2 Review of environmental guidelines: India vs. other countries

Power generation scenario in India

Coal is the major fossil fuel for power generation in India and all utility boilers use the pulverised firing system for combustion of coal. Indian coal contains a high ash content of around 35-42 per cent with average calorific value of 4000 kcal/kg and average sulphur content of 0.35 per cent. The installed capacity of power generation based on fossil fuels is as follows: coal 61012 MW (63 per cent) and gas/naphtha 7804 MW (nine per cent). The percentage share of hydropower generation is about 25 per cent (21658 MW). In future, it is projected that coal will continue as the main fuel for power generation in the country. Natural gas contains 85 per cent of methane and other higher hydrocarbons. Natural gas has Hydrogen Sulphide (H_2S) ranging from 0 to 0.5 per cent and nitrogen content is also low (0.1-0.5 per cent). The average sulphur content in naphtha is 0.017 per cent. Therefore, SO_2 pollution from gas-based or naphtha-based thermal power plants (TPPs) may not be having any significant impact. It is imperative to maintain a balance between the increasing demands for electric power and acceptable environmental quality which implies a need for the continual upgradation of pollution control and improvement of environmental management system.

Environmental guidelines

The MoEF has promulgated environmental guidelines for thermal power plants which include siting criteria, EIS (environmental impact statements) and environmental management. The CPCB has also prescribed a set of guidelines for permissible flue gas emission and liquid effluents for thermal power plants using coal, oil and natural gas fuel. The CPCB has also notified revised national ambient air quality standards (under the Air Act, 1981), in 1994 for industrial, residential, rural and other areas, and sensitive areas. In 1992, the MoEF issued the National Conservation Strategy and Policy Statement on Environment and Development which included energy generation and uses. The statement emphasized the need for EIA prior to an investment decision and site selection; adoption of cleaner

technology; ensure lesser displacement of people and loss of biodiversity; promote energy conservation and provide incentives for non- conventional energy sources.

Siting guidelines

The MoEF has notified certain guidelines for judicious siting of thermal power plants in the country. The aims of the siting guidelines are the protection of ecologically sensitive areas, archaeological sites, national parks and sanctuaries, settlements etc. Proper siting of thermal power plants can reduce not only the cost of the required pollution control measures but also the total damage that these stations would cause to natural and human environment. Due consideration needs to be given to topography, geology, hydrology, meteorology, fuel storage, ash disposal, etc., in the selection of site. The CPCB undertook a project in 1995 to prepare a Zoning Atlas for each district in India. The atlas is being prepared based on overlapping thematic maps relating to human settlements, industrial activities, forest areas, national parks, biosphere reserves, wildlife sanctuaries and other ecologically sensitive sites over the base map. This would facilitate to a great extent the proper siting of thermal power plants.

A few countries like Germany, Denmark etc., have developed mapping as a part of developmental planning at federal, state, district and municipal levels for identifying suitable locations for industrial siting. In many countries, there are no defined siting guidelines for setting up power plants. The project would be first evaluated on a criteria of maximized positive environmental impacts, socio-economic benefits and profitability, and minimized temporal adverse impacts for the proposed site, before granting it permission.

The World Bank has proposed some guidelines for siting of different capacity of power plants in good, moderate and poor quality air sheds as given in Table 2.1. The definition of an airshed is discussed under ambient air quality. The World Bank has recommended various offset provisions for setting up power plants in moderate or poor airsheds (Table 2.1). The monitoring and enforcement of offset provisions would be the responsibility of the appropriate local or national agency responsible for granting and supervision of environmental permits. The proposed guidelines suggest that large power plants should not be developed in airsheds with moderate or poor air quality. Under the project proposal, project sponsors who do not wish to get into negotiations, need to put together an offset agreement or can opt to move their plant to some other airsheds with good air quality or rely upon an appropriate combination of clean fuels and/or controls.

Table 2.1 World Bank guidelines for siting of power plants

Power plant capacity	Airshed category	Environmental assessment and emission requirements
Less than 500 MW	Good air quality	Subject to the maximum emission levels specified in the guidelines including SO_2 emission of 0.2 tpd per MW of capacity (maximum of 100 tpd for 500 MW) and maximum concentration of 2000 mg/m^3.
Greater than equal to 500 MW	Good air quality	Subject to the maximum emission levels specified in the guidelines including SO_2 emission of 0.2 tpd per MW upto 500 MW and 0.1 tpd for each additional capacity over 500 MW.
Less than 500 MW	Moderate air quality	Subject to the maximum emission levels specified in the guidelines provided that the environmental assessment shows that the plant will not lead to either the airshed dropping into category having poor air quality or an increase of more than 5 µg/m^3 in the annual mean level for the entire airshed of the pollutant. If either of these conditions is not satisfied, then lower site-specific emission levels should be established. The limit of 5 µg/m^3 increase will apply to the cumulative total impact of all power plants built in the airshed within any 10 years, beginning and after the date of the guidelines comes into effect.
Greater than or equal to 500 MW	Moderate air quality and all plants in airshed with poor air quality	Subject to site specific requirements that includes offset provisions to ensure that no net increase in the total emissions within the airshed of the pollutants which are the reason for the airshed being classified as having moderate or poor air quality. The measures agreed under the offset provisions must be implemented before the power plant comes fully on stream.

Note. Offset provisions include:

1. Installation of new or more effective controls at other units within the same power plant or at other power plants in the same airshed.
2. Installation of new or more effective controls at other large sources namely district heating or industrial plants in the same airshed.
3. Investment in gas distribution or district heating systems designed to substitute for the use of coal for residential heating and other small boilers.

Environmental impact assessment

Environmental impact assessment (EIA) is the process in which environmental factors are integrated into project planning and decision making to achieve the ecologically sustainable development. The best practice EIA identifies the environmental risks, lessens conflict by promoting community participation, minimises adverse environmental effects, informs decision makers and helps lay the base for environmentally sound projects.

The United Nations Environment Programme (UNEP) in 1987 has set the goals and principles of EIA and defined the EIA as an examination, analysis and assessment of planned activities with a view to ensuring environmentally sound and sustainable development. The Rio declaration in 1992 has given emphasis on EIA (Principle no.17) as a national instrument, and said it shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority. In Agenda 21, Chapter 8 is entirely devoted to integrating environment and development in all stages of policy, planning and decision making processes, providing an effective legal and regulatory framework, making effective use of economic instruments, market and other incentives and establishing systems for integrated environmental and economic accounting.

The field of EIA was pioneered in the USA by the formulation of the Natural Environmental Policy Act (NEPA) in 1969. Subsequently, a number of developing and developed countries have enacted similar legislation at different times, such as Canada in 1973, Australia and New Zealand in 1974, Japan in 1981, the European Community in 1984, the Netherlands in 1986 and the United Kingdom in 1988. EIA is a dynamic process and, therefore, a lot of experiments have been going on throughout the world for its effective application for environmentally sustainable development.

EIA practice in India and other countries

In India, MoEF has, under the Environment (Protection) Act 1986, promulgated a notification on 27 January, 1994 making environmental clearance mandatory for all new projects and expansion or modernization of existing projects as listed in Schedule I of the notification. Till 1994, EIA clearance was an administrative requirement for big projects undertaken by the Government or public sector undertakings. EIA clearance is required for 29 categories of industries including power plants (thermal, nuclear and hydel).

Environmental appraisal committees have been constituted by the MoEF for various types of developmental projects including hydroelectric projects; atomic power and nuclear fuel projects and thermal power projects. The MoEF has also

developed guidelines for the preparation of EIA reports along with questionnaires and checklists. In addition, site clearance is also required from the MoEF for specified projects including power plants.

The MoEF has amended the EIA notification (S.O.No. 60E) on April 10, 1997, making a public hearing mandatory before environmental clearance. Figure 1* shows the various steps that are required to obtain EIA clearance. The SPCBs will conduct the public hearing before proposals are submitted by the project proponent to MoEF for obtaining environmental clearance. Through another notification issued in April 1997, the MoEF has delegated powers to the State Government for granting environmental clearance to certain categories of power plants (Table 2.2). In case of pit-head thermal power plants, the applicant shall intimate the location of the project site to the State Government while initiating any investigation and surveys. Proposals, where forest land is a part of the project site, need prior forestry clearance from MoEF before it issues environmental clearance. To obtain environmental clearance documents that need to be submitted to MoEF include the project report, public hearing report, site clearance for site-specific projects, no objection certificate from SPCB, environmental appraisal questionnaire, EIA/EMP report, risk analysis for projects involving hazardous substance and rehabilitation plans if more than 1000 people are likely to be displaced.

Table 2.2 Category of power plants requiring environmental clearance from the State Government

Type of plant	Capacity
Co-generation captive plants	
Co-generation plants	All co-generation plants irrespective of the installed capacities
Captive power plants (both coal and gas/naphtha-based) coming up separately and not along the main industry	Up to 250 MW
Utility projects	
Coal-based plants using fluidized bed technology subject to sensitive areas restriction	Up to 500 MW
Coal-based power plants using conventional technologies	Up to 250 MW
Gas/naphtha-based power plants	Up to 500 MW

* All Figures have been given at the end of this chapter, along with the annexures.

Note. Any project proposed to be located within the radius of 25 km boundary of reserved forests, ecologically sensitive areas which may include national parks, sanctuaries, biosphere reserves, critically polluted areas and within 50 km of an inter state boundary shall require environmental clearance from the Central Government.

The MoEF has not prescribed any specific EIA guidelines for power transmission and distribution projects. Since power transmission projects may have some unavoidable environmental and social implications, there is need for specific guidelines for the same. The Power Grid Corporation of India (POWERGRID) has provided a framework, called Environmental and Social Policy and Procedures (ESPP), for identification, assessment and management of environmental and social concerns at both organizational as well as project levels. The ESPP document comprises of four sections. Section I elaborates the environment and social policy of POWERGRID. Section II contains legal enactment, regulations, and requirements of multilateral agencies. Section III outlines the environmental and social assessment and management framework and Section IV details the organizational support required to operationalise transmission projects.

In USA, an EA (environmental assessment) is required first to determine whether EIS is required or a finding of no significant impact (FONSI) can be issued to grant an exemption from EIS. An EIS is often required by major banks, and other funding agencies, government agencies and other citizen groups involved in the permit process. The impact statement ensures that the proposed project has the potential to succeed under all foreseeable environmental, geological and marketing problems throughout its project life and to guarantee the return of the initial capital with interest. Effectively, EIS offers an assurance that the final project will culminate with positive environmental and social impacts.

In Australia, the project proposal would be referred to the Government authority for its decision on whether assessment is necessary, or the level of environmental assessment. The assessing authority will provide the Notice of Intention (NOI) or Initial Advice Statement to the company for the preparation of EIA report called EIS or PER (public environmental report). A PER is prepared when potential environmental impacts are few or easily managed. An EIS is required for proposals with significant potential impacts. The assessing authority will conduct a public review of the report and ensure that all the comments put forward are incorporated in the report. The minister will take the final decision on environmental approval and setting of conditions based on the recommendations of the assessing authority. Figure 2 shows the steps that are involved in the EIA process in Australia.

For WB projects, EA should be carried out early in the project cycle in order to establish emission guidelines and other measures on a site specific basis for a new thermal power plant or unit of 50 MW or larger. It is important to stress that the results of the environmental assessment are critical to defining many of the design parameters and other assumptions such as location, fuel choice etc. This is required to develop the detailed specification of the project and must be integrated with economic analysis of the key design options. It is essential that the work of preparing environmental assessment should be initiated during the early stage of project conception and design so that the initial results of the study can feed into subsequent stages of project development. It is acceptable to prepare an environmental assessment that considers a small number of options in order to justify a predetermined set of design choices. The various tasks of the EA process include screening, scoping, terms of reference development, preparing the EA report, EA review, project appraisal, and project implementation (Figure 3).

The mechanism of environmental clearance as exists in different countries is given in Table 2.3. In most countries, a core agency is responsible for coordination of the EIA process with the help of local authority. Most countries, place special importance on a public hearing so that public views and aspirations are reflected in the EIA report. Very few countries are monitoring the provisions that are made in the EIA report. A few countries have linked an environmental performance bond with the EIA process so as to ensure the proper execution of the provisions that are committed in the EIA report. If this is done it would ensure that the project culminates with positive environmental impacts and social benefits.

Table 2. 3 EIA for project proposals in different countries

Country	Main oversight agency	EIA preparer	Public participation	Coordination with local authority	Penalty for violation
India	Ministry of Environment & Forests	Project proponent	Yes	Yes	No
China	National Environment Protection Agency	Project proponent	No public hearing	Yes	Yes
Thailand	Ministry of Science, Technology and Environment	Project proponent	Yes	Yes	No
USA	Federal Govt. Agencies	Project proponent	Yes	Yes	Yes
Austra	Environment	Project	Yes	Yes	No

lia Protection Agency proponent

Issues related to EIA

The various issues and constraints pertaining to environmental clearance, project monitoring and implementation are given below.

Regulatory vs. Management tool: EIA is to be introduced as both regulatory and management tool to ensure an environmentally sustainable project.

Legal framework: There is a need to strengthen the enforcement mechanism for the implementation of the provisions made in the EIA report.

EIA evaluation period: There is a need to specify a timeframe at each step in the EIA process. It would provide confidence to the operators.

Review process: There is a need for clear guidelines for the review process, which would facilitate to remove conflicts of interest in the review panel. Representatives from NGO's should be included in the review panels.

Implementation mechanism: The implementation mechanism needs to be strengthened by using the effective regulatory provisions, extending economic incentives or keeping provisions for environmental guarantee funds which can be used to pay for damages caused or for rehabilitation necessitated by a project.

Baseline data: Lack of availability of baseline data increases the cost of preparation of EIA/EMP. In some cases, even though it is available, it is not made available to project authorities.

Institutional mechanism: The lack of an institutional mechanism and coordination during project initiation, decision making, execution and implementation process fails to address and ensure the environmentally sound project development. Post-project monitoring needs to be stepped up to observe the compliance of performance committed in the project report. Therefore, it is imperative to strengthen and ensure the institutional linkages in all stages of the project.

Public participation: A mechanism is needed to ensure that all affected parties participate in the EIA process including NGOs.

Training: There is a need for training and information dissemination amongst state, regional, local authorities and NGO's for effective public hearing and implementation of EIA.

Regional vs. project specific EIA: It is increasingly felt that EIA is often applied to individual projects rather than to policies, plans or programmes. Regional EIA would facilitate regional planning integrating ecology, economy, institution, technology and social dimensions. For planning regional development, it is imperative to take into account the supportive capacity of the resources and the assimilative capacity of the environment. Environmental assessment of policy, plan or programme is commonly called strategic environmental assessment.

Emission guidelines

Emission norms for power plants are set for particular pollutants based on the desired level of control that needs to be achieved from particular sources or activities. Emission standards in many countries are determined by the policy of promotion of best available technology, or state of the art technology or best practicable means, apart from ensuring protection of environment and human health. In India, the CPCB has prescribed emission standards for particulate matter and gaseous pollutants emanating from power plants using coal, naphtha and natural gas fuels. The existing emission standards for India and few other developed and developing countries are given in Table 2.4. Justification for fixing of the present standard and possibility of achieving the most stringent standard are discussed below. In India, at present there are no standards prescribed by MoEF and CPCB for diesel power plants. However, the MoEF has proposed norms in draft form for diesel power plants with capacity equal or more than 35 MW as given in Annexure 2.1. In view of the growing power shortage in different regions in India, diesel power plants of different capacities are expected to come up. There is a need to develop and notify environmental norms for various capacity diesel power plants.

Table 2.4 Emission standards for India and other countries

Country	Particulate matter (mg/Nm^3)	SO_2 (mg/Nm^3)	NO_x (mg/Nm^3)
India	150 (210 MW and above) 350 (<210 MW)	220 m stack height (200 to 500 MW) 275 m stack height (500 MW and above)	50 ppm (Natural gas) 100 ppm (Naphtha)

			75 ppm (Natural gas) 100 ppm (Naphtha)
USA	120	960	350
European Union	50	400 (500 MW and above)	450 (liquid fuel) 650 (solid fuel)
Japanese	100	Ambient	410
World Bank	50	2000 or maxm level 0.2 tpd per MW upto 500 MW	750 (365 ppm) (Coal) 460 (225 ppm) (Oil) 320 (155 ppm) (Gas)
Australia	80	Ambient	800 (solid fuel) 800 (liquid fuel) 350 (gaseous fuel)
China	200-600	1200-2100	650-1000

Particulate matter

In India, the CPCB has prescribed emission standards for particulate matter, which should not exceed 150 mg/m^3 for power generation units of capacity of 210 MW and above and 350 mg/m^3 for units less than 210 MW. These standards are based on Indian coal characteristics, meteorological conditions, existing flue gas concentration level, and best available control technology.

The existing emission standard for particulate matter for WB and European Union is 50 mg/m^3. Alternatively, WB guidelines propose that particulate removal efficiency should be designed for 99.9 per cent if 50 mg/m3 is not achievable and operated at least at 99.5 per cent efficiency. The emission norms for power plants in USA, Japan, Australia and China are given in Table 2.4.

Control technology

There are two globally acceptable technologies for control of particulate matter (PM), namely electrostatic precipitators (ESP) and bag filters using fabric filter which can offer over 99.8 per cent reduction in particulate emission. The basic criteria for selection of a control system is the desired level of control needed. The choice of technology depends on resistivity of the ash, which depends on fly ash composition and sulphur content of the coal, and operational factors. The commercially proven indigenous ESP's are being used in all the coal based thermal power plants in India. For Indian coal, with an ash content of 35-45 per cent, the ESP efficiency is 99.7 per cent and more is required for meeting the standard of

150 mg/m^3. While thermal power plants in India commonly use ESP, which is less expensive to install and operate, bag filters are the most efficient, particularly while dealing with smaller particulate and are insensitive to ash resistivity, inlet particulate concentration and changes in the flue gas flow rate. However, flue gas with acid or alkaline presence reduce baghouse life, and hygroscopic material and tarry components in the ash can lead to baghouse filter plugging.

The choice of advanced control technology is governed by the coal quality (particularly its high ash and silica content and low sulphur content) and operating practices. The more robust design and operational characteristics of ESPs, along with their lower O & M costs (as compared to baghouse filters) suggests that they are the preferred particulate control technology to meet emission standards more than or equal to 100 mg/m^3, since there is a relatively small cost difference between ESPs and baghouse filters upto this emission limit. Figures 4 and 5 show the capital and levelized cost estimates for ESPs and baghouse filters. The figure indicates that for high-resistivity coal, ESPs are the most cost-effective option for emission limits higher than 120 mg/m^3. Pulsejet baghouse filters are more economical for lower emission limits, but have high O & M costs. However, to achieve emission limits of 50 mg/m^3 or less, both the levelized and the capital costs of ESPs are at least 20 per cent more than that of pulsejet baghouses. However, lack of experience in bag house operation and maintenance in India suggests that a long learning process may be inevitable if the adoption of this technology is required to meet future standards.

Using washed coal in boilers is an important control option for particulate matter. The CPCB has notified the use of coal with an ash content not exceeding 34 per cent for coal based thermal power plants located beyond 1000 km from pit-head and located in urban, sensitive and critically polluted areas irrespective of their distance from pit-head, effective from 1st June 2001.

Sulphur dioxide (SO_2)

Indian coal in general has low sulphur content. The typical SO_2 emissions from coal based power plants are estimated to be 1250 mg/m^3. Emission of SO_2 from existing gas-based power plants was found to vary between 2.4 to 58.8 mg/m^3. Therefore, CPCB has not yet fixed any emission standards for SO_2, but has suggested the monitoring of SO_2 emissions from the stack height. It has prescribed stack height for various capacities of power generation namely 275 m for 500 MW and above, 220 m for 200 MW to 500 MW and for units less than 200 MW, the stack height is governed by the formula $H = 14(Q)^{0.8}$ metres, where H is the stack height and Q is the emission rate in kg/hr. However, when the power plant uses

heavy distillates as fuel, having high sulphur content varying from one to two per cent or HSD having sulphur content around one per cent, stack height of the plant should be higher and be governed by the formula $H = 14 (Q)^{0.3}$ where Q is the emission rate of SO_2 in kg/hr as prescribed by CPCB.

The WB has prescribed emission standard of 2000 mg/m^3 for SO_2. It also states that the maximum permissible emission level would be 0.2 tonne per day (tpd) per MW upto 500 MW and 0.1 tpd per MW for each additional MW over 500 MW but mot more than 500 tpd for any plant. Emission standards for SO_2 are prescribed to be 960, 400, 1200-2100 mg/m^3 for USA, EU and China respectively.

Control measures

In general, as proposed in WB guidelines, for low sulphur (< 1%S) and high calorific value fuels, specific control may not be required. Coal cleaning (when feasible), sorbent injection or fluidized bed combustion may be adequate for medium sulphur fuels (1-3 per cent S). FGD may be considered for high sulphur fuels (> 3 per cent S). The choice depends on factors like cost, operating characteristics, and quality of coal.

Oxides of nitrogen

India does not have any NO_X emission limits for coal based thermal power generation. The typical emission level from a boiler is about 650 ppm. But over the last few years, burners with emission of less than 400 ppm have been introduced. CPCB has prescribed standards for NO_x emission for natural gas and naphtha based thermal power plants. For existing natural gas and naphtha based power plants of capacity 400 MW and above, 100-400 MW and less than 100 MW, standards for NO_x emission are 50 and 100, 75 and 100 and 100 ppm respectively. The standards were set based on existing technology available in India and achievable emission levels using different fuels. The proposed WB emission standards for NOx is 750 mg/m^3 (365ppm), 460 mg/m3 (225 ppm) and 320 mg/m3 (155 ppm) for coal, oil and natural gas-based power plants respectively. Emission norms in EU, Australia and China for thermal power plants using solid, liquid and gaseous fuels are given in Table 2.4.

Control measures

Two types of control systems namely low NO_X burner (LNB) and off stoichiometric combustion based on combustion modification are generally used. Tangentially fired boiler generates less NO_X than the front wall fired boilers. High

amount of exhaust air is used to control temperature thus reducing NO_X emission. Reduction of NO_X using LNB ranges between 30-50 per cent. In off stoichiometric combustion, oxygen content in the furnace is regulated to reduce the fuel NO_X and some of the thermal NO_X reduction is possible up to 30 per cent. Further reductions can be achieved only by treating the flue gas to reduce NO_X to N_2. These reduction strategies could be based on selective non-catalytic reduction (SNCR) or on selective catalytic reduction (SCR). The combustion modification and the reduction technologies together can achieve up to 95 per cent reduction in NO_X emissions. Combustion modifications, such as LNB and OFA, are the most cost effective interventions but can reduce emissions only upto 60 per cent. They also have low operation & maintenance costs. On the other hand, both the capital and O & M costs for SCR are very high, and variable costs for SCR can represent up to 50 per cent of the total levelized cost. The air to fuel ratio is reported to be 1:5 to 1:8 in India. The WB recommended control options are low NO_X burners with or without other combustion modifications, reburning, water/steam injection and selective catalytic or non-catalytic reduction.

Ambient air quality standard

The existing ambient air quality standards for SPM, SO_2, NO_x prescribed in India, China, Australia, Japan, and USA are given in Table 2.5. The standards prescribed by EU and WHO are also given. The factors that determine the formulation of standards for specific parameters are the protection of human health, vegetation, property, sensitive areas/locations and the overall environment.

In India, there are national ambient air quality standards for SO_2, NO_x, SPM, RPM (PM_{10}), Pb and CO, prescribed for industrial, residential, rural and other and sensitive areas as presented in Annexure 2.2. The standard is based on meteorological condition, topography, existing concentration levels, population, and other activities.

Besides these defined areas, CPCB has identified 24 polluted areas in the country based on existing activities, pollution load and levels and population exposure. There is a National Ambient Air Quality Programme to monitor various pollutants namely SPM, SO2, NO_x, etc., from 290 stations covering over 90 towns/cities spread over 24 States and four Union Territories. The proposed power plants have to ensure compliance with these standards while setting up the plant. It is mandatory for new power plants to carry out a thorough assessment of expected impact on air, water, land, soil, ecology and socio economic aspects within a 25 km

radius of the power plant and provide management that ensures the safety and health of both people and the environment.

The WB guidelines have introduced the concept of airshed of good, moderate and poor quality based on the concentration level of PM_{10} (particulate less than 10 µm in size), TSP (total suspended particulate) and SO_2 (sulphur dioxide) (as defined in Table 2.6). The airshed will be taken to refer to the local area around the plant whose ambient air quality is directly affected by emission from the plant.These would be the major guiding factors for selecting sites for power plants. An airshed will be classified as moderate when an annual mean value of PM_{10} and/or SO_2 exceed the concentration of 50 µg/m^3 (or 80 µg/m^3 for TSP) or the 98 percentile of 24 hour mean values of PM_{10} and SO_2 over a period of a year exceeds 150 µg/m^3 (or 230 µg/m^3 for TSP). The airshed will be treated as poor when the annual mean value of PM_{10} and/or SO_2 is more than twice the annual trigger value for the airshed with moderate air quality or the 95 percentile of 24 hour mean value of PM_{10} and/or SO_2 over a period of a year exceeds the trigger value for peak exposure levels in an airshed with moderate air quality. The size of the relevant local airshed will depend upon plant characteristics (such as stack height) as well as local meteorological conditions and topography.

Table 2.5 Ambient air quality standard

Country	Suspended particulate matter (SPM), µg/m^3		Sulphur dioxide (SO_2), µg/m^3		Oxides of Nitrogen (NO_x), µg/m^3	
	24 hours	1 year	24 hours	1 year	24 hours	1 year
India						
Industrial	500	360	120	80	120	80
Residentia	200	140	80	60	80	60
l	100	70	30	15	30	15
Sensitive						
China						
Class III	500		250		150	
Class II	300		150		100	
Class I	150		50		50	
Australia		90		60		
Japan	100		100		100	
USA	260		365	80		100
EU	300	150	250	80		200
WHO	150-230	60-90	100-150	40-60	150	

Table 2.6 Airshed as per WB guidelines

	Airshed quality	
Parameters	Moderate	Poor
Particulate matter less	*The annual mean value of PM_{10} exceeds 50 µg/m^3	*The annual means value of PM_{10} for the airshed is more than twice the

Parameters	Airshed quality	
	Moderate	Poor
than 10m size (PM_{10})	Or *The 98th percentile of 24-hr mean values of PM_{10} over a period of a year exceeds 150 µg/m^3	annual trigger value for an airshed with moderate air quality. Or *The 95th percentile of 24-hr mean values of PM_{10} over a period of a year exceeds the trigger value for peak exposure levels in an airshed with moderate air quality.
Total suspended particulate (TSP)	*The annual mean value of TSP exceeds 80 µg/m^3 Or *The 98th percentile of 24-hr mean values of TSP over a period of a year exceeds 230 µg/m^3.	
Sulphur dioxide ($SO_{2)}$	*The annual mean value of SO_2 exceeds 50 µg/m^3 *The 98th percentile of 24-hr mean values of SO_2 over a period of a year exceeds 150 µg/m^3.	*The annual means value of SO_2 for the airshed is more than twice the annual trigger value for an airshed with moderate air quality. Or *The 95th percentile of 24-hr mean values of SO_2 over a period of a year exceeds the trigger value for peak exposure levels in an air shed with moderate air quality.

Note: The airshed will be taken to refer to the local area around the plant whose ambient air quality is directly affected by emission from the plant. The size of the relevant local airshed will depend upon plant characteristics (such as stack height) as well as local meteorological conditions and topography. In some cases, airsheds are defined in legislation or by the relevant environmental authorities. If not, the EA should clearly define the airshed on the basis of consultations with those responsible for local environmental management.

Water quality standards

The CPCB has prescribed standards for effluent discharge in a power plant from various sources namely condenser cooling water, boiler blowdown, cooling tower blowdown and ash pond effluent from thermal power plants as given in Annexure 2.3. For the open cooling water cycle, the standard prescribed is that the difference between the temperature at the intake and the temperature at the outflow to the lake or river should not be more than 7^0 C. However, for closed CW system (water-cooling towers) there is no restriction. All the effluent must be neutralized and treated before discharge into waterways or drains. The temperature of discharge water was set keeping in consideration the higher ambient temperature in India.

The WB has set effluent levels for different parameters (Annexure 2.4) which should be achieved daily without dilution. Temperature increase should not be more than 3^0 C within 100 m from the point of discharge. Total suspended solids (TSS) have been set at 50 mg/l against 100 mg/l prescribed by CPCB for thermal power plants. In view of the very high ash content in Indian coal, and the fact that cenosphere in ash contributes to the formation of suspended solids, the standard for suspended solids was kept higher.

The USEPA has prescribed the effluent standards for power plants for different control technologies namely best practicable control technology currently available, best available technology economically available, and best conventional pollutant control technology. The standards for TSS and oil and grease are set to be 100 and 20 mg/l respectively, which is comparable to Indian standards.

In Thailand, effluent standards set for TSS, DS (dissolved solid) and oil and grease are 150 mg/l (dilution ration of 1:301 to 1: 500), 2000 mg/l and 5 mg/l respectively. However, no guidelines are available for temperature of discharge effluent water into surface water.

Monitoring and enforcement

The existing monitoring and enforcement mechanisms for few countries are given in Table 2.7. Most countries depend on the command and control system namely pollution permit, authorization letter, consent of operation etc., for controlling environment pollution. Many countries have experimented with economic tools towards achieving better pollution control. Few developed countries are also experimenting with voluntary agreements where the Pollution Control Agency would go for an agreement with industries whereby industry would comply with the standards and PCA would extend necessary technical assistance. In the

command and control system, effective monitoring and reporting systems are essential prerequisites for proper pollution control management.

The CPCB in India has notified the schedules for air quality monitoring of various parameters in the National Ambient Air Quality Standards as given in Annexure 2.5. The CPCB has also recommended the number of monitoring stations for source emission and ambient air quality for thermal power plants as presented in Annexure 2.6.

For monitoring water quality, the enforcement mechanism as laid down by the Central and State Pollution Control Boards sets water quality standards, with, source-specific controls devised for abatement of water pollution. Moreover, each source separately acts as a point source in defining a surface water body system. In other words, the water quality for surface water bodies like tanks and rivers would depend on the efficiency of controls for industry.

The CPCB and IS (Indian standard) 2490 have laid down certain minimum effluent discharge standards. Therefore, it is essential to monitor the water quality parameter for the effluents arising out of industrial activities for all these parameters.

The parameters which need to be monitored are covered by the IS specification IS-2490 (part 1)-1981, given in Annexure 2.7. However, the critical parameters would include pH, BOD, COD, TDS, TSS, total hardness, temperature, and Ammoniacal Nitrogen. Methods for determination of these parameters are also given in the Table. The flow rate should be essentially measured at the time of sample collection for the effluent stream.

The World Bank has proposed direct measurement of the concentrations of PM_{10}, SO_2 and NOx and heavy metals (where applicable) in samples of flue gases be regularly performed to validate surrogate monitoring results or for the calibration of the continuous monitor (if used). At least three data points for direct emissions measurements should be based on an hourly rolling average. Continuous monitoring of particulate, SO_2 and NO_x in the stack exhaust for the new power plants is encouraged to assess the performances of the pollution control system. The WB has recommend an automatic air quality system for measuring ambient levels of PM_{10}, SO_2 and NOx outside the plant boundary. The pH and temperature of the waste water discharge should be monitored on a continuous basis. Level of suspended solids, oil and grease and residual chlorine should be measured daily and heavy metals and other pollutants in waste water discharges should be measured monthly if treatment is provided.

Table 2.7 Monitoring and enforcement mechanism

Country	Environmental norms	Technology	Command & control	Economic tool	Effectiveness
India	Yes	BAT	Consent of operation	Very less	Not effective
China	Yes	BAT	Pollution discharge permit system	To some extent polluter pays principle	Not effective
USA	Yes	MACT	Pollution permit	Voluntary agreement	
Germany	Yes	SOAT	Licensing	Voluntary agreement	Effective
UK	Yes	BATNEEC	Authorization letter		
Thailand	Yes	BAT	Industrial permit	Polluter pays principle	Not effective

Note: BAT- best available technology, MACT-maximum achievable control technology, SOAT-state of the art technology, BATNEEC-best available technology not entailing excessive cost

Summary

The EIA practiced in India needs to be improved. Screening and scoping have to be integral parts of EIA before carrying out EIA studies, as practiced in many developed countries. Provisions made in EIA have to be effectively implemented through proper institutional mechanisms. Emission norms for particulate matter, prescribed in India, are comparable to the norms prescribed in other countries. Standards were set based on various factors namely high ash content in coal, high resistively coal, available control technology, existing flue gas concentration levels, etc. However, the World Bank norm for particulate matter is more stringent (50 mg/m^3) than the Indian standard (150 mg/m^3) for particulate matter. India coal contains very low sulphur and therefore, there is no standard for SO_2 for coal based power plants. The average SO_2 emission (1200 mg/m^3) from coal based power plants in India is less than the standard prescribed by the World Bank (2000 mg/m^3) and the European Union (1200-2100 mg/m^3). India does not have a NO_x emission standard for coal-based power plants, but after installing a low NO_x burner (which is normally the case), it was found that Indian power plants can achieve the norms prescribed by the World Bank (365 ppm). However, emission norms for NO_x for oil and natural gas-based power plants are more stringent in India than are WB norms and norms in other countries. Ambient air quality standards prescribed in India fall within the same range with many developed and

developing countries. The greatest lacuna in the Indian context is the system used while monitoring environmental parameters in India. In practice this has implied that the norms and standards achieved are lower than what has been prescribed.

Displacement, resettlement and rehabilitation

Involuntary displacement caused by initiation of a development project, is known to bring on a plethora of problems for the affected community. The process starts with steps being initiated to acquire the land. This process is completed with the PIA (Project Implemmenting Authority) taking control over the land after payment of compensation for assets. The PAPs (Project Affected Person) are in the, meanwhile, given land to, resettled in another site. The problem of rehabilitation or recreation of alternate sources of income becomes important after the PIA has taken control of the land and people are displaced. Some problems faced by PAPs include a fall in household income, insanitory living conditions, impoverishment, increasing morbidity and an increase in psychological disorders among the affected population.

There is no national legislation on R&R (Resettlement and Rehabilitation) which highlights the rights of the people. A National Draft R&R policy exists but that is yet to be sanctified as a law and till that time it remains a guideline and organisations are not bound to follow it. Some states have taken initiative in the right direction by formulating laws and policies laying down rights and entitlements for people affected by projects to be implemented in their respective states. The states of Maharashtra, Madhya Pradesh, and Karnataka have R&R Acts (Orissa has a R&R policy) which were made primarily to address the displacement caused due to irrigation projects but the provisions can be extended to other projects if so required. Though the effort is commendable, the lacunae present in all the above mentioned acts need to be addressed.

In the face of the lack of a national R&R policy/ act, most organizations whose nature of work causes displacement, have formulated their own policies regarding the issue. Apart from these, most international development funding agencies have their own guidelines, followed in any project which has received their funding. Over time, the guidelines of such funding organizations have become benchmarks to be followed with respect to R&R in India. Table 2.8 compares the R&R policies of WB and that of some Indian organizations.

While WB's OD (official document) 4.30 and the Indian National Draft Policy on R&R stipulate that people losing homesteads for which they have a valid title must be given an equivalent land or cash compensation at replacement cost, most

Indian organization policies stipulate an alternative housing site of a fixed area and/ or cash compensation at replacement rates.

Similarly, for agricultural land held with valid title deeds while WB's OD 4.30 and the Indian National Draft Policy on R&R stipulate land for land or rehabilitation in way of employment or self-employment or cash compensation at replacement rates, Indian organizations stipulate land for land or cash compensation as per the Land Acquisition Act (the value as determined under the present Land Acquisition Act has been found to be lower than the replacement cost) and offer possibility of employment.

For squatters, WB's OD 4.30 mentions the provision of a basic dwelling unit or cash compensation for the lost dwelling structure, the Indian National Draft Policy on R&R and Indian organization policies do not mention the rights and entitlements of such people.

For the issue of rehabilitation (or replacement of lost livelihoods), while WB's OD 4.30 and the Indian National Draft Policy on R&R stipulate concrete measures in terms of jobs, self-employment or a rehabilitation grant, Indian organisation policies mention preference for job in the organization or self-employment. Apart from this, the policies either do not mention rehabilitation grants or do so in a limited way, wherein only a selected few are entitled to the same.

The limitations discussed above prevent R&R policies from becoming more effective. Most limitations arise due to a limited extent of entitlement or due to ambiguous/ inappropriate mechanisms followed to implement the same. There is, thus, a need to examine the issue, compare the various policies that are currently being followed and to develop a new, more appropriate policy based on the same.

Table 2.8 Comparison of norms followed by Neyveli Lignite Corporation Ltd., World Bank OD 4 30, National Draft Policy, C.I.L policy, N.T.P.C Policy, and Powergrid's Social Entitlement Framework

Type of issue/impact	Neyveli Lignite Corporation Ltd	World Bank OD4.30	National Draft Policy	Coal India Limited	National Thermal Power Corporation	Powergrid's Social Entitlement Policy
1. Loss of land						
a.Homestead						
i. with valid title	i. Alternative resettlement site with common infrastructure (proportionate to extent acquired/size of land) and cash compensation as per Land Acquisition Act	i. Equivalent land or cash compensation at replacement cost	i. Equivalent land or cash compensation at replacement cost	i. Replacement cost of homestead + structures on it. In addition, an alternate housing site measuring 100 sq m per family	i. Alternate house site measuring 50' x 40' along with community infrastructure facilities	i. Equivalent area of land subject to availability (State Govt./ Voluntary sellers at existing rate) within a radius of 25 km or cash compensation as per National Draft Policy+ Rehabilitation Assistance
b. Agricultural land						
i. with valid title	i. Cash compensation according to the Land Acquisition Act and estimated cost of structures/ development on the land including trees ii.	i. Alternative land for PAPs based on agricultural practice only or employment or self-employment scheme or cash compensation at replacement	i. Alternative land for PAPs based on agricultural practice only or employment or self-employment scheme or cash compensation at replacement	i. All landowners will receive monetary compensation for the land acquired or land for land. The value of land will be determined on the basis of legal norms. If feasible, employment will be offered only to those PAP who have received	i. Land for land, or self-employment, or shop or award of petty contract, or job (after accounting for compensation legally due under land acquisition act) **SET A**	i. Alternative land of equivalent production potential subject to: ▪ Agriculture-based PAPs (rendered landless by project or left with land holdings that are not economically viable) ▪ Availability (State Govt./voluntary sellers at existing rate) within a

Type of issue/impact	Neyveli Lignite Corporation Ltd	World Bank OD4.30	National Draft Policy	Coal India Limited	National Thermal Power Corporation	Powergrid's Social Entitlement Policy
	Employment/self-employment opportunities iii. Award of contract or temporary jobs to members of PAP societies	cost	cost	monetary compensation		radius of 25 km ▪ Maximum limit is land ceiling limit or cash payment as per National Draft Policy + Rehabilitation Assistance
ii. tenants, sharecroppers, leaseholder	i. Assist PAP to establish non-farm self-employment through provision of petty contracts or formation of society or jobs with contractors	i. Alternative land for PAPs based on agricultural practice only or employment or self-employment scheme or cash compensation at replacement cost	i. Alternative land for PAPs based on agricultural practice only or employment or self-employment scheme or cash compensation at replacement cost	i. Assist the PAP to establish non-farm self-employment through the provision of infrastructure, petty contracts or formation of co-operative or jobs with contractors	i. **SET A** when no claim made by original landlord: or self-employment or shop or award of petty contract or job (**SET C**) in case original landlord claims compensation under LA act and **SET A** option	i. Local standard for min. economic land holding or cash payment as per National Draft Policy + Rehabilitation Assistance

2. Loss of structure						
a.House						
i. with valid title	i. Structure value as estimated by NLC at PWD rates: Shifting and dismantling allowance of Rs 3000-5000 + recovery of reusable material (with proof of residency)+ considered an affected person	i. Alternate structure at resettlement site or cash compensation at replacement cost.	i. Develop plot of 60' * 90' size or 200 sq m with cash compensation to rebuild the house + transportation charges for building material	I. Alternate house site measuring 100 sq m + assistance in designing the new house if desired by PAP	I. Alternate house site measuring 50' x 40' along with community infrastructure facilities + transportation charges for reusable material from old house	i. Cash compensation as per National Draft Policy + Rehabilitation Assistance
ii. tenant, leaseholder	ii. 50% of the structure value as estimated by NLC at PWD rates (100% for conditionally assigned lands)+.shifting and dismantling allowance of Rs 3OOO+ recovery of reusable material (without proof of residency) lump sum amount of Rs3000.	ii. Transition allowance for new establishmen t	ii. Transition allowance for new establishment	ii. No specific mention	ii. No specific mention	ii. Lumpsum payment equivalent to six months rent to re-establish residence
iii. squatters		iii. Basic dwelling	iii. No specific	Iii. No specific mention	iii. No specific mention	iii. Lump sum payment, as per State Government norms,

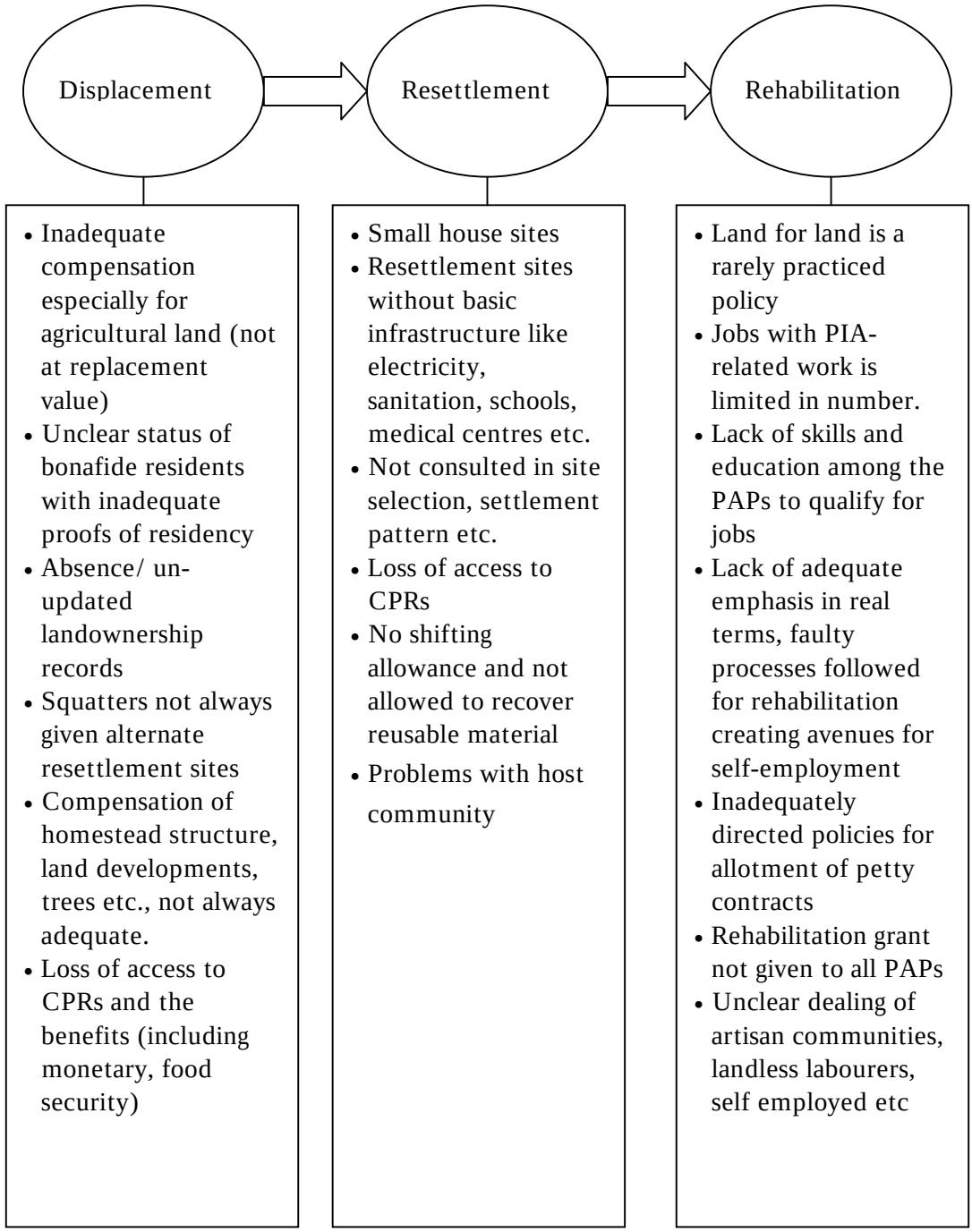
		unit as per local norms or cash comp.	mention			finalized by land purchase committee to re-establish residence
b. Shop/ Institutions						
i. With valid title	i. Cash compensation ii. Considered affected person	i.No mention, but are covered under PAPs	i. No mention, but are covered under PAPs	i. No mention,	I No mention,	i.Structure of equivalent standard or cash compensation as per National Draft Policy + Rehabilitation Assistance
ii.Tenants, leaseholder		ii. No mention, but are covered under PAPs	ii. No mention, but are covered under PAPs	ii.No mention	ii. No mention	ii.Transition allowance equivalent to six months income
iii. Squatters		iii. Basic dwelling unit as per local norms or cash compensation	iii. Basic dwelling unit as per local norms or cash compensation	Iii. No mention	iii. No mention	iii. Lump sum payment as per State Government norms finalized by land purchase committee to re-establish residence
3. Loss of livelihood/trade/ occupation						
a.Wage/self-employment						
i. Agriculture / commercial	i. 60% unskilled jobs and 40% of unskilled jobs arising in NLC contractual wok to be reserved for PAPs. Priority I: Those whose one hectare or more of land has been	i.Job or self-employment scheme + cash allowance for loss of income during transition and re-establishment	i.Job or self-employment scheme + cash compensation as per one year income	i.Job with C.I.L or contractor or non-farm based self-employment scheme. If none of the other packages is available, a PAP with less than 2 acres of land would receive rehab. assistance in the form of a	i.job with N.T.P.C or contractor or self-employment scheme (assistance in the range of Rs 15,000-30,000)	i.Package for starting a income generating enterprise and transition allowance as per National Draft Policy

	acquired Priority II: Those given lands below one hectare			subsistence allowance or grant to be used for productive investments		
	ii. Preference for awarding of certain contractual work					
4. Loss of access to common resources						
a. Rural common property resources	i. Not mentioned	i. Replacement of CPR/ facilities or access to equivalent services/ facilities or cash compensation as per market value	i. Replacement of CPRs or access to equivalent services or cash compensation as per market value	i. Replacement of CPR or access to equivalent services	i. Replacement of CPRs or access to equivalent services	i. Replacement CPRs/amenities or provisions according to Govt. norms
b. Urban civic amenities						ii. Access to equivalent amenities/services as per National Draft Policy for either category, only the cultivator will get actual compensation for crops
5. Loss of standing crops/ trees						
a. With valid title	i. Cash compensation as per estimates for NLC by relevant Government departments	i. Compensation against damage at market rate	i. Not mentioned	i. Not mentioned	i. Not mentioned	

b. Tenant/lessee			Not mentioned	Not mentioned	Not mentioned	.
6. Losses during transition of displaced persons/ establishments						
a. shifting/Transport	i. Shifting and dismantling allowance between Rs3000-5000	i. Provision of transport or cash	i. Provision of transport or cash	i. Shifting allowance covering the full cost of transportation	i. Provision of transport	i. Provision of transport or cash equivalent as per National Draft Policy
b. Maintenance	ii. Recovery of reusable material	ii. No mention	ii. a lump sum grant as assessed by the committee	ii. No mention	ii. No mention	ii.Cash payment as per National Draft Policy
c. Construction	iii. No mention	iii. No mention	iii. Cost of transportation of building materials	iii. Assistance in designing the new house	iii. Free transport for reusable material from old house	iii. Cash for transport of materials as per National Draft Policy
7. Losses to Host Communities						
a. Amenities/Services	i. No mention	i. Augmentation of existing resources to sustain the pressure of PAPs	i. Augmentation of existing resources to sustain the pressure of PAPs	i. Augmentation of existing resources to sustain the pressure of PAPs. All community benefits made available to host community as well	i. Augmentation of existing resources to sustain the pressure of PAPs. All community benefits made available to host community as well	i. Augmentation of resources of host community to sustain pressure of PAP’s

Issues related to R&R

The policies discussed above help address various aspects of R&R with varying degrees of satisfaction. In some cases, the policy addresses the right issue but certain lacunae prevent it from achieving the desired results. This may be on account of ambiguities in definition of some concepts, absence of reliable, acceptable methods to ascertain values, inadequate financial allocations, technical limitations of the PIA, inappropriate implementation mechanisms etc. Some limitations that need to be addressed are:



The process of land acquisition must be participatory on which the PAPs are consulted and informed at every step. Comprehensive information must be collected from the PAP community in a bid to understand their views, needs and concerns. This can be done by means of a baseline survey, discussions etc. The information so collected must be the basis for formation of a Rehabilitation Action Plan (RAP). This must be prepared before the acquisition process is complete and must detail R&R package for the PAPs, conditions for eligibility for benefits mechanisms for implementation. This should be a time-bound document, wherein initiation and ending of each activity must be specified along with the process of implementation and the objective/achievements of the same. This document must be considered contractual and thereby binding on the organization. The RAP document must also clarify the process of redressal of grievances.

Displacement related

Compensation amount: In most cases of acquisitions for public sector units, the compensation package including the entitlements for lost land are prepared by the Revenue Department according to approved procedures. It has been seen that the compensation amount so adjudged is usually lower than the prevailing market rates. This is a major grievance of PAPs against the PIA. The discrepancy arises due to many factors, including the fact that most sales of land are registered for a value which is lesser than the prevailing market price in a bid to save on taxes. It is apparent that the PAPs should be compensated for their assets such that they are able to purchase similar asset, eg., land of similar productivity, nearby. This has been tackled in the Indian context primarily by two ways:

One is by ascertaining the market value of lands of various categories (irrigated, unirrigated etc.) and pegging a lump sum value to be given over and above the value determined by the Government departments per land unit. For example Rs 20000/acre additional for unirrigated areas or parts of thereof.

The other way is to acquire land by private negotiations (for which there is provision in the Land Acquisition Act), which will ensure that the selling price is the right one. Though commendable, this method has been found to be cumbersome and prolonged for large-sized acquisitions.

Evacuation is many cases is a forced one, made possible by use of force. The agitation and hardships caused by the same leads to a loss of trust and goodwill for the organization. A consultative process by which the PAPs help decide the date for evacuation and wherein they are kept informed about the same, can prevent the loss of trust among the people.

Process related

It is seen that PAPs are usually unaware about the details regarding the process of acquisition, the documentary proofs required, the progress of the acquisition process, PAPs rights as per organisation's policy, etc. The process of acquisition of land must be marked with interaction with the community and taking their views into account on key aspects likely to affect their lives.

Often, legitimate PAPs are unable to get the rightful benefits, as the documentary proof required is not complete. They are, thus, treated as squatters. No doubt, that a certain amount of caution is required so that impostors and opportunists do not take undue advantage, yet, the process must allow for inclusion of bonafide residents be (residents for three to five years prior to the initiation of acquisition process) as PAPs inspite of incomplete documentary proof. This can be achieved by taking active inputs from the local Government bodies on a case-to-case basis.

Many PAPs lose their right to rightful compensation in face of absence of, or because of the non-updation of land records. Mandatory updation of land records by the concerned government, before the acquisition process is initiated, is required. This must be done such that both the poor and the rich get a fair chance to update their records.

Delays in the process of acquisition and between payment of compensation and evacuation must be avoided. A long delay forces greater hardship on people. Such delays create a situation where PAPs are forced to live on in the area, despite the absence of any new developmental activity in the area, unable to secure loans and by the time they are evacuated, the compensation amount has been spent leaving little or nothing for rehabilitation purposes.

Rehabilitation

For land losers

The first priority as stated in most R&R policies is replacement of land with land of equivalent productivity. This is also the most preferred option by the PAPs, but due to paucity of land it is not widely implemented. This implies that alternative ways of recreating income flow need to be created for affected households.

The loss of land means a loss of livelihood and way of life. Land losers often lack skills to create an alternative livelihood and, unable to acquire requisite new skills unaided, they are pushed into penury after displacement. Besides loss of income, displacement also pushes the households into a more monetized economy where food and other needs have now to be purchased. The policies, as discussed in Table 2.8, provide for employment opportunities within the organization, in

associated works as well as in setting up alternate income- generation units. From past experience it is clear that the most effective rehabilitation has been in cases of provision of employment within the organization, but these are limited in number. Casual labour, with contractors connected with the PIA, and petty contracts with the PIA provide irregular employment to many others. However, these are not able to rehabilitate all the PAPs leaving many others in search of an appropriate source of income.

Thus there is an increasing need to make alternative ways for rehabilitation successful. There is a need to implement this programme by interacting extensively with the PAPs, and providing help in the form of training in various aspects like work-related skill development, book keeping, initial marketing linkages, etc. Identification of appropriate ventures and the process of implementation of the programme holds the key to its success. There is an obvious need to allocate more resources to this aspect of rehabilitation, than what is currently proffered in the present scenario. It might be necessary to involve NGOs and CBOs in the process of information dissemination and implementation of this programme.

Rehabilitation grant

Land losers, who are not given a job in the PIA, have not received up to 180 days of contractual work with PIA-related work, and who have not received any other assistance towards rehabilitation by a pre-set date (eg., two years after the acquisition of land) must be given a rehabilitation grant that meets the minimum wage levels for at least two years and is preferable based on the estimated income of the households in the previous few years. The rehabilitation grant must be given to all PAPs eligible for rehabilitation and not be limited on the grounds of any pre-set economic conditions.

Other communities

The effect of displacement is also severe on PAPs who worked primarily as agricultural labourers or artisans who earned their livelihood by providing goods and services for villagers in return for food and/or cash. Such PAPs are not entitled to rehabilitation by the PIA yet are affected severely due to loss of their traditional patrons. As, these are also traditionally poor communities and the loss of patrons pushes them below the poverty line. It is imperative that the needs and extent of loss be assessed and they be compensated adequately for rehabilitation.

Resettlement

Community participation

The process of land acquisition should be marked by community participation and by maintaining a transparent relationship with them. Mechanisms need to be evolved such that the PAPs are consulted in each decision likely to effect them. Awareness-generation is required on many aspects like the R&R policy of the PIA, the process and documentary requirements for acquisition, the possible ways of rehabilitation, sources of skill training, sources of finance, importance of utilisation of the compensation amount in a productive manner, etc.

Resettlement centres

It is important to ensure that the plots allocated at the resettlement site are of a suitable size. Too small a size forces PAPs to abandon rearing animals, which has an adverse effect on their income besides forcing them to live in cramped surroundings. Also, the site must be developed and include all basic infrastructure facilities such as sanitation, electricity, drinking water, a dispensary, school, roads, ponds etc. These should be provided even if all these were not present in the original village to help them adapt successfully in circumstances thrust upon them.

The other needs of people, the pattern of settlement and the site of settlement for any community must be decided in consultation with the community.

Squatters must be given a reasonably sized house site at the resettlement centre. Households must be evacuated only after alternate sites have been allocated at a resettlement site and after an adequate time period to enable them to build their homes. In cases of acquisition of land on an urgent basis, transit accommodation must be provided such that PAPs have adequate time to build an alternate home.

There should be no multiple displacement of the PAPs. It is common in most areas where a development project is initiated, that PAPs are displaced many times over in a short span of time. A 50 year master plan of the surrounding area must be made in collaboration with other Government bodies. This will enable the organization to assure PAPs that they will not be displaced again for at least 50 years.

A dedicated R&R corpus fund must be established which can continuously sustain activities like the maintenance of the Resettlement Centre, pensions for deserving households consisting of aged people, women-headed households etc.

Shifting allowance

Transition/ shifting allowance to at least take care of the expenses of shifting and allow the recovery of reusable material.

Common property resources

It has been seen that displacement leads to loss of access to common property resources (CPR) like ponds, forests, grazing land etc., which are often not available on the resettlement sites. This imposes a change in the lifestyle of the PAPs, economic loss and loss of food security. Some, but not all policies recognize the loss and state that the same should be compensated either with replacement of the lost asset or monetarily. In spite of policies stating this, the mode of implementing the same has not been clarified, and PAPs are often neither compensated for the loss/nor are often neither compensated for the loss nor are facilities made available at the resettlement site.

In some cases, there may be communities dependent on such CPRs who do not live within the project area yet are affected all the same. This may include pastoral communities, fishermen, potters etc. Such communities must also be recognized as PAPs and benefits extended to them.

Conclusion

Displacement upsets the lifestyle of PAPs, many of whom may not be able to recreate previous lifestyles. It is the responsibility of the PIA to eliminate, or at least diminish these sufferings. Appropriate policies need to be framed to provide adequate flexibility to the PIA for interpretation of the rules so framed and for development of innovative solutions.

From past experience it is clear that the requirement of the day is a more sincere and more effective implementation of the R&R policies. The policies must be not be implemented with a paternalistic attitude wherein lip service is provided to this aspect of project development. It is imperative that the people who have sacrificed for the project be made partners in progress. A sincere and dedicated effort at implementation, both at the stage of interpretation of the policy and its implementation is required.

Figure 1 Environmental clearance – procedural framework

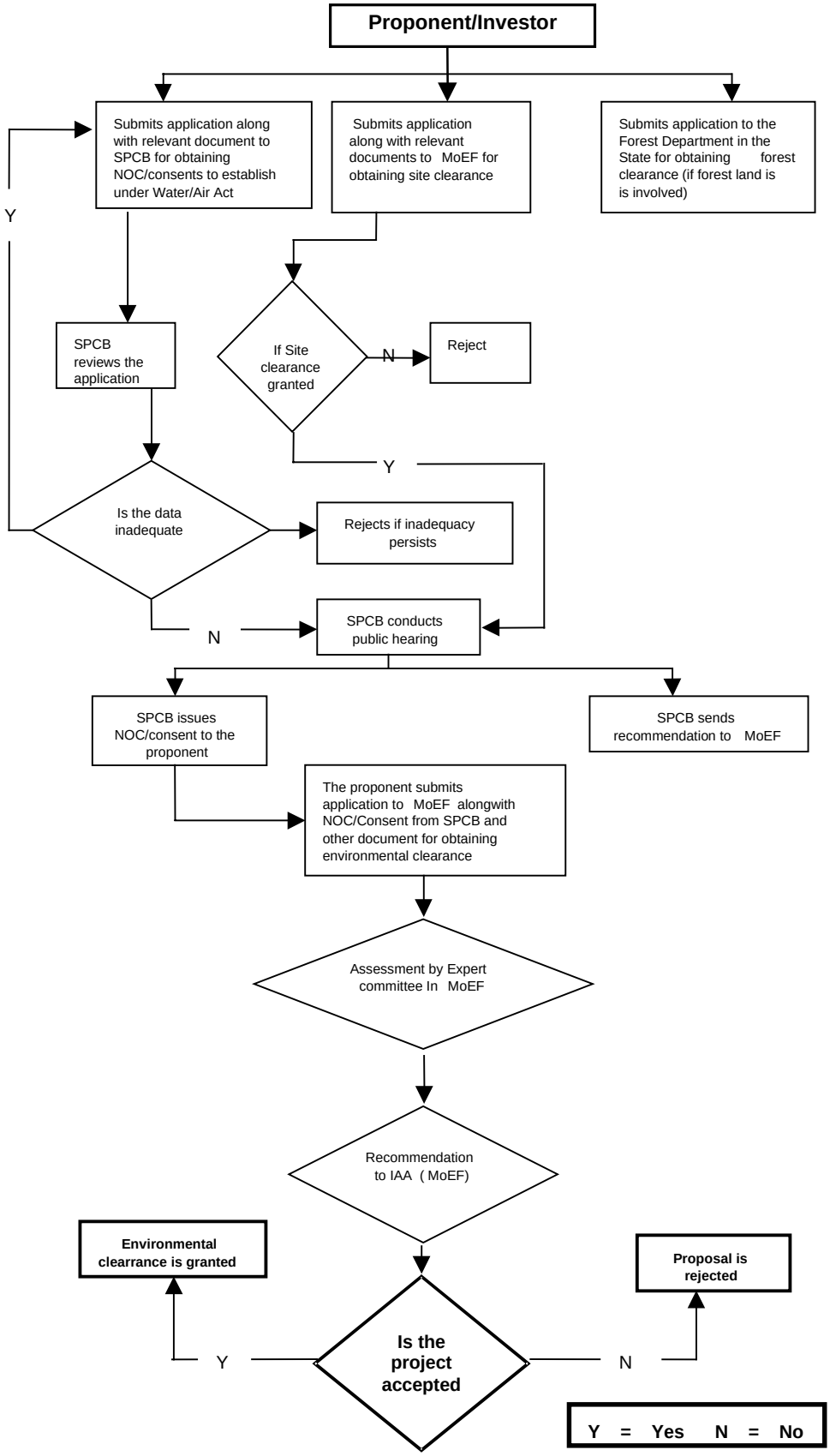


Figure 2 Commonwealth environment protection procedures in Australia

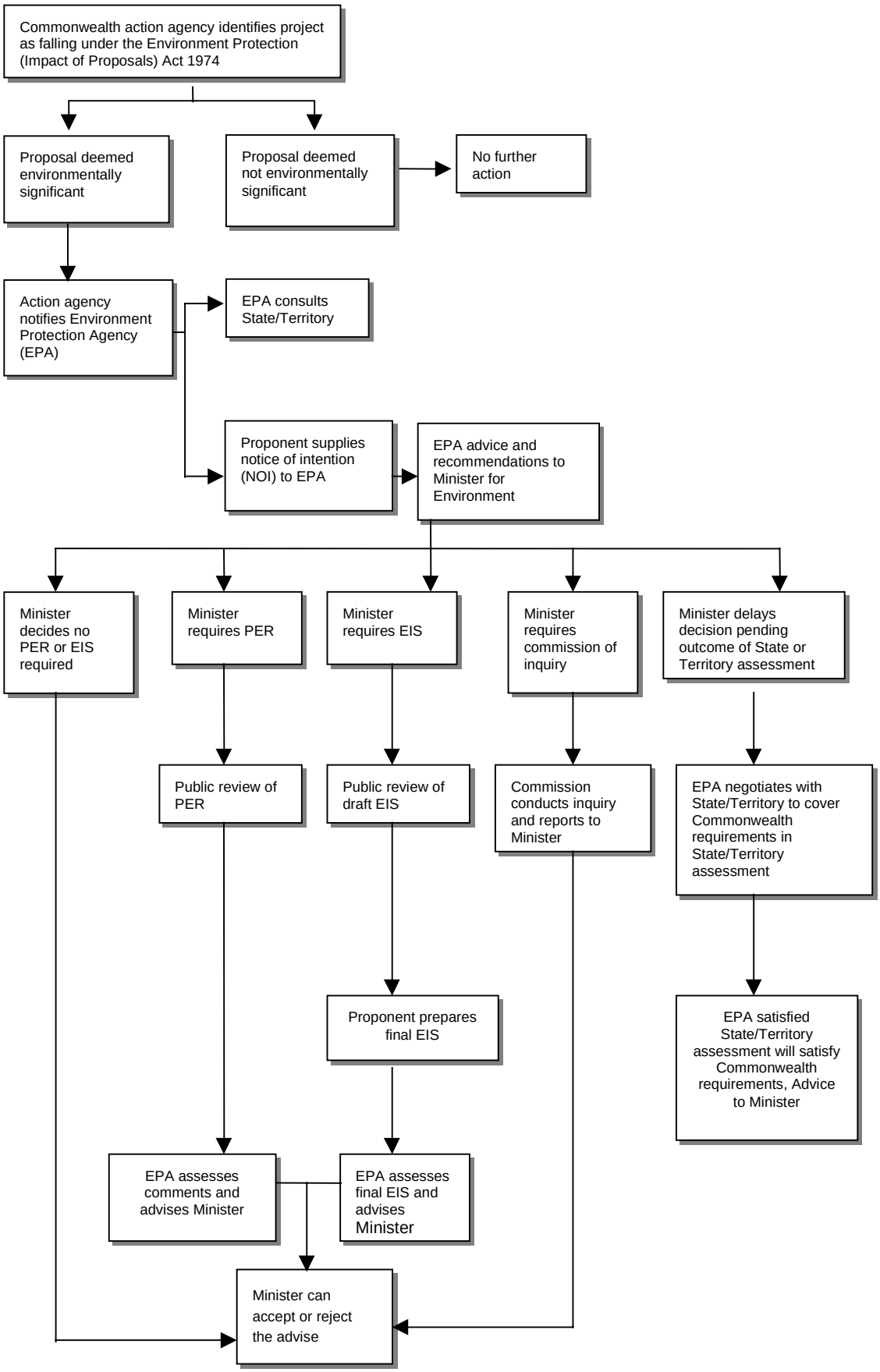
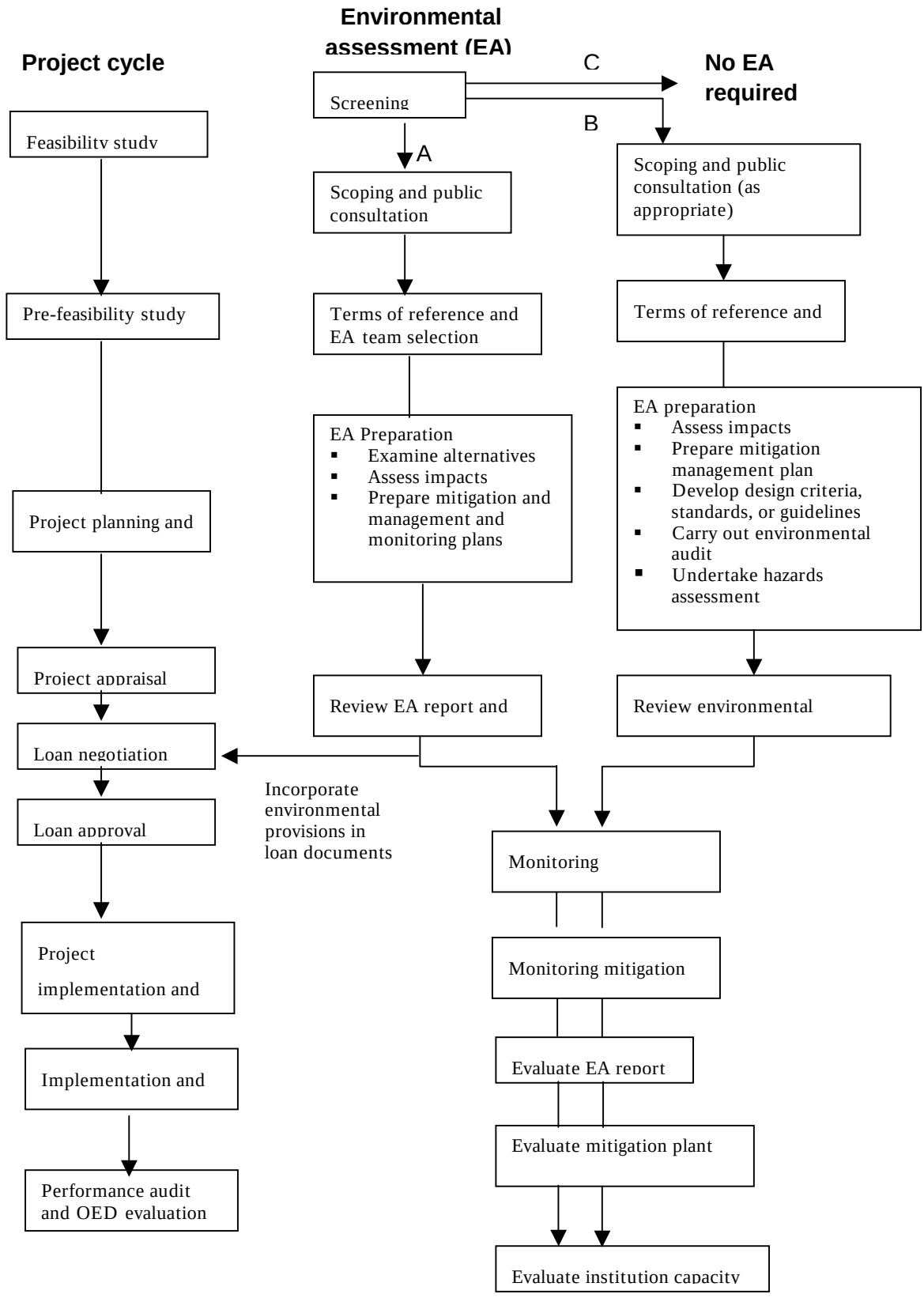


Figure 3 Environmental assessment process recommended by the World Bank



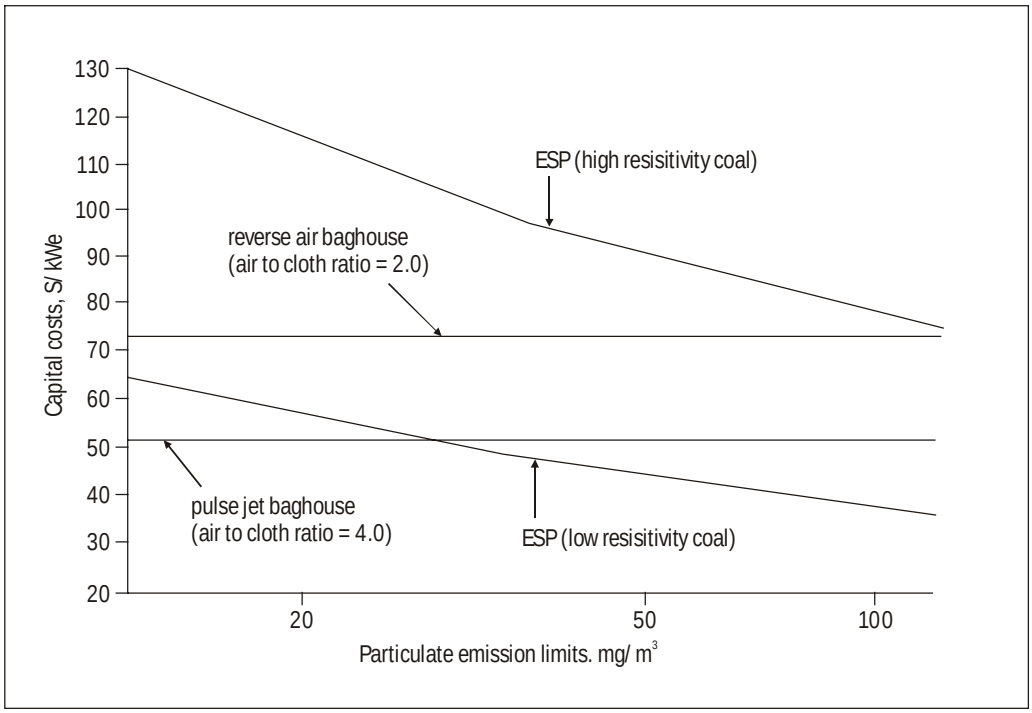


Figure 4 Capital cost per kW installed for ESPs and baghouse filters

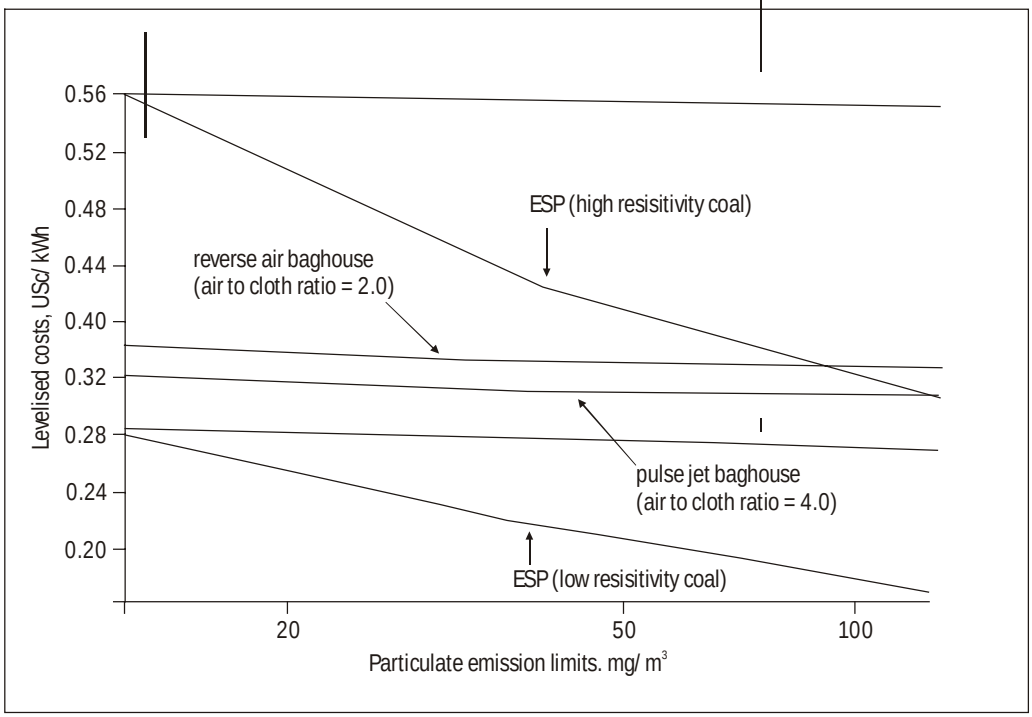


Figure 5 Levelized cost per kWh of electricity produced for ESPs and baghouse filters

Annexure 2.1

Draft environmental norms for diesel engine-based power plants with capacity greater than 150 MW

Pollutant	Limiting value
Particulate matter	75 mg/Nm^3
Carbon monoxide	150 mg/Nm^3
Hydrocarbon	150 mg/Nm^3
Sulphur dioxide	Sulphur content in fuel should not be more than 2%, if it is more, then 90% efficient flue gas desulphurization unit to be installed. Stack height to be calculated using formula $H = 14 Q^{0.3}$ ($Q = SO_2$ emission in kg/hr)
Oxides of nitrogen	710 ppm (15% O_2) up to 2000 AD 180 ppm (15%) from 1.1.2001 AD

Draft environmental norms for diesel engine-based power plants with capacity of 35 MW and up to 150 MW

Pollutant	Limiting value
Particulate matter	75 mg/Nm^3
Carbon monoxide	150 mg/Nm^3
Hydrocarbon	150 mg/Nm^3
Sulphur dioxide	Sulphur content in fuel should not be more than 2%, if it is more, then 90% efficient flue gas desulphurization unit to be installed. Stack height to be calculated using formula $H = 14 Q^{0.3}$ ($Q = SO_2$ emission in kg/hr)
Oxides of nitrogen	1110 ppm (15% O_2) up to 2000 AD 710 ppm (15%) from 1.1.2001 AD

Annexure 2.2

National ambient air quality standards for India

Pollutant and time-weighted average	Concentration in ambient air		
	Industrial area (micrograms per cubic metre)	Residential, rural, and other areas (micrograms per cubic metre)	Sensitive area (micrograms per cubic metre)
Sulphur dioxide			
Annual average	80.0	60.0	15.0
24 hours	120.0	80.0	30.0
Oxides of nitrogen			
Annual average	80.0	60.0	15.0
24 hours	120.0	80.0	30.0
Suspended particulate matter			
Annual average	360.0	140.0	70.0
24 hours	500.0	200.0	100.0
Respirable particulate matter (size less than 10 µm)			
Annual average	120.0	60.0	50.0
24 hours	150.0	100.0	75.0
Lead			
Annual average	1.0	0.8	0.5
24 hours	1.5	1.0	0.8
Carbon monoxide			
8 hours	5.0*	2.0*	1.0*
1 hour	10.0*	4.0*	2.0*

* in milligrams per cubic metres

Annexure 2.3

Effluent standards for thermal power stations

Source	Parameter	Maximum limiting concentration milligram per litre (except for pH and temperature)
Condenser cooling water (once through cooling system)	PH	6.5-8.5
	Temperature	Not more than 5° C higher than the intake water temperature
	Free available chlorine	0.5
Boiler blowdowns	Suspended solids	100
	Oil and grease	20
	Copper (total)	1.0
	Iron (total)	1.0
Cooling tower blowdowns	Free available chlorine	0.5
	Zinc	1.0
	Chromium (total)	0.2
	Phosphate	5.0
	Other corrosion inhibiting material	Limit to be established on case-by-case basis by Central Board in case of Union Territories and State Board in case of states
Ash pond effluent	PH	6.5-8.5
	Suspended solids	100
	Oil and grease	20

Annexure 2.4

World Bank proposed effluent levels for TPPs

Parameters	Maximum level
PH	6-9
Total suspended solids	50 mg/l
Oil and grease	10 mg/l
Total residual chlorine	0.2 mg/l
Chromium (total)	0.5 mg/l
Copper	0.5 mg/l
Iron	1.0 mg/l
Zinc	1.0 mg/l
Temperature increase	Less than or equal to 3^{o} C (100 m from the point of discharge)

Annexure 2.5

Ambient air quality monitoring schedule prescribed by CPCB

Parameters	Period (hours)	Days/week	Measurements/ year	Measurement method
SPM	24	2	104	Average flow rate not less than 1.1 m^3/min
SO_2	24	2	104	Improved West & Gaeke method Ultraviolet fluorescence
NO_x	24	2	104	Jacob & Hochheiser modified method Gas phase Chemiluminescence
RPM (PM_{10})	24	2	104	
Pb	24	2/month	24	AAS method after sampling using EPM 2000 filter paper
Co	8	2/month	24	Non dispersive infrared spectroscopy

Annexure 2.6

CPCB recommended monitoring guidelines

Boiler capacity	Ambient air quality monitoring stations	Source emission monitoring
Less than 200 MW	2 stations	Once in 4 weeks
Greater than and including 200 MW	3 stations	Once in 2 weeks
Greater than and including 500 MW	4 stations	Once in a week

Note: All the stack gas emission results shall be normalized to 12 per cent CO_2 in the flue gas

Annexure 2.7

Methods of determination of critical parameters of water, waste water and monitoring schedule

Parameter	Sampling frequency	Recommended method
PH	Once a month	Electrometric method
Velocity of flow	Once a month	Current meter or float method
Dissolved oxygen	Once a month	Iodometric method
Biochemical oxygen demand	Once a month	Dilution method
Total coliform	Once a month	Multiple tube dilution technique
Fecal coliform	Once a month	Multiple tube dilution technique
Chloride	Once a month	Argentometric method
Hardness	Once a month	EDTA titrimetric method
Calcium	Once a month	EDTA titrimetric method
Sodium	Once a month	Flame photometric method
Potassium	Once a month	Flame photometric method
Chemical oxygen demand	Once a month	Dichromate reflux method
Solids (TSS, TDS)	Once a month	Gravimetric method
Turbidity	Once a month	Nephelometer
Ammoniacal nitrogen	Once a month	Calorimetry