



Centre of Excellence for Research on Clean Air (CERCA)

Indian Institute of Technology Delhi

Research on Air Pollution and Climate Change

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Editorial

Improving Thermal Power Efficiency - A Long term solution for Delhi

The COVID-19 lockdown resulted in dramatically lowering pollution in the capital city, with the air quality index returning to 'satisfactory' levels. However, with the activity levels returning to normal, coupled with a drop in temperatures, resumption of industrial operations and stubble burning by farmers, pollution levels are back to dangerous levels in Delhi. **The average annual PM_{2.5} concentration across India was 58.1 µg/m³ in 2019, whereas Delhi alone recorded an average PM_{2.5} concentration of 98.6 µg/m³ thereby making it the most polluted capital city in the world!**

It is well accepted that coal-based thermal power plants, which account for 77% of the electricity generated in the country, will continue to meet most of India's power requirements for many years to come. However, **Thermal Power Plants (TPPs) are a major source of air pollution and GHG emissions. There is a need to develop an acceptable environmental impact rating system (EIR) for prioritising off-take of power from cleaner plants, leading to public health benefits.** The current Merit Order dispatch system should be refined to prioritize power evacuation from plants with low adverse health impact, low variable cost and low global warming impact. Each TPP can have an opportunity to upgrade its EIR number by improving its thermal efficiency, installing emission control equipment such as FGD, and using a higher quantity of Biomass. Further, long term investment in coal-based power should be completely stopped. **The cost of installing pollution control technology can be recovered through tariff hikes. In addition, based on the principle of Polluter Pays, the economic cost of producing cleaner coal-based power can be borne equitably by the industrial, agricultural and domestic consumers, and also supported by Govt grants. The biggest positive spin off, of this exercise, would be visible in terms of cleaner air and improved public health, making the investment well worth the effort.**



Delhi The Most Polluted Capital City In The World !

Comparative Delhi PM 2.5 Graph



A 25% increase in PM 2.5 levels in January 2021 vs. January 2020 have been observed.



CERCA Events & Expert Opinions

Delhi City Science and Technology Cluster - Tackling Air Pollution Aggressively: Despite a series of measures taken in the last two decades, annual particulate matter (PM) levels in Delhi remain more than double the national ambient air quality standard (NAAQS).

This project aims to help Delhi, first, to attain the National Clean Air Program target of 20-30% reduction in PM levels in the next few years, and then also lay the foundation for bigger and more aggressive interventions in the next phase. The broad objective of the proposal is to tackle the air pollution problem in Delhi by providing technical and academic support to the pollution control boards for efficient implementation of the clean air action plan.

Calibration of low-cost sensors by Beta Attenuation Monitor (BAM) installed by CERCA at IIT Delhi used in two crucial projects:

In recent years, use of low-cost sensors is gaining importance to address the spatio-temporal gap in sampling. CERCA has installed BAM (Beta Attenuation Monitoring) equipment at IIT Delhi, which is a regulatory grade equipment for measurement of PM_{2.5} on a continuous basis. Currently, co-location activity for two projects is being carried with BAM to validate different low-cost sensors, the NASA Citizen Science project, supported by NASA and RTI in collaboration with IIT Delhi and CEEW; and the DAPHNE study, which was conceptualized in collaboration with the UK investigators under the joint Indo-UK program on Air Pollution and Human Health (APHH) in mega-cities to fill up gaps in local evidence.

Regression-based flexible models for photochemical air pollutants in the national capital territory of megacity Delhi:

- Site-specific models with meteorology have better performance over the indicative city level model.
- Lower degrees of polynomial transformation on pollutant prediction show smaller error.

[Read More>](#)

Natural ventilation in warm climates: The crucial 8 percent difference:

In designing buildings, there is a need to be able to cope with increasing heatwaves and pollution, particularly in warm climates. This review paper looks at the ability of natural ventilation to provide adequate thermal comfort, resilience against heat waves, and good Indoor Air Quality in warm climates. A critical synthesis of the literature suggests that these systems can generate high ventilation rates and keep indoor temperatures around 8 °C cooler than outdoor temperatures in warm weather (>35 °C).

[Read More>](#)

Environmental Rating of Coal-Based Thermal Power Plants

Riya Rachel Mohan and Priyavrat Bhati, Center for Study of Science, Technology and Policy (CSTEP)

Studies point out that despite the Government of India's renewable energy target of 450 GW by 2030, electricity generation from coal-based thermal power plants (TPPs) will still be more than half of the total supply. TPPs release pollutants, such as sulphur dioxides (SO_x), oxides of nitrogen (NO_x) and particulate matter (PM), which have a serious impact on human health. Coal mining and fly ash from coal combustion pollute both surface and ground water. Additionally, TPPs are responsible for around 40% of India's total GHG emissions. Any form of climate action has to address emissions from coal power plants.

To rein in pollutants from coal-based TPPs, the Ministry of Environment, Forest and Climate Change (MoEFCC) announced stringent norms in 2015, which the TPPs were required to comply with by December 2017. However, there has been little progress in installation of pollution control measures. For instance, only 6 units (2.2GW) have so far installed Flue Gas Desulphuriser (FGD), which cuts SO_x emissions, against a plan for 448 units (169.7 GW). Several reasons, such as huge investment, technology unsuitable for Indian coal, inappropriate norms, etc., have been cited for the delay. This is unfortunate given that several studies emphasise that the health benefits of implementing these standards outweigh the investment costs.

India's environment protection regulatory framework relies on punitive actions, such as environmental penalties, plant closure, etc., which are neither effective nor practical. We believe that economic tools that incentivise generation by cleaner power plants while penalising the polluting ones will be far more efficient.

The Way Forward

To expedite the adoption of emission control technologies as well as to incentivise generation by cleaner, efficient plants, we suggest modifying the Merit Order Dispatch (MOD), the policy mechanism used by DISCOMs to schedule power from generating units in the order of lowest variable cost.

Many old, inefficient plants have low variable costs due to access to cheap coal. In addition, the new emission norms for older, smaller units are lesser, and can be met by installing cheaper control measures, giving them additional cost advantage compared to newer, efficient TPPs.

This outcome is the opposite of what is desired but, under our proposed recommendation, it can be addressed by modifying the MOD mechanism.

We suggest supporting generation of cleaner plants and offsetting the unreasonable cost penalty being borne by them by considering environmental externalities of TPPs. First, we should assess the environmental externalities of TPPs – spread of emissions, impact of air pollution on health of communities, GHG emissions that are driven by plant efficiency, water use and pollution, fly ash management. These negative impacts can be consolidated to generate an overall Environmental Impact Rating (EIR), say from 1 to 10, with 1 being the cleanest.

The EIR can then be translated into an environmental cost using a scaling factor, which considers the impact of various externalities. This environmental cost may be used in several ways to incentivise clean plants. It may be added to the variable cost of plants to determine MOD. Since cleaner plants will have low environmental cost they will move up the ladder increasing their generation and revenues while reducing the sector's overall impact on environment. In addition, government could also design policy using an incentive-penalty approach wherein, the dirtier plants (high EIR rated) are penalised while cleaner plants (low EIR rated) are incentivised. This will give the cleaner plants dual benefits- early power despatch and additional tariff.

These tools will help clean plants recover the investment in pollution control equipment faster, expediting installation and operation of pollution control technologies. Given the twin problems of severe air pollution across wide swathes of India and continued resistance to invest in pollution control by TPPs, it is time to acknowledge the limitations of punitive regulatory actions and to explore economic tools and incentives to encourage decisive steps by the power sector.



CERCA in Circulation



"Unless there is a solid plan for controlling traffic emissions, short term strategies for future projects will not help". - Sagnik Dey, Professor, Centre for Atmospheric Sciences, IIT-Delhi

The Supreme Court (SC) in its judgement on the Central Vista redevelopment project on Tuesday has directed that "the project proponent may set up smog tower(s) of adequate capacity, as being integral part of the new Parliament building project; and additionally, use smog guns at the construction site throughout the construction phase, in progress on the site." However, Sagnik Dey, Professor, Centre for Atmospheric Sciences, IIT-Delhi said that scientifically, there is no evidence that smog guns and smog towers work. [Read More>](#)



'No Car Sunday' organised in Connaught Place catches on in other cities:

Scores of Delhiites, including youngsters, gathered in Connaught Place on Sunday morning, with a message for people to ditch their private vehicles for a day. The campaign called, 'No Car Sunday', which was first started by a group of teenage environmental activists, has now become a multi-city campaign that was organised on Sunday in Mumbai, Bangalore and Lucknow. [Read More>](#)



Giant lungs at Kharghar demonstrate the effect of pollution in one day!

A giant pair of artificial lungs fitted with filters and fans to mimic the human lungs, fitted in Navi Mumbai's Kharghar by an environmental organisation on Friday, started turning black within a day. [Read More>](#)



Do fine particles affect the health of those living near airports?

A recent trial conducted at Schiphol finds reduced lung function and heart changes in young people who exercised near the airport. More studies are urgently needed to determine the long-term health impacts for people living close to airports. [Read More>](#)

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