13 July 2026

Exempted but emitting: The largest SO2 sources around Delhi NCR continue operating without control technology

Key Findings

- Globally, India is the largest emitter of sulfur dioxide (SO2) from the power sector, releasing over 6 million tonnes annually.
- Emission norms first issued in 2015 mandated the installation of flue gas desulphurisation (FGD) systems on CFPPs to reduce SO2 emissions by 2017. Not only has the deadline been extended four times, but the latest notification issued in July 2025 exempted 78% of coal-fired power plants from installing FGD systems.
- CREA's estimates of SO2 emissions from CFPPs within a 300-km radius of the Delhi National Capital Region (NCR) found that there are 12 coal-fired power plants with a total of 37 units — publicly available data on their stack emissions show that 20 units exceeded the SO2 emission standards, five complied, and the remaining 12 had no data available.
- Our assessment estimated that 154 kilotonnes of SO2 are emitted by 25 units with data. Of these, 90% of emissions come from CFPPs without FGD. Category “C” coal-fired power plants, which, by mandate, do not require FGD installation, accounted for 81% of estimated SO2 emissions.
- According to a recent peer-reviewed study, the energy sector contributed up to 16% of particulate matter pollution in the Delhi-NCR cities. The ongoing operation of CFPPs without any control technology contributes to the formation of secondary PM2.5, worsening local and transboundary pollution and posing health risks.
- CREA's findings strongly recommend reinstating the mandatory installation of FGDs at all coal-fired power plants, regardless of their categorization. Real-time online continuous emission monitoring data must also be made available to the public to verify compliance.

Background

Sulfur dioxide (SO2), a toxic gaseous pollutant, is crucial to control at the source because once in the atmosphere it is converted into secondary pollutants, thereby contributing a significant portion to particulate matter. Fossil fuel burning in coal-fired power plants (CFPPs) and industries is a major source of anthropogenic SO2 emissions. Globally, India is the largest emitter of SO2 from the power sector, with 6.2 million tonnes, followed by South Africa at 2.5 million tonnes, Turkey at 2.3 million tonnes, Saudi Arabia at 2.2 million tonnes, and China at 2.1 million tonnes. India's emissions are 2.5 times those of the second-most-SO2-polluted country, South Africa.

China and the US, once the largest emitters of SO2 totalling over 10 million tonnes combined, have reduced their emissions to 2.1 million tonnes and 0.8 million tonnes, respectively. This was possible because both the US and China have adopted control technologies, mostly FGD systems for CFPPs, which have the potential to reduce SO2 emissions by up to 95%.

Interestingly, despite having one-fifth of China's coal-fired power plant installed capacity (1243 GW), India's SO2 emissions (230 GW) are almost three times China's. Currently, India has FGD systems installed in only 12% of CFPPs, which is why emissions are disproportionately high. However, despite the international evidence, the Indian government exempted 78% of coal-fired power plants from installing FGD systems in July 2025.

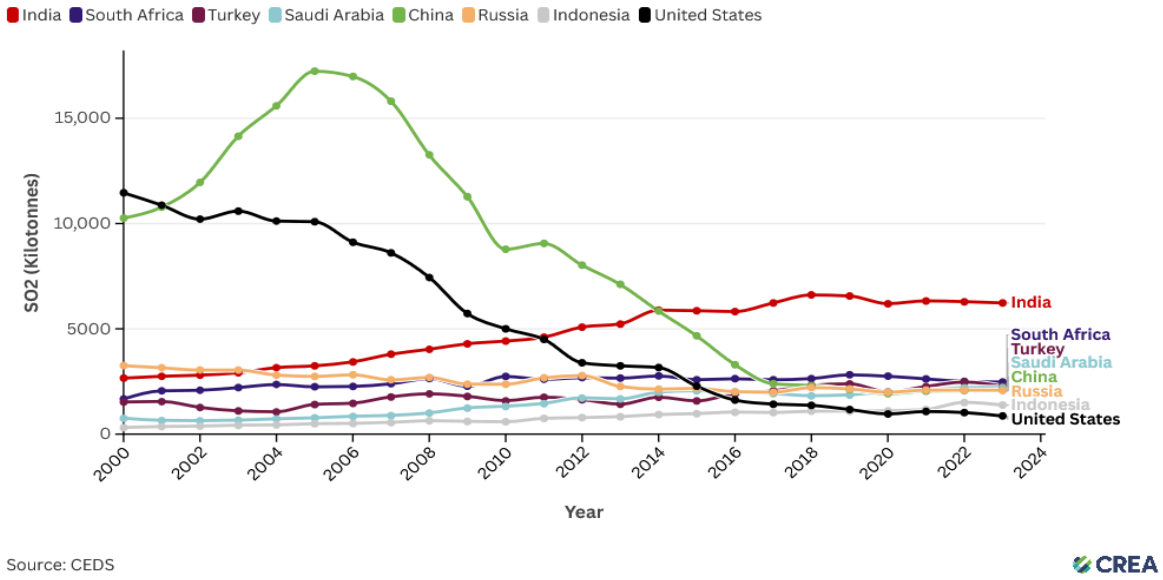

Figure 1 — Top global SO2 emitters from electricity generation

Policy context

The Ministry of Environment, Forest and Climate Change (MoEFCC) issued a notification in December 2015 requiring all CFPPs to comply with SO2 emission norms by installing FGD by 2017. However, due to repeated, widespread non-compliance, the government has extended the compliance timeline for coal-fired power plant units four times (see Figure 2).

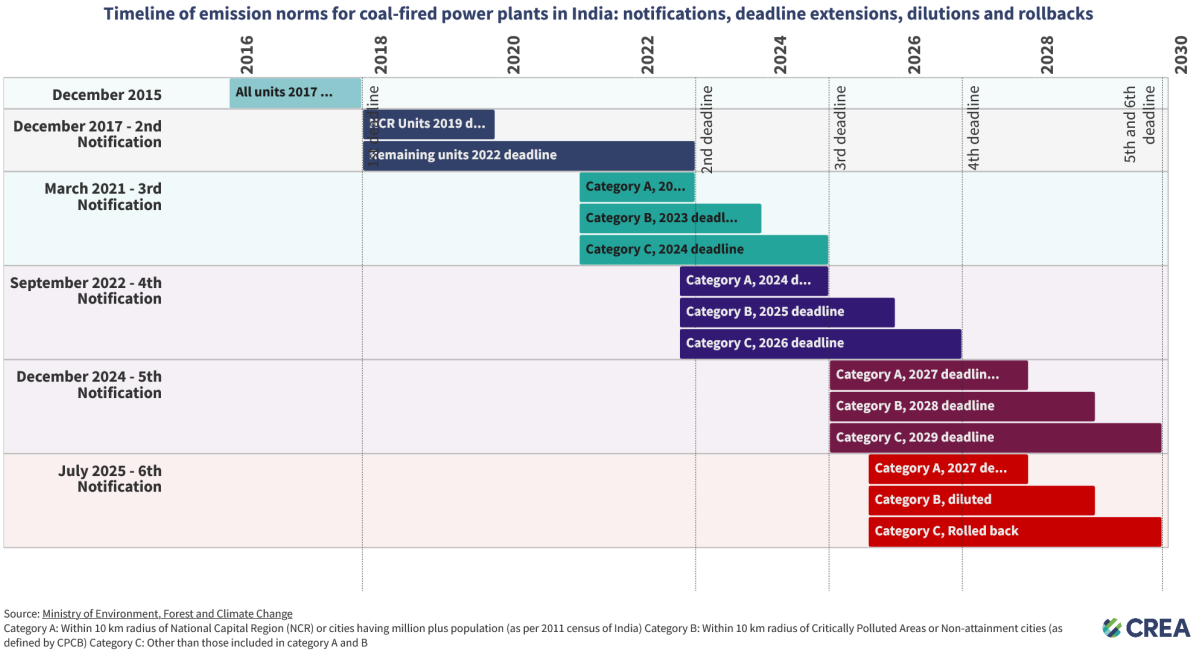

Figure 2 — Timeline of emission norms notification, extensions, dilutions, and rollback

The third notification in 2021 divided India's coal-fired power plants into three categories based on location. Category A includes plants within 10 kilometers of the National Capital Region or cities with a population exceeding 1 million. Category B plants fall within 10 kilometers of critically polluted areas or non-attainment cities. All other plants would fall in Category C. The compliance deadline also varied by CFPP category.

Last year's notification in July 2025 marked a significant rollback. As there were no changes for Category A and it had to comply by 2027, Category B coal-fired power plants had to comply on a case-by-case basis, subject to an expert appraisal committee. But for Category C, all units (78% of Indian plants) were exempted, meaning no control technology is required.

Fact-checking key arguments

The MoEFCC relied on a few studies conducted by the National Environmental Engineering Research Institute (NEERI), the National Institute of Advanced Studies (NIAS), and the Indian Institute of Technology Delhi (IIT Delhi, 2022 and 2024) to dilute the 2015 notification. The selective interpretation of findings from these studies was highlighted as a key argument, which is summarized in the table below. Additionally, a fact-check of each key argument is also provided.

The table clearly indicates that although the environmental impact of FGD is minimal, it is presented as a major concern. It is also important to note that all referenced studies were non-peer-reviewed, and several peer-reviewed studies were not considered. Additionally, the health benefits of installing FGD systems, which are a crucial element of any air pollution-related policy, have been overlooked.

Table 1 — Key arguments used to justify the 2015 emission norms dilution and fact check

Study arguments	Fact-check
Ambient SO2 levels are lower than Indian standards	• The 2015 regulations for coal-fired power plant emissions are not based on ambient SO2 concentrations. • According to data from the Central Pollution Control Board (CPCB), SO2 levels in cities have consistently been lower, even prior to the 2015 regulations. • Ambient monitoring does not capture the complete impact of emissions from CFPPs, as SO2 can convert into secondary PM2.5, or monitoring stations may not be positioned in downwind areas.
Installing FGD increases CO2 emissions	• Increased CO2 emissions are equivalent to those of a 3 GW coal-fired power plant, while India has a total coal-fired power plant capacity of 230 GW.
Low sulfur content in Indian coal	• Indian coal has a lower gross calorific value compared to coal from other countries. As a result, more Indian coal is required to generate the same amount of electricity, leading to higher emissions than with imported coal that has a higher gross calorific value.

No significant air quality benefits of installing FGD	• Installing FGD can reduce PM2.5 concentrations by 8% and prevent 1.24 lakh premature deaths annually.
Increased limestone consumption	• FGD requires less than 3% of current limestone consumption, while nearly 95% is consumed by the cement sector.
Economically not feasible	• Health and environmental benefits outweigh the FGD installation cost.

Implications of the July 2025 notification

According to the latest notification, 78% of coal-fired power plant units classified under Category C are exempt from installing any pollution control technology to reduce SO2 emissions. An additional 11% of units in Category B may or may not be required to install FGDs, depending on recommendations from the expert appraisal committee. Thus, only 11% of India's CFPP units, categorized as Category A, are mandated to install FGDs.

It's important to note that the classification of CFPPs into Categories A, B, and C is primarily based on a 10 km radius around each plant. However, the IIT Delhi study cited to support diluting these norms itself noted that SO2 emissions from coal-fired power plants can travel hundreds of kilometers from their sources. This leads to regional and transboundary pollution, indicating that the impacts of SO2 emissions cannot be confined to a 10 km radius, as they can adversely affect air quality and public health far beyond the immediate area.

Regardless of the category assigned to a CFPP, the nature of stack emissions remains the same. Limiting the mandatory installation of FGDs only to Category A plants neglects the significant emissions coming from Categories B and C. Once released into the atmosphere, SO2 undergoes chemical transformation, forming sulfate aerosols, which are a major component of PM2.5. Exposure to PM2.5 is a leading risk factor for premature mortality in India and is linked to various cardiovascular and respiratory diseases. In addition to permitting unabated emissions from Category C plants and potentially from Category B plants, the revised framework disregards the health impacts on communities living near CFPPs and on those residing in downwind regions. These continuous emissions cause air pollution and lead to adverse health outcomes both locally and regionally.

A recent peer-reviewed study estimated that controlling SO2 emissions from all coal-fired power plants could reduce SO2 concentrations by 0.1 to 13 ppb and PM2.5 concentrations

by 0.3 to 12 µg/m3 across India. This is a huge reduction potential from a single sector. Also, this reduction would prevent 1.24 lakh premature deaths in India.

Unlike other sectors, such as industries and Micro, Small and Medium Enterprises (MSMEs) in which emissions are even more difficult to monitor and quantify, the coal-fired power plants represent an easier target for pollution control. Their locations are well-known, emissions can be controlled at the stack, and proven technologies such as FGDs are readily available. Exempting the majority of CFPPs from installing FGDs is a missed opportunity to achieve significant reductions in SO2 emissions. Moreover, the ongoing release of unabated SO2 emissions will complicate efforts to reduce PM2.5 concentrations and meet air quality improvement targets set under the National Clean Air Programme (NCAP) as well as those established by the Commission for Air Quality Management (CAQM) in the National Capital Region (NCR).

Delhi NCR assessment

There are 12 thermal power plants with a total of 37 units located within a 300-kilometer radius of Delhi NCR. Recent publicly available data indicate that 20 coal-fired power plant units are exceeding stack emission standards. Of the remaining units, six are compliant, and four of these are equipped with FGD. Additionally, compliance data for 12 units is unavailable. It seems that even with the installation of FGDs, some plants still fail to meet compliance standards, likely due to either operating without FGDs or having FGDs undergoing maintenance or temporarily out of service.

In addition to checking compliance, we estimated SO2 emissions from CFPPs within a 300-kilometer radius of Delhi-NCR. Our assessment estimated that 154 kilotonnes of SO2 are emitted by 25 units with data. Coal-fired power plant units installed with FGD emitted 16 kilotonnes, and those without FGD emitted 138 kilotonnes. This shows that 90% of emissions are from coal-fired power plants without FGD.

The Dadri and Mahatma Gandhi coal-fired power plants, equipped with FGD, emitted the lowest levels among the plants in the study region. Despite generating 3,400-4,000 million units (MU) of electricity annually, Mahatma Gandhi TPP Units 1 and 2 emitted an estimated 1,775 tonnes and 2,154 tonnes of SO2, respectively, due to their FGD installations.

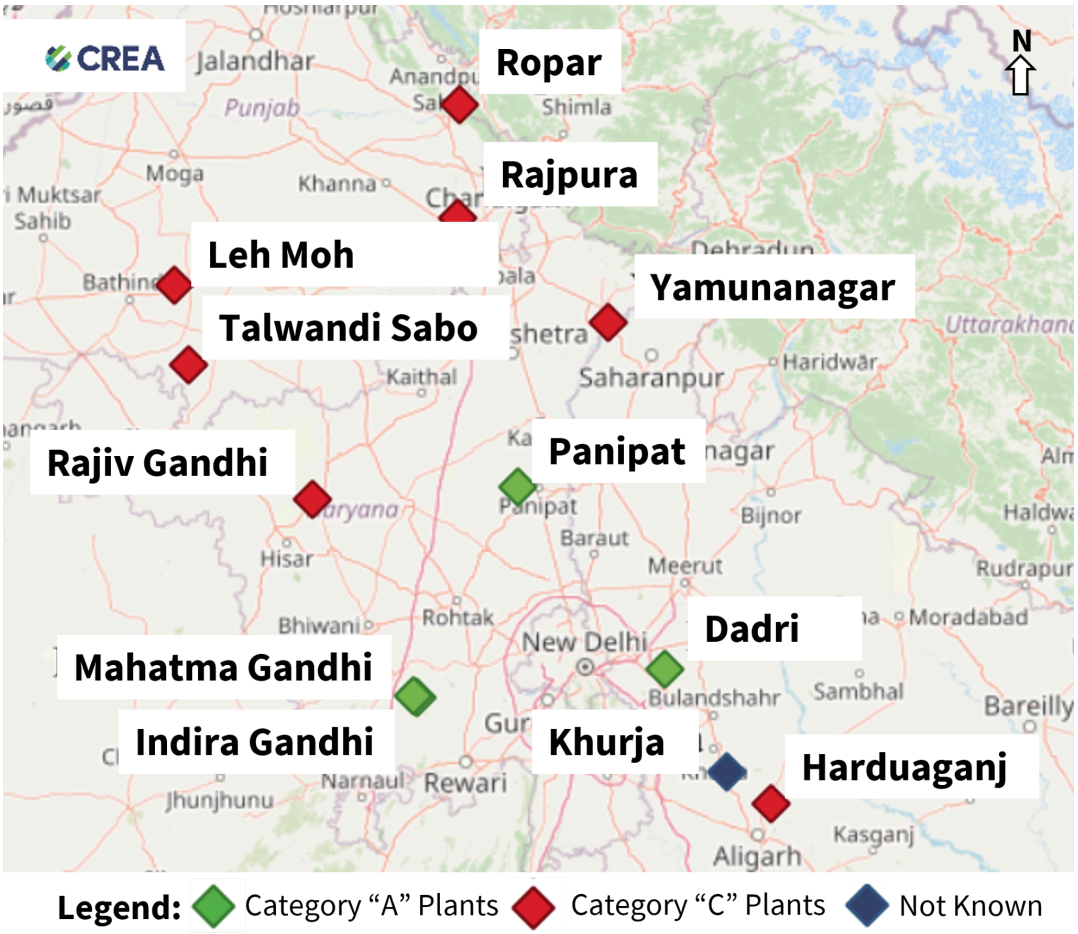

Figure 3 — Location of coal-fired thermal power plants within a 300 Kms radius of Delhi NCR. Note: There are no Category B coal-fired power plants

The highest SO2 emissions are estimated for Rajpura thermal power plant units 1 and 2, which emitted 20,851 and 22,690 tonnes of SO2, respectively. Talwandi Sabo power plant (units 8 and 9), Rajiv Gandhi thermal power station (units 1 and 2), Guru Hargobind thermal power station (units 1,3, and 4), Harduaganj thermal power station (units 8 and 9), and Ropar thermal power station (unit 6) also emitted several thousand tonnes of SO2. None of these plants have installed FGD, resulting in high SO2 emissions.

In addition, based on category, about 29 kilotonnes of SO2 are emitted by Category A plants, while 125 kilotonnes are emitted by Category C plants. Notably, these largest SO2 emitters (81% of estimated SO2) within a 300-kilometer radius of Delhi NCR fall under category "C", which, by mandate, does not require FGD installation and can continue operating without them.

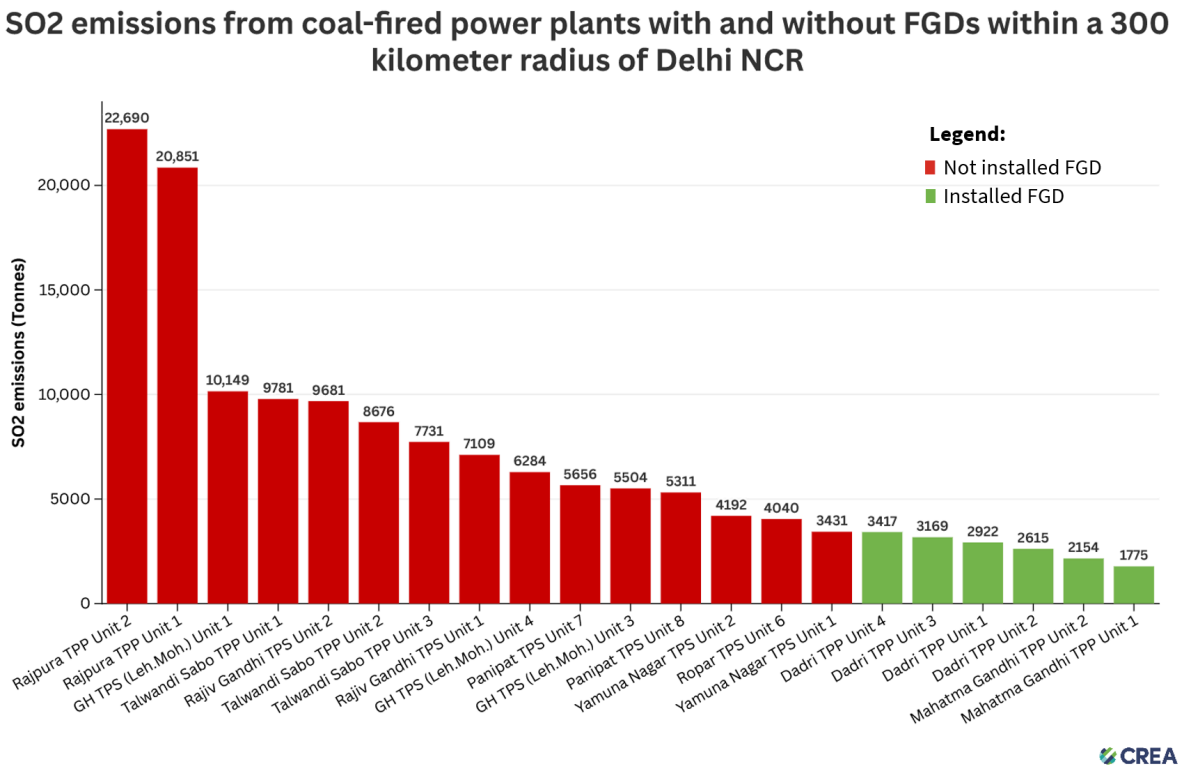

Figure 4 — Comparing the SO2 emissions from coal-fired power plants with and without FGD located within a 300-kilometer radius of Delhi NCR

Recommendations

According to a recent peer-reviewed study, the energy sector contributed up to 16% of particulate matter pollution in the Delhi-NCR cities. Further, most of the coal-fired power plants are located in the predominant directions for Delhi NCR.

Thus, to reduce the substantial amount of SO2 emitted and its contribution to particulate matter formation in India's most polluted region, the mandatory installation of FGD must be extended to all coal-fired power plants in India to reduce pollution and human health impacts, regardless of category.

Real-time online continuous emission monitoring data must also be made available to the public to verify compliance.

Methodology

SO2 emissions from coal-fired thermal power plants within a 300-kilometer radius are estimated for the year 2025 using a bottom-up approach, following the equations provided below. Data on coal consumption and electricity generation are obtained from the National Power Portal (NPP). The gross calorific value was sourced from the "Unlocking Transparency through Third Party Assessment of Mined Coal" (UTTAM) portal. Average stack emissions are obtained from the parliamentary questionnaire. Additionally, for this study, the flue gas flow was assumed to be 350 Nm^3/GJ based on guidelines from the International Finance Corporation (IFC).

Unit level coal consumption (grams (g) = Coal consumption at plant level (g) * [Unit-wise energy generation (Million Units) / Plant total generation (Million Units)] (1)

Emissions (g) = Unit level coal consumption (g) * Average SO2 emissions (g/m3) * Flue gas flow (m3/Gj) * Gross calorific value (Gj/g) (2)

Limitations of the study

Uncertainties may arise from the assumptions in the input data. The current SO2 estimates were based on the most recent publicly available emissions data for the fiscal years 2023-24 and 2024-25. Furthermore, the operational status of FGD units could not be independently verified. For example, while the Rajpura thermal power plant had an FGD installed, the latest public data indicate it was not operational at that time. Therefore, the estimates assumed that the plants operated without FGD. Unit-level coal consumption was unavailable and was calculated from the unit's electricity generation. Additionally, the gross calorific value of coal was not updated for most plants, so we relied on the latest available data for each plant. The study also assumed a uniform flue gas flow rate.

The accuracy of these estimates could be improved if there were transparent, online continuous monitoring data made publicly available and if the status of FGD installations were published periodically.