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Regulation of suspended particulate matter (SPM) in Indian coal-based thermal power plants: A static approach

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Abstract

This study aims to find the best policy, which would induce the Indian coal-based power plants to abate particulate emissions in the most cost effective way. The empirical analysis of the power plants suggests that replacing the age-old boilers is of utmost importance along with switching to low-ash albeit expensive coal is cost effective. Installation of pollution control equipment in the form of an ESP or a baghouse depends on the target emission level. In the Indian scenario an ash tax can be considered the best policy instrument along with an emission tax to induce the power plants to adopt the cost efficient technology.

JEL classification: Q49; Q53

Keywords: Power plants in India; Particulate matter; Pollution control

1. Introduction

The concern for air quality has been an issue with Indian government for the past few years. Growing urbanization along with industrial and vehicular pollution is leading to environmental degradation faster than in other countries. A study by USAID in 2001 found that in "14 of India's 20 largest cities, citizens breathe air the government deems "dangerous." Six cities endure levels of airborne particulates at least three times the World Health Organization standards. A thriving industrial base and rapid economic growth–about 5% a year–account for much of the

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severe pollution, which costs India an estimated $9.7 billion a year in environmental damage" (USAID, p.1, 2001).

Many of the environmental problems that confront India today are connected to the use of energy. The emissions that arise due to burning of fuel are mainly air borne. These are emitted into the air and are small enough to be suspended in the atmosphere. *Suspended particulate matter (SPM)* levels in the air have been found to be at critical levels in urban cities, especially in residential areas, in India. The ambient levels of SPM in most of the urban areas of India are above 150 mg/m^3, which far exceeds the WHO standards of 50 mg/m^3 (CPCB, 2000b). The Central Pollution Control Board (CPCB) in India has set the standards for particulate matter at 150 mg/m^3. Alternatively, the WHO guidelines propose that if the goal of 50 mg/m^3 is not achievable, then at least the efficiency of the pollution control equipment should be designed at 99.9% and should be operated for at least 99.9% efficiency (TERI, 2000). At present, there is no strict penalty for non-compliance in India.

The coal-based thermal power plants in India are considered to be one of the chief industrial emitters of SPM in India. These plants use lower grade high ash coal, which generates large amounts of ash when burnt. This burning of high ash coal power produces huge amounts of particulate emissions. Even though the Indian government is trying to use this ash waste into various uses like brick making, this effort is very minimal (reference). Moreover the power plants are facing the problem of dumping this huge ash deposit. Ash generation was about 100 million tons in 2000. A bare 10% has been utilized so far. This ash disposal and utilization is an area of concern for the Indian government. Several projects are underway and few other technologies are in demonstration stages in India (Kumar et al., 2000).

Coal-based power plants constitute 62.3% of electric power generation in India. Increasing reliance on coal as the main fossil fuel in thermal power generation has led to numerous environmental problems. Table 1 gives the share of coal and other fuels in electric generation along with the amount of SPM emitted per kilogram of fuels used.

There are two globally accepted technologies for the abatement of particulate matter. They are the Electro-Static Precipitators (ESP) and baghouse. An ESP is considered a cheaper option than a baghouse. Presently the power plants in India use an ESP as the pollution control device. However, the efficiency of the ESPs in India is adversely affected due to the low sulfur content and the abrasive nature of high ash domestic coal. The World Bank has been funding various studies in India to study the efficacy of baghouse over an ESP as an effective mechanism to control pollution in the Indian coal-based power plants. Baghouse even though more expensive than an ESP is not sensitive to the ash content of the coal.

The purpose of this paper is twofold. First, to study the cost effectiveness of the various options available to the power plants. Second is to study the best possible policy, which will induce them to adopt these cost effective options to reduce the emissions of SPM. The issue is to study whether it is possible to reduce the emissions of particulate matter more cost effectively other than by just installing a baghouse. The aim here is to compare the policy options given the costs of each technological option.

Table 1
Share of fuel in electric generation and emission per unit

Fuel	Share in electric generation	SPM emitted
Coal	62.3%	85 g/kg
Oil	10.2%	1.7 g/kg
Natural gas		2.7 g/kg