

Environmental Assessment Report

Summary Initial Environmental Examination
Project Number: 41614
August 2009

IND: Assam Power Sector Enhancement Investment Program

Prepared by Assam State Electricity Board for the Asian Development Bank (ADB).

The summary initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature

SUMMARY INITIAL ENVIRONMENTAL EXAMINATION

A. INTRODUCTION

1. The Government of India (GOI) and Government of Assam (GOA) have requested ADB to provide \$200 million in loan funding via a multi-tranche financing facility (MFF) to support continued investment in the state power sector, specifically for transmission and distribution system expansion and upgrades. GOA and ASEB will be the Executing Agencies (EA) for the MFF. For the purpose of project preparation, a Detailed Project Report has been prepared for the transmission system expansion (the Project). The Implementing Agency (IA), the Assam Electricity Grid Corporation Ltd. (AEGCL), has prepared a draft Initial Environmental Examination (IEE) for the proposed transmission system project.¹ This summary IEE (SIEE) outlines key aspects of the proposed investment program, environmental benefits and negative impacts, public consultations, proposed mitigation measures, and preliminary environmental management plan (EMP).

2. The proposed Project is classified as Category B² under Asian Development Bank (ADB) Environment Policy (2002). The IEE of the proposed investments is being carried out following the Asian Development Bank's (ADB) *Environment Policy (2002)*, *Environmental Assessment Guidelines (2003)*, and the Government of India (GOI) environmental assessment regulations and guidelines. The primary statutory body responsible for ensuring environmental compliance by the Project is the Assam Department of Environment and Forests (ADEF), and the Assam State Pollution Control Board (APCB) which operates under the aegis of the ADEF.^{3,4}

3. An Environmental Assessment and Review Framework (EARF)⁵ has been prepared which is applicable to all investments funded by the proposed MFF, including subsequent tranches that have not been fully defined. The EARF outlines the policies, procedures, and institutional requirements for preparing subsequent tranches. ASEB would be responsible for preparing the required environmental assessments and obtaining ADB concurrence before implementation. These approvals must be in place before contracts are finalized and work begins. The EARF specifically notes that sensitive areas will be avoided at the design and planning stage to the maximum extent possible. ADB requirements for environment Category B

¹ The transmission route survey is being conducted as of early May 2009. The IEE will be finalized after the route survey is complete. This Summary IEE is based on information gathered and site reconnaissance visits as of 1 April 2009. The findings, recommendations, and conclusions are not expected to change based on the draft/final IEE report.

² This category is assigned due to "greenfield" transmission lines and substations which are assigned Category B.

³ The Ministry of Environment and Forests updated environmental assessment procedures prescribed in the Environment (Protection) Rules, 1986, via notification published 14 September 2006 in the Gazette of India, Extraordinary, Part-II, and Section 3, Sub-section (ii). Transmission systems are not included in the list of projects subject to the notification and environmental impact assessment clearance requirements. Government of India regulations consider transmission and distribution systems to be non-polluting activities, and as such do not require environmental assessments or prior regulatory approval from the Ministry of Environment and Forests. State- and central-level regulatory approval is required for right-of-way and sites located in reserved forests, wildlife preserves, national parks, and other designated sensitive areas.

⁴ The following acts, laws, rules and guidelines may be applicable to the investment program: (i) Air (Prevention and Control of Pollution) Act, 1981; (ii) Water (Prevention and Control of Pollution) Act, 1974; (iii) Forest (Conservation) Act, 1980 and its amendments; (iv) Forest (Conservation) Rules, 2003 and its amendments; (v) Wildlife (Protection) Act, 1972; (vi) Wildlife (Protection) Amendment Act, 2002; and (vii) IS Codes and CPCB Guidelines for monitoring and analysis of air, water, soil, etc.

⁵ The draft EARF is presented separately as Supplementary Appendix A.

sensitive (or A) projects may be applied in cases where technical design constraints require access to reserved forests or other environmentally sensitive areas.⁶

4. A preliminary EMP that will apply to all components and subprojects has been prepared. The EMP is based on environmental analysis of the proposed transmission facilities, as well as a review of environmental impacts of other typical power transmission and distribution projects in India. The mitigation measures for other tranches will be developed in accordance with the EARF and EMP framework.

B. DESCRIPTION OF THE ASSAM POWER SECTOR INVESTMENT PROGRAM

5. The Government of India and Government of Assam have requested ADB to provide \$200 million in loan funding via a multi-tranche financing facility (MFF) to support continued investment in the state power sector, which is necessary for economic growth and poverty reduction. The MFF will partly finance the expansion and augmentation of the transmission and distribution (T&D) networks. The proposed investments are necessary to:

- (i) Facilitate increased power transfers to accommodate increased demand and economic growth; peak demand is projected to increase from the current 848 megawatts (MW) to 1443 MW, and total energy demand will increase from current 4398 gigawatt-hours (GWh) to 7585 GWh by 2012;
- (ii) Improve supply-side energy efficiency by system de-bottlenecking and reducing technical losses;
- (iii) Reduce the intensity of greenhouse gas (GHG) and other emissions due to avoided generation via improved system efficiency;
- (iv) Support private sector participation in distribution system operations and other energy services; and
- (v) Facilitate poverty reduction via improved access to electricity services and economic growth.

6. **Tranche 1: Transmission Capacity Expansion.** The first tranche (the Project) of \$60.3 million will partly finance transmission system expansion and augmentation including:

- (i) Six (6) new transmission lines, with total length of 262 kilometers (km);
- (ii) Six (6) new substations to accommodate the new transmission lines;
- (iii) Expansion of two (2) existing substations to accommodate new transmission lines;
- (iv) Upgradation of ground wire to OPGW.

7. The basic design of the major system components are summarized in Tables 1 and 2. The Project will help complete the state-level transmission “backbone” over a broad geographic area in western, central, and eastern Assam, serving the major load centers including the Guwahati urban area. Individual transmission lines have a 3-year construction schedule, and substations have a 2-3 year construction schedule depending on specifics (new vs. augmentation and expansion). Overall project implementation is scheduled over the 5-year period from 2009 through 2014. The proposed facilities will be constructed mainly in existing transmission and transportation corridors, avoiding reserved forests, wildlife preserves, and national parks.

⁶ Environmentally sensitive areas are avoided to the maximum extent possible in the planning and design stage. Some project sites may cross reserved forest areas; ADEF has a built-in mitigation procedure for such instances (see discussion in Appendix 1).

Table 1: Proposed Transmission System Investments

Transmission Lines and Length	Associated Substations	
	New	Expansion
Rangia – Sishugram/Kahilipara 132 kV D/C LILO to new Kamalpur substation 15 km	Kamalpur 132/33 kV 80 MVA	
Samaguri – Nagaon 132 kV S/C on D/C towers 25 km	Nagaon 132/33 kV 50 MVA	Samaguri 220/132/33kV
Salakathi (BTPS) – Rangia 220 kV D/C 180 km	Rangia 220/132 kV 200 MVA	Salakathi 220/132/33 kV 2 new 220 kV bays
Lakwa – Namrup 132 kV S/C LILO to new Sonari substation 7 km	Sonari 132/33 kV 80 MVA	
Tinsukia – Rupai 132 kV S/C on D/C towers to new Rupai substation 30 km	Rupai 132/33 kV 50 MVA	
Dibrugarh – Moran 132 kV S/C LILO to new Khanikar substation 5 km	Khanikar (New Dibrugarh) 132/33 kV 50 MVA	

D/C = double circuit, kV = kilovolt, LILO = loop-in / loop-out, MVA = megavolt-amperes, S/C = single circuit
Source: Detailed Project Report for Transmission system expansion. ADB staff and consultant notes from reconnaissance visits.

Table 2: Transmission System Auxiliary Facilities

Power Line Carrier Communication (PLCC) system to be installed on following sub-station:
<ol style="list-style-type: none"> 1) Rangia 220 kV. 2) Nagaon 132 kV. 3) Kamalpur 132 kV 4) Bihiating 132 kV. 5) Rupai 132 kV 6) Sonari 132 kV.
Upgradation to OPGW is proposed for the following lines:
<ol style="list-style-type: none"> (i) Mariani – Samaguri – Sarusajai 220 kV (ii) Samaguri – Sonabil 220 kV (iii) Namrup – Tinsukhia 220 kV (iv) Sarusajai – Kahilipara – Amingaon – Rangia – Barnagar – Dhaligaon – Salakathi 132 kV (v) Mariani – Lakwa – Namrup 132 kV

kV = kilovolt, MVAR = megavolt-amperes reactive

Source: Detailed Project Report for Transmission system expansion

C. DESCRIPTION OF THE ENVIRONMENT

1. Physical Resources

8. Assam is located in India, between 24° and 28° north latitude and 90° and 96° east longitude. Total area is 78,438 square kilometers (km²).

9. The state lies in the sub-tropical belt with a monsoonal climate, with heavy summer rainfall, winter drought, and high humidity. Summers are hot (maximum temperature between 33°C and 44°C) and at some places it remains humid, while winters are reasonably comfortable (between 27°C and 10°C). The monsoon season runs from late May or early June to early October, with average rainfall of 2,263 millimeters per year and 144 rainy days. Assam has been divided into six agro-climatic zones: (i) North bank plains (Dhemaji, Lakhimpur, Sonitpur and Darrang districts), (ii) Upper Brahmaputra Valley (Goalaghat, Jorhat, Sibsagar, Dibrugarh and Tinsukia districts), (iii) Central Brahmaputra Valley (Nagaon and Morigaon districts), (iv) Lower Brahmaputra (Dhubri, Bongaigaon, Kokrajhar, Goalpara, Barpeta, Nalbari and Kamrup districts), (v) Barak Valley (Karimganj, Cachar and Hailakandi districts), and (vi) Hill districts of Karbi Anglong and North Cachar. The project components will be located in the broad river valley of the Upper, Central, and Lower Brahmaputra zones.

10. Satellite imagery shows that surface morphology in the Project area is dominated by the major river systems, with numerous tributary rivers and streams, oxbow lakes, relict oxbow lakes, and relict stream channels. In the project area, some rocky hills are present with elevations less than 1 kilometer (km) above the surrounding river valley.

11. Soils can be generally classified into 3 types based on topography: hilly areas with rocky soils; foothill areas with mixed soil types; and alluvial plain dominated by river deposits of sand, silt, and clay. Soil chemistry varies from acidic to alkaline, with varying porosity, cation exchange capacity, and organic matter content. Surface soils have been extensively altered by agricultural development, primarily rice paddies, tea estates, and livestock grazing.

12. Surface water and ground water are used for drinking, agriculture, municipal supply, and industrial processes. Surface water resources cover an area of 365,000 hectares (ha), of which 56% is rivers and streams, 28% is oxbow lakes and wetlands ("beels"), and 7% is ponds (including man-made ponds, or "tanks"). The Brahmaputra has low organic load and dissolved mineral content. The SPCBs of Assam, Nagaland, and Sikkim monitor water quality at 31 stations along the river and its tributaries. Water quality is variable, with pH and conductivity within drinking water norms.⁷ Dissolved oxygen (DO) varies from 2.0 to 10.5 milligrams per liter (mg/L) vs. the standard of 4.0 mg/L; biochemical oxygen demand (BOD) varies from 0.3 to 6.2 mg/L vs. the standard of 3.0 mg/L; total coliform is exceeded at all monitoring stations, and faecal coliform is exceeded at some stations.⁸ There is essentially no modern sewage treatment at any cities or towns along the river, which probably accounts for the high levels of DO, BOD, and coliform.

13. Groundwater resources have been mapped by drilling of 304 exploratory tube wells and 381 observation wells. Sustainable groundwater resources are estimated at 27.23 billion cubic meters (Bm³), with annual availability of 24.89 Bm³, and annual withdrawals of only 5.44 Bm³.

⁷ GOI standard IS 2296 for surface water class C, suitable for drinking after conventional treatment and disinfection.

⁸ Data from http://www.cpcb.nic.in/oldwebsite/New%20Item/images/content_chapter-6.pdf

Groundwater is generally suitable for drinking water and other uses,⁹ but high iron concentrations are common on the north bank of the Brahmaputra River, and high fluoride concentrations have been observed in the districts of Kamrup, Nagaon, and Karbi Anglong on the south side of the Brahmaputra. Arsenic has been detected above drinking water limits in Dhemaji and Karimganj districts; the arsenic source has not been determined.

14. Assam's energy resources include coal, crude oil, hydropower, and natural gas.¹⁰ Coal reserves are estimated at 320 million tons, with 2 surface mines operating in eastern Assam. The identified coal reserves have high sulfur content and high volatile matter content, making it unsuitable for coke production and less than desirable for power generation. Proven Crude oil reserves are 1.3 billion tons. In the past 4 years, exploratory activity resulted in 32 new discoveries.

15. Proven natural gas reserves are 156 Bm³. Natural gas is used as a fertilizer feedstock and for power generation with about 220 MW of gas-fired capacity in operation at 2 plants (Namrup and Lakwa). Total installed hydropower capacity is 375 MW, mostly in the Barak river watershed. Additional potential of 159 MW has been identified at 93 sites with less than 5 MW per site.

16. Other natural resources include limestone and granite, estimated at 703 million tons and 1 billion m³, respectively. Limestone is used for cement production and some granite is quarried for construction material.

17. Routine ambient air quality data for residential sites in the Guwahati urban area for 2006, 2007, and 2008 are presented in Table 3. Air quality is well within the standards for residential areas for sulfur dioxide (SO₂) and nitrogen dioxide (NO₂) at all stations. Respirable particulate matter (RPM) and suspended particulate matter (SPM) standards for residential areas are exceeded at all stations on all monitoring dates. RPM and SPM are attributable mainly to mobile sources (vehicle emissions), small point sources (e.g., open trash burning), and non-point sources (e.g., unpaved roads) rather than electric power generation and/or other power sector facilities.

18. Additional air quality monitoring data from various environmental assessment reports for industrial projects were obtained from the Assam PCB website. Results are summarized in Table 4. Data indicate that standards SO₂ and nitrogen oxides (NO_x) are met at all stations. SPM standards are met at all locations. RPM standards are met with 1 exception which is in the Amguri project area. Data in Tables 2 and 3 indicate that ambient SO₂ and NO_x standards are met in most areas near proposed Project sites, but that RPM and SPM are routinely exceeded in urban areas and occasionally exceeded in some industrial areas.

19. Noise survey data from the EIAs referenced in Tables 3 and 4 indicate that noise standards are exceeded routinely in urban areas due to traffic. Noise in villages and rural areas is within allowable standards.

⁹ Based on groundwater sampling data conducted in the course of environmental impact assessments for 4 industrial projects listed on ADEF/SPCB website; data are from 2007 - 2008.

¹⁰ One of the 1st commercial crude oil discoveries in Asia was made in the 19th century at Naharkotia, in Dibrugarh District. The world's oldest continuously operating oil refinery is located at Digboi.

Table 3: Ambient Air Quality in Guwahati Residential Areas

Date	Parameters	Location				
		Bamunimaidan	Dispur	ITI	Santipur	Paltan Bazar
	SO₂	Standard = 80 micrograms per standard cubic meter				
February 2006	Maximum	8.0	13.8	7.8		7.5
	Average	4.8	5.5	4.8		6.3
March 2007	Maximum	18.5	14.0	17.5	13.0	
	Average	12.7	9.3	12.8	8.2	
February 2008	Maximum	13.3	12.5	12.3	11.8	
	Average	9.1	8.8	7.9	8.4	
	NO₂	Standard = 80 micrograms per standard cubic meter				
February 2006	Maximum	25.6	39.5	23.0		33.5
	Average	9.8	27.2	20.1		32.5
March 2007	Maximum	28.0	22.3	26.8	21.3	
	Average	21.6	17.2	21.1	15.7	
February 2008	Maximum	25.5	23.0	22.5	22.3	
	Average	20.5	18.0	17.4	18.0	
	RPM	Standard = 60 micrograms per standard cubic meter				
February 2006	Maximum	501.5	326.0	462.5		114.0
	Average	213.4	165.8	227.5		103.0
March 2007	Maximum	484.5	223.0	257.0	220.5	
	Average	234.3	145.2	144.8	132.3	
February 2008	Maximum	234.0	224.0	230.0	197.0	
	Average	176.2	162.0	155.6	148.7	
	SPM	Standard = 140 micrograms per standard cubic meter				
February 2006	Maximum	864.0	811.5	728.0		250.0
	Average	395.1	340.1	406.8		241.7
March 2007	Maximum	951.5	417.0	393.5	341.5	
	Average	466.6	226.2	226.6	197.9	
February 2008	Maximum	304.0	307.0	314.0	256.0	
	Average	249.6	233.3	226.5	209.7	

NO₂ = nitrogen dioxide, SO₂ = sulfur dioxide, RPM = respirable particulate matter,

SPM = suspended particulate matter

Source: Assam State Pollution Control Board. Standards are annual average for residential areas.

Table 4: Other Ambient Air Quality Monitoring Results

Parameters	Location					
	Oil India	Raksha	ISWM	Naftogaz	APGCL	Coal India
	Amguri	Koraibi	Guwahati	Margherita	Namrup	Tikak
SO₂	Standard = 80 micrograms per standard cubic meter					
Maximum	21.5	11.0	4.0	8.9	19.0	28.0
Minimum	3.2	6.0	3.0	3.0	8.0	8.0

NO_x	Standard = 80 micrograms per standard cubic meter					
Maximum	35.8	26.0	22.0	12.6	25.0	36.0
Minimum	4.1	12.0	14.0	3.1	10.0	10.0
RPM	Standard = 120 micrograms per standard cubic meter					
Maximum	136.0	62.0	107.0	17.0	61.0	62.0
Minimum	21.0	23.0	73.0	5.0	31.0	12.0
SPM	Standard = 360 micrograms per standard cubic meter					
Maximum	321.0	175.0	336.0	65.0	221.0	110.0
Minimum	46.0	88.0	203.0	30.0	75.0	39.0

APGCL = Assam Power Generation Company, Ltd., ISWM = Integrated Solid Waste Management Facility, NO_x = nitrogen dioxides, SO₂ = sulfur dioxide, RPM = respirable particulate matter, SPM = suspended particulate matter
Standards are annual averages for industrial areas.

Sources:

EIA Report for Coal India Tikak Open Pit Coal Mine, Tinsukia District, data from January 2008

EIA Report for Naftogaz Oil Drilling Project, data from December 2007 and January 2008

EIA Report for Oil India Drilling Project in Amguri, data from January - February 2008

EIA Report for Raksha Cement Plant in Kamrup District, undated

EIA Report for Integrated Solid Waste Management Facility in Guwahati, data from February-March 2007

EIA Report (Executive Summary) for Namrup 100 MW Combined Cycle Gas Turbine plant

2. Ecology: Fauna, Flora, and Forests

20. Assam has a broad spectrum of flora and fauna, with eco-systems broadly grouped into 7 categories: tropical wet evergreen forest, tropical semi-evergreen forest, tropical moist deciduous forest, sub-tropical broadleaf hill forest, sub-tropical pine forest, littoral and swamp forest, and grassland and savannahs. Of the thousands of species that have been catalogued, 433 plant species are identified as endangered, and 71 species are identified as vulnerable or threatened (ADEF website).

21. The notable wildlife species include are one horned rhino, elephant, Indian bison, swamp deer, sambar, hog deer, sloth bear, tiger, leopard cat, jungle cat, hog badger, capped langur, hollock gibbon, jackal, goose, hornbills, ibis, cormorants, egret, heron, and fishing eagle. Potentially endangered and rare species include pigmy hog, hispid hare, white winged wood duck, and great Indian hornbills among many others. The protected area network is host to 105 species of mammals, 49 species of fish, and 581 species of birds. Assam also hosts a variety of aquatic fauna and reptiles, including 19 species of tortoises, 77 species of snakes and lizards, and 39 species of freshwater snails.

22. Assam has 5 national parks, 17 wildlife sanctuaries, and 3 proposed wildlife sanctuaries.¹¹ The total protected area network is 3,925 km², about 5% of the state's total area.

23. The total forested area in the state is about 27,829 square kilometers (km²), which constitutes 35.48% of total land area of Assam. A substantial amount of forest land is degraded to some extent, with actual forest cover of about one-quarter of total land area (about 19,608 km²). Of this, about one-half is reserved forest (about 9804 km²). ADEF has approved diversion

¹¹ The project components will not be located in any of these sensitive areas.

of 6212 ha of reserved forests (0.6% of reserved forest area), and has afforested 9889 ha (about 1% of reserved forest area).¹²

3. Socioeconomic Conditions, Religious, Cultural and Other Amenities

24. The population of the state was 26.6 million people in 2001.¹³ Average population density is about 340 persons per km². The economy is based primarily on agriculture, crude oil and natural gas production, and petrochemical production. Per capita income is \$355 per year, about two-thirds of the national average.

25. About 73% of the population lives in rural areas, and 77% of the workforce is employed in the agriculture sector. About 40% of total land area is cultivated. Agriculture and allied activities account for about 40% of GDP. The main crops are tea (over 50% of total Indian production), bamboo, ginger, chilies, peas, rice, wheat, and oil seeds. By 2010, rice, wheat, and oil seed production is projected to reach 1.47 million tons, 74,000 tons, and 107,000 tons respectively. Assam is the 6th-ranked state in fruit and vegetable production. Livestock includes 8 million head of cattle, 2.7 million goats, 1.1 million pigs, and 700,000 water buffalo. Poultry are raised mainly in "backyard" operations.

26. Despite the large share of GDP accounted for by agriculture, food demand outstrips supply, and this demand-supply gap is expected to grow. Farm mechanization is very low, and energy supplies constrain groundwater extraction for irrigation; supply is limited to 0.3 horsepower per ha, which limits most farm operations to a single crop per year. Livestock productivity is also limited by the lack of technical and extension support. Average farm size is 1.27 ha. Landholding distribution is summarized in Table 5.

Table 5: Landholding Distribution

Landholding Size (ha)	% of Total Landholdings	% of Total Operated Area
< 1	60.3	19.3
1 to 2	22.2	24.5
2 to 20	16.6	44.9
>20	0.9	11.3

Source: Road Map for Agrarian Prosperity in Assam¹⁴

27. The literacy rate is nearly 64.28%, comparable to the all-India average. Assam has 5 universities, 4 engineering colleges (including Indian Institute of Technology), 3 medical colleges, 23 vocational training institutes, 8 polytechnic schools, and 1 junior technical school.

28. About 78% of villages have been electrified, but the household electrification rate is currently about 22%. Per capita electricity consumption is 170 kilowatt-hours per year (kWh/y), which is 27% of the national average. Piped water supply is available in larger towns and cities. Hand-pumped wells are common in villages. Sewage systems are essentially non-existent, and solid waste management systems and management facilities are not well-developed.

29. Transportation infrastructure includes 69,000 km of roads, 2435 km of railways, and 6 airports (Dibrugarh, Guwahati, Jorhat, North Lakhimpur, Silchar, and Tezpur). Two GOA-owned

¹² Data in this paragraph are from GOA Official Website and ADEF website.

¹³ Statistics are taken from *Statistical Data Handbook of Assam, 2007*. Directorate of Information & statistics, GOA, Guwahati.

¹⁴ Dr. Arun K. Bandyopadhyay, Chief General Manager, National Bank for Agriculture and Rural Development, Assam RO, Guwahati, 2004. Information in paragraphs 25, 26, and 27 and Table 5 are from this reference. Available at <http://assamagribusiness.nic.in/Agrarianprosperity/Forward.pdf>

enterprises operate inland water transport of passengers and freight. Water is the only means of transport in some hinterland areas. The Brahmaputra River connects Assam to ports in Haldia and Kolkatta in West Bengal, and Chittagong in Bangladesh. Assam has 269 telephone exchanges with 120,000 connections. Mobile phone service is readily available and affordable.

30. Industrial development includes 4 crude oil refineries, 3 fertilizer plants, 2 paper mills, 3 cement plants, numerous brick kilns, and steel mini-mills. A 27 ha Export Promotion Industrial Park has been established at Amingaon (Kamrup district on the north bank of the Brahmaputra, about 15 km from the Guwahati airport); 37 firms have established a presence, including 17 manufacturing facilities. A food processing park is being set up in Chaygaon, a rural area in Kamrup district. An industrial growth center is being established at Matia in Goalpara district (western Assam); a 280 ha site has been defined of which 180 ha will be developed. A second industrial growth center (160 ha) is being set up at Balipara in Sonitpur district (about 15 km from the city of Tezpur in eastern Assam). Industrial infrastructure development centers are planned for 4 districts, and 3 border trade centers have been approved.¹⁵

D. ANTICIPATED IMPACTS AND MITIGATION MEASURES

1. Environmental Effects Due to Project Location and Design

31. Transmission systems have an inherently small footprint compared to other “linear” infrastructure (e.g., expressways and other roads which typically alter topography and drainage in an irreversible manner). Geotechnical and structural engineering considerations favor flat, open areas with bedrock or stable soils which are not being used for other economic purposes. Rivers, lakes, and wetlands are avoided, as these types of sites tend to be relatively unstable, requiring special foundation engineering which increases design and construction costs. Tall vegetation and forests are viewed by design engineers as a nuisance to be avoided, because clearing of vegetation adds to construction and operations cost. Use of reserved forests is a tedious administrative process, which also increases transaction cost at the planning and approvals stage (see discussion in Appendix 1). At the planning and design stage, environmentally-sensitive areas are avoided on engineering and government policy bases. Disturbance of topography, soils, and drainage patterns is minimal, with some minor alterations occurring at new substation sites, and minimal and partly reversible alteration in transmission right-of-way.

32. During project preparation the Detailed Project Report (DPR) was reviewed, along with the existing grid map, and a map of the protected area network published by ADEF. The proposed facilities will be constructed mainly in existing transmission and transportation corridors, avoiding reserved forests, wildlife preserves, national parks, social infrastructure, and other public utilities. The proposed project facilities do not pose any threat to other flora, fauna, public utilities, or other social infrastructure.

33. If access to reserved forests is required due to technical design constraints, regulatory approval from ADEF and MOEF must be obtained in advance; the user must pay a fee for use of the land, which is used for afforestation in other locations. Diversion of reserved forest for other uses has a built-in mitigation mechanism for afforestation/reforestation, and any potential use of reserved forests will not constitute significant environmental impact (see Appendix 1).

¹⁵ Most of the information in this section is from the GOA Official Website, “Assam at a Glance.”

34. The total area required for transmission right-of-way is estimated at 262 ha,¹⁶ and area required for new substations and expansion of existing substations is estimated at 24 ha. The land to be acquired for is mostly government and/or agricultural land, and landholders will be compensated as per GOI norms. No land acquisition will be required for substation augmentation. Substations will not be located in reserved forests or protected areas.

35. Substations will be sited and designed to ensure noise level at the site boundary will not exceed 70 dB(A) at any time. Substations will be equipped with appropriate sanitation facilities. Transformers containing polychlorinated biphenyls (PCBs) will not be used.¹⁷

2. Environmental Effects During Construction

36. Given the small construction and operations footprint noted above, topography, soils, and drainage will not be altered significantly by the project. Typical area required for a new substation is a maximum of 4 ha, requiring some earth moving for civil works. The land surface beneath transmission towers can be returned to previous use, except for the tower footings, which typically require a total of 10 square meters (m²) per tower. Minor changes in surface water flow may result from substation construction, but is not considered to be environmentally significant. The proposed transmission system expansion comprises 5 types of facilities, each with slightly different - but minimal - potential impacts, discussed below.

37. **Substation augmentation:** no new land is required. Some old equipment will be decommissioned, and new equipment (mainly transformers) will be brought to the sites and installed. Off-site waste disposal and/or recycling will be required. Construction traffic will be limited to several truckloads of equipment and materials brought to the site, and a few truckloads of obsolete equipment taken off-site.

38. **Substation expansion:** maximum area required is estimated at 4000 m²; some of the substations slated for expansion have sufficient space within existing boundaries. New equipment will be transported to the sites and installed. Minimal quantities of construction waste will be generated. Construction traffic will be limited to several truckloads coming in to the site.

39. **New substations:** land acquisition will be required; maximum area per substation is estimated at 4 ha. New, permanent, access roads will be required. Surface soils will be disturbed by civil works; drainage patterns may be slightly altered. New equipment and materials will be brought to the site. Minor quantities of construction waste will be generated.

40. **Loop-in / loop-out transmission lines:** 3 lines ranging from 5 km to 15 km in length will be constructed, with aggregate length of 27 km and average length of 9 km. A 10 meter right-of-way will be used during construction, with 3 m preserved during operations. Lines will be constructed mainly on tea estates and other agricultural land, which can be restored to prior use after construction. Vegetation in a 3 m wide strip will be trimmed to maintain required vertical separation from conductors. Trucks will be used to bring equipment and materials to construction sites. Permanent access roads are not required. Construction will use manual labor for the most part, with minimal requirement for heavy equipment.

¹⁶ Area is calculated as follows: 262 km x 10 m x 1000 m/km x 1 ha/10,000m² = 262 ha.

¹⁷ India has phased out the use of polychlorinated biphenyls (PCBs); new transformers available in the Indian and international markets do not contain PCBs.

41. **Point-to-point transmission lines:** 3 lines, ranging from 25 km to 180 km in length, will be constructed, with aggregate length of 235 km and average length of 78.3 km. Construction and operational impacts are the same as for loop-in/loop-out lines.

42. To minimize impacts to topography, soils, and surface water, established roads and tracks will be used wherever possible. Compensation will be paid for temporary loss in agricultural production in accordance with the resettlement action plan. Topsoil will be protected and reinstated after construction is completed, and damaged bunds and irrigation facilities will be maintained in working condition throughout project implementation.

43. Temporary access roads might be needed in some locations. The environmental impacts associated with the establishment of temporary access roads will include disturbance of soils and disruption of small streams or other water bodies. Uncontrolled soil erosion and silt runoff are likely to be minor due to the limited amount of excavation required. Construction will generate noise for a short duration in predominantly rural locations, and is considered insignificant.

44. Construction contract clauses will include specification of construction practices per the environmental management plan (EMP) and compensation paid for any losses in agricultural production. Discharge of wastes such as waste lubricating oils from construction equipment and domestic solid waste and sewage from construction camps and substations will be prevented through design and installation of appropriate oil containment and sewerage systems.

45. Obsolete equipment, including any hazardous wastes, will be disposed of according to the norms of Ministry of Environment and Forests. Health hazards from potential explosions or fire, electric shocks, and accidents to staff and the public will be minimized through implementation of measures including (i) designs using appropriate technologies to minimize hazards, (ii) safety awareness raising for construction and operational staff and the public, (iii) substations equipped with modern fire control systems, (iv) provision of adequate water supply and sanitation facilities for substations and construction camps, (v) provision of adequate staff training in operations and maintenance, and (vi) security fences and barriers around substations and transmission towers in populated areas.

3. Environmental Effects During Operation

46. During construction of transmission lines, right-of-way with a maximum width of 10 meters will be cleared, of which 3 meters will be kept clear as a maintenance right-of-way. The balance of the right-of-way will be returned to agricultural use or allowed to naturally recover. Vegetation will be trimmed to ensure that the required vertical spacing between conductors and vegetation are maintained for safety reasons. To minimize the risk of accidents and exposure to electric fields, houses and other structures will not be allowed within the right-of-way, but agricultural activities can be continued. Table 6 summarizes the anticipated impacts during construction and operations. The Project's minimal potential negative impacts can be mitigated readily and cost-effectively.

Table 6: Potential Project Impacts and Mitigation Measures

Project Stage	Project Activity	Potential Impacts	Mitigation Measures	Institutional Responsibility	Cost Estimate (\$)

Pre-Construction Period	No field activities	None: impacts are avoided through design	Built-in to routing and design	AEGCL	No incremental costs
Construction Period	Clearing of trees and vegetation	Temporary loss of forest cover	Reforestation activities as agreed with ADEF	AEGCL, ADEF	n/a
	Noise from construction equipment operations and maintenance	Noise could exceed 70 dB(A) at site boundary	Equipment to meet local noise standards; construction scheduling to avoid evening and nighttime disruption	Construction Contractor to implement. AEGCL to include appropriate contract clauses. ADB to confirm contract clauses are sufficient	Included in contractors' costs. Incremental cost of all mitigation measures estimated at less than 0.5% of total contract value
	Soil erosion and wastewater from work site and construction camps	BOD and fecal coliform contamination	Primary treatment if needed	Construction contractors' responsibility with AEGCL and ADB oversight	Included in contractors' costs.
	Industrial wastewater from construction equipment maintenance yards	Petroleum and detergent contamination	Sedimentation and biological treatment if necessary	Construction contractors' responsibility with AEGCL and ADB oversight	Included in contractors' costs.
	Waste oil from phased out transformers and other equipment, possible oil with PCBs	Possible soil contamination	Waste oil may be reused after filtration. Other equipment will be managed off-site by registered equipment recycling companies or vendors	Construction contractors' responsibility with AEGCL and ADB oversight. AEGCL is directly responsible for PCB management	Included in contractors' costs. Treatment / disposal of PCBs estimated at maximum \$500 / ton
	Dust during construction and exhaust gases from construction machinery and vehicles (particulate matter, NO ₂ , SO ₂)	Increased SPM, NO ₂ , SO ₂ levels at construction sites, and surrounding areas	Dust control with water sprays. Contractors' equipment to meet GOI equipment and vehicle emissions standards	Construction contractors' responsibility with AEGCL and ADB oversight	Included in contractors' costs.

	Spoils from earth moving; construction debris	Contaminated soil and non-hazardous solid waste	Spoils to be used as base material for substations and greenbelts	Construction contractors' responsibility with AEGCL and ADB oversight	Included in contractors' costs.
Construction Period (continued)	Waste equipment (e.g., steel structures, conductors, circuit breakers)	Possible soil and groundwater contamination if not properly managed	Can be stored in secure depot, and disposed / recycled off-site in compliance with GOI standards	AEGCL has primary responsibility. Disposal / recycling vendors have secondary responsibility	Nil: waste equipment and materials can be auctioned off to licensed salvage vendors
Operational Period	Noise from transmission lines and associated substations	Noise could exceed 70 dB(A) at site boundary	Locate facility 70–100 m from nearest receptor; walls, fencing, and/or greenbelt to provide partial noise barrier	AEGCL	Nil: noise impacts avoided at design stage
	Domestic wastewater from substations and storage yards	BOD, fecal coliform contamination in groundwater and surface water	Primary treatment if needed	AEGCL to include in design. Contractors to build to specification	Nil: no incremental cost
	Wastes from transformer replacement (scrap metal, possible oils with PCB)	Potential soil and groundwater contamination	Secure on-site storage, or off-site disposal at licensed facility	AEGCL has primary responsibility. Disposal / treatment vendors have secondary responsibility	Treatment / disposal of PCBs estimated at maximum \$500 / ton
	Air emissions from equipment using CFCs and halons (e.g. fire suppression systems)	Minor GHG releases to atmosphere	Replace equipment with non-CFC and non-halon equipment; dispose in accordance with GOI standards	AEGCL has primary responsibility. Disposal / treatment vendors have secondary responsibility	One-time cost, estimated at less than \$25,000
	Garbage from substations and storage yards; process waste or scrap waste	Potential soil and groundwater contamination	Dispose at on- or off-site facilities approved by APCB	AEGCL and solid waste system operators	Recurring cost estimated at less than \$1000 per month

APCB = Assam Pollution Control Board, BOD = biochemical oxygen demand, CFC = chlorofluorocarbons, dB(A) = decibel acoustic, GHG = greenhouse gases, NO₂ = nitrogen dioxide, NO_x = nitrogen oxides, PCB = polychlorinated biphenyl, SO₂ = sulfur dioxide, SPM = suspended particulate matter.

Source: Asian Development Bank assessment

4. Potential Cumulative and Induced Effects

47. The proposed Tranche 1 investments do have potential cumulative and induced effects, which are considered largely positive. Direct impacts result from acquisition of right-of-way and land for transmission lines and substations. Indirect impacts include increased air emissions from a new thermal power plant at Bongaigaon, possible increases in air and water pollution loads from new industrial development, and possible increases in groundwater withdrawal for irrigation as electricity supplies increase. These potential impacts are expected to be minimal. Computer modeling conducted for the power plant EIA concluded that ambient air quality standards will be met in the Bongaigaon area after the new power plant becomes operational. New industrial development is being concentrated in designated industrial zones and is subject to environmental assessment requirements and regulation by MOEF, ADEF, and APCB, with an overall development objective of meeting ambient environmental standards. Groundwater withdrawal is currently about 22% of identified reserves; therefore there is ample margin for increasing groundwater utilization over the long term.

48. Positive effects will result from improvements in power system efficiency: the transmission system efficiency improvements will result in energy savings of at least 171,000 MWh per year, with corresponding GHG emissions reduction estimated to be 68,400 tons CO₂-equivalent per year. The Project will reduce reliance on captive diesel-fired power generation units used by industrial and commercial facilities. Railway electrification will be expanded from the western Assam border at Srirampur to Guwahati, further reducing diesel fuel consumption.

49. Indirect effects include: (i) expansion of the power generation base (facilitated by the transmission and distribution system investments); (ii) increased investment in energy efficiency; (iii) economic growth related to improved power supplies; and (iv) reallocation of government funding away from loss-incurring utility operations and toward social investment in education, health, water supply, and sanitation.

50. A transmission line will deliver power from 1 new power plant: a 3 x 250 MW coal-fired plant at Bongaigaon.¹⁸

E. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MANAGEMENT PLAN

51. The PMU will assume primary responsibility for the environmental assessment as well as implementation of EMPs for their respective components. At the direction of the ASEB, an environmental and social management cell (ESMC), responsible for environment, resettlement, and any other social development obligations, will be established at the PMU.¹⁹

52. The duties of the ESMC will include at minimum: (i) oversight of construction contractors for monitoring and implementing mitigation measures; (ii) preparing and implementing environment policy guidelines and environmental good practices; (iii) liaising with the ADEF and seeking their help to solve the environment-related issues of project implementation; (iv) providing awareness training on environmental and social issues related to power transmission

¹⁸ The EIA report for the Bongaigaon power plant is being reviewed by the ADB project team. Environmental issues on this associated facility are summarized in Appendix 2.

¹⁹ ADB advises that all EAs develop in-house capability for environmental, health, and safety (EHS) program consistent with international best practices. The EHS program should include accounting for environmental benefits resulting from investment projects. Presently, ASEB does not have a separate environmental cell for dealing with the various environmental issues.

projects to AEGCL and ASEB staff; and (v) preparation of environmental management reports every 6 months.

53. Consulting services will be mobilized as necessary to assist in initial operations, to ensure that the ESMC will be self-sufficient for EMP implementation, submission of progress reports, and preparation of environmental assessment for subsequent tranches. Additional third-party services may be employed by the AEGCL as necessary.

54. Construction contractors will be responsible for implementation of mitigation measures during the construction stage. The environmental engineer of the ESMC will ensure inclusion of environmental mitigation measures in contract documents. ADB will (i) review and endorse IEEs and EMPs before contracts are finalized and work begins; (ii) review monitoring reports; and (iii) officially disclose environmental safeguards documents on its Web site as necessary in accordance with the ADB *Public Communications Policy* (2005).²⁰ The IEEs include EMPs that cover (i) summary of potential impacts, (ii) mitigation measures, (iii) environmental monitoring, (iv) public consultation processes, (v) outline of responsibilities and authorities for implementing the proposed monitoring and mitigation activities, (vi) reporting and review procedures, (vii) work plan (including staffing and schedules of assigned personnel, activities, and inputs of other government agencies and stakeholders), (viii) environmentally responsible procurement plan, (ix) cost estimates, and (x) mechanisms for feedback and adjustment.

55. Table 7 presents minimum provisions for environmental monitoring related to procurement and construction for the respective components. Estimated costs for monitoring measures, including sampling and analyses, are provided in Table 8. Detailed design work will follow the recommendations of the IEE and EMP. AEGCL will certify that the detailed designs comply with IEE recommendations (including EMP) before contracts can be made effective.

²⁰ ADB. 2005 *Public Communications Policy*. Manila

Table 7: Minimum Provisions for Environmental Monitoring²¹

Project Stage	Mitigation Measure	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Cost
Pre-construction	Route survey to define alternative alignments	Possible encroachment on reserved forests	All transmission and substation sites	Field mapping with Global Positioning System (GPS) equipment	1-time survey to finalize design	AEGCL / PMU through route survey contractor	n/a
Construction	Dust, equipment emissions, erosion, and noise control Waste management	Incorporation of appropriate clauses in construction contracts	All construction contracts for all substation and transmission sites	Field inspection to ensure that appropriate measures are implemented and facilities are installed	1 time per month	AEGCL and PMU to include in bidding documents. ADB to verify through review of bidding documents. ²²	Included in construction contract (estimated at < 0.5% of total contract value)
	Dust, equipment emissions, and erosion control Waste management	Suspended particulate matter (SPM) Noise Water: pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), total suspended solids (TSS), hydrocarbons and PCBs ²³ Solid waste generation and disposal	All substation sites and selected transmission lines	“Grab” samples for air and water Spot check for noise using portable monitoring device Spot check for solid waste generation and disposal	Every 6 months, beginning with initial activity, for total of 18 months Monitoring will be extended if necessary Spot checks for solid waste activities	Contractors to implement, PMU staff to provide oversight via regular field inspections; ADB to audit during project review missions AEGCL has responsibility for solid waste management	See details in Table 8.
Operations and Maintenance	Dust, equipment emissions, and erosion control Waste management	Same parameters as during construction period	All substations and transmission lines	Spot checks based on visual inspections and any complaints	As necessary based on inspections and complaints	AEGCL through PMU ADB to audit during project review missions	

ADB = Asian Development Bank, AEGCL = Assam Electricity Grid Corporation Ltd., BOD = biochemical oxygen demand, DO = dissolved oxygen, PCB = polychlorinated biphenyls, PMU = project management unit, SPM = suspended particulate matter, TSS = total suspended solids

Source: Asian Development Bank assessment.

Table 8: Summary of Estimated Costs for EMP Implementation

Activity	Units	Unit cost (\$)	Total Cost (\$) ^a
Transmission Route Survey	262 km	521	136,502
Civil works	8 sites	n/a	61,657
Utilities and sewage	8 sites	n/a	43,651

²¹ Monitoring of issues related to compensation of landowners for land acquisition will be included in the resettlement plan.

²² ADB will review documents and provide “no objection” at each stage of bidding, contract evaluation, and contract award.

²³ These parameters should be monitored if warranted based on visual observations or complaints.

Drainage controls	8 sites	n/a	163,690
Site access controls	8 sites	n/a	147,322
Fire safety and suppression	8 sites	n/a	47,917
SUBTOTAL - Design & Construction²⁴			600,739
Environmental Services			
Test of Environmental parameters	lump sum		65,000
Environmental Training	lump sum	-	15,000
Consultant Services (remuneration)	16 p-m	5,000	80,000
Consultant Services (per diem)	Per month	3,450	55,200
Consultant Services (transportation)	Per month	1,875	30,000
ESMC Staff (8 person-months)	Per month	2,500	20,000
Report/Communication	Lump sum	-	5,000
Subtotal – environmental services			270,200
Contingency (10 %)			27,020
Total			897,959

^a Estimated costs are indicative only for expected implementation effort as per assumptions.

Assumptions:

1. Design and construction costs: route survey @ 100% of DPR estimate; civil works @ 33% of DPR estimate; utilities and sewage @ 33% of DPR estimate; drainage controls @ 100% of DPR estimate; site access controls @ 50% of DPR estimate; fire safety & suppression @ 100% of DPR estimates. Total = 0.9% of total project cost.

2. Air and noise sampling/testing at substations @ Rs 5000 per sample and Rs 3000 per sample. Air and water sampling at construction camps @ Rs 5000/per sample and Rs 5000/per sample respectively. Total of 60 samples each (of air, noise, and water) x 4 events. Testing frequency proposed at commencement of construction, and every 6 months afterward for the following 18 months, for a total of 4 testing events.

3. Environmental monitoring and compliance training for ESMC personnel estimated at 2 person-months domestic consultants @\$5000/month + \$5000 associated costs (travel, per diem, document preparation, seminar rooms, etc.)

4. Consultant services for total of 4 person-months per monitoring event x 4 events spread over initial 18 month implementation period; domestic consulting @ \$5000/p-m

5. ESMC Staff to conduct field inspections; 2 people x 4 months during the 18 month project period; 8 p-m @ \$2500/p-m

6. Exchange rate: \$1 = INR 48

7. Total environmental services = 15% of design and construction cost = 0.14% of total project cost

Source: ADB staff and consultants estimates.

F. PUBLIC CONSULTATION, INFORMATION DISCLOSURE, AND GRIEVANCES

56. Affected communities have been consulted during preparation of the project in general and as part of the IEE preparation. The objectives of these consultations were as follows:

- (i) Disseminating information on the project to the stakeholders.

²⁴ Contingency costs are included within.

- (i) Gaining a better understanding of existing environmental conditions.
- (ii) Helping the stakeholders contribute meaningfully to the Project design.
- (iii) Gaining greater trust with the Project proponent and support for the Project.
- (iv) Reducing potential conflicts and substantial delays.
- (v) Helping recognize possible alternatives.
- (vi) Ensuring the sustainability of the Project.

57. The communities generally support the proposed investment components, as electricity service is expected to improve and some employment opportunities will be created. Details of public consultations are incorporated in the IEEs. The consultations undertaken during fact-finding field visits are summarized in Table 9. Additional consultations are being conducted during the route survey.

Table 9: Summary of Initial Public Consultations

Date	Project Component / Venue	Number of Participants	Issues Discussed / Remarks
11 February 2009	Nagaon	26	<ul style="list-style-type: none"> • Awareness about the project and environmental pollution • Benefits of the projects • Likely impact on direct/indirect development • Environmental problems in the region • Presence of environmental sensitive areas in the region • Health and safety issues • Compensation payment mechanism initiatives for minimal environmental/social impacts
12 February 2009	Sonari	10	
13 February 2009	Dibrugarh	11	
21 February 2009	Kamalpur	5	

Source: ADB /PPTA field survey and consultations.

58. The summary IEE and EMP for the Project will be translated into local language (Assamese) and made available to the public. A grievance redress mechanism has been established by ASEB: a special office has been set up at the ASEB headquarters, which is open on a regular schedule to receive visitors with complaints. The GOI Right to Information Act (2005) provides an additional legal channel for affected to people to obtain information about the proposed Project.

59. ASEB and IA will be responsible for internal monitoring of EMP implementation, and will forward semiannual progress reports to the Government and ADB. The reports will cover EMP implementation with attention to compliance and any needed corrective actions. On-going consultation measures will be incorporated in the EMP. Project documents will be made publicly available in accordance with the ADB *Public Communications Policy 2005*.

G. FINDINGS AND RECOMMENDATIONS

60. The Project has been planned and is being designed with careful attention to environmental and social safeguards issues. Project components will not be sited in protected areas. Reserved forest areas will be avoided as well. If reserved forest land is required due to technical design constraints, advance clearance by ADEF will be required. ADEF has a built-in mitigation system for such cases. The Project will have minimal environmental impacts during

construction and operations. Negative environmental impacts, mainly during construction, are considered temporary and insignificant provided mitigation measures are implemented as detailed in the EMP. The Project will have long term positive impacts arising from improved quality and reliability of electricity supplies.

61. Mitigation and monitoring measures with cost estimate have been developed in the EMP. The EMP will be implemented by the IA and construction contractors, with oversight by ASEB and ADB. Public consultation has been undertaken during project preparation. ASEB maintains an open-door policy for receiving complaints, and will conduct additional consultations as necessary during project implementation.

H. CONCLUSIONS

62. None of the Project components are in environmentally sensitive areas. The Project will not result in any long-term significant adverse impacts. Minimal negative environmental impacts are anticipated, mostly during construction. These can be mitigated successfully by implementing the EMP. Environmental and social benefits of the Project and long-term investment program objectives outweigh the negative impacts.

63. Based on environmental assessment activities conducted to date, the Project is confirmed as environmental category B and the IEE, including the EMP, is considered sufficient to meet the environmental assessment requirements of ADB, GOI, and GOA. A full environmental impact assessment study is not required.

SIEE – APPENDIX 1

Access to Reserved Forests

64. The Government of Assam (GOA) manages forests pursuant to the Forest (Conservation) Act 1980 (the Forest Act) and its amendments, and the Forest (Conservation) Rules 2003 and its amendments. These are unique pieces of legislation, which elucidate a regulatory mechanism that reflects the collective will of the nation to protect its rich forests, biodiversity and natural heritage and resources. The act permits only unavoidable use of forest land for various development purposes. It embodies the firm commitment of the GOA and the Assam Department of Environment and Forests (ADEF) to balance the conservation of forests with the sustainable developmental need of the society contributing to better environment, health and economy.

65. The Forest Act implicitly acknowledges the demarcation of forested areas during the British colonial period, which reflected prevailing knowledge of forest management at the time, but obviously predates current concepts such as “ecosystem services” and “global commons.” In effect, the areas mapped as “reserved forests” were not designated on the basis of modern procedures for defining ecologically-sensitive areas (the youngest of the forest maps being at least 50 years old). Alternatively stated, designation as “reserved forest” does not imply the presence of endangered or threatened species or globally significant bio-diversity: areas with such special ecological resources are defined as wildlife sanctuaries and national parks. Reserved forests are, simply stated, areas designated for conservation.²⁵ In fact, reserved forest areas have been significantly altered by human activity, and the designation does not warrant that a particular site is actually covered by forest.

66. The Forest Act is regulatory in nature and not prohibitory, and provides a built-in mitigation process for cases where forest access is unavoidable. Project proponents request use of forest land. ADEF reviews the request, and if granted, the project proponent pays user fees to ADEF. The fees are used for afforestation and reforestation in other areas. The reserved forest area used by the projects is “diverted,” or effectively re-zoned for project purposes. This type of environmental offset mechanism is consistent with other market-based regulatory instruments such as wetlands mitigation and banking and emissions trading.

67. As of March 2006, ADEF has granted clearance to divert forest for 169 cases, including 23 cases for pipelines and transmission lines. Reserved forest area diverted is 6212 hectares, and total afforested area (in reserved forests) is 9889 hectares. An additional 745 hectares have been afforested. Table A1.1 summarizes the forest clearance and afforestation activity as of year-end 2006.

68. The proposed transmission project to be supported by ADB will minimize forest use by design. New substations will not be located in reserved forests. Some forest area may be requested if technically necessary due to design constraints. Total right of way is estimated as: 596 km total line length x 10 m right of way x 1000 m/km x 1 ha/10,000m² = 596 ha. If the entire right-of-way were to be located in reserved forest, the area required (596 ha) represents only 0.0006% of total reserved forest area (9804 km² = 980,400 ha). Assuming that 1% of the ROW crosses reserved forest, the area required would be 1% x 596 ha = 5.96 hectares. This area is equal to about 0.06% of the total area afforested (9889 ha), and is well within the capacity of

²⁵ In this context, reserved forests are not to be equate with “environmentally sensitive areas as defined by ADB, and as such, encroachment on reserved forest areas should not automatically trigger the classification of environment Category B-sensitive.

ADEF management. As mitigation is built-in to the forest diversion process, no significant impacts will result from the Project.

Table A1.1: Summary of Forest Diversion Activities in Assam

1	Purpose of Diversion	Nos.
	(I) Irrigation Projects	2
	(II) Hydroelectric Projects	3
	(III) Mining	2
	(IV) Construction of Road	3
	(V) Laying of Railway lines	4
	(VI) Laying of Transmission line/pipe line	23
	(VII) Others	132
	Total	169
2	Forest Area Diverted (hectares)	6211.53
3	Compensatory Afforestation Stipulated (hectares)	
	(I) On Forest Land	6548.615
	(II) On Non- Forest Land	1263.664
	Total (hectares)	7812.279
4	Compensatory Afforestation done as of 31.12.2006 (hectares)	
	(I) On Forest Land	9889.054
	(II) On Non- Forest Land	744.964
	Total (hectares)	10634.018

SIEE – APPENDIX 2

Associated Facilities, Due Diligence, and Cumulative and Induced Impacts

I. Associated Facilities And Due Diligence

69. Associated Facilities are referenced in a footnote of the Resettlement OM, which states simply that if there are associated facilities with safeguards implications, then ADB may conduct due diligence. In practice, if a facility is economically dependent on ADB's direct investment, then it is considered to be an "associated facility" and may be subject to due diligence. In the context of safeguards compliance, due diligence is limited to a determination of whether the facilities are in compliance with the host country regulatory requirements. Due diligence may logically include a review of potential financial risks.²⁶ The safeguards categories of the ADB investments are determined independently.²⁷

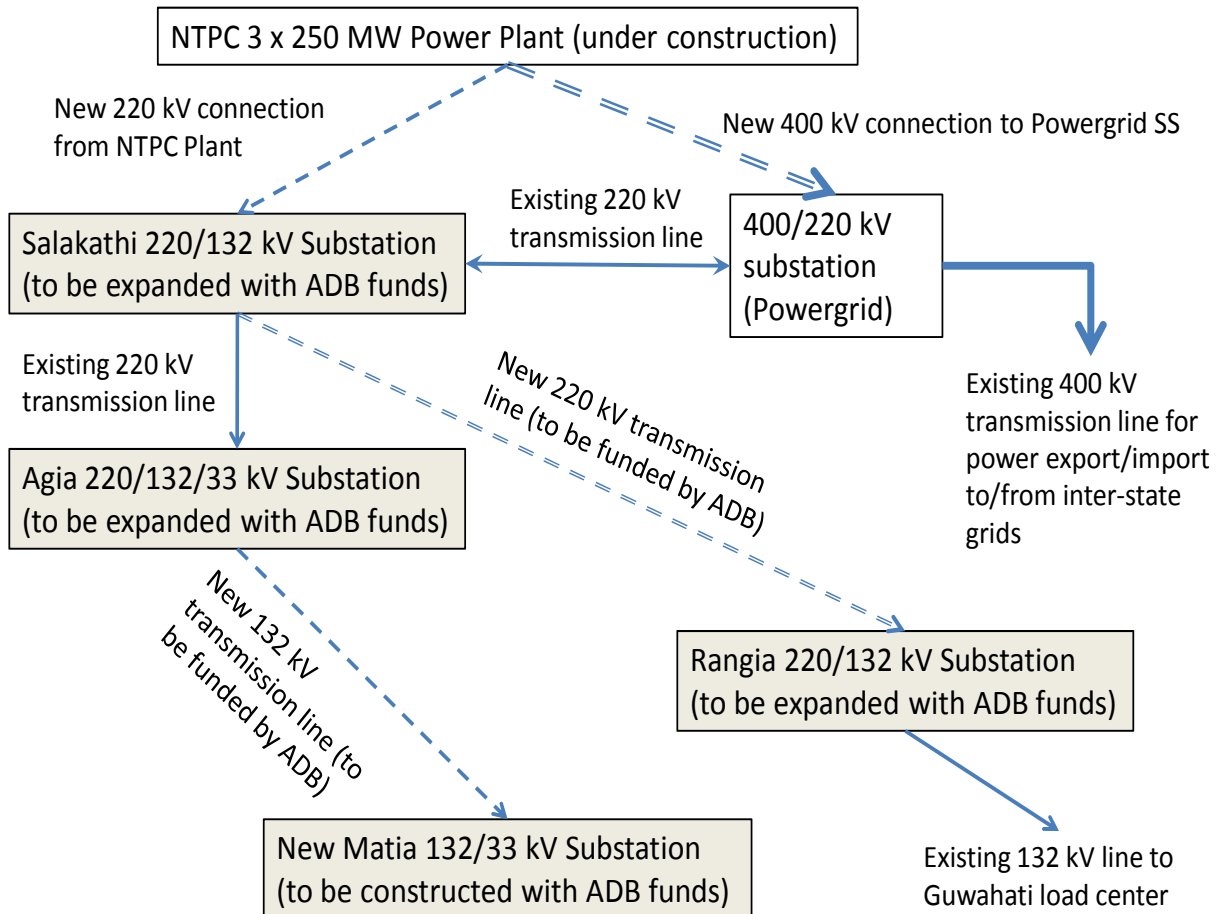
II. Possible Associated Facilities in the Assam Transmission Project

70. The first tranche project includes 1 possible associated facility, as follows.

71. ADB financing is proposed for a transmission line which will deliver power from a new 3 x 250 MW coal-fired power plant at Bongaigaon (owned by NTPC, Ltd., an ADB client) built on the site of a decommissioned 4 x 60 MW coal-fired plant. The proposed layout is shown schematically in Figure A2.1. The transmission system will allow the NTPC plant to deliver power into the state grid and inter-state grids. The overall transmission system upgrade will allow imports of power from the inter-state grids as well. The NTPC plant is not economically dependent on the ADB-funded transmission line, as all of the power could be delivered into the inter-state grids. On this basis, the NTPC plant is not necessarily an associated facility. However, the Assam distribution companies have committed to buy 381 MW of power from the NTPC plant, and on this basis the NTPC plant may be deemed as an associated facility. NTPC prepared the required environmental impact assessment, and environmental clearance was received in June 2007. The plant is considered to be in compliance with GOI standards at this time. NTPC has a corporate environmental, health, and safety (EHS) department, and is acknowledged as the one of the best-performing power utility companies in India.

²⁶ ADB standards are not imposed on the associated facilities.

²⁷ The ADB Rapid Environmental Assessment checklists do not include associated facilities. Determination that an associated facility is present does not change the category of the ADB-supported investments.

Figure A2.1: Transmission System Layout from Bongaigaon Power Plant

III. Cumulative And Induced Impacts of the Assam Investment Program

72. In the context of transmission and distribution projects in India, most of the ADB-funded projects are addressing under-served areas with suppressed energy demand. Such transmission and distribution projects are in fact induced by economic growth, not *vice versa*. For the proposed Assam investment program (the Program), the scope of assessment is limited as follows: (i) “upstream” power plants determined to be associated facilities are included in the environmental review; (ii) electricity consumers “downstream” of the distribution substations are not included in the environmental review, but development indicators are included in the Design and Monitoring Framework to evaluate the overall economic impact of the project. In terms of overall development and environmental impact, the key issue for evaluation of the associated power plants is whether ambient air quality will be maintained within GOI recommended levels when the new plants are in operation.

73. The Program will remove transmission bottlenecks and reduce transmission and distribution losses, reducing the emissions intensity of delivered power. Based on computer modeling of the transmission system to be financed by the MFF, the components proposed for ADB financing will result in power savings of 45 MW compared to business-as-usual, and

energy savings of 171,000 MWh/year. The corresponding GHG emissions reduction is estimated to be 68,400 tons CO₂-equivalent per year. The distribution system expansion will reduce system losses and reduce reliance on back-up diesel generators, which will further reduce emissions from electricity consumers. The ADB-supported investments will also facilitate railway electrification, which will further reduce diesel consumption.

IV. Conclusions and Recommendations

74. The proposed ADB financing program will improve energy efficiency in the Assam state electricity grid, with significant reduction in emissions intensity from upstream power plants. Emission intensity from some downstream consumers will also be reduced. The associated facility at Bongaigaon is owned by an existing ADB client with a good environmental performance track record. The environmental impact reports for the associated power plant has been obtained and reviewed to determine the possible impacts on ambient air quality. The EIA for the Bongaigaon plant concluded that ambient air and water quality standards will be met after the plant becomes operational. Based on this preliminary review, the associated facilities do not have significant environmental impacts.