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Environment Impact Assessment of Thermal Power Plant for Sustainable Development

Sameer Kumar[1], Dhruv Katoria[2] and Dhruv Sehgal[3]

Department of Environment Engineering, Delhi Technological University (D.C.E), Bawana, Delhi, India.

Abstract

Thermal Power plants are the major source of generation of electricity for any developing country. Around 60% of electricity generation in our country is met by thermal power plants. Fuel is blown into the combustible chamber of the boiler where it is burnt at high temperature where Heat energy converts water into steam. High energy steam is passed through the turbine and the steam creates force on the turbine causing the shaft to rotate at high speed. A generator is coupled at one end of the turbine shaft which generates power. The thermal power plant has serious impacts on land , soil, air and various social impacts the thermal power plant are also said to emit large amount of mercury and generate large quantity of fly ash which destroys the surrounding environment. These plants also consume a large amount of water. Due to these problems they require a proper Environmental impact assessment before commencement of the project which is not done judiciously in our country. Various mitigation measures for the control of pollution caused by thermal power plants along with some new technologies are discussed.

Keywords: Thermal Powerplant, Environment Impact assessment, Open cycle system, Close cycle system, SOX, NOX.

1. Introduction

A thermal power station is a power plant in which the prime mover is steam driven. Water is heated, turns into steam and spins a steam turbine which drives an electrical generator. After it passes through the turbine, the steam is condensed in a condenser

and recycled to where it was heated; this is known as a Rankine cycle. The greatest variation in the design of thermal power stations is due to the different fossil fuel resources generally used to heat the water. Some prefer to use the term *energy center* because such facilities convert forms of heat energy into electrical energy. Certain thermal power plants also are designed to produce heat energy for industrial purposes of district heating, or desalination of water, in addition to generating electrical power. Globally, fossil fueled thermal power plants produce a large part of man-made CO_2 emissions to the atmosphere, and efforts to reduce these are varied and widespread. The energy efficiency of a conventional thermal power station, considered salable energy produced as a percent of the heating value of the fuel consumed, is typically 33% to 48%.

2. What is EIA

An environmental impact assessment (EIA) is an assessment of the possible impacts that a proposed project may have on the environment, consisting of the environmental, social and economic aspects.The purpose of the assessment is to ensure that decision makers consider the environmental impacts when deciding whether or not to proceed with a project. The International Association for Impact Assessment (IAIA) defines an environmental impact assessment as "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made. EIAs are unique in that they do not require adherence to a predetermined environmental outcome, but rather they require decision makers to account for environmental values in their decisions and to justify those decisions in light of detailed environmental studies and public comments on the potential environmental impacts.

Environmental issues related with Coal based power sector during construction phase

Table 1

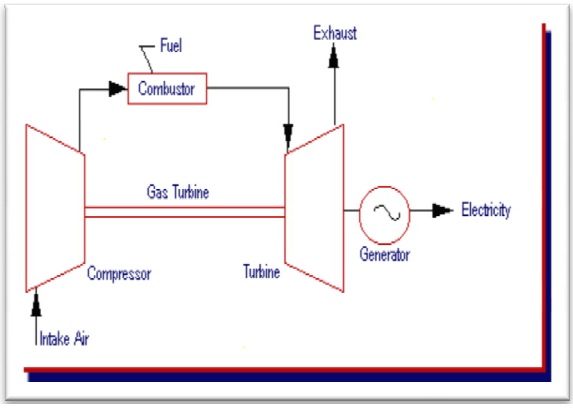
Activities/Issues	Impacts
Change in land use pattern/ Site clearing	• Erosion • Loss of biodiversity • Loss or change of soil quality and quantity
Civil works such as earth moving and building of structures	• Huge diversion and acquisition of land in case of power plant with captive mine • Dust pollution Noise pollution

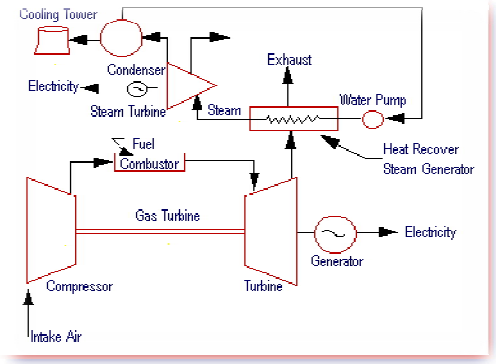
Environmental impact during operational stage
Among thermal based power generation, coal based power plants are highest in: Air pollution, Waste generation ,Water consumption ,Emission of mercury ,Greenhouse emission

Impact of Thermal power plant on water source
Water Intensive

- New thermal power plant of 500 MW installed capacity requires – around 14 million m3 of water per annum.
- High impact on river & ground water
- Water demand for the once-through system is 30 to 50 times that of a closed cycle system.

3. Types of Cycle





Open Cycle system Close Cycle System

Use of Open Cycle System has been prohibited due to moreefficiency of closed cycle system than open cycle system andbecause of economical reasons.

4. Thermal power plant: Largest emitter of mercury[7]

- Typical power plant emits 90 % of its mercury into the air and 10 percent on land
- On an average 65 tonnes of mercury released in the atmosphere by Indian thermal power plant.

5. Air pollution due to thermal power plants

5.1 Air Pollution from point source:

Particulates matter, Gaseous emission - Sulphur dioxide, oxides of nitrogen, carbon monoxide, carbon dioxide, Hydrocarbon.

5.2 Air Pollution from non-point source:

- Transportation of coal, Loading/unloading of fuel, Coal storage yard,Fly ash handling & Transportation.,Coal storage yard

6. Thermal power plant: Potential source of water pollution

1) Sources of water pollution
   - Cooling Tower Blow Down,Boiler Blow Down, Demineralisation (DM) Plant Effluent,Coal Handling Plant Dust Suppression ,Ash handling (Leachate of heavy metal (ash pond) contaminate groundwater) ,Effluent from oil handling and transformer areas ,Power House and Turbine Area Effluent ,Domestic waste water

Remediation Measures in thermal power plant

2) Air pollution control – Point source
   - For boiler stacks – ESP/Bag house.
   - Coal crusher – Bag filter
   - Coal mill – Bag filter

Table 2

SOx control technology	NOX control technology
• Use of alternative fuel • Use of low sulphur containing fuel • Lime dosing • High stack	• NH3 injection • Use of low NOX burner • Flue gas recirculation

3) Fugitive Dust Control
   - Covered storage yard for coal
   - Closed unloading of coal with adequate dust suction device
   - Closed conveyor belt for transportation of raw

Material with bag filter at every transfer points

4) Fly Ash Management
   - Ash disposal site shall be lined to prevent metal contamination.

- Construction of green barrier all around the ash pond.
- Pizometric hole shall be constructed upside and downside of the ash pond.
- Recycling of ash pond effluents.
- Switching from medium concentration slurry disposal system (MCSD) with ash concentration in slurry 40-45% to high concentration slurry disposal systems (HCSD) with ash concentration in slurry 65-72%

7. New Technological Practices

5) Super Critical Technology
   - Larger unit size (more than 500 MW) Higher thermal efficiency (of 5% and above)
   - Low gaseous & soot emissions

6) Fluidised Bed Combustion **(**CFBC/PFBC)
   - Can burn wide range of coals and other fuels such as pet coke, lignite etc.
   - Higher thermal efficiency (>40%)

8. Water Conservation Techniques

Big power plant - Closed loop instead of open loop ,Small power plant - Air cooling instead of water cooling ,Recycle and reuse of process and effluent water ,Zero discharge in case of small plant ,Demineralised backwash water shall be treated with RO and reuse in process ,Collection of rain water which can be used for many purposes

9. Practices to Reduce Transportation Impact

Encourage bulk transportation by train, Only pollution certified vehicles should be engaged in transportation , Appropriate infrastructure for vehicles such as concrete or pitched road ,Separate approach road for transportation of raw materials such as coal, diesel, caustic etc.

10.Practices for Soil Management

Provision for topsoil storage and reuse, Separate stacking of topsoil with adequate collection rain all around

, Topsoil storage heap should be covered with grasses and bushes to avoid erosion , Removing vegetative cover only from the specific site on which construction has to take place.

11. Practices for Reducing Noise Pollution

- Design of equipments, Acoustic enclosures / barrier shields ,Construction of sound barrier in the form structure , Personal protective equipment i.e. ear plug & ear muffs ,More than 33 % of total area under green cover

Recommendation of dust scavenging plant (reduce 5 to 6 dB noise)

- Azardirachta indica (Neem),Polyalthia longifolia (Ashoka),Callistemon citrinus (Bottle Brush),Termanilia catappal (Jangal Badam),Terminalia arjuna (Arjun),Melia azedarch (Melia),Phoenix dactylifera (Khjoor)

12. Conclusion

On studying the whole thermal power plant we have come to a curb that though thermal power plant generates electricity but it is troublesome for the environment so we have to deal it with the technique mentioned in our research for reducing its consequences.

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