

Environmental Impact Assessment of A Proposed 2640 MW Thermal Power Plant at Sompeta Using RIAM

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Abstract

Coal is the only natural resource and fossil fuel available in abundance in India. Consequently, it is used widely as a thermal energy source and also as fuel for thermal power plants producing electricity. India has about 90,000 MW installed capacity for electricity generation, of which more than 70% is produced by coal-based thermal power plants. Hydro-electricity contributes about 25%, and the remaining is mostly from nuclear power plants (NPPs). The problems associated with the use of coal are low calorific value and very high ash content. The ash content is as high as 55–60%, with an average value of about 35–40%. Further, most of the coal is located in the eastern parts of the country and requires transportation over long distances, mostly by trains, which run on diesel. About 70% oil is imported and is a big drain on India's hard currency. This paper evaluates an Environmental Impact Assessment (EIA) using the Rapid Impact Assessment Matrix (RIAM). It considers all 4 components: physical / chemical, biological / ecological, social / cultural, economic / operational. These are then evaluated using universal criteria common to all impact consideration. Figures and tables made comparisons much easier. This Matrix was applied to the EIA of the future Coal based thermal power plant at Sompeta village in Srikakulam District, Andhra Pradesh.

Keywords: Andhra pradesh; EIA; Power plant; RIAM; Srikakulam

Introduction

Nagarjuna Construction Company has proposed to set up a 4 x 660 MW (Phase- I: 2 x 660 MW and Phase- II: 2 x 660 MW) coal based power plant at Sompeta village and Mandal, in Srikakulam district of Andhra Pradesh. The cost of the total project is Rs/- 12,000 Crores which includes Rs/- 1177 Crores for environmental protection measures. The land identified for the proposed project site is 762 hectares. The project site is generally plain with an average site elevation of about 2.0 m above mean sea level [1].

Details of proposed project

The proposed power plant will be operated on coal as main fuel to generate 2640 MW of power. Pulverized coal fired boilers with super critical technology will be installed in the project. The details of the proposed power project are given below in Table 1.

Environmental base line data

The 10 km radial distance from the plant boundary has been considered as study area for Environmental Impact Assessment (EIA) baseline studies. Environmental monitoring for various attribute like meteorology, ambient air quality, surface and ground water quality, soil characteristics, noise levels and flora and fauna have been conducted at specific locations and the secondary data collected from various Government and Semi- Government organizations.

Land use

The land use pattern of the study area has been studied by analyzing the available secondary data published in the District Primary Census abstract of the year 2001.

As per the Census records, the 10 km study area admeasure to about 27570-ha. In that total area consists of irrigation land of 7293.22-ha (26.46%), un- irrigated land about 12458.40-ha (45.19%), cultivable waste land of 1045.34-ha (3.79%), and land not available for cultivation is about 6770.69-ha (24.56%) [2].

Soil quality

A total of ten samples within 10 km radius of the plant site were

collected for assessment of soil quality. The baseline environmental monitoring studies were carried out from 1st March 2009 to 31st May 2009. The sampling was carried out study period. The pH of the soil extracts varied from 6.7 to 7.7 indicating neutral to slightly alkaline. The electrical conductivity was observed to be in the range of 232 μ S/cm to 336 μ S/cm. The nitrogen values range between 321.1 kg/ha to 55.4 kg/ha. The nitrogen content in the study area falls in very less to fewer categories. The phosphorus values range between 121.4 kg/ha to 172.3 kg/ha, indicating that the phosphorus content in the study area falls in more than sufficient category. The potassium values range between 63.4 kg/ ha to 109.8 kg/ha, which indicate that the soils have very less quantity of potassium. The chlorides were found to be in the range of 69.9 mg/kg to 236 mg/kg of soil.

Meteorology

On-site monitoring was undertaken for various meteorological variables in order to generate the site specific data. Data was collected every hour continuously from 1st March to 31st May 2009. The maximum and minimum temperatures recorded during the study period are 34.3°C and 22.8°C. The relative humidity found varying from 76.3% to 81.2%. The predominant winds are mostly from south west (25.5%) and south (13.7%) directions. The rainfall recorded during the study period was 15.5 mm [3].

Ambient air quality

To establish the baseline status of the ambient air quality in the study area, the air quality was monitored at 8 locations. The summary of the ambient air quality monitored is given below in Table 2.

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Sea water quality

The results of analysis indicate that the pH ranges in between 8.0–8.1. The Total Dissolved Solids concentrations were found to be ranging in between 50600 mg/lit to 50700 mg/lit. The Chlorides and Sulphates were found to be in the range of 18570 mg/lit to 19072 mg/lit and 1481 mg/lit to 1523 mg/lit respectively.

Ground water quality

The results of analysis indicate that the pH ranges in between 6.8 to 7.3 which are well within the specified standard of 0.5 to 8.5. The Total Dissolved Solids concentrations were found to be ranging in between 358 mg/lit to 1810 mg/lit. The Chlorides and Sulphates were found to be in the range of 78 mg/lit to 1105 mg/lit and 14.1 mg/lit to 128 mg/lit respectively. The hardness was observed to be ranging from 185 mg/lit to 960 mg/lit.

Ambient noise levels

Day time noise levels: the daytime noise levels at all residential locations are observed to be in the range of 41.9 dB to 48.3 dB, 52.6 dB to 51.7 dB at the commercial locations and 36.4 to 39.8 dB at sensitive locations.

Night time noise levels: The nighttime noise levels at all residential locations are observed to be in the range of 38.0 dB to 43.7 dB, 49.0 dB to 46.8 dB at the commercial locations and 30.3 to 34.0 dB at sensitive locations.

Flora and fauna

Based on the primary data collected by field visits and literature survey, there are birds from Australia and Siberia, known locally as “kondamkodi and nathagotta”, which visit the natural habitat” beela”. There are several animal species like varudu and peddhanakka which visit the habitat [4].

Socio-economic environment

As per 2001 census the study area consists of 155107 persons inhabited in the study area of 10 km radial distance from the periphery of the proposed plant. The males and females constitute 48.05% and 5.95% of the study area population respectively. The average household size of the study area is 4.3 persons. The density of the population reveals that the study area has an overall density of 102 persons per sq.km. In the study area, 6,615 of the population belong to Scheduled Castes (SC) and 11.13% of the population belongs to Scheduled Tribes

(ST). The study area experiences average literacy rate of 50.20%. As per 2001 census records, altogether the main workers works out to be 27.65% of the total population.

Land use

The proposed thermal power plant (2 x 660 MW) shall be installed in around 27570 hectares of land at Sompeta village in Srikakulam district of Andhra Pradesh. The land is partially barren land, free from habitation and partially irrigated lands. The construction activities attract a sizeable population and influx of population is likely to be associated with construction of temporary hutment for construction work force. However, this will be only a temporary change and shall be restricted to construction period. As soon as the construction phase is over, the land use pattern modified to meet the requirement of construction phase shall be reversed. In view of the above, no change in land use pattern is envisaged due to construction and operation of the project. But the irrigated land will turn into a barren land thereby will become unfit for cultivation which is a cause of concern.

Solid waste

Ash is the major solid waste to be generated from the coal based power plant. Coal consumption of 12.5 MTPA at 85% PLF was considered for estimation of ash generation. Fly ash about 4.2 MTPA and bottom ash of 1.05 MTPA will be generated. This ash may lead to skin diseases when exposed over a long duration. This can be monitored by disposing off using High Concentrated Slurry Disposal (HCSD) technology.

The sludge generated from sewage treatment plant should be dried; vermin-composted and used as manure for greenbelt maintenance otherwise it may lead to the contamination of ground water.

Socio-economics

As the area is close to Sompeta town, the skilled people from the town will be available to work here. So, there will be no major change of local occupational scenario, though the establishment of the proposed project will increase the direct and indirect jobs and other economic opportunities. There will be some development of secondary service market, which will be beneficial to the local economy.

Methodology

RIAM procedure

The impacts of the activities of the project are evaluated

TS. No.	Features	Description
1	Capacity	2640 MW
2	Configuration	4x660 Super critical technology
3	Power evacuation	Power will be evacuated into PGCIL's grid through 765/400 KV level
4	Fuel	Blended coal(70% indigenous & 30% imported coal)
5	Source of coal	Coal for the plant will be sourced from Mahanadi Coal fields Limited/ South Eastern Coal fields Limited and imported coal
6	Coal requirement	About 12.5MTPA@85% PLF About 14.5MTPA@100%PLF
7	Sulphur content (max.)	0.6%(indigenous coal) / 0.8%(imported coal)
8	Ash content in coal (max.)	42% - indigenous coal/ 15% - imported coal
9	Ash generation	5.25 MTPA
10	ESP efficiency	>99.9%
11	Stack	Two stacks with 274 m height
12	Water requirement	28700 m ³ /hr
13	Water source	Bay of Bengal

Table 1: Salient features of the project.

according to the environmental components, and for each condition a classification is determined (using the pre-defined criterion), what provides an expected impact measure for environmental components. The importance of the evaluation criterion is divided in two groups: criteria relative to the degree of the relevance of the condition, and that individually can alter the resulting classification (A); criteria relative to the development of the condition but individually is not capable of altering the obtained classification (B). The value designated for each group of criteria is determined by the use of a series of simple formulas. Those formulas allow the determination, in well-defined bases, of the classifications for individual conditions. Positive and negative impacts can be demonstrated using scales that pass of negative values the positive ones through zero for the group criteria (A), where the value zero presents a condition of "any alteration" or "any relevance." Using zero this way, in group A's criteria, it allows a single criterion to isolate conditions that don't present any alteration or which relevance is null for the analysis. However, the zero is a value avoided in the group B's criteria because, if the classification of all of criteria of that group was equal to zero, the final result of the ES would, naturally, be also zero. Eventually, that situation of nullity of the magnitude of the impact could happen in group A's criteria that presented some relevance degree. To avoid this situation, the scale of group B's criteria uses the unitary value (1) as classification for no alteration/ without relevance.

A measure of the importance of the relevance condition (A1) is evaluated according to the space borders or interest of the man that will be affected. The scale is defined in the following way:

- 0 - irrelevant;
- 1 - relevant just to the local condition;
- 2 - relevant to the areas immediately out of the local condition;
- 3 - relevant to the Regional / National interest;
- 4 - relevant to the National / International interest;

The magnitude (A2) is defined as a measure of the scale of benefit / damage of an impact or condition. The scale is defined in the following way:

- 3 – Extremely positive benefit;
- 2 – Moderately positive benefit;
- 1 – Lightly positive benefit;
- 0 – No alteration/ Actual state;
- 1 – Lightly negative damage;
- 2 – Moderately negative damage;
- 3 – Extremely negative damage;

This permanent criterion (B1) defines if a condition is temporary or permanent, and if it should only be seen as a measure of the temporary state of the condition. The scale is defined in the following way:

- 1 – No alteration / actual state;
- 2 - Temporary;
- 3 - Permanent;

TSPM($\mu\text{g}/\text{m}^3$)	SO ₂ ($\mu\text{g}/\text{m}^3$)	NO _x ($\mu\text{g}/\text{m}^3$)
62.5-142.4	17.5-40.2	6.1-9.9

Table 2: Summary of ambient air quality.

The reversibility criterion (B2) defines if a condition can be changed and if it can be seen as a measure of control on effect of the condition. The scale is defined in the following way:

- 1 - No alteration / actual state;
- 2 - Reversible;
- 3 - irreversible;

This cumulative criterion (B3), where the effect of a condition will have a single direct impact or there will be a cumulative effect during the course of time, or, on the other hand, a synergetic effect with other conditions. Theoretically, the cumulative criterion is the mean used to judge the sustainability of a condition, and it should not be confused with a permanent situation or reversible condition. Its scale is defined in the following way:

- 1 - No alteration / not applicable;
- 2 - Non cumulative / of direct effect / singular;
- 3 - Cumulative / of indirect effect / synergetic;

The RIAM requests the definition of specific components of impact evaluation and each one of those environmental components falls upon one this four categories:

Physical/Chemical (PC): Includes all physical and chemical aspects of the environment, including nonrenewable natural resources (non-biological) and the degradation of the physical environment through pollution.

Biological/Ecological (BE): Includes all biological aspects of the environment, including renewable natural resources, conservation of the biodiversity, interaction between species and pollution of the biosphere.

Sociological/Cultural (SC): Includes all human aspects of the environment, including social subjects that affect the individuals and the communities; with cultural aspects, it is included the inheritance conservation and human development.

Economical/Operational (EO): To identify qualitatively the economic consequences of environmental change, temporary and permanent, as well as the complexities of administration of the projects inside the context of the activity project. After necessary calculations, the RIAM classifies the degree of the damage or benefit according to Table 3.

Results and Discussion

The description of the various components and the impact categories of a thermal power plant at Sompeta are given below in Tables 4-7 and the summary of their results are given in Table 8. The results obtained using RIAM for various components can also be represented with the help of histograms as shown in Figures 1 and 2.

Conclusion

Environmental impact assessment of the proposed thermal power plant at Sompeta has been carried out using Rapid impact assessment matrix method. The RIAM presents the overall results of the EIA study in an easy and transparent way. Potential environmental negative and positive impacts of 2640 MW Sompeta thermal power plant were identified and evaluated using RIAM. There is a majority of negative impacts due to the proposed project although positive impacts also occur. Most negative impacts relates to physicochemical components like surface and ground water quality, land use, surface temperature, soil

Environmental classification (ES)	Value of the class	Value of the class (numerical)	Description of the class
72 to 108	E	5	Extremely positive impact
36 to 71	D	4	Significantly positive impact
19 to 35	C	3	Moderately positive impact
10 to 18	B	2	Less positive impact
1 to 9	A	1	Reduced positive impact
0	N	0	No alteration
-1 to -9	-A	-1	Reduced negative impact
-10 to -18	-B	-2	Less negative impact
-19 to -35	-C	-3	Moderately negative impact
-36 to -71	-D	-4	Significantly negative impact
-72 to -108	-E	-5	Extremely negative impact

Table 3: Classification of the degree of the benefit or damage.

	Components	ES	RB	A1	A2	B1	B2	B3
PC1	Land Use/Land Scape	-36	-D	2	-2	3	3	3
PC2	Ambient Air Quality	-48	-D	2	-3	3	3	2
PC3	Ambient Water Quality	-36	-D	3	-2	2	2	2
PC4	Surface Water Quality	-24	-C	2	-2	2	2	2
PC5	Surface Temperature	-24	-C	2	-2	2	2	2
PC6	Loss Of Soil Fertility	-36	-D	2	-2	3	3	3
PC7	Vibrations	-6	-A	1	-1	2	2	2
PC8	Radiations	-32	-C	2	-2	2	3	3
PC9	Ground Water Quality	2	-3	3	3	3	3	3

Sompeta thermal power plant, Srikakulam district
Physical and Chemical Component (PC)

Table 4: Description of physical and chemical (PC) components and the impact categories of Sompeta power plant.

	Components	ES	RB	A1	A2	B1	B2	B3
BE1	Deforestation/ Devegetation	-108	-E	4	-3	3	3	3
BE2	Flora & Fauna	-81	-E	3	-3	3	3	3
BE3	Loss of Wild Life & Birds	-54	-D	3	-2	3	3	3
BE4	Ecological Imbalance	-108	-E	4	-3	3	3	3
BE5	Solid Waste/ Disposal	-36	-D	2	-2	3	3	3
BE6	Sewage Disposal/Sanitation	-36	-D	2	-2	3	3	3
BE7	Depletion of Natural Resources	-108	-E	4	-3	3	3	3
BE8	Ash Disposal	-81	-E	3	-3	3	3	3
BE9	Aquatic Biota	-24	-C	2	-2	2	2	2

Biological and ecological components (BE)

Table 5: Description of biological and ecological (BE) components and the impact categories of Sompeta power plant.

	Components	ES	RB	A1	A2	B1	B2	B3
SC1	Rehabilitation/Resettlement	-18	B	1	-3	2	2	2
SC2	Loss of Livelihood	-54	-D	2	-3	3	3	3
SC3	Loss of Lives Due to Accidents	-27	-C	1	-3	3	3	3
SC4	Housing/Infrastructure	18	B	1	2	3	3	3
SC5	Education & Training	18	B	1	2	3	3	3
SC6	Health Aspects	-54	-D	2	-3	3	3	3
SC7	Cultural Heritage	-81	-E	3	-3	3	3	3
SC8	Mobile Clinics/Recreation Facilities	12	B	1	2	2	2	2
SC9	Power & Water Supply	7	A	1	1	3	2	2
SC10	Communication & Basic Amenities	14	B	1	2	3	2	2
DC11	Community Halls & Market Centers	14	B	1	2	3	2	2
SC12	Aesthetics	-36	-D	2	-2	3	3	3

Sociological and cultural components (SC)

Table 6: Description of sociological and cultural (SC) components and the impact categories of Sompeta power plant.

Components		ES	RB	A1	A2	B1	B2	B3
EO1	Loss on Agricultural Land	-16	B	1	-2	3	3	2
EO2	Housing/Infrastructure	18	-D	1	2	3	3	3
EO3	Financial Development	108	-C	4	3	3	3	3
EO4	Commercial Establishment	12	B	1	2	2	2	2
EO5	Employment Generation	81	B	3	3	3	3	3
EO6	Business Development	54	-D	3	2	3	3	3
EO7	Uplift of Backward Area	54	-E	2	3	3	3	3
EO8	Green Belt Development	54	B	3	2	3	3	3

Economical and operational components (EO)

Table 7: Description of economical and operational (EO) components and the impact categories of Sompeta power plant.

Summary of scores	-108	-71	-35	-18	-9	0	1	10	19	36	72
Range	-72	-36	-19	-10	-1	0	9	18	35	71	108
Class	-E	-D	-C	-B	-A	N	A	B	C	D	E
PC	0	5	3	0	1	0	0	0	0	0	0
BE	5	1	1	0	0	0	0	0	0	0	0
SC	1	1	1	1	0	0	1	5	0	0	0
EO	0	0	0	1	0	0	0	2	0	3	2
Total	6	11	5	2	1	0	1	7	0	3	2

Summary of scores

Table 8: Summary of the results.

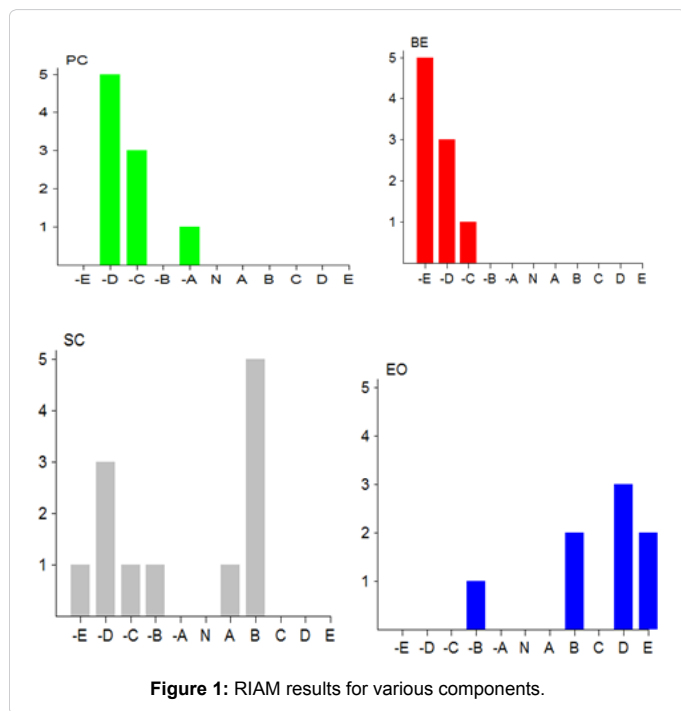


Figure 1: RIAM results for various components.

fertility etc., biological and ecological components like flora and fauna, wildlife, fly ash, solid waste, sewage, etc., and also a few socio-cultural aspects like rehabilitation, loss of lives due to accidents, aesthetics, etc. The positive impacts due to the proposed project are housing or infrastructure, upliftment of the backward areas, employment, etc. Hence it is observed that the project will bring economic development but at the same time it will degrade the environment. So the negative impacts can be minimized by adopting effective environmental management plan which includes mitigation measures for improving the eco-profile of the site area.

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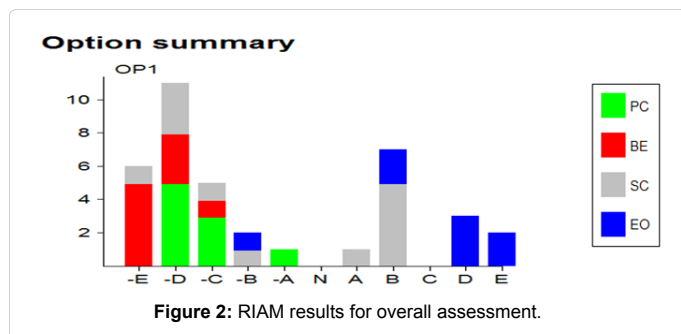


Figure 2: RIAM results for overall assessment.