technology, JFPR = Japan Fund for Poverty Reduction, km = kilometer, kV = kilovolt, NWPGCL = North-West Power Generation Company Limited, Q = quarter, SGCL = Sundarban Gas Company Limited.

[a] Government of Bangladesh, Ministry of Planning, Planning Commission. 2012. *Perspective Plan of Bangladesh, 2010–2021: Making Vision 2021 a Reality.* Dhaka.

[b] This will be developed based on the results of the pilot test under output 4.

[c] All activities under output 4 will be financed by the JFPR grant.

[d] Vulnerable households are (i) households headed by women, persons with disabilities, or the elderly; (ii) households falling under the generally accepted indicator for poverty; and (iii) households that are landless or without legal title to land, subject to results of social survey and assessment.

[e] Girls' and boys' schools will be connected to the national grid, and the solar panels fitted will be an additional source of cleaner and cheaper electricity.

Source: ADB.

LIST OF LINKED DOCUMENTS

http://www.adb.org/Documents/RRPs/?id=50161-003-3

1. Loan Agreement
2. Grant Agreement
3. Project Agreement
4. Sector Assessment (Summary): Energy
5. Project Administration Manual
6. Contribution to the ADB Results Framework
7. Development Coordination
8. Financial Analysis
9. Economic Analysis
10. Country Economic Indicators
11. Summary Poverty Reduction and Social Strategy
12. Risk Assessment and Risk Management Plan
13. Japan Fund for Poverty Reduction Grant
14. Gender Action Plan
15. Environmental Impact Assessment
16. Resettlement Plan

Supplementary Documents

17. Financial Management Assessment
18. Supplementary Financial Analysis
19. Economic Analysis of Climate-Proofing Investment
20. Assessment of Gas Demand, Supply, and Transmission System Capability to Ensure Sustainable Gas Supply to the Proposed Rupsha 800-Megawatt Combined Cycle Power Plant
21. Procurement Capacity Assessment Report
22. Climate Risk Assessment and Management Report
23. Climate Risk Vulnerability Assessment
24. Minutes of the Meeting for Cooperation, Coordination, and Exchange of Information between Asian Development Bank and Islamic Development Bank for Rupsha 800-Megawatt Combined Cycle Power Plant Project