

# Environmental Assessment Report

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Summary Initial Environmental Examination  
Project Number: 39630  
July 2007

## India: National Power Grid Development Investment Program

Prepared by Power Grid Corporation of India Limited (POWERGRID) 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**

**NATIONAL POWER GRID DEVELOPMENT INVESTMENT PROGRAM**

**IN**

**INDIA**

**July 2007**

This report was prepared by Power Grid Corporation of India Limited (POWERGRID).

**CURRENCY EQUIVALENTS**

(as of July 2007)

Currency Unit	–	Indian Rupees (INR)
INR 1.00	=	\$ 0.025
\$1.00	=	40 INR

**ABBREVIATIONS**

ADB	–	Asian Development Bank
EARF	–	Environment Assessment and Review Frame Work
EIU	–	Environmental Implementation Unit
EMF	–	Electromagnetic fields
EMP	–	Environmental management plan
ESMD/CC	–	Environmental & Social Management Department/Corporate Centre, POWERGRID
KPP	–	Koteshwar (Tehri) Pooling Point Substation
IEE	–	Initial environmental examination
MOEF	–	Ministry of Environment and Forests
SIEE	–	Summary initial environmental examination

**Electrical Terminology**

V	(Volt)	-	Unit of voltage
kV	(kilovolt)	-	1,000 volts
W	(Watt)	-	Unit of active power
kW	(kilowatt)	-	1,000 watts
MW	(Megawatt)	-	1,000 kW
kWh	(kilowatt-hour)	-	Unit of Energy
LILO		-	Loop-in-Loop-out
MWh	(Megawatt-hour)	-	1,000 kWh
VA	(Volt-ampere)	-	Unit of apparent power
MVA	(Million volt-ampere)	-	10 <sup>6</sup> VA
Transmission System		-	400 kV or 220 kV line supplying (incoming & outgoing feeder) grid substations (Substation) with primary voltage of 400 or 220 kV

**NOTE**

- (i) In this report, "\$" refers to US dollars.

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## I. INTRODUCTION

1. This summary initial environmental examination (SIEE) report for the National Power Grid Development Investment Program (the Investment Program) in India analyzes the environmental impacts that may occur during the construction and operation of the proposed first component transmission system investments in the North Region grid, and briefly discusses cumulative impacts of overall Investment Program. The Investment Program will partly finance 2 components: (i) upgrade of the high-voltage transmission system in the Uttarakhand–Uttar Pradesh corridor, and (ii) a proposed high-voltage direct current (HVDC) transmission line between the Northeast and Northern Region grids. The objective of the Investment Program is to provide adequate transmission arrangement for reliable transfer of power from northern and northeastern India to constituents of Northern Region, including operation and maintenance, without causing any major environmental and social problems. The first and second components have been classified by ADB as environment Category B. An initial environment examination (IEE) report was prepared by Power Grid Corporation of India Limited (POWERGRID) covering the first component: augmentation of two substations (upgrading existing substations), expected environmental impacts, and mitigating measures. An IEE for the second component is under preparation.

2. Transmission line projects are exempted from environmental impact assessment (EIA) by the Ministry of Environment and Forests (MOEF), Government of India. However, for the transmission lines traversing through a forest, the project implementing agency is required to obtain forest clearance from MOEF. The first component of the Investment Program involves only upgrade of 2 substations at 765 kV levels and does not involve construction of transmission line, hence forest clearance is not required.

3. The environmental assessments conducted for the first component substations have been undertaken following Asian Development Bank's (ADB) *Environmental Policy*, and *Environmental Assessment Guidelines, 2003*, Indian environmental assessment guidelines and regulations, and POWERGRID's *Environmental and Social Policy & Procedure (ESPP'05)*. POWERGRID teams have carried out desk reviews and visited existing substations to collect data for preparation of IEE and SIEE.<sup>1</sup>

4. Based on the findings of the IEE, an EIA is not required for the first component.

## II. DESCRIPTION OF THE INVESTMENT PROGRAM

5. There is large hydro potential in Tehri Valley and other basins of Uttarakhand. The Tehri Hydro Development Corporation (THDC) has already constructed the 1000 megawatt (MW) Tehri phase 1 hydropower plant; two units were commissioned in July 2006, with the balance commissioned in March 2007. THDC has also undertaken construction a 400 MW hydro power plant at Koteshwar with target completion by October 2007 and has a firm plan to complete an integral 1,000 MW pumped storage facility by May 2010. With commissioning of these facilities, a total of 2,400 MW will be available from Tehri Valley. To evacuate power from Tehri valley POWERGRID has already constructed 765 kV transmission lines, initially charged at 400kV level, in May 2006 up to Meerut in Uttar Pradesh. As the existing transmission system does not have sufficient capacity to transfer 2,400 MW reliably, there is an urgent need to expand the

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<sup>1</sup> POWERGIRD and ADB project team members have visited the project area periodically beginning in June 2004 through early 2007.

transformation capacity at Koteshwar Pooling Point Substation (KPP) and at Meerut from 400 kV level to 765 kV level for further dispersion of power to Delhi ring and transfer beyond to various beneficiaries of the Northern Region through existing transmission lines.

6. The first component investments will provide adequate substation capacity to reliably transmit power generated from Tehri Valley in the state of Uttarakhand to constituents of the Northern Region, by upgrading existing 400kV sub-stations at Tehri Pooling Station (Koteswar) and Meerut to 765kV level with 3x1500 MVA transmission capacity each within the existing sites and modification of series capacitors for operation at 765kV level.<sup>2</sup>

7. The assessed substation augmentation subprojects consist of following distinct elements:

- (i) Up gradation of existing 400kV level to 765kV level with 10x500 MVA transmission capacity each at Tehri Pooling Station and Meerut within the existing site and
- (ii) Modification of series capacitors for operation at 765kV level

8. The purpose of the Investment Program is to support the Government's strategy for continued poverty reduction through sustained economic growth by assisting in the financing a power transmission project to ensure a sufficient and stable power supply for the northern region in India, which is one of the key economic zones. The Investment Program will also improve system stability and security, reduce losses, and improve reliability. The environmental assessment and review framework (EARF), as well as the selection criteria, for subprojects under the subsequent components are also described in detail in Appendix 1.

### III. DESCRIPTION OF THE ENVIRONMENT

9. The first component i.e. existing 2 sub-station sites are situated at Koteshwar in Uttarakhand and Meerut S/s in Uttar Pradesh. The Meerut substation is situated in plain area whereas KPP in hilly area.

#### 1. Physical Resources

10. Uttarakhand is bounded by Nepal & the P.R. China in North, UP in south and east and Himachal Pradesh in west. It lies between lat.23°52' and 31°28' N and long.77°5' and 84°38'E. Uttar Pradesh is bounded by Uttarakhand and Nepal in North, Madhya Pradesh and Chhattisgarh in south, Rajasthan, Haryana and Delhi in West and Bihar and Jharkhand in east. It lies between lat. 23° 52' and 31° 28' N and long. 77° 5' and 84° 38' E.

11. Physiographically, Uttarakhand can be divided in to distinct subdivisions namely, the Outer Himalaya comprising the Tarai and Bhabhar, Sub-Himalayan belt of the Siwalik, the Lesser Himalaya, the Great Himalaya and the Trans-Himalaya or Tethys. The state is embodying the Kumaon and Garhwal Himalayas with a geographical area of about 53,485 sq. km. Physiographically Uttar Pradesh can be divided in to two distinct regions i) Indogangetic plain ii) Southern hills.

12. The main rivers of the Uttarakhand and Uttar Pradesh are the Yamuna, the Ganga, the

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<sup>2</sup> An additional 1000 MW of power may be transferred from hydropower plants in the upper Bhagirathi River basin via the Koteshwar pooling point substation.

Ramganga and the Ghaghara. All the rivers emerge from the Himalaya. The Yamuna and the Ganga flow from north-east to south-west in their upper mountainous courses, from north to the south in western parts of the state.

## **2. Biological Resources**

13. The recorded forest area of Uttarakhand state is 346.62 million ha which constitutes 64.8% of its geographic area. By legal status, Reserved Forest constitutes 68.7%, Protected Forest 30.8% and Un-classed Forest 0.5%. The flora of a region includes all the varieties of plants, which grow there. Vegetation is the general effect produced by the growth of some or all these plants. The diversity of fauna living in water and land in the air are found in the State. Important species mainly found in the state includes fish, amphibian, reptiles, aves, mammals and other common species, etc. Other common species found here are Tiger, Panther, Snow Leopard, Sambhar, Cheetal, Kastura, Chinkara, Black Deer, Nilgai, Back-brown Bear, Mountain Goat, Hyena, Hill Dog, and Elephant, etc. Among the birds Fowl, Pheasant, Partridge, Florican, Duck, Goose and Wader are common.

14. The recorded forest area of Uttar Pradesh is 1.70 million ha, which constitutes 7.06% of its geographic area. By legal status, Reserved Forest constitutes 74.10%, Protected Forest 8.08% and Un-classed Forest 17.82%. The flora of a region includes all the varieties of plants that grow there. Vegetation is the general effect produced by the growth of some or all these plants. The plains of Uttar Pradesh have been very rich in natural vegetation that has, however, diminished due to wide-ranging needs of the people. Only a few patches of natural forest are now found scattered here and there in the plains. There are 1 National Park and 23 wildlife sanctuaries covering an area of 0.57 million ha. which constitute 2.36% of geographic area. The main types of fauna found in Uttar Pradesh are almost similar to Uttarakhand.

15. No forests are involved in the subprojects. No endangered or rare species of flora or fauna exist in the proposed subproject areas.

## **3. Socio-Economic conditions**

16. The population of Uttarakhand was 8.489 million (Male-4.326 & Female-4.163), of which 25.6 % is urban. The population density is about 159 persons per sq. km. Uttar Pradesh is the most populous state in the country. The population of Uttar Pradesh was about 166.05 million, of which 20.80% is urban. The population density is about 689 persons per sq. km.

17. The economy of Uttarakhand is primarily agriculture based. One of the most backward states of northern India, Uttarakhand, despite being rich in natural resources, has one of the country's lowest per capita incomes- nearly 70% of the population lives below the poverty line. Uttarakhand depends largely upon agriculture for its income; manufacturing industries are virtually non-existent in the state. The bulk of the state's population is rural and survives by cultivating food grains - Haridwar, Udham Singh Nagar, the Doon Valley and Nainital district being the important agricultural areas. Horticulture may be a more lucrative option in areas where growing grain is not economically viable. There's a lot of scope for growing apple, pear, plum, apricot, litchi, grape, and more- provided agricultural research, storage and distribution systems are improved. Another potential contributor to the economy could be the cultivation of

medicinal plants and herbs for the pharmaceutical industry- an activity fairly small at the moment. The other important revenue earner for Uttarakhand is tourism. Garhwal and Kumaon are now also becoming an attractive destination for adventure seekers who want to go wildlife watching, trekking, white water rafting, angling, and mountaineering.

18. The economy of Uttar Pradesh is primarily agriculture based. Uttar Pradesh (UP) is rich in human and natural assets. Most of State's farmland is well watered and naturally fertile. UP is the largest producer of food grains and oilseeds in the country. It leads all the states in India in the production of wheat, maize, barley, gram, sugarcane and potatoes. The state (India's sugar bowl) produces about one half of the total sugarcane output in the country. The western region of the state is more advanced in terms of agriculture. Majority of the population depends upon farming as its main occupation. Wheat, rice, sugar cane, pulses, oil seeds and potatoes are its main products. Sugar cane is an important cash crop almost through out the state and sugar mills and other cane crushers who produce Gur and Khandsari are common throughout the state. Uttar Pradesh is an important state in so far as horticulture is concerned.

19. The state of Uttarakhand is poor in mineral resources. Only considerable deposits of limestone, sand, gravels and boulders are available. UP is also poor in mineral resources. Only considerable deposits are of limestone, andalusite and red sandstone in Mirzapur, Dolomite occurs in small quantities in Bandal and Varanasi. Pyrophyllite and diaspore in Jhansi and Hamirpur districts. Coal is available in Singrauli (Mirzapur district).

20. There are no reported or known areas of sensitive or protected ecology or habitats in the subproject areas.

21. Densely populated areas, some residential areas, towns or villages are not involved in the first component.

22. Substation site is not located in, or cross-areas of, virgin forest. It is not close to any areas of significant or sensitive ecological habitats or is located in areas identified as being of very specific scenic value.

23. No water bodies are reported to be nearby. The existing substation sites to be augmented in the first component have enough space for up gradation/construction.

24. There are no specific large-scale developments planned in the proximity of the first component areas.

#### **IV. FORECASTING ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES**

##### **1. Environmental Impacts Due to Subprojects' Location**

25. Potential adverse environmental impacts associated with transmission lines and substations can be avoided or minimized through careful route and site selection. The transmission system route is normally selected to avoid the forestland and ecologically sensitive areas and would mainly pass through the government owned land, wasteland, agricultural land and grazing land.

26. The first component is accommodated in the existing substation sites and it was ensured that the sites: (i) did not have human resettlements; (ii) did not affect monuments of cultural or historical importance; (iii) did not create a threat to the survival of any community with special reference to tribal communities; (iv) did not affect any public utility services like playgrounds or schools; (v) did not involve any sanctuaries, national parks, etc; and, (vi) minimized damage to the existing forest resources. Additional information on location of sensitive receptors is presented in Appendix 2.

27. The first component is located in villages detailed in Table 1 below and will be accommodated in the existing substations.

**Table 1:** Location of Subproject activities

<b>Name of the Substation for up-gradation</b>	<b>State/Union Territory</b>	<b>Name of the District</b>	<b>Name of Village</b>
Koteshwar Pooling Point Substation (KPP)	Uttarakhand	Tehri	Fafon
Meerut substation	Uttar Pradesh	Meerut	Daurala

28. The first component is for up-gradation/construction of existing substations, are already in existence, there will be no additional need for land acquisition, as the transformers and other equipment will be installed within the boundary of the existing sites. At this location, the new equipment will fill the vacant space. At existing substation site the location for additional equipment is away from the perimeter wall and as such will largely be unnoticed and residential areas are on an average 500 to 800m away from the substation perimeter walls. Therefore, the extent of landscape impacts will be negligible, as the new equipment will just add to the already existing plant and machinery and towers that are present.

29. Based on past experience, the nearby land prices are generally expected to rise in the areas receiving power. The value of land will not be adversely affected to a significant degree.

30. Historical, cultural monuments are not present in near by area of both substations.

## **2. Environmental Problems Due to Design**

31. **Escape of polluting materials.** The equipments to be installed in substations are static in nature and do not generate any fumes or waste materials.

32. **Explosion/fire hazards.** Location of existing sub-stations are away from oil/gas pipelines and other sites with potential for creating explosions or fires.

33. **Erosion hazards due to inadequate provision for resurfacing of exposed area.** This is not called for in any case in substation subprojects. However, infertile and rocky material will be dumped at carefully selected dumping areas and used as fill for leveling the area.

34. **Environmental aesthetics.** In the subprojects, environmental aesthetics is not a problem. POWERGRID normally takes up plantation of trees to buffer the visual effect in its

substations (2 to 5 % of the area depending upon the land size) and to provide better living conditions. POWERGRID also holds discussions with local forest department officials to determine feasibility of planting trees along roads to buffer visual effect in these areas, if felt necessary. POWERGRID will take up plantation of trees to buffer the visual effect around its sub-stations and to provide better living conditions.

35. **Noise/vibration nuisances.** The equipments installed at sub-stations are mostly static and are so designed that the noise level always remains within permissible limits i.e. 85 dB as per Indian and International standard-7194. POWERGRID had monitored noise/sound level by measuring it at different places in and around reactor and transformer (at 1 m distance). The noise level was found to be ranging from 75 to 83 well within permissible limit of 85 dB. To contain the noise level measures like providing sound and vibration dampers and rectification of equipments are undertaken. In addition, plantations of sound absorbing species like Casuarinas, Tamarind, Banyan and Neem are raised at the sub-stations that reduce the sound level appreciably. It is reported that 93 m<sup>3</sup> of woodland can reduce the noise level by 8 dB. Actual noise levels measured at perimeters of existing Substations are 30 to 40 dB.

36. **Blockage of wildlife passage:** The first component does not involve any wild life area or migration path of wildlife. Hence, the possibility of disturbance to wild life is nil or remote.

### 3. Environmental Problems during Construction Phase

37. **Uncontrolled silt runoff.** The first component involves only small-scale excavation for foundations within the boundary of existing substations and no huge quantities of earthwork are envisaged. The quantities of surplus excavated material expected are very minimal and can be used as fill material for leveling of undulated area and for green belt development within the substation site.

38. **Nuisance to nearby properties.** The existing substations under first component are away from settlements. Further, all the construction activities will be undertaken through the use of mechanical devices. Construction activities are restricted only in the existing sub-stations. Hence, nuisance to nearby property is not expected.

39. **Interference with utilities and traffic and blockage of access way.** The construction activities are restricted only in the existing sub-stations; therefore, interference with utilities and traffic and blockage of access way is not expected.

40. **Inadequate resurfacing for erosion control.** Since up-gradation is to be carried out in existing sub-stations within the boundary erosion problem is ruled out. However, in case of Tehri pooling station, which is situated in hilly area best engineering practices is undertaken to prevent soil erosion. This may include cutting and filling slopes wherever necessary depending upon the elevation level of 765 kV system to minimize cutting/removal of earth. The back cut slopes and downhill slopes will be treated with revetments, if required. Adequate steps shall be taken to ensure to prevent soil erosion.

41. **Inadequate disposition of borrow area.** Borrowed earth is not required for this component. However, in case of surplus excavated soil, it shall be utilized in the subproject areas for filling and leveling purpose etc.

42. **Protection of Worker's health/safety.** Provisions for workers' health and safety will be guided by the Safety Regulations/Safety Manual published by POWERGRID, and included in tender documents. Various aspects such as, work and safety regulations, workmen's compensation, insurance are adequately covered under the Erection Conditions of Contract (ECC), a part of bidding documents. In addition training is imparted to the workers in fire fighting and safety measures. Safety tools like helmet, safety belt, gloves etc. are provided to them in accordance to the provisions of Safety Manual. First aid facilities will be made available with the labour teams, and doctors called in from nearby towns when necessary. Remedial actions consistent with Indian standards will be taken immediately when safety violations are discovered. In order to minimize/checking of spread of socially transmitted diseases e.g. HIV/AIDS etc. POWERGRID will conduct awareness-building programs on such issues for the construction workers. Remedial actions consistent with Indian standards will be taken immediately when safety violations are discovered. A regular health team is proposed to conduct routine health checkups for construction workers on regular basis. The construction sites and construction workers house will be disinfected regularly.

43. **Noise and Vibration** The main noise sources during the construction phase will include equipment and transportation vehicles. Based on the range of works to be carried out for foundation of substation equipment, the need of blasting or heavy equipment is not envisaged. The existing substation sites have been planned at a safe distance (more than 500 m) from villages and schools. In addition to choosing equipment of low noise and vibration, the construction activities with noisy equipment will be scheduled to avoid school class hours and those taking place near residential areas will avoid the use of noisy equipment at night. With such good engineering practices and management measures, no significant disturbance to local communities from construction related activities is anticipated.

44. **Water Environment.** During the construction phase, the wastewater will comprise domestic sewage from construction camps and staff quarters, and industrial wastewater from washing of construction equipment and vehicles. The construction contractors will be required to adopt water-saving construction practices and conduct training of construction workers to minimize the discharge of wastewater. The small quantities of domestic sewage from staff quarters and construction camp will be treated in local soak pits. Sewer system is already available in existing substations and will be utilized for above. For the existing substation sites, presence of any water bodies (lake, pond, nallah, stream or river) is not reported. Meerut substation for the component is designed with rainwater harvesting provisions while the provision of the same is not feasible for TPS as it is in hill slope.

45. **Air Quality.** Since both substation sites are accessible, no construction of access roads is envisaged, thereby avoiding any airborne dust pollution in the vicinity. Air quality impacts will be restricted to the construction phase as there will be no emissions to air during ordinary operations of the substations. Impacts on air quality due to airborne dust in the vicinity of the work sites (for proposed up-gradation of substations) have the potential to occur as a result mainly of excavation and construction activities and tail gases from construction equipment and vehicles. During excavation and material handling activities dust and particulates may be generated. The scale of the impact will be determined by the proximity of any residential properties (that could be affected by dusts etc.) to the work sites, the nature of the material being excavated, its soil water/moisture content and the prevailing weather conditions at the time of excavation. Experience has shown that frequent spraying of water in construction sites and on exposed earth surfaces, covering of transportation vehicles with tarpaulins and training of equipment operators and drivers in fuel efficiency and antilting can effectively reduce the air

emissions. With the adoption of these mitigation measures for the first component, the residual atmospheric impact is anticipated to be temporary and minimal.

#### 4. Environmental Problems Resulting from Operation

46. **O&M Staff/Skills less than acceptable resulting in variety of adverse effects.** The O&M program in POWERGRID is normally implemented by sub-station personnel for both, the lines as well as sub-stations. The supervisors and managers entrusted with O&M responsibilities are intensively trained for necessary skills and expertise for handling these aspects. A monthly preventive maintenance program will be carried out to disclose problems related to cooling oil, gaskets, circuit breakers, vibration measurements, contact resistance, condensers, air handling units, electrical panels, and compressors. Monitoring results are published monthly, including a report of corrective action taken and a schedule for future action.

47. **Exposure to Electro Magnetic Fields (EMF).** The first component requires only up-gradation/construction in existing Substations. The addition of transformers and associated plant and equipment at the existing substations is not expected to have an additive effect on EMF outside the existing site boundary. All new plant will be located away from perimeter walls generally towards the centre of the sites and as such the EMF levels that are being produced currently are unlikely to be increased for residents outside the site boundary. The existing substation sites are located in rural areas without any residential properties being located nearby.

48. **Poly-chlorinated biphenyls (PCBs) management.** POWERGRID has discontinued procurement of poly-chlorinated biphenyls (PCBs) transformer oil and pure mineral oil is being used. New transformers and capacitors to be purchased under the first component will not have any adverse environmental impacts. Used transformer oil will be collected and reclaimed by authorized contractors. Scrap will be collected and disposed of in compliance with the Environmental Protection Act, 1986, and applicable regulations and rules. POWERGRID's current technical specification for transformer oil and practices of reclamation of used transformer oil shows its capability of handling process-generated wastes to minimize adverse environmental effects. POWERGRID will comply with India's Environmental Protection Act and other applicable regulations for the handling of used transformer oil. All new transformer and capacitors purchased under the Investment Program by POWERGRID will be PCB-free and specifications in the bidding documents will be made accordingly. POWERGRID has set up regional testing laboratories for testing of existing oil for PCB traces. No significant concentrations of PCBs have been detected.

49. **Chlorofluorocarbons (CFCs) management** Similarly processes, equipment and central cooling systems involving the use or potential release to the environment of chlorofluorocarbons (CFCs), including halon, shall not be installed, and their use, if any, in existing processes and systems will be phased out and these will be disposed of in a manner consistent with the requirements of the Government of India.

50. **Noise and Vibration** During the operational phase, the noise will come from the switchyard equipment. The anticipated levels at a distance of 2 m from the equipment are about 60 to 70 dB. Since the up-gradation of substations are located within boundary of existing substations and away by more than 500 meter from the villages /schools and with adequate greenbelt by planting bushes and trees along the substation perimeters, no significant additions are expected to the existing noise levels. As such no significant impacts are envisaged. Meerut substation (existing in UP) is near to roads with reasonable traffic and Tehri substation (existing

in Uttarakhand) is in hill slope and far away from roads & locality. Therefore, the additional noise caused by the switchyard equipment will not contribute significantly to the existing noise levels.

51. **Waste Management.** Currently, for the substation colony plantation, pesticides and herbicides are used as advised by the experts. It is recommended that POWERGRID adopt the usage of neem based or other bio-pesticides in place of chemical based pesticides and herbicides. This would prevent any groundwater and soil contamination. Storage and liquid impoundment areas for fuels, raw and in-process materials, solvents, wastes and finished products will be designed with secondary containment (e.g. dykes) to prevent spills and the contamination of soil, groundwater and surface waters. Normal operation of the substation sites will result in the generation of relatively small amounts of commercial type waste including paper, cardboard, plastics, food waste, etc., which will be disposed of properly.

## **5. Potential Cumulative and Induced Impacts**

52. The proposed Investment Program does have potential cumulative and induced impacts, which are considered to be largely positive. POWERGRID will transfer low-carbon energy from hydropower plants in Uttarakhand and the Northeast Region to state-level transmission companies (TRANSCOs), who in turn will wheel energy to distribution companies (DISCOMs). Direct, negative, impacts result from (i) acquisition of additional right-of-way (RoW) and land by TRANSCOs and DISCOMs for transmission lines and substations, and (iii) impacts associated with hydropower and pumped storage facilities in Uttarakhand and hydropower plants in the Northeast Region.

53. Positive impacts include (i) expansion of low-carbon energy, offsetting emissions from thermal power plants, (ii) transmission system efficiency improvements, and (iii) economic growth related to improved power supplies to millions of consumers. The cumulative emissions offsets are estimated as follows: (i) 685 million tons of carbon dioxide equivalent, (ii) 5,8 million tons of sulfur dioxide, (iii) 2.9 million tons of nitrogen oxides, and (iv) 0.48 million tons of particulate matter. These emissions offsets will ameliorate negative impacts of local, regional, and global air pollution. Additional discussion on associated and cumulative impacts is presented in Appendix 3.

## **V. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PLAN**

54. An outline environmental management plan (EMP) has been prepared reflecting best practices and to ensure that those impacts that do occur are minimized wherever possible. A summary of the environmental impacts from the development has been included in the outline EMP that also references the proposed mitigation measures (see Appendix 4). This has included consideration of impacts during the following stages: (i) pre-construction, (ii) construction, and (iii) operation and maintenance. More detailed, site-specific mitigation measures and monitoring plans for all the subprojects will be provided in the IEE reports to be prepared by POWERGRID.

55. Similarly, a summary of monitoring requirements has also been included which identifies when and where the parameter will be monitored, how often and against what aspect.

56. Monitoring the implementation of environmental mitigation measures is required to ensure that these are undertaken in accordance with the EMP, and to enable mitigation to be

adapted and refined as required. Auditing the success of implemented mitigation is also required to identify ineffective measures or implementation procedures, and thus enabling the design and incorporation of improved measures and the implementation of corrective actions. Estimated costs are envisaged for the monitoring elements. Independent audit costs have been subsequently identified.

#### **A. Responsibilities for Monitoring**

57. Monitoring is a continuous process at all the stages be it the site selection, construction or maintenance. Apart from the site managers reviewing the progress on daily basis, regular project review meetings would be held at least on monthly basis, chaired by the Executive Director of the region wherein the environmental aspects of the subprojects would be discussed, and remedial measures taken wherever required. The exceptions of these meetings will be submitted to the Directors and Chairman and Managing Director of POWERGRID. Following is the existing organization support system in POWERGRID for proper implementation and monitoring of environmental & social management plans:

58. **Corporate Level:** An Environmental Management Cell at corporate level has been created within POWERGRID in 1992 and subsequently upgraded to an Environment Management Department (EMD) in 1993 and in 1997 it has been further upgraded to Environment & Social Management Department (ESMD). Currently 8 professionals form the corporate level team (ESMD). Briefly, the ESMD's responsibilities are as follows:

- Advising and co-ordinating regional and divisional head quarters (RHQs and DHQs) to carry out environmental and social surveys for new subprojects.
- Assisting RHQs and DHQs to finalise routes of entire power transmission line considering environmental and social factors that could arise en-route.
- Help RHQs and DHQs to follow-up with the state forest offices and other state departments in expediting forest clearances and the land acquisition process of various ongoing and new subprojects.
- Act as a focal point for interaction with the MOEF for expediting forest clearances and follow-ups with the Ministry of Power.
- Imparts training to POWERGRID's RHQs & DHQs on environment and social issues and their management plan.

59. **Regional Level:** At its regional office POWERGRID has an Environmental and Social Management cell (ESMC) to manage environmental and social issues and to coordinate between ESMD at the corporate level and the divisional headquarters. Currently 14 professionals from 7 regional offices form the regional level teams (i.e. ESCM). The key functions envisaged for ESCM are:

- Advising and coordinating field offices to carry out environmental and social surveys for new subprojects envisaged in the corporate investment plan.
- Assisting the ESMD and DHQs to finalize routes of entire power transmission lines considering the environmental and social factors that could arise en-route.
- To follow-up forest clearances and land acquisition processes with state forest offices and other state departments for various ongoing and new subprojects.
- Acting as a focal point for interaction with the ESMD and DHQs on various environmental and social aspects.

60. **Site Office:** At the divisional headquarters level, POWERGRID has made the head of the division responsible for implementing the environmental and social aspect of subprojects and is termed as Environmental and Social Management Team (ESMT). Currently about 35 to 40 officers at various sites form the site level teams (i.e. ESMT). Key functions of the ESMT are:

- Conduct surveys on environmental and social aspects to finalize the route for the power transmission subprojects.
- Conduct surveys for the sites to being considered for land acquisition.
- Interact with the forest departments to make the forest proposal and follow it up for MOEF clearance.
- Interact with revenue authorities for land acquisition and follow it up with authorized agencies for implementation of social management plan (SMP).
- Implementation of environment management plan and SMP.
- Monitoring of environment management plan and SMP and producing periodic reports on the same.

61. Environmental monitoring will consist of routine systematic checking that the above mitigation measures have been implemented effectively during each stage of the subprojects (Table 2)

**Table 2: Summary Environmental Monitoring Plan**

<b>Environmental Monitoring Tasks</b>	<b>Implementation Responsibility</b>	<b>Implementation Schedule</b>
<b>Pre Construction Phase</b>		
Bidding documents to include general and specific contract conditions based on IEE and EMP. (EMPs will be provided to contractor at time of contract award).	POWERGRID – ESMU	At time bidding documents are issued.
Monitor contractor’s detailed alignment survey to ensure relevant environmental mitigation measures in EMP have been included.	POWERGRID – ESMU	Prior to POWERGRID approval of contractor’s detailed alignment survey.
Audit detailed designs of Facilities to ensure standard environmental safeguards/mitigation measures (as identified in EMP) have been included.	POWERGRID – ESMU	Prior to POWERGRID approval of contractor’s detailed designs.
<b>Construction Phase</b>		
Regular monitoring and reporting of contractor’s compliance with contractual environmental mitigation measures.	POWERGRID – ESMU	Continuous throughout construction period.
<b>Operation and Maintenance Phase</b>		
Observations during routine maintenance inspections of facilities and transmission lines RoWs. Inspections will include monitoring implementation status of mitigation measures specified in EMP.	POWERGRID – ESMU	As per POWERGRID inspection schedules

62. POWERGRID is well equipped to implement and monitor its EMP. The EMP will be reviewed by POWERGRID not less than 2 months prior to proposed commencement of work.

Implementation of mitigation measures and monitoring will be supervised by POWERGRID and ensure compliance in terms of EMP and IEE commitments.

63. The POWERGRID will be the Executing Agency (EA) for the Investment Program. An Environment Implementation Unit (EIU) will be established for each substation, headed by in-charge Sub-stations, which will be accountable and responsible for implementation of the EMP. Each unit will have a designated environment officer to co-ordinate implementation of the EMP.

64. The EIUs will also be responsible for internal monitoring, quality control, and progress reports on implementation of the EMP. The implementation period of EMP shall be a time bound activity. The EIU will submit a comprehensive report on the compliance of EMP to ADB through ESMD/CC in an acceptable format biannually. ESMD/CC will also undertake audit annually. An external auditing will also be carried out, if required. The audit report will also be submitted to ADB.

## **B. Preliminary Cost Estimates**

65. Cost estimate summaries for the implementation of environmental mitigation measures, and monitoring costs for the first component subprojects are provided in Table 3 below.

**Table 3: Summary of Estimated Costs\* for EMP Implementation**

<b>Item</b>	<b>Sub –Item</b>	<b>Total Cost (Rs. million)</b>
Mitigation measures	As prescribed under EMP and IEE	1.00
Implementation Monitoring & Audit	As detailed under EMP	0.5
Contingency	3 %	0.05
<b>Total=</b>		<b>1.55</b>

\* Estimated costs are only indicative

## **VI. PUBLIC CONSULTATION AND DISCLOSURE**

66. The proposed first component does not involve construction of transmission line. It involves only up-gradation of Sub-stations within existing boundaries. However, Public information centers (PIC) shall be available for public enquiry. The component only involves up-gradation of existing 400kV systems to establish 765/400KV, 10x500 MVA transformation capacities each at Tehri Pooling Station and at Meerut Sub-station within the existing substations/boundaries.

67. The EMP prepared for present subprojects will be translated into local language(s) and made available at the village/community level. Copies of EMPs will be available at the local level to stakeholders for local inputs.

## **VII. FINDINGS AND RECOMMENDATIONS**

68. This SIEE has identified that, for the subprojects under the first component assessed, no significant environmental impacts are expected to occur during the subproject implementation. Environmental impacts are likely to result from the proposed development but none are

considered significant. Those impacts that do occur can be reduced through the use of mitigation measures, most of which will be standard methods of working for construction sites.

69. The first component subprojects have no emissions since only substations are involved. Further the subprojects will neither divide animal habitats nor cause substantial change of vegetation. Therefore, environmental assessment of sector impacts, including cumulative/synergistic impacts, is not considered necessary because of the insignificant scale and nature of the subprojects under the first component.

70. No impacts are expected beyond those already predicted that would change the conclusions of this report. Extra care will be taken during the detailed design phase to take into account the unknowns and ensure that appropriate procedures are incorporated as part of the construction works. This will be achieved through the use of an EMP, an outline of which is provided in this SIEE and in the EARF.

71. It is considered that with careful mitigation and monitoring, none of the environmental impacts from the proposed subprojects will be of significant concern. In addition, specific selection criteria and review/assessment procedures for the subprojects have been specified for future subprojects under the Investment Program to ensure minimal impacts to take place and adequate mitigation and monitoring to address them.

72. There is an element of uncertainty for some components of the construction works and as many of these will be addressed during the work still to be undertaken. Where it will not be possible to address these specifically until the detail design phase, these will be addressed as part of the EMP. This will address the issues that must be taken into account as part of the detailed design to ensure that those environmental impacts that could not be specified or identified at this stage are taken account of and mitigated where necessary as part of the construction work.

## **VIII. CONCLUSIONS**

73. For the National Power Grid Development Investment Program in India, the works proposed for the substations will consist of up-gradation and augmentation of existing facilities. The land acquisition is not involved. The expected impacts are likely to be both, short-term temporary impacts during the construction phase and the potential for longer-term permanent impacts as a result of the operation of the facilities. Any impacts will be adequately mitigated and the significance of the remaining impacts after successful implementation of mitigation will be minimal.

74. Permanent impacts are likely to be restricted to those on landscape and visual elements, which are not considered to be significant.

75. This study has not identified any environmental impacts that would necessitate a more detailed EIA to be conducted. However, an outline EMP has been prepared in order to ensure that mitigation measures identified are successfully implemented and environmental impacts are managed in an appropriate manner during the construction phase. A detailed EMP is prepared by the POWERGRID for other subprojects (part of EARF).

76. The first component will not result in any significant environmental impacts provided that recommended mitigation measures be properly implemented. Recommended mitigation measures should be vigorously monitored throughout each phase of the subprojects.

Appropriate training in environmental management and monitoring of power transmission projects should be provided to POWERGRID staff.

77. The IEE, including the environmental management plan and monitoring program is considered sufficient to meet the environmental assessment requirements for the first component, and no further environmental assessment is required.

## **ENVIRONMENTAL ASSESSMENT AND REVIEW FRAMEWORK**

### **A. INTRODUCTION**

1. Power Grid Corporation of India Ltd. (POWERGRID) through Government of India (Government) has requested the Asian Development Bank (ADB) to provide a multi-tranche financing facility (MFF) to partly fund the National Power Grid Development Program (the investment program) for interstate transmission system expansion program in India. The investment program will cover physical investments in extra/ultra high voltage transmission lines, substations, and auxiliary equipment and materials. The MFF will be implemented for specific subprojects on a time-slice basis.

2. The investments to be supported by ADB will (i) improve quality and reliability of power; (ii) remove transmission bottlenecks; (iii) facilitate interregional power transfers; and (iv) facilitate a reduction in nationwide transmission system losses. The investment program will sustain the transmission system expansion established with earlier ADB support.

3. This Environmental Assessment and Review Framework (EARF) is applicable to all investments funded by the MFF, and particularly to projects included in any subsequent tranches which have not yet been fully defined. The EARF outlines the policy, procedures, and institutional requirements for preparing subsequent projects. POWERGRID as the Executing Agency (EA) is responsible for preparing the required environmental assessments and obtaining ADB concurrence prior to implementation. These approvals must be in place prior to finalization of contracts and commencement of work.

### **B. ENVIRONMENTAL REGULATORY AND POLICY FRAMEWORK FOR SUBPROJECT SELECTION**

4. GOVERNMENT and ADB environment policies and procedures apply to all projects/subprojects funded by the MFF. The environmental regulations of the Ministry of Environment and Forests (MOEF) categorize development projects according to their anticipated potential environmental impact. As per the Notification in the Gazette of India, Extraordinary part II, and Section 3, sub-section (II), Ministry of Environment and Forest dated September 14, 2006, transmission projects are exempt from Environmental clearance requirements. POWERGRID is obligated to comply with (i) section 68 of the Electricity Act 2003, (ii) forest clearances under the Forest (Conservation) Act 1980, and (iii) specific environmental clearances are required for two designated areas in the Aravalli Range (Alwar in Rajasthan and Gurgaon in Haryana).

5. Power transmission projects normally are classified by ADB as Category B. Category B-sensitive or Category A may apply to projects located in environmentally sensitive areas.<sup>3</sup> For each investment subproject an initial environmental examination (IEE) will be prepared following ADB's Environment Policy, 2002 and Environmental Assessment Guidelines, 2003 and national environmental assessment regulations and guidelines (as noted above), and POWERGRID

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<sup>3</sup> National Parks, Wildlife Sanctuaries, Bio-reserve zones, nature reserves, or wetlands as designated by MoEF and areas declared as heritage sites.

*Environmental and Social Policy & Procedures 2005 (ESPP)*. The IEEs (or EIAs) will include an environmental management plan (EMP) with implementation budget.

**C. Environmental criteria for additional subproject selection**

6. Specific environmental criteria for project/subproject selection are:

- i. Projects/subprojects will not be located within national parks, wildlife sanctuaries and nature reserves, or wetlands, unless unavoidable for technical reasons.
- ii. Monuments of cultural or historical importance will be avoided.
- iii. An environmental management plan (EMP) with adequate budget will be developed for each subproject.
- iv. Environment Category A and B-sensitive subprojects must comply with ADB's 120-day disclosure policy.
- v. Potential environmental impacts will be minimized by routing of transmission lines and siting of substations to avoid sensitive areas. Re-alignment or selection of alternative sites may be required.
- vi. Clearing of any existing forest resources will be avoided if possible, and where unavoidable will be minimized and compensated as per Government regulatory criteria.
- vii. New equipment / facilities specifications shall follow international standards and best practices to avoid use of chemicals causing greenhouse gas (GHG) emissions, and all equipment procured shall be CFC & Polychlorinated Biphenyl (PCBs) free (as per international standard wherever applicable as specified in Technical Specification) as per ESPP of POWERGRID.

**D. Environmental assessment and review procedures of additional subprojects**

**1. Application of selection criteria**

7. Proposed projects/subprojects will be screened for compliance with selection criteria listed above prior to additional analysis. Environmental categories will be assigned using the rapid environmental assessment (REA) checklist (as described in ADB Environmental Assessment Guidelines 2003). Design changes may be suggested or required by ADB and GOVERNMENT for proposed projects that initially do not meet the selection criteria, and environment categories will be changed as necessary.

**2. Preparation of Environmental Assessments**

8. After categorization,<sup>4</sup> an IEE or EIA including an EMP with implementation budget will be prepared for each component. Public consultation will be conducted with local community and potentially affected people as early as possible for each project/subproject. For Category A

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<sup>4</sup> Categorization using the ADB REA checklist will be done at the earliest possible time. Category B is expected for most projects (about 90% of all POWERGRID projects are classified as Category B).

projects/subprojects, public consultations will be conducted at least twice: (i) once during early stage of EIA field work, and (ii) once with the draft EIA report is available, and before submission of the relevant PFR. IEE results will be communicated to the local community during public consultation process and before commencement of construction. IEE or EIAs will be reviewed and approved by ADB and GOVERNMENT. Summary IEEs (SIEE) or summary EIAs (SEIA) will be prepared and disclosed in accordance with ADB's *Public Communication Policy 2005* for Category B-sensitive and A projects and the SIEE or SEIA shall be made available to general public at least 120 days before the corresponding Periodic Financing Request is submitted to ADB.

### **3. Responsibilities /Authorities of various agencies**

9. POWERGRID as the EA will be solely responsible for the implementation of the entire environmental assessment and review procedures. This include, among others, ensuring that the selection criteria are adhered to strictly, the preparation of IEE, SIEEs, EIAs, and SEIAs be done in a timely and adequate manner, environmental monitoring and institutional requirements be fully met while public consultations be carried out satisfactorily. POWERGRID will submit the REA checklist, IEE, SIEE, and monitoring reports to ADB for review. POWERGRID will also be responsible for obtaining regulatory approval of any relevant regional environmental protection agency<sup>5</sup> as per the regulatory requirements of the GOVERNMENT.

10. ADB will be responsible for regular review and timely approval of checklists, IEE/SIEEs and EIA/SEIAs. Technical guidance will be provided by ADB to EAs as needed. ADB will also be responsible for reviewing regular monitoring reports and officially disclosing the SIEEs (for Category B-sensitive components/subprojects) and SEIAs (for Category A components/subprojects) on its website.

### **4. Preparation of detailed design and construction contracts**

11. Detailed design work for all subprojects will follow the recommendations of the IEE or EIA. POWERGRID will review detailed designs before contracts are finalized and modifications are incorporated if considered necessary. Construction contracts will include general and specific conditions for environmental protection with details derived from IEEs and EMP, as per normal POWERGRID practice.

### **5. Monitoring**

12. Monitoring during construction and operations will be POWERGRID's responsibility. Monitoring will be sufficient to comply with contract provisions, determine the state and health of affected environmental resources, and determine the effectiveness of mitigation measures. Reporting will be to ADB and the relevant environmental agencies as per GOVERNMENT requirements and ESPP on a regular basis. For Category A and B-sensitive projects, POWERGRID will submit semi-annual reports on EMP implementation to ADB. The EMP outlines monitoring requirements for design, construction, and operations.

## **E. Environmental Management Plan**

13. Attachment 1 presents the generic environmental management plan in matrix form that applies to all subprojects. The matrix is developed on the anticipated impacts of typical power

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<sup>5</sup> E.g., right-of-way must be recommended by state level forest department and approved by the MOEF.

transmission projects. Mitigation measures for specific subprojects will be developed in the spirit of the principles agreed upon in this EMP framework.

14. Environmental monitoring will consist of routine systematic checking to demonstrate that EMP requirements have been implemented effectively during each stage of the subproject. Table 1 (below) presents the summary monitoring plan for subprojects to be funded by the MFF.

## F. Institutional Arrangements

15. For each subproject an Environmental and Social Management Unit (ESMU) will be established at the POWERGRID project level, headed by the concerned head of POWERGRID Region, which will be accountable and responsible for implementation of the EMPs. The ESMU will have an Environment Officer to coordinate implementation of the EMP. The EA will hire local environmental consultants if required. The local consultants will work in close coordination with ESMU in facilitating EMP implementation. POWERGRID will further ensure the environmental management and monitoring budgets are available and utilized as necessary for timely EMP implementation.

16. The ESMUs will also be responsible for internal monitoring, quality control, supervising activities of local consultants, and progress reports on EMP implementation. The implementation of EMP shall be a time bound activity.

**Table 1: Summary Environmental Monitoring Plan**

<b>Environmental Monitoring Tasks<sup>6</sup></b>	<b>Implementation Responsibility</b>	<b>Implementation Schedule</b>
<b>Pre Construction Phase</b>		
Bidding documents to include general and specific contract conditions based on IEE and EMP. (EMPs will be provided to contractor at time of contract award).	POWERGRID – ESMU	At time bidding documents are issued.
Monitor contractor's detailed alignment survey to ensure relevant environmental mitigation measures in EMP have been included.	POWERGRID – ESMU	Prior to POWERGRID approval of contractor's detailed alignment survey.
Audit detailed designs of Facilities to ensure standard environmental safeguards/mitigation measures (as identified in EMP) have been included.	POWERGRID – ESMU	Prior to POWERGRID approval of contractor's detailed designs.
<b>Construction Phase</b>		
Regular monitoring and reporting of contractor's compliance with contractual environmental mitigation measures.	POWERGRID – ESMU	Continuous throughout construction period.
<b>Operation and Maintenance Phase</b>		
Observations during routine maintenance inspections of facilities and transmission lines RoWs. Inspections will include monitoring implementation status of mitigation measures specified in EMP.	POWERGRID – ESMU	As per POWERGRID inspection schedules

<sup>6</sup> Monitoring of issues related to compensation of landowners for land acquisition and loss of production, etc. are addressed in the Resettlement Action Plan.

## **G. Consultation, Disclosure, and Grievances**

17. SIEEs or SEIAs prepared for all sub projects will be available on website and hard copy as well as translated version into local language(s) shall be made available to project affected people (APs) and the public through site office in accordance with POWERGRID and ADB policies, as noted in para. 8.

18. There is a need for an efficient grievance redress mechanism, which will assist the project affected peoples (APs) in resolving queries and complaints. For the implementation of SIEEs/EMP, the GRC process is built in the process of compensation because after the notice the revenue officials assess the damages based on actual site condition and the version of land owner. After the preliminary assessment owner is given a chance to substantiate the claim if he is not satisfied with the assessment. If the owner is not satisfied he/she is allowed to access the higher authority for any grievance towards compensation that is generally addressed in open forum and in the presence of many witnesses. Process of spot verification and random checking by the district collector also provides forum for raising the grievance towards any irregularity/complain. Apart from this POWERGRID officials also listen to the complaints of affected farmers and the same are forwarded to revenue official for doing the needful and, if required POWERGRID takes necessary action to mitigate simultaneously.

19. Apart from this, general public and affected peoples shall have easy access to project authorities through the POWERGRID project office (site) which will be located in the project area and can easily monitor the EMP implementation and any shortcoming can be reported to project authorities for remedy.

## **H. Monitoring and Evaluation**

20. The EMP will have both internal and external monitoring and evaluation (M&E). The POWERGRID ESMUs will be responsible for internal monitoring of the EMP implementation, and will forward regular progress reports to Corporate ESMD with details of activities and progress made in EMP implementation. POWERGRID will submit semi-annual monitoring reports to ADB as part of periodic project reporting.

21. POWERGRID ESMD will undertake internal monitoring and evaluation (M&E) of safeguards compliance. Within three months of loan effectiveness an independent Committee, if required on case to case basis depending upon the sensitivity, with previous experience in environmental & social safeguards activities and familiarity with the related environmental & social policies, will be constituted, and ADB will be informed accordingly. The Committee will audit EMP implementation to determine whether environmental goals and objectives have been achieved, and provide recommendations for improvement, if necessary. The audit committee will undertake half-yearly evaluation on a sample basis and on project completion. This will ensure that affected peoples (AP) views on any outstanding environmental issues are recorded. The Committee will also evaluate the performance of the EA. The committee will report its findings to the EA and to ADB through EA twice a year. Provisions have been made in the EMP budget for engaging an external monitor and auditing.

## Distance of important locations and sensitive receptors from substations

### **1. Tehri Pooling (GIS) Substation**

**TOTAL LAND (Size) - 300 x 230 Meters**

- |  |  |
|--|--|
| 1. Primary School                        | : 6 Kms.   |
| 2. Secondary School                      | : 6 Kms.   |
| 3. Temple                                | : 4 Kms.   |
| 4. Hospitals                             |  |
| i) Primary Clinic                        | : 6 Kms  |
| ii) Main Hospital                        | : 19 Kms   |
| 5. Population/Inhabitant (in Pockets)    | : 0.50 Km  |
| 6. Non-metal access path to the villages | : 0.50 Km touching boundary: (Cost of diversion of access path included in project cost) |

*Note: This is a Gas insulated Station (GIS). All equipment except Transformers & reactors if any, is housed/shall be housed in GIS buildings*

### **2. Meerut Substation**

**TOTAL LAND (Size) - 800 x 1200 Meters**

- |   |   |
|---|---|
| 1. Primary School                               | 1 Km  |
| 2. Secondary School                             | 10 Kms.   |
| 3. Temple                                       | 2 Kms   |
| 4. Hospitals                                    |   |
| (a) Primary Clinic                              | 2 Kms   |
| (b) Main Hospital                               | 10 kms  |
| 5. Population/Inhabitant (Pockets of Residents) | 1 Kms   |
| 7. Road - NH 58                                 | 50 meter from road entrance to facility wall; NH 58 connects Delhi to Uttarakhand |

## **Environmental Sector Assessment of the Proposed Powergrid Corporation of India Ltd. Investment Program**

### **A. India's Generation Subsector and Clean Energy Policies**

22. Power generation in India will continue to be dominated by coal for the foreseeable future. In order to meet basic policy objectives (1000 kwh/year per capita by 2012), nation-wide generating capacity will have to be doubled from the 2003 base of 125,000 MW. Under current Government of India (GOI) policy, the current thermal:hydro mix of 75:25 will evolve to 60:40 by 2012. Renewable energy (RE) will probably make up less than 10% of the generation base by 2012. Energy efficiency (EE, including cogeneration) potential nationwide is estimated to be well over 20,000 MW, but policy and regulatory incentives are needed to further develop this potential. The ADB energy program for India supports the development of clean energy and efficiency improvements, including clean coal technology and hydropower.

23. India has one of the most advanced policy frameworks for clean energy promotion of any developing country. E.g., India has the 4<sup>th</sup> largest installed wind capacity in the world, almost all of which has been financed and operated by the private sector. GOI is strengthening the policy and regulatory framework to facilitate investments in EE and RE. GOI published its *Integrated Energy Policy* report in August 2006, which highlights the need to further develop EE and RE as part of the national energy strategy. The Integrated Energy Policy addresses technical, financial, economic, regulatory, environmental, and social issues related to energy supply and security. GOI considers hydropower (all sizes and designs) to be renewable energy.

24. The Ministry for New and Renewable Energy (MNRE) provides cost-sharing incentives for small hydropower, advanced cogeneration at sugar mills, and solar water heating. The Bureau of Energy Efficiency (BEE) is implementing product standards and labelling to raise consumer awareness and promote conservation and reduction in energy demand. BEE also provides cost-sharing to states for development of energy efficiency action plans. Individual states have counterpart agencies to BEE and MNRE; a few states have a single agency that serves as a counterpart to both BEE and MNRE. The state-level alternative/renewable energy development agencies typically focus on research and development and public awareness, and have limited resources for project development and implementation.

### **B. Environmental Policy and Regulatory Compliance Issues**

25. India has one of the most mature environmental regulatory systems of ADB's Developing Member Countries. The system is based on "command and control" instruments: laws, regulations, and standards. Environmental impact assessments (EIAs) for category A projects are prepared in a manner consistent with ADB's environmental safeguards requirements. EIAs are required for individual power plants, and are prepared by the project sponsors/owners. MOEF has final authority for EIA approval on large power plants, and gives environmental clearance prior to construction and operations. State Pollution Control Boards normally issue a "no objection" certificate for individual power plants, and are responsible for routine compliance oversight. Transmission lines are considered to be "non-polluting" and are exempt from these EIA requirements.

26. The EARF (Appendix 1) clearly indicates that any plants connected to ADB-funded transmission lines must meet all GOI regulatory requirements, and ADB reserves the right to conduct due diligence on any potential associated facilities.

### C. The Hydropower Subsector and Related Hydropower Facilities

27. The thermal:hydro mix was close to 50:50 in the early 1960s, partly because early economic development policy emphasized support for agriculture, which has extensive irrigation demands. Industrial development became a priority in the 1960s, after which new thermal plants dominated the generation mix. For a variety of reasons, by 2003 GOI recognized the need to increase the hydropower proportion and introduced an initiative to develop up to 50,000 MW of new hydro capacity as part of the Power for All by 2012 policy. Preliminary feasibility studies were conducted under Ministry of Power lead on over 300 candidate sites, and identified over 30,000 MW of potential hydropower that can be commercially developed (based on estimated 1<sup>st</sup>-year tariff of Rs. 2/kwh or less).

28. The physical investments under the proposed Investment Program will facilitate transfer of clean energy from hydropower plants to consumers in the Northern Region grid, and will improve high voltage transmission system efficiency.<sup>7</sup> The related hydropower capacity will be about 2600 MW for the first tranche (which includes a 1000 MW pumped storage plant), and initially 2600 MW for the second tranche, with an additional 3000 MW to be added (well after the ADB-funded transmission line is completed).

### D. Potential Associated and Cumulative Impacts

29. The proposed Investment Program does have potential associated and cumulative impacts, which are considered to be largely positive. POWERGRID will transfer low-carbon energy from hydropower plants in Uttarakhand and the Northeast Region to state-level transmission companies (TRANSCOs), who in turn will wheel energy to distribution companies (DISCOMs). Direct, negative, impacts result from (i) acquisition of additional land for right-of-way (RoW) by TRANSCOs and DISCOMs for transmission lines, distribution lines, and substations, and (iii) various impacts associated with hydropower and pumped storage facilities in Uttarakhand and the Northeast Region, which are addressed in EIAs and environmental management plans (EMPs) for the individual power plants.

30. Positive impacts include (i) expansion of low-carbon energy, offsetting emissions from thermal power plants, (ii) transmission system efficiency improvements, and (iii) economic growth related to improved power supplies to millions of consumers. The cumulative emissions offsets from related hydropower plants are estimated as follows: (i) 685 million tons of carbon dioxide equivalent, (ii) 5.8 million tons of sulfur dioxide, (iii) 2.9 million tons of nitrogen oxides, and (iv) 0.48 million tons of particulate matter. These emissions offsets will ameliorate negative impacts of local, regional, and global air pollution.

31. A summary of anticipated associated and cumulative impacts is presented in Figure A3.1 and Table A3.1. The estimated air emissions offsets are summarized in Table A3.2.

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<sup>7</sup> The ADB energy sector program in India has been dominated by transmission and distribution system projects since the late 1990s.

**TABLE A3.1: POWERGRID MULTITRANCHE FINANCING FACILITY: IMPACT CHARACTERIZATION AND ASSESSMENT**

Related Project or Sector	Impact Characteristics				Comments
	Additive	Compensatory	Synergistic	Masking	
Tourism Development	Requires expanded infrastructure (roads, water supply, wastewater and solid waste treatment)	Tourism preferred as more environment-friendly compared to industrial development.			Tourism potential is high and is being actively promoted in Uttarakhand, but not in Assam and NE Region.
Agricultural Development	Requires good infrastructure (roads, irrigation facilities, power)	Agriculture has major share in economy and is more environment friendly compared to other industrial activities.	Is directly related to public health and livelihood	Access roads for construction may be utilised for transportation of agricultural products to market places	Tehri-I project provides irrigation water for expanded agriculture. Access roads may be supported by ADB Uttarakhand Road Connectivity MFF approved in December 2006.
“Upstream” : hydropower plants and pumped storage facilities	Additional hydropower will be delivered through transmission system. Main impacts from large hydro plants are attenuation of river flow, changes in sediment transport patterns, and disruption of fish traffic.	Transmission system losses will be reduced to about 4% for conventional AC lines and to 2-3% for NHDC lines.  Tehri Pumped Storage Project will improve system efficiencies, including improved efficiency of coal-fired power plants currently used to meet peak load.	Short-term disruptions associated with expansion of downstream T&D systems		Expanded power supplies from overall Investment Program and related facilities will be sufficient to supply 30+ million consumers with 1000 kwh/year reliable power.  Powergrid is investigating possible carbon credit opportunities for the HVDC line in component 2.
“Downstream”: state and local transmission and distribution systems	“Downstream” impacts mainly limited to construction of new transmission and distribution lines to accommodate additional power transfer	Substantial emissions offsets result from low-carbon power sources and improved transmission efficiencies.			GOI considers all hydropower to be renewable energy regardless of size and design.
Industrial Activity	Increased air emissions may result from new industrial activities.	Will create local employment opportunities.  Industrial air emissions are offset by low-carbon power sources.		New access roads may be required for some industrial activities.	Air emissions subject to pollution load control restrictions to maintain air quality.



















