Environmental impact assessment of coal-based thermal power plant near Udupi Power Corporation Limited in Karnataka – India

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Abstract: The Udupi District in Karnataka, South India, is an eco-sensitive region known for its copious rainfall, greenery and rare species of flora and fauna. Commissioning of a coal-based thermal power plant in this region has an adverse effect on the environment. The purpose of this study is to identify and assess the environmental impact on the villages surrounding the thermal power plant commissioned by Udupi Power Corporation Limited (UPCL) at Nandikur, Udupi District. This study concludes that thermal power plant is causing serious issues to the environment and social life of the people. Hence people have started to resist further industrial growth. Results of the study are an important source of information for the regulatory bodies to promote sustainable development. This study is a visible indicator of social ethics and serves as a warning signal to the management of UPCL to make their operations more environmentally friendly.

Keywords: environmental impact assessment; thermal power plant; sustainable development; environmental degradation; power generation; social impact; India.

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1 Introduction

Increase in energy consumption results in pollution (Dincer and Rosen, 1998).Energy consumption is directly related to population increase. The development of infrastructure project has to care for the environment and the society. Taylor et al., (1995) state that all environmental alterations have social implications. It is the responsibility of governments, companies, individual and society to ensure that projects that benefit one set of people do not adversely affect other section. The environment plays a significant role in the development of country. Environmental status of a region represents overall health and sensitivity of the ecosystem. The method of predicting and evaluating the environmental consequences and measuring the impacts on the ecosystem by the proposed project is termed as Environmental Impact Assessment (EIA). Early detection of hazardous environmental impacts helps the people and the local government to revise and review the environmental acceptability norms of the proposed project. The environmental impacts are caused due to the activities like operation of coal-based thermal power plants, mining, road construction, dams and construction of the mega industries that alters bio-diversity of the region (ASI, 2009). It is a recognised fact that thermal power plants are serious pollution sources due to coal that is a non-renewable source of energy (Niu et al., 2009) in supply chain of energy production.

This study profiles the environment aspects of five villages including – Nandikur, Yellur, Santhoor, Padebettu and Padubidri that surrounds the UPCL thermal power plant and are located in Udupi District, Karnataka within the radius of ten kilometres from the centre of the plant operation. The people in the study region are facing high level of economic and environmental risk due to the prevalence of air pollution, soil pollution and water pollution because of the operation of plant. Fly ash, a by-product from thermal power plant causes adverse environment impact and this has resulted in loss of jobs, health problems, migration and environmental degradation (Somna et al., 2016). The settling of disposed fly ash has reduced the photosynthesis rate resulting in the drop of agricultural productivity in the vicinity of UPCL thermal power plant. Health related problems arising from improper disposal of fly ash are reported that has caused ailments like allergic bronchitis, silicosis, coughing, breathing problem and asthma. The environmentalists and social activists report that the UPCL has set up this coal-based thermal power plant at Nandikur in Udupi District without conducting a feasibility study. The ground water gets polluted because of the breakage of salt water pipeline and seeps into the surrounding wells making it unsuitable for consumption. Considering all the above aspects this study is being carried out in order to identify and assess the environment impacts of UPCL thermal power plant operations on the selected villages.

2 Objectives of the study

- To study the nature and state of the environmental impact of UPCL's thermal power generation operations in the vicinity of the company's location.
- To make an in-depth study of effects of air pollution in the Nandikur and the nearby villages, by assessing the present status of air, soil, and water.
- To evaluate the proposed pollution control measures.
- To identify and assess the decline in water table and salt water intrusion.
- To assess the impact of pollutants on the sensitive flora and fauna in the surroundings of UPCL thermal power plant.

3 Literature review

According to Avirneni and Bandlamudi (2013), fossil-fuel coal is abundantly available that is used for power generation in India. This coal is of low calorific value and has high ash content. Many of the coal-based thermal power plants installed in India lack the facility of automatic dry fly ash collecting system hence the fly ash and bottom ash are discharged in the form of slurry to the ash pond, causing dangerous effects on the environment, economy and the society. The global studies have reported that the coal-based thermal power plants are known to create hazardous effects on the environmental segments of the surrounding region (Pokale, 2012,). The emissions of large amount of SOX (oxides of sulphur), NOX (oxides of nitrogen) have worsened the environmental balance, causing respiratory related ailments on the human beings, flora and fauna. Further it affects the process of photosynthesis the major nutrients in the plants, soil fertility and corrodes buildings and other infrastructures. The emission of high amount of carbon dioxide (CO_2) from the thermal power plant causes global warming resulting in climate change. The ash pond (that stores the burnt coal) contains harmful heavy metals like boron, arsenic and mercury that over a period of time will leach out, polluting the nearby ground water and making it unsuitable for drinking and domestic purposes. The effect of thermal power plants on the environment is based on the three parameters such as rehabilitation and resettlement, destruction of the civic amenities and the health hazards caused to the individuals (Pokale, 2012). In a study conducted on the environmental impacts of Barapukuria thermal power plant situated at Bangladesh (Alam et al., 2011) it was found that the pH value of the water was slightly alkaline and the surface water was contaminated by bacteria. The surface water sources, water quality, air quality, ground water sources, noise level, health condition, landscape and ecology were negatively affected by the operation of the project. The above mentioned negative impacts were caused due to the site preparation, raw materials handling, refining, and preparation of fuel, fabrication, power generation, reprocessing, transport activities and the storage of wastages caused by the project.

Thermal power plant relies on the coal burning practice and the burnt coal creates a residue as a fly ash. The commonly available fly ash disposal facility for the coal-based thermal power plants is the ash pond. Due to the deposition of fly ash in the ash pond, the heavy metals present in the fly ash sink into the soil and leach into the ground water over a period of time. It has been observed that the presence of heavy metals such as iron, calcium, and magnesium have deteriorated the ground water quality. The leaching potential of heavy metals from the ash ponds was found higher during the seasonal changes. In a study conducted on the effect of pond ash on ground water quality (Suresh et al., 1998) observed that the fly ash leaching had an adverse effect on the water ecosystem while the solid particles were emitted to the atmosphere. Disposal of fly ash is done in wet slurry and in some cases through dry disposal process. In both the disposal methods, the fly ash is dumped in an open land that results in degradation of soil, and eventually causing air and water pollution, ultimately affecting the human health. In a similar study conducted in Kosova it was observed that underground water contamination was due to ash deposits (Avdullahi and Fejza 2010).

The fly ash and the particles are harmful to human health and hence continuous exposure to fly ash result in irritation of eyes, nose, throat, skin, respiratory tract and it may even enter the blood stream. Improper disposal of fly ash result in land, water and atmospheric degradation (Sharma and Kalra, 2006).The major problem faced by the nations of the world is the atmospheric pollution. The rapid industrial growth has resulted in harmful waste products that are being released into the atmosphere. The air pollution that is caused by the coal-based thermal power plants has adverse effects on the soil, water, vegetation, crops, animals and wildlife, weather, buildings, man-made materials, climate, transportation, production of crops, it also reduces the economic value, wellbeing and personal comforts. The major source of air pollution is the release of significant amount of SO_2 (sulphur dioxide), NOX (nitrogen oxides), CO (carbon monoxide), CO_2 (carbon dioxide), smoke, dust and fly ash (Balaceanu and Cepisca, 2011).The production of power in India (70%) is mainly due to coal-based thermal power plants, to produce 90,000 MW of electricity to meet the demand. The air pollution caused by the coal-based thermal power plants has adverse impacts on the soil, water, ecosystem, vegetation and human health, in the vicinity of the plant situated.

When coal is burnt in the thermal power plant it is found that the traces of mercury present in coal is released to the environment. In addition mercury enters the hydrological system through the disposal of fly/bottom ash in the ash pond. During the process, the mercury gets methylated and enters the human food chain system. Among the various toxic heavy metals, the emission of mercury is of high concern. When the food chain systems are exposed to high levels of mercury there is a high risk of damaging the kidneys, brain, heart, immune system and lungs of the people. The average concentration of Mercury in Indian coal ash is 0.53 mg/kg based on the measurements taken from the selected few power plants (Rai et al., 2013).

The coal that is used in Indian coal-based thermal power plants is bituminous and sub bituminous, that releases 40% of fly ash on combustion. Burning of these coals releases toxic heavy metal like Arsenic that is toxic to humans, terrestrial and aquatic life. The coal combustion residues include boiler slag, fly ash, bottom ash and flue gas desulphurisation that causes health and other environmental related problems. The Industrial Toxicology Research Centre (ITRC), Lucknow, India, studied the environmental risks in the Singrauli region that is also known as 'Energy capital' of India with operation of six thermal power plants and situated in the south eastern part of Uttar Pradesh, India. During the establishment of these thermal power plants a large population has been shifted to other region (location, area). Also, due to the operation of these power plants, there exists high level of contamination of surface water, ground water, man-made reservoirs; in addition heavy metals were deposited on the soil that was above the permissible limits. It was also cited that the Mercury level in the blood samples of the human population of Singrauli region was high (Pandey et al., 2011; Rai et al., 2013). The study conducted at Yellur, Udupi district by (Ramachandra et al., 2012) reported that there is a reduction in the land cover by vegetation and area under crops within a span of eight years. Also the community was affected by health issues, reduced crop productivity, infrastructural damages due to fly ash dust, salinity and heavy metal vaporisation. By the interaction with the local farmers it was revealed that the paddy yield had declined drastically by 57–66% (Ramachandra et al., 2012).

4 Research methodology

This study uses descriptive research based on primary data. The primary data was collected using questionnaire with Likert type five-point scale. Statistical analysis of data is carried out using factor analysis, principal component analysis and one-sample t-test. The statistical tool used for analysis is IBM Statistical Package for Social Sciences (SPSS) software version 22.0.

4.1 Sampling design

The sampling frame for this study includes the population residing in the five villages surrounding the UPCL plant namely Yellur, Nandikur, Padebettu, Santhoor and Padubidri. The population for the study includes all the major stake holders including the farmers residing in the affected villages, people from small scale business groups, environmental experts, physicians, social and media group. The simple random sampling technique was the procedure adopted for the study. The total population of five villages surrounding the UPCL plant are as follows.

$$\mathrm{N_p} = \text{Size of sample i.e. total population of the five villages}$$
$$= \text{Population of Nandikur} + \text{Yellur} + \text{Padebettu} + \text{Santhoor} + \text{Padubidri}$$
$$= 2{,}987 + 5{,}453 + 1{,}865 + 2{,}461 + 12{,}958$$
$$\mathrm{N_p} = 25{,}724$$

4.2 Sample size calculation

The sample size is calculated using the equation (1) (Kothari, 2009)

$$n = \left(Z^2 * p * q * N_p\right) / \left(e^2 * \left(N_p - 1\right)\right) + \left(Z^2 * p * q\right) \tag{1}$$

where

Z = 1.96 (the table scores for normal distribution within selected range of z for *a* confidence level of 95%)

P = proportion of the defects in the universe (2% defect is assumed)

$q = (1 - p)$

N_p = total finite population 25,724

e = acceptable error (error 2% of the true value is assumed)

n = 189 (minimum sample size).

As per the above sample size calculation, 189 is the minimum sample size to be collected but statistical accuracy is a function of the sample size and larger the sample size greater the statistical accuracy of the results. Hence it was decided to have a sample size of 552 for the actual analysis.

The data was collected with random respondents from the following villages as per the distribution given in Table 1.

Table 1 Respondents selected for survey

Village name	*Samples collected*
Nandikur	134
Yellur	213
Santhoor	93
Padebettu	20
Padubidri	92
Total	552

To achieve the objective and answering the research queries the following hypothesis were framed:

H_{01} UPCL plant operations do not have impact on the environment of the surrounding villages.

H_{a1} UPCL plant operations do have an impact on the environment of the surrounding villages.

H_{02} The industrial wastes from the UPCL plant are properly disposed and do not cause any problems in the locality.

H_{a2} The industrial wastes from the UPCL plant are not properly disposed and cause problems in the locality.

H_{03} UPCL plant has proper drainage systems in place and does not affect the land, water, soil of the locality.

H_{3a} UPCL plant does not have proper drainage systems in place and it affects the land, water, soil of the locality.

H_{04} The quality of air, water and soil in the Nandikur and nearby villages is not affected by the UPCL plant operations.

H_{4a} The quality of air, water and soil in the Nandikur and nearby villages is affected by the UPCL plant operations.

H_{05} The quality of drinking water is not affected by the UPCL plant operations.

H_{5a} The quality of drinking water is affected by UPCL plant operations.

H_{06} The UPCL plant operations have not affected the soil and agricultural activities in the surrounding villages.

H_{6a} The UPCL plant operations have affected the soil and agricultural activities in the surrounding villages.

H_{07} The yield of crops has not been affected due to the UPCL plant operations.

H_{7a} The yield of crops has been affected due to UPCL plant operations.

5 Results and discussion

The analysis is based on the data collected from 552 samples. Following statistical tests are used to achieve the objectives of this research: factor analysis, principal component analysis and one-sample t-test with the results of the said statistical tests are shown in the next section.

5.1 Factor analysis

The purpose of factor analysis is data reduction (Robinson et al., 1992). Factor analysis is used to get small set of variables (preferably uncorrelated) from a large set of variables (most of which are correlated to each other). Factor analysis creates indexes with variables that measures similar things and it identifies correlation between and among variables to bind them into one underlying factor driving their values. Since, the factors for evaluating the environmental dimensions were already defined in the literature confirmatory factor analysis are conducted for each dimension. The Kaiser-Meyer-Olkin (KMO) and Bartlett's test is done and is applied to resultant correlation matrix to test whether sample adequacy and measure the predicted values narrow. The KMO measure of sampling adequacy test is based on the correlation and partial correlation of the variables. Use of factor analysis is significant when the test value in KMO measure is closer to one, if KMO is closer to zero then factor analysis is insignificant for the variables and the data. Table 2 shows the value of test statistic as 0.951 that means the factor analysis for the selected variables is found to be appropriated to the data.

Table 2 Results of KMO and Bartlett's test

Measure of sampling adequacy		*0.951*
	Approx. chi-square	15515.24
Bartlett's test of sphericity	df	465
	Sig.	0.0001***

Note: ***þ < 0.0001.

To support this Bartlett's test of sphericity is used to test the correlation identity matrix that considers all the diagonal terms in the matrix as one and the off diagonal terms as zero. In short it is used to test whether the correlation between all the variables is zero and the value (15,515.24) and with significance level as þ < 0.001. With the value of test statistic and associated significance level being small, it appears that the correlation matrix is not an identity matrix which implies that there is an existing correlation between the variables. On similar ground the pre factor reduction practice was tested for environmental dimension through KMO measure of sampling test.

Table 3 Results of KMO and Bartlett's test for environmental dimension

KMO measure of sampling adequacy		*0.937*
	Approx. chi-square	6130.71
Bartlett's test of sphericity	df	45
	Sig.	0.0001***

Note: ***þ < 0.0001.

Results of the test show the statistical value as 0.937 that depicts the factor analysis for the selected variable is found to be appropriate to the data.

5.2 *Principal components analysis*

Once the eligible criteria for factor reduction is accepted then comes the determination of the method of factor extraction, number of initial factors and the estimates of factors. Principal Component Analysis (PCA) is used to extract factors. The PCA is a method used to transform a set of correlated variables into a set of uncorrelated variables (in this case factors) so that the factors are unrelated and variables selected for each factor are related. The PCA in this case is used to extract number of factors required to represent the data. Table 4 shows the values of principal component analysis of environmental dimension.

Table 4 Total variance explained for the environmental dimension

Component	Initial eigenvalues			Extraction sums of squared loadings		
	Total	*% of variance*	*Cumulative %*	*Total*	*% of variance*	*Cumulative %*
1	7.415	74.149	74.149	7.415	74.149	74.15
2	0.711	7.108	81.257			
3	0.494	4.944	86.200			
4	0.356	3.565	89.765			
5	0.296	2.958	92.723			
6	0.231	2.308	95.031			
7	0.173	1.733	96.764			
8	0.121	1.209	97.973			
9	0.111	1.112	99.084			
10	0.092	.916	100.000			
Extraction method: orthogonal rotation PCA						

Table 5 PCA with RCM for the environmental dimension

Statement (item description)	*Component one*	*Factor extracted name*
The quality of air in the area surrounding the plant is good.	0.836	
The quality of drinking water sources is excellent in the village.	0.849	
The water quality of irrigation systems is suitable for agriculture.	0.865	
The industrial wastes from the plant are properly disposed and do not cause any problems in the locality	0.907	
The plant has proper drainage systems in place and does not affect the land, water or soil of the locality	0.896	
There has been no reduction in agricultural land suitable for cultivation due to UPCL operations.	0.923	Environmental dimension
The soil fertility has not been affected due to the plant operations.	0.913	
The grazing area for livestock/cattle has not been affected due to UPCL operations.	0.912	
There has been no deforestation in and around the area where the plant is located.	0.850	
Noise from the plant is not causing any sleeping disorders for the people in the village	0.619	

Note: **þ < 0.001.

The second column in the above result (see Table 4) the initial eigenvalues of the % of variance, it is found that the variances on the new factors were successively extracted. In the third column these values are expressed as a percent of total variance, is attributed to about 74.15% of total variance. As expected the sum of Eigen values is equal to number of variables. The third column contains the cumulative variance extracted. From the measure of how much variance each successive factors extract decides the number of factors to retain or to remove. Retaining only those factors with Eigen values greater than one (Suryanarayana, and Mistry, 2016). This criterion is probably the one most widely used and is followed in this study also. In this study, using the above criterion three principle factors are retained.

The idea of factor analysis is to identify the factors that meaningfully summarise the set of closely related variables, the rotation phase of factor analysis attempts to transfer initial matrix into one that is easier to interpret, commonly termed as Rotated of component matrix (RCM).

The result obtained after the PCA and rotated component matrix with ten items of the questionnaire on the environmental dimension indicates that the values range from lowest 0.619 to highest 0.923 (Table 5).

One sample t-test is a statistical procedure used to test whether the null hypothesis is to be rejected. The test was carried out for this study and the results are as seen on Table 6.

Table 6 Hypothesis test by one sample t-test

Hypothesis	*Mean (μ)*	*Standard deviation*	*t- value*	*p value*
Hypothesis 1 H_{a1}	2.0121	1.13341	–20.478	< 0.01**
Hypothesis 2 H_{a2}	1.9710	1.28197	–18.858	< 0.01**
Hypothesis 3 H_{a3}	1.9620	1.27677	–19.102	< 0.01**
Hypothesis 4 H_{a4}	2.0503	1.21183	–18.413	< 0.01**
Hypothesis 5 H_{a5}	2.2101	1.41910	–13.077	< 0.01**
Hypothesis 6 H_{a6}	1.9609	1.18376	–20.624	< 0.01**
Hypothesis 7 H_{a7}	2.0163	1.27296	–18.156	< 0.01**

The Hypothesis H_1 to H_7 were tested using one sample t-test with the test value of three which corresponds to neither agree nor disagree according to the questionnaire which is used for the data collection.

Hypothesis 1: The result of one sample t-test for this hypothesis showed that the UPCL plant operations has an impact on the environment of the surrounding villages ($\mu = 2.0121$, t is –20.478, $p < 0.01$). Hence, the null hypothesis H_{01} is rejected at 1% significance level.

Hypothesis 2: The result of one sample t-test for this hypothesis showed that the industrial wastes from the UPCL plant are not properly disposed and causes problems in the locality($\mu = 1.9710$, t is –18.858, $p < 0.01$). Hence, the null hypothesis H_{02} is rejected at 1% significance level.

Hypothesis 3: The result of one sample t-test for this hypothesis showed that the UPCL plant does not have proper drainage systems in place and it affects the land, water, soil of the locality ($\mu = 1.9620$, t is –19.102, $p < 0.01$). Hence, the null hypothesis H_{03} is rejected at 1% significance level.

Hypothesis 4: The result of one sample t-test for this hypothesis showed that the quality of air, water and soil in the Nandikur and nearby villages is affected by the UPCL plant operations (μ =2.0503, t= –18.413, $p < 0.01$). Hence, the null hypothesis H_{04} is rejected at 1% significance level.

Hypothesis 5: The result of one sample t-test for this hypothesis showed that the quality of drinking water is affected by UPCL plant operations (μ = 2.2101, t is –13.077, $p < 0.01$). Hence, the null hypothesis H_{05} is rejected at 1% significance level.

Hypothesis 6: The result of one sample t-test for this hypothesis showed that the UPCL plant operations have affected the soil and agricultural activities in the surrounding villages (μ = 1.9609, t is –20.624, $p < 0.01$). Hence, the null hypothesis H_{06} is rejected at 1% significance level.

Hypothesis 7: The result of one sample t-test for this hypothesis showed that the yield of crops has been affected due to UPCL plant operations (μ = 2.0163, t is –18.156, $p < 0.01$). Hence, the null hypothesis H_{07} is rejected at 1% significance level.

The negative t value indicates that the sample mean is less than the hypothesised mean and all are significant at þ < 0.001 (significant at 1% level) thus providing evidence to reject the null hypothesis (Kothari, 2016).

6 Discussion

A study of current status of the environment (soil, air, and water) and decline of water table-salt water intrusion in the villages surrounding the UPCL was carried out in the villages surrounding the UPCL within the ten kilometre range: Nandikur, Yellur, Santhoor, Padebettu and Padubidri which surround the UPCL plant and are located in Udupi Taluk, Udupi District, Karnataka. During the field survey the qualitative data was collected from the people (local experts, farmers, residents) pertaining to their land, soil, water, phenological aspects (flowering), crop productivities, rehabilitation and resettlement, health problems and socio-economic aspects. Interviewing the local farmers and the people residing in the above mentioned villages has been done in order to know the before and after effects of the operation of the UPCL plant (Ramachandra et al., 2012).

A study on the nature and state of the environmental impact of UPCL's operation in the vicinity of the company's location was done in detail. Study was also conducted on the decline in water table and salt water intrusion in the surrounding villages. Qualitative data was collected pertaining to the set objectives and pictures were taken during the field visit in order to support the observations. With the comparison of above observations and the analysis of the 552 samples collected the following conclusions were drawn:

- The result from the Table 6 of one sample t-test for Hypothesis 1 showed that the UPCL plant operations have an impact on the environment of the surrounding villages.
- The result of one sample t-test for Hypothesis 2 showed that the industrial wastes from the UPCL plant are not properly disposed and causes problems in the locality.
- The result of one sample t-test for the 3rd Hypothesis showed that the UPCL plant does not have proper drainage systems in place and it affects the land, water, soil of the locality.

- The result of one sample t-test for this Hypothesis 4 showed that the quality of air, water and soil in the Nandikur and nearby villages is affected by the UPCL plant operations.
- The result of single sample t-test for Hypothesis 5 clearly shows that the quality of drinking water is affected by UPCL plant operations.
- The result of one sample t-test for Hypothesis 6 showed that the UPCL plant operations have affected the soil and agricultural activities in the surrounding villages.
- The result shows that the yield of crops has been affected due to UPCL plant operations as evident in the Hypothesis 7.

Hence, the operations of thermal power plant has caused negative impact on the environment (soil, water, air) in the villages surrounding the UPCL, Karnataka in India.

7 Conclusions

Because of the environmental impact by these thermal power plant natural resources like plants, trees, precious plants and other species are affected. The settling of disposed fly ash has reduced photosynthesis rate resulting in the drop of agricultural productivity in the vicinity of the plant. Leaf burn, drying of leaves and premature falling of leaves (saplings) are observed in coconut, arecanut, banana, jackfruit, paddy, mango, jasmine, thulsi and various other fruit bearing trees and vegetation. Because of this cultivation, vegetation and the yield is reduced. A large number of plants and trees perished because of the effluent, salty water seeping into the surrounding areas. In short the UPCL operation has caused negative impact on the environment. There exists an abandoned agriculture and horticulture field, because the streams are contaminated with seepage into to the agricultural fields due to which the fertility of the soil is reduced. Soil has become unproductive and unfit for agriculture.

Because of such environment issues people have stopped growing household vegetables which has affected them economically. The use of effluent contaminated water for cultivation of paddy has drastically reduced crop yield. Salty dew drops are seen on the plants early in the morning due to the discharge from the cooling towers. Black dust deposition (fly ash) is seen on the vegetation and the surroundings at least to a range of two kilometres. There exists stunted growth of plants and trees in this vicinity. Corrosion is found on the iron pillars, agriculture equipment's, iron sheets, dish antennas, motor pump set, windows, electrical wires and other metal elements in the nearby houses. Corrosion of transmission lines reduces the diameter of the cable and may cause danger to life of the people.

8 Future scope

The study may get extended in the future by conducting experimental investigation of water, air and soil surrounding the UPCL plant to measure the pollution level. The UPCL authorities must take initiative to carry out in-depth study based on socio-economic impact by company operations on surrounding villages to become a socially responsible company. An extensive study on cost benefit analysis in mega power generation plant adds value to the society in preserving the eco-status of the surrounding villages. New frame work towards green power generation project helps to mitigate the impact of the environment.

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