ASIAN INFRASTRUCTURE INVESTMENT BANK

PD000302-IND
January 28, 2021

Project Document
of the Asian Infrastructure Investment Bank

Sovereign-Backed Financings

Republic of India

Assam Intra-State Transmission System Enhancement Project

Currency Equivalents
(As at Nov. 10, 2020)

Currency Unit – Indian Rupee (INR)
INR1.00 = USD0.0136
USD1.00 = INR73.3528

Borrower's Fiscal year
April 1-March 31

Abbreviations

ADB	Asian Development Bank
AEGCL	Assam Electricity Grid Corporation Ltd.
AERC	Assam Electricity Regulatory Commission
AIIB	Asian Infrastructure Investment Bank
APDCL	Assam Power Distribution Company Ltd.
APGCL	Assam Power Generation Company Ltd.
ARR	aggregate revenue requirement
CEA	Central Electricity Authority
DSI	design, supply and installation
ERP	enterprise resource planning
ES	environmental and social
ESMP	environmental and social management plan framework
ESMPF	environmental and social management planning framework
ESP	Environmental and Social Policy
ESS	Environmental and Social Standard
FM	financial management
FY	fiscal year
GDP	gross domestic product
GIS	gas-insulated substation
GWh	gigawatt hour
IPPF	Indigenous Peoples Planning Framework
km	kilometer
kV	kilovolt
kWh	kilowatt-hour
MDB	multilateral development bank
MVA	megavolt-ampere
O&M	operation and maintenance
PDS	project delivery strategy
PMC	project management consultant
PMU	project management unit
RPF	resettlement planning framework
WTP	willingness to pay

Contents

1. Summary Sheet
Republic of India
Assam Intra-State Transmission System Enhancement Project

Project No.	000302-IND
Borrower	Republic of India
Project Implementation Entity	Assam Electricity Grid Corporation Ltd.
Sector Subsector	Energy Power Transmission and Distribution
Project Objective	To improve the reliability, capacity and security of the power transmission network in the state of Assam.
Project Description	The project aims to strengthen Assam's electricity transmission system by (a) constructing 10 transmission substations and laying transmission lines with the associated infrastructure; (b) upgrading 15 existing substations, transmission lines and existing ground wire to optical power ground wire; and (c) providing technical assistance to support project implementation. The strengthening program of the transmission system of Assam has been divided into 2 phases, this project constitutes phase 1 of the program.
Implementation Period	Start Date: Jan. 31, 2021 End Date: Dec. 31, 2025
Expected Loan Closing Date	April 30, 2026
Cost and Financing Plan	Project Cost: USD365 million <u>Financing Plan</u>: AIIB Loan: USD304 million Government of Assam: USD61 million
Size and Terms of AIIB Loan	USD304 million Final maturity of 24 years, including a grace period of 5 years, with level repayments at the Bank's standard interest rate for sovereign-backed variable spread loans.
Cofinancing (Size and Terms)	None
Environmental and Social Category	Category B
Risk (Low/Medium/High)	Medium
Conditions of Effectiveness	Receipt of legal opinion on the loan and the project agreements
Key Covenants	The borrower shall ensure that the implementation of all project activities complies with AIIB's Environmental and Social Policy and Standards, Policy on Prohibited Practices and Procurement Policy and its associated Interim Operational Directives on Procurement Instructions for Recipients.

Retroactive Financing (Loan % and dates)	Up to 20 percent of the loan amount for expenditures incurred and paid for not earlier than 12 months before the signing date of the loan agreement.
Policy Assurance	The Vice President, Policy and Strategy, confirms an overall assurance that the Bank is in compliance with the policies applicable to the project.

President	Jin Liqun
Vice President	D.J. Pandian
Director General (Acting)	Rajat Misra
Manager	Rajat Misra
Team Leader	Pratyush Mishra, Investment Operations Specialist
Team Members	Abhishake Vijay, Economic and Financial Consultant Aditi Khosla, Counsel, Investment Operations Dasarathi Mandayam, Electrical Engineer Consultant Georgi Dzhartov, Social Development Specialist Mengmeng He, Finance Associate Jurminla Jurminla, Senior Procurement Specialist Yogesh Malla, Financial Management Specialist Zhaojing Mu, Environmental Specialist

2. The Project Description

A. Rationale

1. **Country Priority.** India's rapid economic development and growing population require a power system that can meet demand for higher-quality and cleaner electricity services. In 2007-2017, India's economic progress drove up average annual growth of peak power demand to 5.1 percent and energy demand to 5.5 percent.[1] India is the third-largest consumer of electricity globally, yet its per capita electricity consumption of 1,149 kilowatt-hours (kWh) in 2018 was one-third of the global average. Energy demand is expected to continue to grow rapidly with rising incomes, industrialization and urbanization. India is expected to be the largest source of primary energy growth globally through 2040.[2]

2. Reliable electricity supply remains a major barrier to industrial and business development. In 2014, the Government of India announced the 24x7 Power for All program, in partnership with state governments, to ensure uninterrupted power for all homes, industries and commercial establishments. To grow the economy and create jobs, particularly by strengthening manufacturing, the government must guarantee affordable and reliable electricity. The 2016 World Bank Enterprise Survey found that almost half of business managers in South Asia identified lack of reliable electricity as a major constraint on their firms' operation and growth. They ranked blackouts as a bigger barrier than other issues such as regulations, taxes, corruption and human capital. While significant progress has been made in delivering electricity access across the country, providing quality and reliable uninterrupted power supply remains a challenge. A significant number of grid-connected consumers still face unreliable electricity supply, and those who can afford it use expensive, inefficient and polluting backup generation.

3. The Government of India has undertaken programs to strengthen electricity transmission and distribution infrastructure in states, seeing the lack of it as a bottleneck for improving reliability of electricity supply. Central sector funds are provided under the Integrated Power Development Scheme to serve urban areas, Deendyal Upadhyaya Gram Jyoti Yojana to serve rural areas and Sahaj Bijli Har Ghar Yojana (Saubhagya) to support downstream electricity connections to all unconnected households.

4. This project aims to improve the reliability and security of power supply in Assam by strengthening the electricity transmission network and is exactly in line with the Government of India's key priority.

5. **Institutional Context.** Since 2007, India has gradually moved from a position of energy deficit to one of energy balance. The eastern region, however, and especially Assam, has not yet witnessed this transformation. Assam still has energy and peak deficits year after year. The load generation balance reports of the Central Electricity Authority (CEA) for the past two years indicate that Assam had a substantial energy and peak demand deficit. Peak demand deficit was 237 megawatts (MW) (~eleven percent) and energy demand deficit 516 gigawatt hours (GWh) (~five percent) in fiscal year (FY)2020. CEA anticipates that the situation is unlikely to improve in the current fiscal year and forecasts a peak demand deficit of 719 MW and energy deficit of 1,932 GWh for FY2021. However, the general situation for India is different. The country had

[1] Central Electricity Authority. 2017. Growth of Electricity Sector in India from 1947-2017.
[2] International Energy Agency. 2018. World Energy Outlook. p.35.

peak demand and energy deficits of less than one percent in 2019 and 2020. The main reason for the power-deficit scenario in Assam is its severe distribution and transmission network congestion.

6. Until 2004, the Assam State Electricity Board was the sole agency responsible for generating, transmitting and distributing electricity in the state. The agency was unbundled in 2004, resulting in the creation of Assam Power Generation Company Ltd. (APGCL), Assam Electricity Grid Corporation Ltd. (AEGCL) and Assam Power Distribution Company Ltd. (APDCL) to focus on power generation, transmission and distribution, respectively.

7. AEGCL, Assam's sole transmission utility, is responsible for the operation, maintenance and development of the transmission system. AEGCL currently operates 66 substations with 6,882 megavolt-ampere (MVA) capacity, and its transmission network comprises 5,701 circuit kilometers (km) of transmission lines of various voltage classes, from 33 kilovolt (kV) to 400 kV, and an exclusive network of 1,373 km of optical power ground wire.

8. The project aims to tackle transmission network constraints and congestion in the state by increasing the transmission line and substation capacity through construction of new transmission substations (with associated transmission lines) and augmentation of existing transformation capacity. The project will reduce transmission losses, resulting in the same generation capacity serving additional demand. These outputs will enable the state's electricity utilities to meet existing unmet demand and demand served by alternate sources such as independent power producers or diesel generators. The power network is likely to become more reliable because of the project.

9. **Strategic Fit for AIIB.** The project is well aligned with AIIB's Energy Sector Strategy: Sustainable Energy for Asia,[3] which focuses on (a) promoting, directly or indirectly, access to modern energy by those who currently have little or no access; (b) improving the reliability of electricity supply; and (c) aggressive loss reduction and utility-driven energy efficiency programs. The project also fits in one of AIIB's key strategic investment priorities, i.e., sustainable infrastructure—by improving energy efficiency in the transmission system, which will in turn help reduce greenhouse gas emissions.

10. **Value Addition by AIIB.** AIIB's participation mobilizes financial resources to fill the investment gap in a project that is vital for the region's socioeconomic growth. The value addition resulting from AIIB's involvement in the project includes the following:

(a) AIIB's involvement will strengthen the project by ensuring that the project is prepared and implemented using international good practices; is cost-effective; has sustainable investments; and meets high standards of governance, fiduciary control and environmental and social (ES) management. These measures will enhance the quality of the project, which, in turn, will generate substantial benefits to the country.

(b) AIIB's participation in the project will help develop the capacity of the implementing agency, not only in project preparation, procurement and implementation monitoring but also in preparation and monitoring of environmental and social management plans (ESMPs) and guidelines.

[3] AIIB. 2016. Energy Sector Strategy.

11. **Value Addition to AIIB**. The Government of India's ambitious plans to provide reliable and affordable power for all its citizens is expected to result in many such projects in other states. AIIB's engagement in this stand-alone project will help replicate a similar approach when similar opportunities arise. Through the project, AIIB will further develop its expertise and understanding of India's power sector; and build its capacity to help clients meet international standards of ES management, financial management (FM) and procurement.

12. **Lessons Learnt from Previous Projects.** Implementing agencies' capacity has been a key concern in AIIB's financing of transmission and distribution projects in countries such as India, Nepal and Bangladesh. Even though these projects are quite traditional in nature, the appointment of a project management consultant (PMC) right at the beginning of project implementation goes a long way in ensuring adequate implementation and monitoring support to the implementing agencies. We have, therefore, ensured that a PMC will be appointed at the beginning of implementation of this project as well.

13. A few AIIB-financed road projects in India have set up web-based programs to monitor project implementation. The efforts have been successful and allow implementing agencies and AIIB to monitor project progress efficiently. A similar portal for monitoring project progress will be setup for this project as well.

B. Project Objective and Expected Results

14. **Project Objective.** The project objective is to improve the reliability, capacity and security of the power transmission network in the state of Assam.

15. **Expected Results.** The project is expected to improve the transmission network and reduce transmission losses. The key results will be measured and monitored using the following indicators (Annex 1):

(a) Primary energy consumption saved (GWh).

(b) Additional capacity added to the transmission system (MVA).

(c) Greenhouse gas emissions reduction (tons of CO_2 equivalent per year).

16. **Expected Beneficiaries.** The project is expected to benefit about 3.1 million electricity consumers by reducing load shedding and enable many households and businesses to improve their economic, commercial, educational and entertainment opportunities.

C. Description and Components

17. **Overview**. AEGCL's electrification program aims to strengthen the existing intrastate transmission network of Assam by augmenting it with newer networks to achieve affordable, secure, efficient and reliable 24×7 power. Doing so will bring Assam closer to ensuring long-term sustainability of its electricity supply. The program envisages the construction of about 24 new high-voltage grid substations (400 kV, 220 kV and 132 kV) along with associated transmission lines. It also aims to upgrade 15 existing substations and associated transmission lines. The program has two phases.

18. Phase 1 (the project) comprises the following components:

(a) **Component 1**. Constructing 10 new high-voltage grid substations (2 x 400 kV, 7 x 220 kV and 1 x 132 kV) with a combined capacity of 3,900 MVA and 333 km of associated transmission lines.

(b) **Component 2**. (i) Upgrading 15 substations, including conversion of an air-insulated substation to a gas-insulated substation, by increasing their capacity to 1,570 MVA (combined); (ii) upgrading 186 km of transmission lines to high tension, low sag; and (iii) replacing 636 km of existing ground wire with optical power ground wire.

(c) **Component 3**. Technical assistance, including (i) supporting the purchase, installation and operation of an enterprise resource planning (ERP) system to help AEGCL optimally manage its capital-intensive assets; (ii) engaging a PMC to help support implementation of the project; and (iii) organizing training and workshops on project implementation to improve AEGCL's capacity.

D. Cost and Financing Plan

19. The total project cost is USD365 million, of which AIIB will finance USD304 million (83 percent of the project cost) (Table 1).

Table 1. Indicative Project Cost and Financing Plan

Item	**Project Cost** (USD million)	**Financing** (USD million and %)	
		AIIB	**Government of Assam**
Component 1: Construction of new substations	278	228.5 (82%)	49.5 (18%)
Component 2: Upgradation of existing substations and transmission lines	64.5	53 (82%)	11.5 (18%)
Component 3: Technical assistance	22.5	22.5 (100%)	-
Total	**365**	**304 (83%)**	**61 (17%)**

Note: All components include a contingency of 15 percent and will be financed inclusive of taxes.

E. Implementation Arrangements

20. **Implementation Period.** The project is expected to be implemented from Jan. 31, 2021 to Dec. 31, 2025.

21. **Implementation Management.** AEGCL has established a project management unit (PMU) to carry out the day-to-day activities related to preparing and implementing the project. Headed by a project director (with the rank of general manager), the PMU is responsible for project preparation, implementation, procurement, FM, ES safeguard compliance and liaison with AIIB. The PMU consists of staff members from various units, including technical, procurement, ES and FM. The PMU will be supported by district offices in the project areas. AEGCL has operated similar PMUs for Asian Development Bank–financed projects and is, therefore, familiar with the setup of PMUs for projects funded by multilateral development banks (MDBs).

22. **Monitoring and Evaluation.** The PMU will monitor implementation progress and prepare monitoring and evaluation reports, including (a) consolidated quarterly reports, (b) quarterly interim financial reports, (c) annual reports on project implementation progress, (d) biannual ES monitoring reports during the construction phase and annual ES monitoring reports during the operation phase and (e) annual independent financial audits of the project. The PMC will prepare quarterly progress reports, which will cover all essential aspects of project implementation, including

contract awards, disbursements, physical progress as per defined key performance indicators, key implementation issues and solutions and updated implementation and procurement plans for the next 12 months. The PMC will help AEGCL conduct supplementary subproject ES assessment for AIIB's review before construction starts. The PMC will also be required develop or provide a web-based program to monitor project implementation.

23. **AIIB's Implementation Support.** AIIB will monitor project implementation through regular implementation support missions, including project inception, review and midterm review missions, if necessary. To mitigate the effect of longer-term potential international travel restrictions because of the COVID-19 pandemic, AIIB will explore the possibility of employing remote-sensing tools such as high-resolution satellite imagery and relying on locally based consultants to conduct monitoring and oversight. By regularly monitoring implementation, AIIB will ensure that AEGCL is executing the project in line with the agreed procedures documented in the legal agreements. To ensure that the project is continuously viable and sustainable, AIIB will regularly review project accounts, AEGCL's audited financial statements and the associated auditor's report.

24. **Procurement.** AEGCL will conduct project procurement activities in accordance with the provisions of AIIB's Procurement Policy, January 2016, and Section II of the Interim Operational Directives: Procurement Instructions for Recipients (PIR), June 2016. The procurement of goods and works will follow international open competitive tender processes (PIR, paragraph 10.1) and national competitive tender processes (PIR, paragraph 10.4), using an electronic platform.[4] Almost all the civil works contracts are for design, supply and installation (DSI). AEGCL has made appropriate procurement arrangements, as reflected in the project delivery strategy (PDS), to entrust single responsibility to the appointed contractor to deliver the scope of works on a turnkey basis. A PDS that reflects the procurement and contracting strategy has been prepared and agreed upon, and any modifications, if required, will be done as needed.

25. **Financial Management.** AEGCL will be responsible for overall project FM. The PMU is staffed with qualified finance and accounts personnel responsible for maintaining acceptable levels of project FM. The PMU will prepare an annual project budget for the subsequent year by September of each fiscal year and submit it to AIIB for review before finalizing and approving it. Implementation of this budget will be reviewed quarterly and a revised budget, if required, will be shared with AIIB. A separate head of account will be created for the project in Assam's annual budget.

26. AEGCL will apply its internal control process and procedures to the project. AEGCL's internal audit unit will conduct an internal audit of the project on a half-yearly basis and share the report with AIIB. The PMU will maintain a separate project account and all supporting documents. The project's financial progress will be reported on a quarterly basis through interim unaudited financial reports, within 45 days from the end of each fiscal quarter. AIIB will review the expenditures reported in these reports. The project financial statements will be prepared on an accrual basis and audited by an independent chartered accountant firm appointed by the Comptroller and Auditor General of India based on the terms of reference accepted by AIIB. The project audited financial statements including an audit opinion and a management letter, will be submitted within 9 months of the end of each fiscal year.

27. The government of Assam will pre-finance the project expenditures and release funds periodically to AEGCL. Based on the statement of expenditures, AIIB will

[4] Tenders Assam. https://assamtenders.gov.in/nicgep/app

reimburse eligible expenditures under its financing to the government treasury. The disbursement of loan proceeds can also be made using direct payment and advance methods. A disbursement and financial information letter, to be issued by AIIB, will include the list of authorized signatories, process of submitting claims and other terms and conditions of disbursements related to the project.

3. Project Assessment

A. Technical

28. **Project Design**. Much of the existing transmission infrastructure in Assam is either old and outdated or unable to cope with requirements up to 2030. The project design allows for future load demand and meets the technical standards stipulated by various statutory bodies of the governments of India and Assam. To facilitate project works and inventory management, conductors, support types and transformers have been standardized, to the extent possible. The transmission lines and substations to be built under the project are decided according to forecast demand. The selected voltage levels, technology and equipment are compatible with AEGCL's existing system assets and international good practices.

29. AEGCL's electrification program will be executed in two phases to ensure smooth project implementation. The new substations under phase 1 have been selected based on the readiness of designs, surveys and availability of land. Only substations with immediate readiness-those that are on land owned by AEGCL or other government entities and have complete route surveys and masterplans-are included in phase 1.

30. AIIB conducted technical due diligence based on (a) the detailed project report prepared by AEGCL and approved by the CEA and (b) discussions with the planning and design engineers. Assam is prone to earthquakes and floods. The new substations under the project are indoor gas-insulated substations, selected for their long operating life, low maintenance and climate resilience. To deal with climate change related issues (such as flooding and landslides), earthquakes and overheating of transmission lines, the project will apply special foundation and structural designs for the towers and civil structures and high-efficiency, high-temperature low-sag conductors.

31. The project's ERP component envisages turnkey implementation with the selection of a system integrator that will supply the ERP licenses for the product, install and configure the product to meet AEGCL's requirements, manage data migration, train AEGCL employees and implement the solution in all AEGCL offices and functions. To ensure continuance of implementation responsibility, the system integrator will continue to provide support for three years to ensure a successful implementation.

32. AEGCL has a proven track record in financing and implementing similar power transmission projects, including those financed by development partners. To help strengthen the PMU's implementation capacity, AEGCL will appoint a PMC. The PMC's scope of work includes activities such as project supervision, implementation of the environmental and social management planning framework (ESMPF), design and engineering services, coordination with contractor(s) and other government agencies and assistance in procurement activities. Having a PMC on board will ensure that any potential problems or delays are highlighted and resolved immediately and that the project is implemented on schedule.

33. **Climate-Resilient Design.** An assessment on climate related risks has been conducted and the results and recommendations have been incorporated into the

project design. According to the Acclimatise Aware project-specific climate risk screening, the project is exposed to high overall climate-related risk, with high exposure to risks induced by the increase in precipitation, floods, snow loading, landslides and wind speed increase. The following adaptation measures are incorporated into the project design: (a) all transmission towers are designed and tested for maximum wind loads in the area and (b) all foundations will be at least 600 millimeters above the highest flood level in the areas. These adaptation measures will reduce the project's vulnerability to climate change.

34. **Operational Sustainability.** AEGCL operates and maintains 66 substations (6,882 MVA) and a transmission network comprising 5,701 circuit km of transmission lines of various voltage classes. AEGCL has experienced staff, proven systems and adequate facilities to operate and maintain the assets financed under the project. To improve AEGCL's implementation capacity further, training and workshops on project implementation will be organized, if required.

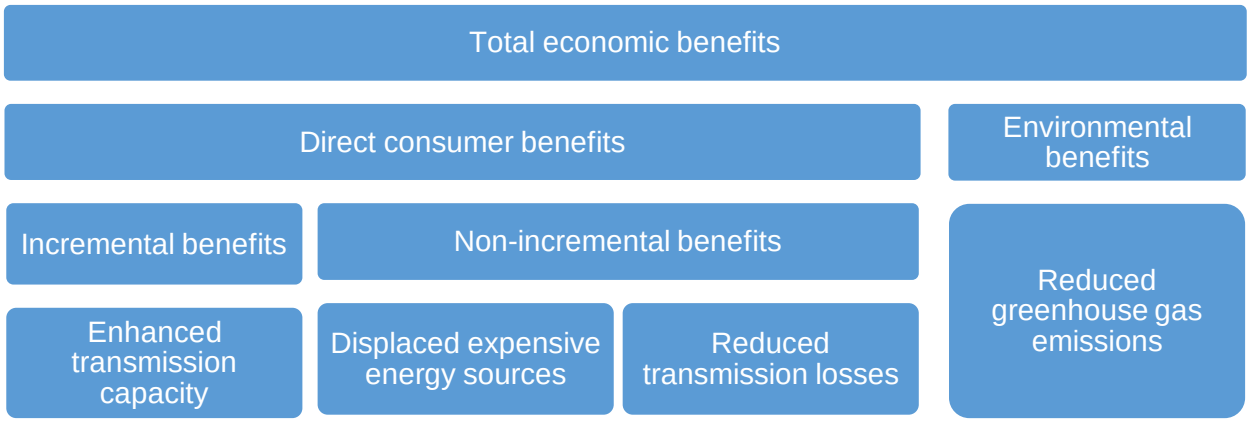
B. Economic and Financial Analysis

35. **Economic Analysis.** A cost–benefit analysis was carried out to assess the economic viability of the project on a with- and without-project basis over a project lifetime of 30 years, inclusive of a five-year construction period. The economic analysis has been carried out for the whole electrification program of Assam (Both phase 1 & 2), economic benefits are segregated in proportion to the phase-wise investment costs, considering the identical cost profiles for achieving unit project benefits under the two phases and expecting to realize similar demand across project areas and consumer mixes. Economic costs and benefits are measured in constant August 2020 prices, excluding transfer payments, financing charges and adjustments for market distortions. Costs and benefits are estimated using an average exchange rate of INR73.3528/USD1.00. An economic opportunity cost of capital of nine percent is applied.

36. Without the project, transmission is constrained, raising the cost of supply with pricey substitutes, leaving some existing demand unserved and suppressing future growth. Operation and maintenance (O&M) expenses are expected to increase as the system will require greater repairs and maintenance on account of higher loading.

37. **Economic Benefits.** Economic benefits with the project are summarized in Figure 1.

Figure 1: Project Economic Benefits



38. The values of the economic benefits considered in the economic analysis are the following:

(i) **Displaced demand (non-incremental).** Valued at INR9.13/kWh, i.e., the average of unit price of diesel generation of INR14/kWh and power procured from bilateral traders and power exchange by APDCL for its consumers of INR4.25/kWh.[5]

(ii) **Reduced transmission loss (non-incremental).** Valued at the average variable cost of INR2.65/kWh for Assam Power Generation Company Ltd. power plants.[6]

(iii) **Increased transmission capacity (incremental).** Valued at INR6.81/kWh, i.e., average willingness to pay of residential, industrial and commercial consumers.

(iv) **Environmental benefits.** Valued using the Indian grid emission factor of 754-ton equivalent of CO_2 per gigawatt hour.[7]

39. **Economic Costs.** The project's economic costs include capital investments in land and the transmission system to be supported by the project, including consulting services and physical contingencies but excluding any price contingencies, debt service charges and any other financial charges. Recurrent costs include O&M costs of the transmission system (two percent of total investments) and the cost of power supply (INR4.25/kWh).

40. **Economic Internal Rate of Return (EIRR).** Based on available data and adopted assumptions, the EIRR for the project in the base case scenario is 29.2 percent, and its net present value at an economic opportunity cost of capital of nine percent is USD631 million. The EIRR exceeds the hurdle rate and the project is considered economically viable.

41. **Sensitivity Analysis.** Given the uncertainties associated with various market and project-specific parameters, a sensitivity study was carried out to assess the economic viability of the project investment. It is highly robust and can withstand large variations in five scenarios: (a) 20 percent construction cost overruns, (b) 20 percent increase in O&M costs, (c) 20 percent less incremental benefits, (d) 20 percent less non-incremental benefits, (e) 20 percent less environmental benefits and (f) a worst-case scenario that combines all the above. The detailed results are in Annex 3.

42. **Financial Analysis.** The financial analysis was carried out from the perspective of AEGCL. Project costs include investment and O&M costs of the transmission system only, which include taxes, duties and physical contingencies but exclude price contingencies and financing costs. All investment costs are expressed in constant prices. Project benefit is measured in terms of revenue from incremental wheeling charge. The analysis assumes that when the project investments commence operation, the wheeling charge (a) will have been adjusted to a level in line with Assam Electricity Regulatory Commission (AERC) tariff guidelines and (b) will be adjusted regularly following the same guideline. Nominal revenues were deflated to constant price values using expected domestic inflation.

[5] Tariff order for APDCL for FY2021.
[6] Tariff order for APGCL for FY2021.
[7] The IFI Dataset of Default Grid Factors.
https://unfccc.int/sites/default/files/resource/Harmonized_Grid_Emission_factor_data_set.pdf

43. **Financial Internal Rate of Return.** Based on the above assumptions, the weighted average cost of capital (WACC) is computed at 1.9 percent, the project investment yields a financial net present value (FNPV) of USD31 million and financial internal rate of return (FIRR) of 2.8 percent (both expressed in post-tax real terms) exceeding the WACC. Therefore, the project investment is financially viable.

44. **Sensitivity Analysis.** The project investment is robust enough to withstand variations in key market and project-specific parameters in three scenarios: (a) 7.5 percent construction cost overrun, (b) one-year delay in commencement of operations, (c) 7.5 percent increase in O&M costs and (d) a combination of all the above. The detailed results are in Annex 3.

45. **Financial Assessment of AEGCL.** AEGCL's tariffs are regulated by AERC. Every year, AERC determines the total revenue to be recovered by AEGCL in the subsequent financial year by issuing a tariff order. During this exercise, AERC also trues up the previous years' revenues and costs, compensating AEGCL for any under-recovery and adjusting any over-recovery in future tariffs. The aggregate revenue requirement (ARR) is the sum of all costs allowed to decide the tariff for any year.

46. **Revenue.** AEGCL's revenue has been fluctuating over the past 5 years. The revenue went from USD73.3 million equivalent in FY2016 to USD162.9 million equivalent in FY2018 and back to USD37.2 million equivalent in FY2020. The fluctuations can be attributed to (a) under-recovery and subsequent truing up of revenues leading to yearly fluctuations and (b) exclusion of interstate transmission charges and costs from both revenues and costs from FY2020, which comprised about half of AEGCL's aggregate revenue requirement.

47. **Net Profit.** AEGCL posted a net profit in FY2018 and FY2019. The losses in the other years since FY2016 are on account of under-recovery. Because AEGCL is a regulated entity, under-recoveries were allowed to be trued up in subsequent years. The truing-up exercise for FY2020 will take place in the next financial year, and additional revenue from the increase in tariffs is expected to be allowed for AEGCL.

48. **Cash Balances.** The average year-end closing cash balance (since FY2016) was USD81.2 million equivalent, with USD124.7 million equivalent in cash at the end of FY2020, indicating adequate liquidity.

49. **Long-Term Borrowings.** Long-term borrowings stood at USD92.0 million equivalent at the end of FY2020, most of which were from the state government. The cash balances at the end of FY2020 were sufficient to cover all the borrowings.

C. Fiduciary and Governance

50. **Procurement.** A procurement capacity assessment (experience, capacity, availability of procurement staff, government procurement regulations) has been carried out. AEGCL is the implementing agency and a dedicated PMU with adequate staff has been established. The procurement specialist in the PMU has experience working in MDB-funded projects and is familiar with MDB procurement requirements.

51. A PDS outlining procurement arrangements including tendering and contracting strategies, capacity assessment of the PMU, market conditions, potential procurement risks and proposed mitigation measures has been prepared. AIIB has reviewed the PDS and concurs with the proposed procurement arrangements and contracting strategies. The PDS will be modified as needed, with mutual consent, during project implementation. As per the PDS, the PMU proposes to adopt a DSI

approach to tendering, with single responsibility to deliver the scope of work on a turnkey basis. An Asian Development Bank–financed project followed a similar approach. AIIB has agreed to this approach, subject to specific modifications to meet AIIB's policy requirements.

52. AIIB has assessed AEGCL's experience in implementing projects and believes that DSI is the most suitable approach for procurement of civil works, particularly for construction of substations and transmission lines. The DSI tender documents for the civil works and the information management system of the ERP have been reviewed and agreed upon, with specific modifications incorporated to meet AIIB requirements. For procurement of services, the PMU will use AIIB's Standard Request for Proposal.

53. All tenders, whether international open or national competitive, will be tendered on the e-procurement platform using a single-stage two-envelope approach.[8] The platform has been assessed by other MDBs and found acceptable for MDB-financed projects. The platform is expected to boost the efficiency, economy and transparency of the procurement process.

54. The PMU has started procuring eight packages of civil works (more than 30 percent of planned civil works procurement) and selecting the PMC. Both processes are nearly final, ensuring that the project's implementation readiness is high and that project progress or disbursements will not be delayed.

55. **Financial Management.** The FM capacity of AEGCL was assessed focusing on institutional capacity, staffing, planning and budgeting, funds flow, accounting, internal controls and audit, reporting and external audit systems. AEGCL has implemented MDB-funded projects and is familiar with their FM requirements. AIIB assessed its FM capacity as adequate and FM risk as medium with proposed mitigation measures.

56. **Staffing**. AEGCL has a finance team, headed by a person of the rank of Chief General Manager (Finance). The team has implemented MDB-funded projects. AEGCL will ensure availability of adequate personnel with the required skills to carry out the project FM activities. If required, the staff members deputed to this project will be trained in AIIB FM and disbursement requirements.

57. **Planning and Budgeting**. The project will follow AEGCL's planning and budgeting procedures. The PMU will prepare an annual budget, based on the procurement plan and activity schedule, which will be reviewed and approved by AEGCL. The project budget will then be submitted to the Government of Assam for inclusion in the annual state budget under a separate budget line.

58. **Funds Flow**. The project will follow the government's treasury system for funds flow from the Government of Assam to AEGCL. The Government of Assam will release funds for the project quarterly and deposit them in a designated bank account for the project. AEGCL will release funds to the PMU quarterly as per the approved annual budget, fund utilization and cash forecast.

59. **Disbursements.** The loan will mainly adopt the reimbursement method of disbursement, although provision for direct and advance payment will also be available under the loan agreement. The Government of Assam will provide adequate budget for its share and pre-finance payments of eligible expenditures. AEGCL will prepare

[8] Tenders Assam. https://assamtenders.gov.in/nicgep/app

documents such as statements of expenditures and a contract summary report for AIIB's part of eligible expenditures (incurred and paid) and submit withdrawal applications through the Controller of Aid, Accounts & Audit to AIIB. AIIB will review the withdrawal claims and disburse funds to the appropriate government account. The disbursement letter will include a list of authorized signatories, the process of submitting withdrawal applications and other terms and conditions of disbursements related to the project.

60. **Retroactive Financing.** All eligible expenditures under the project, incurred in compliance with AIIB's procurement policies and guidelines and in respect of which payments were made not more than 12 months prior to the date of loan agreement, up to an amount of USD60.8 million (i.e. 20 percent), may be financed retroactively.

61. **Accounting, Financial Reporting and Internal Controls.** The project financial statements will be prepared on an accrual basis as agreed with AIIB. The PMU will maintain a separate project account including a loan register. AEGCL uses Tally Accounting software for accounts management. To prepare the financial statements, AEGCL's head office obtains a monthly trial balance in Excel format from the division offices, verifies the Tally data and prepares a consolidated trial balance. The PMU will prepare quarterly interim unaudited financial reports for submission to AIIB within 45 days from the end of each fiscal quarter.

62. AEGCL has a dedicated internal audit team and will apply its internal control process to the project. The internal audit process covers each office location in a cycle of one to three years instead of all offices periodically. In FY2019, 19 out of 32 offices were internally audited. The Audit Committee reviews the internal and external audit reports, recommends corrective actions and follows up for resolution of audit observations.

63. **External Audit**. An independent chartered accountant firm appointed by the Comptroller and Auditor General of India audits AEGCL's financial statements annually. The audit report of FY2019 includes observations like short accounting of interest and transmission charges, lack of reconciliation of accounts and details of interest capitalization and accounting of capital expenses to repairs. AEGCL's statutory auditors will audit the project financial statements, including the statement of expenditures. The audited project financial statements, including audit opinion and management letter will be submitted to AIIB within 9 months of the end of each fiscal year.

64. **Governance and Anti-corruption.** AIIB's Policy on Prohibited Practices (2016) has been provided to AEGCL and will apply to the project. AIIB will regularly monitor implementation. AIIB reserves the right to investigate—directly or indirectly through its agents—any alleged corrupt, fraudulent, collusive or coercive practices relating to the project and to take necessary measures to prevent and redress any issues in a timely manner, as appropriate.

65. **Institutional Capacity.** AEGCL has implemented MDB-financed transmission projects, including contract management. AEGCL's procurement and implementation capacity will be supplemented by the appointment of a PMC. AEGCL's experience in operating and maintaining Assam's existing intra-state transmission system is considered sufficient to maintain the project assets.

66. **Reporting and Monitoring.** AEGCL will engage a PMC firm to assist it in all aspects of project planning and implementation. The PMC will be required develop or provide a web-based program to monitor the project. Additionally, as part of the project,

technical assistance including implementation of measures such as trainings and workshops to improve the capacity of AEGCL shall be undertaken.

D. Environmental and Social

67. **Environmental and Social Policy and Standards.** AIIB's Environmental and Social Policy (ESP), including the Environment and Social Standards (ESSs) and the Environmental and Social Exclusion List will apply to the project. ESS 1 (Environmental and Social Assessment and Management) is applicable to the ES aspects of the project. The project consists of subprojects whose details are not yet identified and require a phased approach in accordance with the ESP. Applicability of ESS 2 (Involuntary Resettlement) and ESS 3 (Indigenous Peoples) will be assessed on a subproject basis during project implementation.

68. **Categorization and Instruments.** The project has been screened and reviewed in accordance with the ESP and ESSs, and the project has been assigned as Category B on the basis of expectation that (a) the general ES impacts of the construction works are localized, (b) the impacts are expected to be reversible and temporary in nature, (c) can be successfully managed using good practice in an operational setting, and (d) AEGCL has experience working on similar projects funded by the national government and other international financial institutions. AIIB has reviewed the ESMPF, a model environmental and social impact assessment for selected subprojects, a generic ESMP, a resettlement planning framework (RPF) and an indigenous peoples planning framework (IPPF) for Scheduled Tribes.

69. **Environmental Aspects.** New substations, related lines and facilities will be sited to avoid any environmentally sensitive and protected areas through the subprojects selection criteria. Anticipated impacts will occur in the construction stage, e.g., dust, noise and interruption to local traffic and local business and residents. These environmental impacts can be largely managed and controlled through properly designed site-specific mitigation measures and adequate implementation management during construction. The ESMP includes provisions related to occupational and community health and safety, plans for ecological protection, air, noise and waste-water pollution control, construction waste management and the management of labor. Archaeological chance finds procedures are suggested to all construction activities. The ESMP has considered the most complicated scenario to address the anticipated impacts, and to set out the institutional arrangements, monitoring, and capacity building for project implementation.

70. **Climate Change Risks and Opportunities.** The project will take into consideration the climate change effects of an anticipated continuous increase in heavy precipitation events. Adaptation measures incorporated into the design include (a) use of special foundation designs for towers located close to rivers or with landslide risks, (b) drainage system strengthening at substations, (c) landfilling of greenfield land used for new substation construction and (d) earthquake-resistant designs. The climate change mitigatory measure is achieved by using low loss conductors for transmission lines and designing the transmission system with adequate spare capacity to reduce losses. Thus, in addition to meeting electricity supply capacity requirements and improving the reliability in the system, the investments will also help reduce greenhouse gas emissions. Based on the joint MDB methodologies for climate finance tracking, USD5.1 million of AIIB's financing will be considered as climate adaptation finance and USD75.5 million will be considered as climate mitigation finance.

71. **Social Aspects.** Potential negative social impacts will be addressed and managed in accordance with the provisions of the ESMP, RPF and IPPF. The proposed substations, which are already identified and finalized, will be mostly located on government *Patta* Land or AEGCL's own land. The acquisition of land is not foreseen for the transmission line component in the project. Design and construction of substations and transmission lines will be undertaken to minimize negative social impacts in compliance with the ESMP, such as permanent/temporary land acquisition, adverse effect on agriculture and/or livelihoods, associated construction disturbances and other risks (including gender-based violence). If permanent or temporary land acquisition is required in certain cases it will be carried out by negotiating with the landowners in the presence of district revenue officers as per the guidelines mentioned in the RPF, following national laws: 'Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013', National Resettlement and Rehabilitation Policy, 2007 Provision in the Electricity Act, 2003 read with relevant provisions of Indian Telegraph Act, 1885 and AIIB's ESP.

72. **Occupational Health and Safety, Labor and Employment Conditions.** AEGCL shall ensure adequate health and safety measures for their workers, and bidding documents will include clauses on how contractors will address health and safety requirements. AEGCL will also ensure that civil works contractors comply with applicable labor laws and regulations and adopt and enforce codes of conduct (including guidelines for resolution of Gender Based Violence) for workers to mitigate possible labor-related issues. Taking cognizance of the situation at the time of mobilization, the contractors shall prepare a COVID-19 response and management plan in line with World Health Organization and Government of India guidelines, taking into consideration of the COVID-19 health and safety practices.

73. **Stakeholder Engagement, Consultation and Information Disclosure.** Consultations concerning the model environmental and social impact assessment have been conducted. This will continue during project implementation, in accordance with national guidelines on restrictions imposed due to the COVID-19 pandemic. The English versions of the ESMPF and English and Assamese versions of the executive summaries of the ESMPF are posted on AEGCL's[9] and AIIB's[10] websites, with hard copies made available in the project area.

74. **Project-level Grievance Redress Mechanism.** A multi-tier Grievance Redress Mechanism (GRM) will be developed in accordance with the requirements of AIIB's ESP. Locally appropriate public consultation and disclosure process will be used to disseminate information about the GRM. Communities and individuals who believe that they are adversely affected by the project will be able to submit complaints to the project-level GRM for their resolution. In addition to the above GRM for addressing complaints from the local community, commensurate mechanism will be made available at the contractor level for worker's grievance.

75. **Project-Affected People's Mechanism**. The Project-affected People's Mechanism (PPM) has been established by AIIB to provide an opportunity for the independent and impartial review of submissions from project-affected people who believe they have been or are likely to be adversely affected by AIIB's failure to implement its ESP in situations when their concerns cannot be addressed satisfactorily

[9] AIIB Funded Assam Intra State Transmission System Enhancement Project. https://www.aegcl.co.in/AIIBProjectDetails.html

[10] India: Assam Intra-State Transmission System Enhancement Project. https://www.aiib.org/en/projects/details/2019/proposed/India-Assam-Intra-State-Transmission-System-Enhancement-Project.html

through the project-level GRM or AIIB's management processes. Information about the PPM is available at: https://www.aiib.org/en/policies-strategies/operational-policies/policy-on-the-project-affected-mechanism.html

76. **Monitoring and Supervision Arrangements.** AEGCL will be responsible for overall coordination, supervision and monitoring of the project's ES aspects. AEGCL has established an ES team to oversee ES aspects associated with project design, implementation and monitoring. AEGCL will engage a PMC to conduct the subprojects' ES assessment and prepare the semi-annual and annual ES monitoring reports during construction and operation respectively. AIIB will conduct ES supervision missions at least twice a year. With the travel restrictions during the COVID-19 pandemic, the AIIB team may conduct virtual supervision missions in lieu of field visits, and actively utilize local ES consultants on the ground to monitor project implementation progress.

E. Risks and Mitigation Measures

77. AIIB has assigned an overall "medium" risk rating to the project. The possible risks and the mitigation measures are in Table 2.

Table 2. Summary of Risks and Mitigating Measures

Risk Description	**Assessment Ratings (High, Medium, Low)**	**Mitigation Measures**
Technical. AEGCL's institutional capacity to implement the project	Medium	(a) AEGCL has successfully implemented similar projects, including those financed by MDBs. (b) A PMC will be appointed to supplement AEGCL's implementation and monitoring capacity. (c) Through regular implementation support and supervision missions, AIIB will help detect delays, if any, at an early stage and to implement mitigation actions.
Procurement. Price increase in goods and materials resulting in project cost overrun	Medium	(a) Tenders for 30 percent of the project cost have been received and are in line with the estimated costs. (b) Sufficient provision for contingencies is available in the project cost.
Procurement. Capacity constraints might delay project implementation.	Medium	(a) A PMC will assist the PMU in procurement and contract management. (b) Implementation has been planned in phased manner.

Risk Description	Assessment Ratings (High, Medium, Low)	Mitigation Measures
Procurement. Transparency in the procurement process	Low	(a) All tenders will be tendered on the e-procurement platform (https://assamtenders.gov.in/nicgep/app) using a single-stage two-envelope approach. (b) Other MDBs have assessed the platform and found it acceptable for MDB-financed projects.
ES. Concerns related to ES performance of AEGCL	Medium	(a) A PMC with adequate ES experts will conduct the supplementary ES assessment and ES monitoring. (b) AIIB will regularly supervise ES performance.
FM. The budget is prepared based on previous year's expenses instead of estimated expenses of the planned activities.	Medium	The budget will be prepared based on the estimated cost of ongoing and new activities as per the PDS and procurement plan.
FM. Internal audit of all cost centers is not conducted periodically.	Medium	Internal audit of project expenditures will be conducted half-yearly and a separate internal audit report will be submitted to AEGCL's audit committee and AIIB within one month of completion of the audit.

Annex 1: Results Monitoring Framework

Project Objective	To improve the reliability, capacity and security of the power transmission network in the state of Assam.									
Indicator Name	**Unit**	**Baseline 2020**	**Cumulative Target Values**					**End Target**	**Frequency**	**Responsibility**
			2021	**2022**	**2023**	**2024**	**2025**			
Project Objective Indicators										
1. Primary energy consumption saved	GWh	-	-	-	0.1	0.3	0.56	0.56	Annual	AEGCL
2. Additional capacity added to the transmission system	MVA	-	-	-	1,118	3,118	5,470	5,470	Annual	AEGCL
3. Greenhouse gas emissions reduction	tCO_2	-	-	-	80	240	450	450	Annual	AEGCL
Intermediate Results Indicators:										
1. Length of transmission lines constructed (400 kV, 220 kV and 132 kV lines)	Km	-	-	-	187	261	333	333	Annual	AEGCL
2. Length of transmission lines upgraded to high tension, low sag	Km	-	-	-	62	138	186	186	Annual	AEGCL
3. New substations constructed	No.	-	-	-	5	7	10	10	Annual	AEGCL
4. Substations upgraded	No.	-	-	-	5	10	15	15	Annual	AEGCL
5. Length of optical power ground wire line constructed	Km	-	-	-	77	477	636	636	Annual	AEGCL

Annex 2: Detailed Project Description

1. **Overview.** The electrification program of Assam Electricity Grid Corporation Ltd. (AEGCL) aims to expand the intrastate transmission network of Assam to achieve affordable, secure, efficient and reliable 24×7 power. Doing so will bring Assam closer to ensuring long-term sustainability of its electricity supply. The program envisages the construction of about 24 new high-voltage grid substations (400 kV, 220 kV and 132 kV) and associated transmission lines. It also aims to upgrade 15 existing substations and associated transmission lines. The program has two phases: phase 1 comprises building of 10 new substations and upgrading 15 existing substations, and phase 2 comprises the balance.

2. Most of AEGCL's business processes, such as accounting, human resource management, procurement, inventory management and operations and maintenance, are manual. Transaction data capture and approval mechanisms are not automated. Management information system (MIS) reporting is arduous, prolonged and prone to human error. The project's enterprise resource planning component will significantly improve processes by eliminating duplication of efforts, reducing paperwork, expediting decision-making with an online MIS and trimming procurement and inventory. The project will, therefore, improve AEGCL's asset management, cash flow planning and financial management.

3. **Project Design.** The project meets the technical standards of the Bureau of Energy Efficiency, Ministry of Power and other statutory bodies of the governments of India and Assam. The voltage at line-ends will be within the permissible 2.87 percent drop by the target year. To expedite project works and inventory management, conductors, support types and transformers have been standardized to the extent possible. The expected load has been determined based on existing loads of similar electrified areas in India, particularly Assam. The expected load is extrapolated to the target year based on recent growth rates. Each planned transmission line and other equipment have been subjected to a voltage drop and loss analysis to determine compliance with the aforementioned standards.

4. **Transmission Line and Substation Design.** Assam's transmission system has been standardized at 400 kilovolt (kV), 220 kV, 132 kV and 33 kV. Sources of supply to the substations are selected by optimum arrangement from either (a) a nearby grid substation or (b) an existing substation using a "line in line out" arrangement with a suitable capacity circuit breaker.

5. In all cases, the voltage drop at the line loading in the target year is computed from the source grid substation. When the tapping is made from existing lines, the voltage drop caused to existing systems is also computed and summed up, as appropriate, to determine final line-end voltage.

6. Phase 1 of the program would comprise the project, with the following components:

7. **Component 1.** Construction of 10 new high-voltage grid substations (2 x 400 kV, 7 x 220 kV and 1 x 132 kV) with a combined capacity of 3,900 megavolt-amperes (MVA) along with 333 kilometers (km) of associated transmission lines:

   (a) A 2x100 MVA, 220/33 kV gas-insulated substation (GIS) at Bihpuria with 88.324 km of associated transmission lines will cater to new industrial areas and domestic and commercial consumers.

(b) A 2x100 MVA, 220/33 kV GIS at Jakhlabandha with 2.715 km of associated transmission lines will cater to new industrial areas and domestic and commercial consumers.

(c) A 2x100 MVA, 220/33 kV GIS at Chhayagaon with 1.619 km of associated transmission lines will cater to new industrial areas and domestic and commercial consumers. The substation is in Kamrup Rural District, close to Guwahati, the capital city of Assam.

(d) A 2x50 MVA, 132/33 kV GIS at Burhigaon with 11.858 km of associated transmission lines will cater to a new industrial and infrastructure development center. The substation is in Darang Rural District, an agricultural area with tea estates.

(e) A 2x160 MVA, 220/132 kV and 2x50 MVA, 132/33 kV GIS at Khumtai with 92.191 km of associated transmission lines, will improve reliability by ensuring redundancy in connectivity. The substation is in Gholaghat District, which has tea estates.

(f) A 2x160 MVA, 220/132 kV GIS at Agamoni with 2.216 km of associated transmission lines. The substation is in Dhubri District, which has tea estates.

(g) A 2x160 MVA, 220/33 kV GIS at Shankardevnagar with 26.457 km of associated transmission lines. The substation is in Karbi Anglong District, which has tea estates.

(h) A 2x500 MVA, 400/220/132 kV GIS with two 80 MVA, 400 kV line reactors and two 125 megavolt amperes of reactive power (MVAR), 400 kV bus reactors and 2x50 MVA, 132/33 kV air-insulated substation at Rangia with 81 km of associated transmission lines. The substation is in Kamrup District and will improve the quality and reliability of power in the capital area.

(i) A 2x500 MVA, 400/220 kV GIS with one 63 MVA, 400 kV line reactor and two 80 MVAR, 400 kV bus reactors at Sonapur with 25 km of associated transmission lines will cater to new industrial areas and domestic and commercial consumers.

(j) A 2x100 MVA, 220/33 kV GIS at Nagaon with 1.565 km of associated transmission lines will cater to new industrial areas and domestic and commercial consumers.

8. **Component 2.** The project will achieve the following:

(a) Upgrading of 14 substations by increasing their capacity to 1,570 MVA (combined): 2x50 MVA, 132/33 kV transformers at Narengi, Bornagar, Moran, Gauripur, Dibrugarh, Depota, Kahilipara, Rangia, Golaghat, Sankardevnagar, Kukurmara, and Panchgram; and 1x160 +1x100 MVA, 220/132 kV transformers at Boko and Agia.

(b) Conversion of an air-insulated substation to a GIS.

(c) Upgrading of 186 km of transmission lines to high tension, low sag.

(1) 76 km of 132 kV line between Salekati and Dhaligaon.

(2) 48 km of 220 kV line between Kukurmara and Sarusajai.

(3) 62 km of 132 kV line between Gossaigaon and Gauripur.

(d) Replacement 636 km of ground wire with optical power ground wire.

9. **Component 3.** Technical assistance including the following:

(a) Support for the purchase, installation and operation of an ERP system with the following functionality:

(1) Operations management.

(2) Maintenance management.

(3) Finance and accounts.

(4) Human resource management.

(5) Procurement management.

(6) Stores and inventory management.

(7) Project management.

(8) Energy chain management.

(9) Tariff filing.

(10) Document management.

(b) Engagement of a PMC to support project implementation.

(c) Organizing of training and workshops on project implementation to improve AEGCL's capacity.

Annex 3: Economic and Financial Analysis

1. This annex comprises (A) the economic analysis of the project investments, (B) the financial analysis of the project investments and (C) the financial assessment of Assam Electricity Grid Corporation Ltd. (AEGCL).

A. Economic Analysis

2. **Assumptions.** The analysis was conducted using a "with-project" and "without-project" framework to compare the project's economic internal rate of return (EIRR) against an assumed economic opportunity cost of capital (EOCC) (the hurdle rate) of nine percent. The program is designed to be executed in two phases to optimize the loan size and financial charges during implementation. Phase 1 will be executed in 2021-2025 and phase 2 in 2022-2026. A separate economic assessment was carried out for each phase. Economic cost–benefit analysis carried out using the following assumptions:

(a) All costs and revenues are expressed in August 2020 constant prices and converted using USD1.00 = INR73.3528.

(b) The capital expenditure consists of all incremental expenditures related to the project, including consulting services and physical contingencies but excluding any price contingencies, debt service charges and any other financial charges.

(c) The operating expenses include all incremental annual expenditures incurred by AEGCL related to the project and were considered as two percent of total investments, in line with standard international practices and similar investment projects in Assam. The assumed operation and maintenance (O&M) expenses included any annual software support or license renewal fees.

(d) The 25-year benefit period is 2026-2050.

(e) The total project benefits are segregated into two phases in proportion to the phase-wise investment costs, considering the homogeneity in accrual of project benefits between the two phases. Because the cost-profiles for achieving unit project benefits under the two phases are identical, expecting similar demand realization across project areas and consumer mixes is considered reasonable.

(f) Marginal benefits and O&M expenses are considered during the implementation period for each phase, bearing in mind the project's modular nature.

(g) No taxes and depreciation are considered for the economic analysis.

(h) The residual value of the project-financed assets was considered as 10 percent of the capital investment expenditure after 25 years of operations.

3. **Methodology.** To evaluate the project's economic viability, two mutually exclusive and alternative scenarios were hypothesized: without and with the project. To assess the incremental benefits arising from the construction of the proposed project, a plausible alternative "without-project" scenario was hypothesized, where the proposed investments were assumed not to be undertaken. In the "without-project" scenario, O&M expenses were expected to increase as the system would require greater repairs and maintenance because of higher loading of the power systems.

However, this incremental cost was excluded from the present analysis for simplicity and conservatism. If these costs were included, the project's economic viability would have been enhanced further.

4. The "with-project" scenario considered all investments to be carried out as planned and that the benefits in the evaluation period materialized as envisaged during project planning. The additional benefits under the with-project scenario compared with the without-project scenario were classified into direct consumer benefits and environmental benefits. Direct consumer benefits were further categorized into incremental and non-incremental benefits.

5. This analysis was carried out for each phase, and the economic costs and economic benefits were combined to evaluate the program's combined economic viability.

6. The phase benefits and economic costs were expressed in real terms in August 2020 prices, and the economic internal rate of return (EIRR) for the economic benefits was calculated. The EIRR was compared with the assumed economic opportunity cost of capital (EOCC) to assess the project's economic viability. After consolidation of phase-wise economic costs and benefits, EIRR and economic net present value (ENPV) were also computed for the whole program.

7. To check the robustness of the project's economic viability, a sensitivity analysis was carried out, where key variables were changed (unfavorably) by reasonable increments and the impact on EIRR and ENPV was tabulated for each independent change and for the combined changes.

8. **Economic Benefits.** The program's economic benefits were assessed for the forecast period. Full project benefits were assumed to arise from 2026 for phase 1 and from 2027 for phase 2, the first year after construction of each phase. Because the project is modular, marginal benefits were considered from the third year onward during implementation. To maintain consistency, reasonable O&M expenses were considered during implementation. Direct consumer benefits included additional electricity demand met from the grid as a direct consequence of the project. Direct consumer benefits were categorized as follow:

(a) **Non-incremental benefits.** The project is expected to meet some of the demand currently being met by alternatives to grid electricity. The benefits were valued at the average of unit price of diesel generation of INR14/kWh and power procured from bilateral traders and power exchange by Assam Power Distribution Company Ltd. (APDCL) for its consumers of INR4.25/kWh.[1]

(b) **Incremental benefits.** The benefits are a result of increased transmission capacity and improved system reliability, resulting in fewer outages. The additional demand served through the project because of incremental benefits was valued at consumers' willingness to pay (WTP):

(1) WTP for domestic consumers of INR4.91/kWh was calculated as the average of both domestic tariff (up to five kW) of

[1] Tariff order for APDCL, FY2021.

INR5.92/kWh and average WTP computed for lifeline consumers of INR3.90/kWh (at current prices).[2]

(2) WTP of INR10.19/kWh for industrial consumers was computed as the average rate of power procured from captive plants or independent power producers of INR12/kWh and high-tension industrial electricity tariff of INR8.37/kWh.

(3) WTP of INR7.55/kWh for commercial and other consumers was assumed to be the average of the WTP for industrial and residential consumers.

9. Other benefits included the resource cost savings from reduced transmission losses. The benefits considered avoided power purchase costs to maintain the same level of energy sales and were valued at the average variable cost of INR2.65/kWh of Assam Power Generation Company Ltd.'s power plants[3]

10. **Environmental Benefits.** The reduced power purchase due to lower transmission losses was considered to reduce greenhouse gas emissions. The emissions were valued using an Indian grid emission factor of 754-ton equivalent of CO_2 per gigawatt hour.[4]

11. **Economic Costs.** The financial costs, including physical contingencies but excluding price contingencies and financial charges during implementation, were converted to economic costs using India's domestic price numeraire. Tradable inputs (goods and services) were adjusted by the shadow exchange rate factor of 1.04,[5] while unskilled labor was adjusted by a shadow wage rate factor of 0.89 for India.[6,7] The total financial investment costs were assumed to include 20 percent labor costs (70:30 skilled to unskilled) and traded goods and services would form 70 percent of total goods and services. The cost of land was also considered.

12. The additional cost of generation was factored by considering an average power purchase cost of the state distribution company, APDCL. This cost of INR4.24/kWh included fixed charges and variable costs.[8] The existing generation or generation planned and under execution is assumed to be sufficient to realize the project benefits, and no additional project-specific generation investments will be required.

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[2] Based on B. Gill, S. Saluja, and D. Palit. 2017. Electricity Pricing and the Willingness to Pay for Electricity in India: Current Understanding and the Way Forward. The Energy and Resources Institute, New Delhi. WTP for Uttar Pradesh. However, per capita income is similar in Uttar Pradesh and Assam and the same WTP for electricity is expected. The WTP was escalated by yearly inflation to arrive at the 2020 value of INR3.90/kWh.

[3] Tariff order for APDCL for FY2021.

[4] https://unfccc.int/sites/default/files/resource/Harmonized_Grid_Emission_factor_data_set.pdf

[5] Rajasthan Secondary Towns Development Sector Project-economic analysis, Asian Development Bank, September 2020. https://www.adb.org/sites/default/files/linked-documents/42267-031-ea.pdf

[6] Shadow exchange rate factor was estimated based on trade statistics from FY2012–FY2013 to FY2016–FY2017.

Shadow wage rate factor = INR224/day (minimum wage in 2019 for unskilled laborers) / INR252/day (practiced labor wage rate paid by contractors to unskilled laborers). Paycheck.in. Minimum Wage—Tripura. https://paycheck.in/salary/minimumwages/tripura

[7] Rajasthan Secondary Towns Development Sector Project-Economic Analysis, Asian Development Bank, September 2020. https://www.adb.org/sites/default/files/linked-documents/42267-031-ea.pdf

[8] Tariff order for APDCL for FY2021.

13. Annual O&M costs were assumed to be two percent of total investment costs, considering the nature of the project assets and in line with international standards.[9]

14. **Economic Internal Rate of Return (EIRR).** The economic analysis confirms that the proposed project is economically viable, with an overall EIRR of 29.2 percent against an EOCC or hurdle rate of nine percent. The ENPV at the EOCC or hurdle rate of nine percent is estimated at USD631 million, confirming the project's robust economic viability.

Table 3. Economic Internal Rate of Return

Year	Economic benefits			Economic costs			
	Incremental	Non-incremental	Environmental	Investments	Operating	Incremental power procurement cost	**Net economic cash flow**
2020	-	-	-	-	-	-	-
2021	-	-	-	37	-	-	(37)
2022	-	-	-	38	-	-	(38)
2023	17	4	1	93	0	10	(81)
2024	41	11	2	90	1	26	(63)
2025	83	22	3	-	2	52	(17)
2026	167	44	6	-	6	104	107
2027	174	46	7	-	6	108	112
2028	181	48	7	-	6	113	117
2029	188	50	7	-	6	117	122
2030	195	51	7	-	6	122	127
2031	203	53	8	-	6	126	132
2032	210	55	8	-	6	131	137
2033	217	57	8	-	6	135	141
2034	224	59	9	-	6	140	146
2035	231	61	9	-	6	144	151
2036	238	63	9	-	6	148	156
2050	238	63	9	(29)	6	148	185
						EIRR (real):	**29.2%**
						ENPV:	**631**

15. The sensitivity analysis (Table 4) demonstrates that the project's expected economic performance is robust.

Table 4. Sensitivity Analysis

	Sensitivity Parameter	**Variation**	**EIRR**	**ENPV** (USD million)
	Base case		29.2%	631
Unfavorable changes				
1	Project capital costs	+ 20%	25.3%	586
2	O&M costs	+ 20%	29.0%	624
3	Incremental benefits	- 20%	26.5%	532
4	Non-incremental benefits	- 20%	27.3%	562
5	Environmental benefits	- 20%	28.9%	621
	All combined		20.8%	400

EIRR = economic internal rate of return. ENPV = economic net present value
Note: ENPV is computed at economic opportunity cost of capital or hurdle rate of nine percent.

[9] Assam Power Sector Investment Program-economic analysis for project 2.

B. Financial Analysis

16. **Methodology and Key Assumptions.** The analysis evaluated the project's financial viability based on and the incremental costs and revenues. An after-tax discounted cash flow analysis was conducted in real terms to determine the weighted average cost of capital (WACC), the financial internal rate of return (FIRR) and financial net present value (FNPV). A sensitivity analysis assessed the impact of adverse movements in the underlying assumptions on the FIRR.

17. Project costs include only investment and O&M costs of the transmission system, including taxes, duties and physical contingencies but excluding price contingencies and financing costs. All investment costs are expressed in constant prices. A 25-year benefit period (2026-2050) was adopted for analysis, with investment assumed to take place in 2021-2026.[10] Realization of a terminal value of 10 percent of total investment was assumed at the end of the benefit period.

18. The project benefit is measured in revenue from incremental wheeling charges. The analysis assumes that when the project assets commence operations, the wheeling charge (a) will have been adjusted to a level in line with the tariff regulations of the Assam Electricity Regulatory Commission (AERC) and (b) will be adjusted regularly following the same guideline. Nominal revenues were deflated to constant price values using expected domestic inflation.

19. AERC determines the aggregate revenue requirement (ARR) of AEGCL yearly. The ARR is approved on full recovery of prudent costs and ensures that all costs against approved investments are recovered and that investments earn a commercial rate of return. This regulated revenue recovery will always result in a project FIRR that is either equal to or marginally higher than the WACC. The ARR includes full recovery of the cost of loan capital by way of accelerated rates of depreciation and interest, post-tax return on equity of 15.5 percent, O&M expenses[11] based on a mix of historical and normative principles, interest on working capital and corporate tax.

20. **Weighted Average Cost of Capital.** To calculate the WACC, financing sources were assumed to consist of an AIIB loan constituting 82.6 percent of the total capital requirement and equity contributions from the state government for the balance of 17.4 percent. The regulatory return on equity allowance of 15.5 percent was adopted as a proxy for the state government's required return on equity. The corporate tax rate of 34.94 percent was considered and included any applicable cess and surcharge. The overall real, post-tax WACC for the investment is 1.9 percent.

21. **Financial Internal Rate of Return.** AEGCL is expected to commission some assets during the implementation period and, therefore, earn tariff revenue on the investments in the commissioned assets. Conservatively, no commissioning of assets (partial or otherwise) resulting in an increase in tariff was considered in the financial analysis. The actual FIRR will be higher if AEGCL commissions some of the assets from this investment during project implementation.

[10] Phase 1 is expected to be fully operational by the end of 2025.

[11] For simplification, O&M expense at a fixed rate of two percent of approved capital expenditure, escalated in nominal terms at four percent per annum, was considered, in line with investment analysis for similar projects in Assam.

22. The project's FIRR works out to 2.8 percent, which is higher than the WACC of 1.9 percent. The project's financial net present value is estimated at USD31 million.[12] Therefore, the project is considered financially viable.

23. **Sensitivity Analysis.** The FIRR's sensitivity analysis for key variables indicates that the project is financially viable and offers acceptable returns in a range of scenarios. Adverse scenarios with a 7.5 percent increase in capital costs and a 7.5 percent increase in O&M costs were considered, with the increase assumed to be not allowed in the ARR of AEGCL. A one-year implementation delay and combined downside scenarios were considered.

24. The project FIRR is found to be most sensitive to change in capital costs and delays in implementation. An 11 percent increase in capital cost will cause the project to turn financially nonviable. Similarly, a two-year delay in implementation will turn the project financially nonviable. However, AERC will allow tariff increases for justifiable cost increases and delays, partially mitigating the risk.

Table 5. Sensitivity Analysis

	Sensitivity Parameter	Variation	FIRR	FNPV (USD million)
	Base case		2.8%	31
1	Capital cost increase	+7.5%	2.1%	8
2	O&M cost increase	+7.5%	2.6%	23
3	Delay	+1year	2.2%	9
4	Combined 1-3		1.4%	(21)

( ) = negative, FIRR = financial internal rate of return, FNPV = financial internal rate of return

C. Financial Assessment of Assam Electricity Grid Corporation Ltd.

Table 6. Assam Electricity Grid Corporation Ltd. Summarized Financial Performance

(USD million)

Particulars	2016	2017	2018	2019	2020
Profit and loss statement					
Revenue from transmission of electricity	73.3	73.3	162.9	157.0	37.2
Other income	11.7	12.4	28.0	19.8	9.6
EBITDA	(16.9)	(38.5)	75.3	39.2	11.5
Interest expenses	5.3	5.0	5.6	6.8	7.8
Net income	(27.2)	(51.7)	48.7	19.9	(24.8)
Cash and equivalents at end of the year	35.5	40.4	70.2	135.0	124.7
Fixed assets (net)	81.0	83.7	82.7	112.4	155.4
Long-term borrowings	70.6	75.4	85.4	89.0	92.0
Net worth	174.5	142.7	202.4	249.3	234.0

Source: Audited financial statements of Assam Electricity Grid Corporation Ltd.

25. **Revenue.** The revenue earned by AEGCL increased substantially in FY2018 and then decreased in FY2020. The steep changes in revenue can be attributed to two major factors:

[12] FNPV was computed at the project post-tax and real WACC of 1.9 percent.

(a) **Adjustment of past under-recovery or over-recovery.** In case of under-recovery, additional revenue in the subsequent financial year will be allowed by AERC by way of true up in the ARR, resulting in an increase in tariff. Under-recovery resulted in suppressed revenues in FY2016 and FY2017. Subsequent truing up led to a substantial increase in revenues in FY2018 and FY2019.

(b) **Adjustment of interstate transmission charges paid to the Power Grid Corporation of India Limited (PGCIL).** Historically, AEGCL paid interstate transmission charges to PGCIL and recovered the same from APDCL, although APDCL was the direct beneficiary of the services. Starting in FY2020, AERC has directed APDCL to pay the charges directly to PGCIL. The charges formed a substantial portion of AEGCL revenue and their omission from the approved ARR substantially reduced revenues in FY2020. However, since corresponding expenses are also reduced, there is no material impact on AEGCL's profitability.

26. **Net Profit.** AEGCL posted a net profit in two out of past five years (in FY2018 and FY2019). The losses in the other years are on account of under-recovery, being a regulated entity, these under-recoveries were allowed in subsequent years. For FY2020, the truing-up exercise will take place in the next financial year, and additional revenue, by way of increase in tariffs, is expected to be allowed to AEGCL.

27. **Long-Term Borrowings.** Long-term borrowings stood at USD92.0 million equivalent at the end of FY2020, most of which was from the state government. The cash balances at the end of FY2020 were sufficient to cover all the borrowings.

28. AEGCL classifies its general provident fund liability, state government loans and ADB loans as long-term borrowings. Loans from the state government have been slowly increasing and funds might have been infused by the state government through loans or extension of repayments. The cash flows of AEGCL indicate no principal repayments over the past few years. As of March 31, 2020, the debt position of AEGCL was very comfortable. Most of its borrowings were from the state government and it had sufficient cash to cover all debt outstanding.

Table 7. Long-Term Borrowings of Assam Electricity Grid Corporation Ltd.

(USD million)

Particulars	2017	2018	2019	2020
Loans from Asian Development Bank	12.7	12.9	13.0	13.0
State government loan	54.3	64.5	68.7	73.0
General Provident Fund	8.5	8.1	7.2	6.0
Long-term borrowings (total)	**75.4**	**85.4**	**89.0**	**92.0**
Repayment due to state government*	4.8	5.4	6.4	6.8

* Included in state government loan.

29. **Net Worth.** AEGCL's share capital has remained constant since FY2016, indicating no direct equity infusion by the state government. However, the company has been receiving grants regularly, which contribute to an increase in the net worth in addition to retention of profits.

Annex 4: Sovereign Credit Fact Sheet

A. Recent Economic Development

1. India is a lower-middle-income country, with a gross domestic product (GDP) per capita of USD2,010 and a population of 1.34 billion.[1] It is the world's third largest economy by purchasing power parity. India's economy grew at an average annual rate of 7.4 percent between FY2014 and FY2018 but has slowed down in recent years.[2] Following disruptions due to the demonetization initiative in November 2016 and the rollout of the goods and services tax in July 2017, growth slowed to 7.0 percent in FY2017 and 6.1 percent in FY2018.[3] Growth slowed further to 4.2 percent in FY2019 due to sluggish growth in private consumption, investment and exports, owing to weak rural income growth, stress in the financial sector and sluggish global demand. Growth in the last quarter of FY2019 (January to March 2020) and the first quarter of FY2020 (April to June 2020) was significantly dented by the COVID-19 outbreak and associated lockdown imposed by the government.[4] The Indian economy contracted by 23.9 percent in the first quarter of FY2020.

2. Low food prices contributed to a decline in inflation, from 4.5 percent in FY2016 to 3.4 percent in FY2018. This allowed the central bank to reduce key policy rates by 135 basis points between February 2019 and October 2019. Inflation inched up during the second half of FY2019 on account of higher food prices and rise in retail oil prices. Inflation averaged around 6.0 percent in the first quarter of FY2020 due to supply side disruptions. In spite of this, the central bank reduced the repo and reverse repo rates by 115 and 155 basis points to 4.0 and 3.35 percent, respectively, to stimulate aggregate demand, which had declined due to the lockdown. The central bank also introduced a series of measures to reduce the borrowing cost, bolster liquidity, improve credit flow to the productive sectors and offer loan moratorium.

3. After rising for two years, the current account deficit shrank to 1.1 percent of GDP in FY2019. Slowdown in economic activity led to a contraction in merchandise imports while exports remained weak as global demand turned sluggish. Services' trade surplus improved in FY2019. A drop in oil prices and weak economic activity resulted in merchandise imports contracting by more than 50 percent in the first quarter of FY2020 while exports declined by 37 percent.

4. General government fiscal deficit at 7.9 percent of GDP remained high in 2019, reflecting tepid growth in revenue and higher recurrent expenditure. A downturn in revenue due to economic slowdown and higher spending on the stimulus package resulted in the fiscal deficit in the first quarter of FY2020 being 20 percent higher than in the previous year.

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[1] The income group classification for fiscal year 2019 is based on World Bank criteria, details seen: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519; Population data use World Bank 2018 data.

[2] Data is based on fiscal years. Fiscal year 2019 (FY2019) begins on 1 April 2019 and ends on 31 March 2020.

[3] On Nov. 8, 2016, India's government announced withdrawal of the legal tender of INR500 and INR1,000 notes, which accounted for 86 percent of the value of currency in circulation, and introduction of new INR500 and INR2,000 notes.

[4] On March 24, the government announced a nationwide lockdown till April 14, subsequently extended to May 30. Lockdown was eased beginning June 1

B. Economic Indicators

Selected Macroeconomic Indicators (FY2015-FY2021)

Economic Indicators[#]	FY 2016	FY 2017	FY 2018	FY 2019*	FY 2020*	FY 2021*
Real GDP growth	8.2	7.0	6.1	4.2	-4.5	6.0
Inflation (% change, average)	4.5	3.6	3.4	4.5	3.3	3.6
Current account balance (% of GDP)	-0.6	-1.8	-2.1	-1.1	-0.6	-1.4
General government overall balance (% of GDP)	-7.1	-6.4	-6.3	-7.9	-12.1	-9.4
Nominal gross public debt (% of GDP)	68.8	69.4	69.6	72.2	84.0	85.7
Public gross financing needs (% of GDP)[1]	11.1	11.0	10.5	11.4	16.4	13.8
External debt (% of GDP)[1]	20.6	20.0	18.9	19.1	19.9	20.4
Gross external financing need (% of GDP)[1]	9.3	9.6	10.4	10.0	10.0	11.3
Net foreign direct investment inflow (% of GDP)	1.6	1.1	1.1	1.3	1.2	1.3
Gross reserves (USD billion) **	370.0	424.5	412.9	434.0	537.5	…
Broad money (M2, % change)	10.1	9.2	10.5	9.7	11.3	11.6
Exchange rate (INR/USD, EOP) **	67.9	63.7	69.6	76.6	73.1	…

[#] Data is based on fiscal years.

* Denotes projected figures.

** FX data from Thomson Reuters. FX rate as of October 5, 2020 while Reserves data pertains to August 2020.

[1] For FY2020 and FY2021, AIIB Staff Estimates based on IMF Data

Source: IMF, World Economic Outlook Database, April 2020, IMF Country Report No. 19/385, December 2019 and Ministry of Statistics and Program Implementation, Government of India.

C. Economic Outlook and Risks

5. According to the World Economic Outlook, released in June 2020, the economy is expected to contract by 4.5 percent in FY2020. However, the extent of contraction may be higher given the shrinkage experienced in the first quarter. The imposition of a lockdown, with limitations on mobility of people and products, to contain the outbreak, will significantly disrupt demand and supply. Workers in the informal sector, who form an overwhelming majority of the workforce and small and medium enterprises will face the adverse economic impact of the lockdown. This, along with constrained global demand and supply line disruptions, is expected to result in the economy contracting in FY2020. In May 2020, Moody's downgraded India's rating to Baa3 with a negative outlook and in June, Fitch revised India's outlook to negative, due to slow reform momentum, challenging environment for policymaking institutions in implementing policies which mitigate the risks of a sustained period of low growth, further deterioration in the fiscal position and stress in the financial sector. Growth is expected to pick up in FY2021 as COVID-19 dissipates and stimulus measures have an impact with a lag.

6. Overall inflation is expected to decline to 3.3 percent in FY2020, due to sluggish aggregate demand on account of the lockdown. Lower oil prices will also dampen inflationary pressures. Supply-side disruptions due to the lockdown may cause prices of some commodities to go up as demand revives in the second half of FY2020, which could be offset by declining food supply disruptions as the lockdown eases. The recent hikes in taxes on petrol and diesel and the rise in food inflation could also moderate the pace of decline.

7. Recognizing that an expansionary fiscal policy is required to mitigate the economic effect of the COVID-19 pandemic, the central government has announced a USD22.5 billion economic relief package, including a USD2 billion package to strengthen the health sector at a fiscal cost of 1.0 percent of GDP. Various states have also announced additional relief measures. The anticipated growth slowdown in

FY2020 will negatively impact tax collections while a subdued equity market will make it difficult to raise revenue from disinvestment. The fiscal deficit is expected to significantly increase to 12.1 percent of GDP in FY2020. Public debt is estimated to rise sharply to 84.0 percent of GDP in FY2020, levels last witnessed in the early 2000s. Although high, India's public debt remains sustainable, given favorable debt dynamics and the projected increasing economic growth trend in the medium term. Furthermore, with public debt having a long and medium maturity, being denominated in domestic currency and primarily held by residents, the debt profile is favorable. India's external debt, currently at 20.6 percent of GDP, remains sustainable.

8. The current account deficit is expected to narrow in FY2020 because of weak domestic demand. Sluggish domestic economic activity will result in the import bill declining significantly, but a weakening rupee and rising oil prices could increase the import bill. Exports of goods and services are likely to contract given the decline in global demand. Remittances are also expected to decline as lower oil prices in the Middle East and the spread of the COVID-19 pandemic in advanced economies reduce economic activity in the countries that employ most migrant Indian workers.