A CSE Report

COAL-BASED POWER NORMS

WHERE DO WE STAND TODAY?

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Maps in this report are indicative and not to scale.

Citation: Soundaram Ramanathan, Sugandha Arora and Vinay Trivedi, 2020, *'Coal-Based Power Norms: Where do we stand today'*, Centre for Science and Environment, New Delhi

Published by
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WHERE DO WE STAND TODAY?

Contents

1 THE STANDARDS: AN OVERVIEW

On the emission standards for the Indian coal-based power sector, their significance, and how they compare with earlier norms and globally

- **India's power sector is largely dependent on coal. About 56 per cent of the generation capacity is coal-based.**
- **Coal-based power is a resource-intensive and polluting industry, and contributes to air pollution. Major pollutants are oxides of nitrogen (NO_x), sulphur dioxide (SO_2) and particulate matter (PM). In addition, the sector is very water-intensive.**
- **According to a 2016 CSE estimate, the sector is responsible for 70 per cent of total freshwater withdrawals by all industries, and accounts for over 60 per cent of industrial emissions of PM; 45 per cent of SO_2; 30 per cent of NO_x; and over 80 per cent of mercury.**
- **The new emission and water discharge norms were introduced in 2015. All plants were mandatorily required to comply with the norms by December 2017.**
- **But there have been delays – the industry first tried to obstruct and prevaricate on the 2015 standards, and now there are delays in implementation.**

Share of coal-based power in total installed power generation capacity

56%

The coal-based power sector in India and its polluting potential

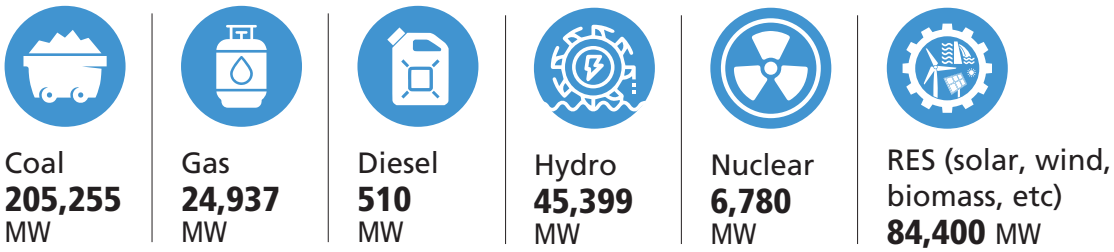
India's total installed power generation capacity (as on December 31, 2019) stood at 367 gigawatt (GW)[1]. Of this, thermal power capacity is 230 GW – 63 per cent. Coal continues to be the bulk energy provider, making up 205 GW or 89 per cent of the thermal power capacity (see *Figure 1 and Graph 1*). Coal thermal power accounts for 77 per cent (895 TWh, or terawatt-hour) of the country's total electricity generation.[2] So, it is important to ensure that it is clean and efficient.

Coal-based power is one of the most resource-intensive and polluting industries, and contributes significantly to ambient air pollution. Major pollutants from coal-fired thermal power plants (TPPs) are oxides of nitrogen (NO_x), sulphur dioxide (SO_2) and particulate matter (PM). In addition to this, TPPs are extremely water-intensive. Estimates by Centre for Science and Environment (CSE) in 2016 show that Indian TPPs are responsible for 70 per cent of the total freshwater withdrawal by all industries. They also account for over 60 per cent of total industrial emissions of particulate matter; 45 per cent of SO_2; 30 per cent of NO_x; and more than 80 per cent of mercury, in the country.[3]

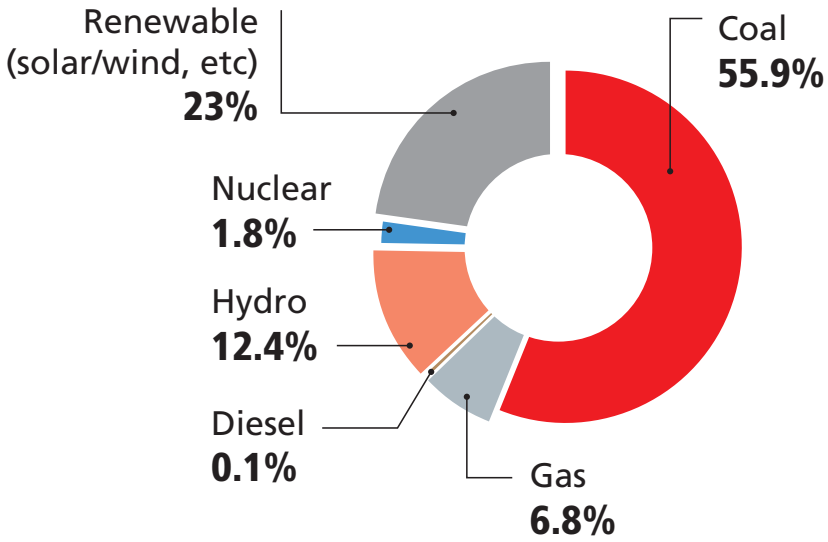
A 2017 study by the US-based University of Maryland has concluded that India's SO_2 emissions increased by 50 per cent since 2007, and the country would soon become the world's top emitter of SO_2.[4] Satellite data also shows high SO_2 concentration in states such as Odisha, Jharkhand, Chhattisgarh, and Maharashtra, which have large coal-fired capacities.[5] Images released by NASA's Aura satellite point to doubling

MEETA AHLAWAT/CSE

Figure 1 and Graph 1: Installed capacity share in India (as on December 31, 2019)
Coal holds the maximum share of 56 per cent in total installed capacity.



Total installed capacity: **367,281 MW**



Source: Central Electricity Authority

of SO_2 concentrations in India from 2005 to 2012.[6] This scenario has arisen due to a lack of effective control measures in India.

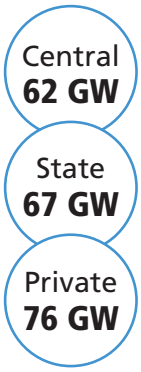
It is clear that the sector needs urgent interventions to control pollution. Technologies to control particulate matter, sulphur dioxide and nitrogen oxide emissions are mature. They are being used across the world for a range of coal quality and operating conditions. So, even if 'clean coal' is an oxymoron, it is possible – given the extensive use of coal-based energy, it is vital that this source be as clean as necessary. This, even as the country moves aggressively towards using renewable sources. This is critical for curbing local pollution in cities and more importantly, in the regions where these plants are located.

Capacity, ownership and age of plants

Coal-based plants are located in 17 states, with Chhattisgarh, Maharashtra and Uttar Pradesh being the ones with the largest installed capacities. By December 2019, the private sector held the maximum share followed by state-owned plants (see *Figure 2: Share of installed capacity based on ownership*).

Figure 2: Share of installed capacity based on ownership (December 2019)

Of the total 205 GW of coal-based capacity, the share of the Central, state and private sectors is about 30 per cent, 32 per cent and 37 per cent, respectively.[7]



Source: National Power Portal

The two most important parameters to decide which pollution control options are the most appropriate are age and size of the unit. Bulk of the Indian coal-based thermal power sector comprises of large and relatively new units (see *Table 1 and Graphs 2-4*). Decisions to make significant investments in pollution control equipment in stations that have exceeded their useful design life (+25 years) must be considered taking into account plant efficiency, cost of power production and environmental impacts.

The coming of the 2015 standards

CSE's 2015 Green Rating Project study on the thermal power sector – *Heat on Power* – had highlighted the huge scope for improvement in this industry's environmental performance. The study report recommended tightening of norms to help bring down pollution levels.[8]

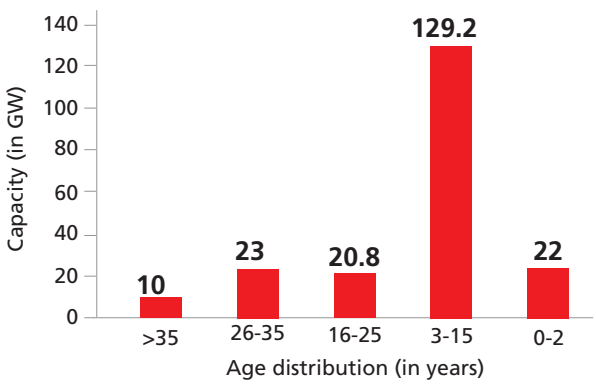
In a long overdue action, on December 7, 2015, the Union Ministry of Environment, Forest and Climate Change (MoEF&CC) introduced stricter environmental standards for coal-based TPPs under the Environment (Protection) Act, 1986.

Till 2015, power plants in India were required to meet only the PM emission norms – this was less stringent than similar norms in China, the US and Europe. There were no national regulations for SO_2, NO_x and mercury emissions from power plants. Standards were specified only for the chimney height to ensure the flue gas, which is loaded with these pollutants, was dispersed. This dispersion was meant to limit incremental ambient concentration. However, increasing levels of pollution from other sources, combined with a sharp growth in thermal power generation, had made this control method inadequate.

Table 1 and Graph 2: Capacity versus age distribution

Overall, India has a relatively young fleet: around 64 per cent (132 GW) of the capacity is less than a decade old. About 73 per cent (150 GW) is less than 15 years old. About 16 per cent (33 GW) is older than 25 years. Of the 33 GW of older capacity units, a major share (about 76 per cent) belongs to small units of up to 250 MW and less.

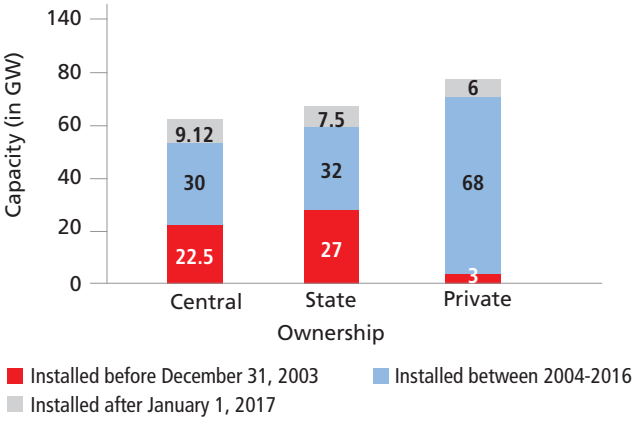
	Age distribution in years					Total
Unit size	> 35	26-35	16-25	3-15	0-2	(in GW)
Up to 250 MW	9	16.15	12.95	20.78	1.95	61
> 250 and < 500 MW	0	0	0.6	14.71	2.67	18
500 MW and < 650 MW	0.5	7.0	7	55.29	1.7	72
650 MW and above	0	0	0	38.39	16.16	55



Source: Centre for Science and Environment's (CSE) 2019 analysis

Graph 3: Ownership versus age distribution

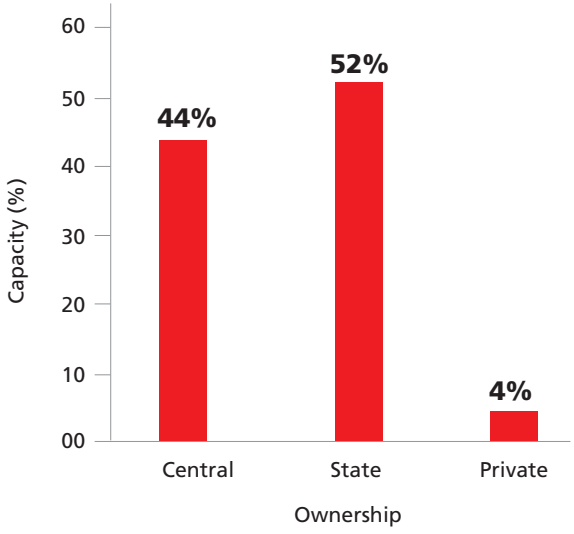
From the ownership perspective, a major share – about 40 per cent of the state-owned capacity and about 32 per cent of Centre-owned capacity – is relatively old. These plants were installed before December 31, 2003. Compared to this, only about 4 per cent of the private sector capacity is older than 2003. During the last decade, the major share of capacity addition has happened in the private sector – about 68 GW was added between 2004 and 2016.



Source: Centre for Science and Environment's (CSE) 2019 analysis

Graph 4: Who owns the plants that are older than 25 years

Units that are more than 25 years old largely comprise of Central- and state-owned plants. More than half of the state-owned capacity and about 44 per cent of Centre-owned capacity has become relatively old.



The Central Pollution Control Board (CPCB) and the MoEF&CC conducted in-house studies and commissioned research from external experts on the environmental impacts and pollution control technology options based on which tighter, comprehensive emissions standards for coal-based power plants were announced in 2015. For the first time, standards were defined for SO_2, NO_x, water and mercury, while PM standards were made more stringent. All TPPs were mandatorily required to comply with the revised norms within a period of two years – by December 2017.

The norms categorise power plants into three groups – units installed before 2004, between 2004 and 2016, and to be commissioned after 2016. Different emission and water discharge standards have been specified for each category. According to CPCB, the new standards considered a range of factors like age of the units, plant technology, potential for upgradation and retrofitment, existing regulations, and environmental clearances (ECs). For example, after 2003 ECs required large units to leave sufficient space to install pollution control equipment. New norms were framed keeping this in mind.

Units commissioned after January 1, 2017 have to meet the most stringent standards. Older and smaller units have to comply with relatively lenient norms compared to newer and bigger units – the rationale was the age of the plant and the need to retire these facilities, which meant that investment in improvement could be avoided.

The 2015 standards are in line with global regulations (see *Table 2: Emission and water use norms – 2015)* and aim to drastically

40-50%

Expected reduction in emissions if the norms are implemented

Table 2: Emission and water use norms – 2015*

- Units installed in 2004 and after are required to meet tighter standards for PM and NO_x irrespective of their capacity.
- In the case of SO_2, stringent norms (200 mg/Nm^3) have been prescribed for units installed before 2016 and with capacity greater than or equal to 500 megawatt (MW).
- Units installed in 2017 and onwards have to meet stringent standards for all three pollutants.

- Units installed before January 1, 2017 are to reduce their specific water consumption to 3.5 m^3/MW or less, while units installed after January 1, 2017 have been given a reduction target of 2.5 m^3/MWh. All once-through plants are required to convert to cooling tower-based plants.

INDIA	PM*	SO_2*	NO_x*
OLD STANDARDS	150-350	None	None
2015 REVISED STANDARDS			
Units installed before December 31, 2003	100	600 (< 500 MW) 200 (≥ 500 MW)	600
Units installed between 2004-2016	50	600 (< 500 MW) 200 (≥ 500 MW)	300
Units installed from January 1, 2017	30	100	100
WORLD STANDARDS			
China	30	100	100
China (key regions)	20	50	100
China New Plants (eastern)	10	35	50
EU BAT	5	20	50
US - NSPS/NESHAP	14.5	100	110
US - BACT	14.5	22	70

* In mg/Nm^3 (milligram per normalised cubic metre);
Notes: BAT = Best Available Technology, BACT = Best Available Control Technology, NSPS = New Source Performance Standards, NESHAP = National Emission Standards for Hazardous Air Pollutants
Sources: Environmental Regulations for Coal-based Thermal Power Plants, CPCB, 2016 and CSE's Heat on Power study 2015

reduce emissions of PM, SO_2 and NO_x. In addition, they will require power plants to sharply curtail freshwater use. According to rough estimates, the implementation of these standards can cut down emission of particulate matter (PM) by 35 per cent, sulphur dioxide (SO_2) by 80 per cent and nitrogen oxides (NO_x) by 42 per cent.[9]

While the new tighter emissions regulations are a welcome step, a lot needs to be done to ensure compliance. Timelines are tight, but they were achievable when the norms were announced. Subsequent chapters discuss the progress made so far in implementing these norms.

SETTING THE NORMS: A CHRONOLOGY

On what transpired and when, from 2015 till the time of going to press

- **2015. CSE recommends revision of the sector's emission norms. The environment ministry notifies new norms, and wants them implemented by 2017.**
- **2017. Action plan to implement the norms submitted by Ministry of Power. 2022 agreed to as new deadline, and the Supreme Court urged to accept the plan.**
- **2018. Sparring begins in Court between the Ministry of Power and EPCA, with EPCA insisting on a 2020 deadline.**
- **On pricing, the power ministry tags the new norms as a "change in law" event: the cost increase due to installation of pollution control technologies will be passed on to the consumer in the tariffs.**
- **Power plants agree in Supreme Court to comply by 2022. EPCA urges the court to direct that non-compliant plants be pushed to the bottom of the merit order despatch.**
- **2018-2019: Specific water consumption standards revised.**

The new deadline for implementation

2022

February 2015: *Heat on Power*, CSE's report on green rating of India's coal-based thermal power plants (TPPs), is released.[1] The report strongly recommends revision of the industry's emission norms.

December 7, 2015: The Union Ministry of Environment, Forest and Climate Change (MoEF&CC) notifies new norms.[2] Says the norms must be implemented by 2017.[3,4]

September 21, 2016: The Union Ministry of Power (MoP) constitutes a committee under the Central Electricity Authority (CEA) to prepare an action plan for the implementation of the new norms (see Box: *The MoP 2016 committee*).

June 30, 2017: The MoEF&CC receives a phase-in plan from the MoP for implementation of the norms. What the plan says:

- SO_2: FGD implementation for 145 GW capacity to be completed within seven years (2017-2024) in a phased manner.
- PM: The compliance for PM norm to follow the same timeline as that of SO_2.
- NO_x: For plants installed before December 31, 2003, the Ministry requests a period of three years to achieve the specified standard of 600 mg/Nm^3. For other plants, it seeks a relaxed norm of 600 mg/Nm^3 (in place of 300 and 100 mg/Nm^3) and extension of three years, after the amendment is made.

September 1, 2017: In a meeting between the two ministries, the MoEF&CC and MoP, it is decided that the MoP plan with an implementation time-line of seven years (up to 2024) was too delayed – instead, it should be implemented by 2022 with respect to all the pollutants. It is also decided that a revised implementation plan would be submitted by the MoP.

The MoP 2016 committee

The MoP's committee included members from the Central Electricity Authority (CEA), Ministry of Coal, MoEF&CC, Central Pollution Control Board (CPCB), Power System Operation Corporation (POSOCO), National Thermal Power Corporation (NTPC), and Damodar Valley Corporation (DVC). The committee met twice, on October 21 and December 13, 2016, to shortlist the names of plants requiring upgradation, analyse space constraints, recommend broad solutions for individual units, and develop the phase-in plan.

A list of power stations with data on PM emission levels and key recommendations – whether they should opt for ESP retrofit or FGD installation – was circulated among the Regional Power Committees (RPCs), which were asked to provide timelines for installation of pollution control equipment by the end of February 2017.

Amendments in the 2015 water use standards

On June 28, 2018, the MoEF&CC issued an amendment to its notification dated December 7, 2015 – in this, the water consumption limit of 2.5 m^3/MWh for new plants installed after January 1, 2017 was revised to 3 m^3/MWh. The amendment also said that sea water-based once-through plants are to be exempted from conversion to cooling tower-based systems.

Answering the query on why the specific water consumption norms were revised, the CEA said the water consumption limit of 2.5 m^3/MWh was very stringent. Initially, it was suggested that the norm should be increased to 2.7 m^3/MWh. But as the operation of the FGD would require an additional water of 0.3 m^3/MWh, the limit was reviewed and revised upward.

October 10, 2017: The MoP submits a revised action plan to implement new emission norms, according to which:

- SO2: FGD implementation plan of 161.4 GW (415 units) to be completed by 2022.
- PM: ESP upgradation plan of 64.5 GW (273 units) to be completed by 2022.
- NO_x: Implementation by 2022.

Some other concerns highlighted by the revised plan were:

- Height of the chimney: Installation of FGD systems will require lining of existing stacks to prevent corrosion. However, the lining of the stacks will entail a long shut-down. Amendment to the existing stack height norms is needed urgently so that environmentally compliant units can construct shorter stacks while FGD installation is in progress.
- Seawater-based FGD: Revised standards do not make a distinction between seawater-based thermal power stations and sweet water-based thermal power stations. Seawater-based plants should be exempted from meeting the norms.

November 17, 2017: In Supreme Court, the *Amicus Curiae* in the ongoing case on air pollution in Delhi and other cities urges the apex court to "direct the implementation of the 2015 emission standards for power plants as per schedule – by December 2017".

December 11, 2017: The Central Pollution Control Board (CPCB) issues directions to power plants as per the deadlines agreed upon by the two ministries.

December 12, 2017: MoEF&CC files an affidavit in Supreme Court presenting the implementation plan and recommending that the deadline of December 2022 should be accepted. The affidavit also asks the Court to allow it to review and modify the NO_x and water consumption standards for plants installed after January 2017 (see Box: *Amendments in the 2015 water use standards*).

Water consumption norm amended

2018

EPCA's Report 81 submitted to Supreme Court

2018

December 2017: The CEA uploads Standard Technical Specifications for retrofitting wet limestone-based FGD systems in a typical 2 x 500 MW TPP.[5]

February 14, 2018: The Environment Pollution (Prevention and Control) Authority (EPCA) submits its Report No 81 to the court.[6] The report recommends the following:

- Deadlines for all plants to meet emission norms should be advanced to 2020 from 2022; PM and NO_x norms should be met by 2018-19 and SO_2, by 2020.
- Schedule for implementing the standards should priortise plants located in critically polluted areas and with high population density – these plants should be required to meet standards by 2019-2020.
- MoEF&CC and CPCB may be asked to review the technical feasibility of the NO_x standard of 100 mg/Nm^3 – however, there should be no change in the NO_x standard of 300 mg/Nm^3.
- All plants installed after January 2017 must meet the PM and NO_x norms at the time of commissioning, and the SO_2 norms by 2019.
- Water standards should not be revised – however, plants located in coastal areas can be exempted.

The EPCA also flags the importance of an effective compliance and monitoring system; it adds that the data generated from the continuous emission monitoring (CEMs) should be used for regulatory controls.

As shut-down of non-compliant plants is found to be difficult because of power demand, the EPCA recommends that there should be a penalty of Rs 1 lakh per day per non-compliant pollutant – estimates indicate that assuming (on an average) three non-compliant pollutants, a unit would need to pay Rs 11 crore every year, till it met the standard. This would be a deterrent and help push for compliance.

March 28, 2018: The MoEF&CC files an affidavit in Supreme Court[7] in response to the EPCA's Report No 81. What it said:

- The present schedule of 2022 is already extremely challenging, since it takes three years to install an FGD system. In units where both FGD and ESP are required, these will be set up simultaneously to avoid shutting down the plants twice.
- A total of 8,966.50 MW (82 units) have been identified for retirement by March 2019.
- NO_x control will be done by 2022 in accordance with the revised plan submitted by the MoP. But this would be dependent on the revision of the standard. NTPC is conducting studies to assess the technical feasibility for 100 mg/Nm^3 (see Box: *Implications of the revision of the NO_x standard*).
- Plants above 25 years of age where FGD and emission control is not possible should be allowed to function for a limited number of hours in a year.

Implications of the revision of the NO_x standard

The Ministry of Power had proposed the upward revision of the NO_x standard – from 300 mg/Nm^3 to 450 mg/Nm^3 – conditional to its meeting the 2021-22 deadline for thermal power emission norms. It was agreed that the CPCB would examine this further. On May 17, 2019, the report of the CPCB was considered by the MoEF&CC in its meeting. The report, based on the CPCB-NTPC joint monitoring report in seven units of four thermal power plants during the period February 13, 2019 to April 2, 2019, found that out of the seven monitored units, five were complying with NO_x emission standards of 300 mg/Nm^3 at full load. Some units did not comply during partial load operations even after combustion monitoring.

The meeting also considered the assurance provided by BHEL that NO_x emission level of 450 mg/Nm^3 can be achieved by combustion modification. It found that there were operational issues with the use of SNCR technology for NO_x reduction, as it required urea and ammonia the amounts of which could differ based on types of boiler and other parameters. Given all this, the joint committee decided that it would recommend the revision of NO_x norms from 300 mg/Nm^3 to 450 mg/Nm^3 for plants installed between January 1, 2004 and December 31, 2016. It did not agree to revise the 100 mg/Nm^3 standard for newer plants.

While the Supreme Court has accepted the recommendations of this committee on August 5, 2019, the notification has not yet been issued to amend the 2015 standard revising the NO_x standard upwards.

For plants installed post-2017 – where the NO_x standard is 100 mg/Nm^3 – the NTPC has conducted pilot projects using technologies for abatement. Its report, completed in mid-2019, is yet to be reviewed.

CPCB-CEA NO_x emission monitoring results (mg/Nm^3)

509 Adani Power, Rajasthan Limited, Kawai: Unit 1	**584** Adani Power, Rajasthan Limited, Kawai: Unit 2	**202.6** NTPC Mouda Super TPS, Nagpur: Unit 3	**178.95** NTPC Mouda Super TPS, Nagpur: Unit 4
71-286 (31-42% load) Mahatma Gandhi TPS, CLP, Jhajjar: Unit 1	**320-227.8 (31-42% load)** Mahatma Gandhi TPS, CLP, Jhajjar: Unit 2	**522.7 (50% load) and 92-282 (100% load)** Naba power, Rajpura, Punjab unit 1	

- The Court should allow extension of Environmental Clearance (EC) of those plants which have been commissioned or are yet to be commissioned post-January 2017 – this is when the 2015 notification specifies that new plants, post-January 2017, would be required to meet the new norms before commissioning.
- The Court should allow 49 plants (12,144 MW) to continue functioning even though they cannot meet the water consumption standard.

Ministry of Power says cost increase due to new norms will be met by tariff hike

2018

April 6, 2018: The CPCB sends Section 5 notices to all the remaining plants that were not included in the first set of directions of December 2017.

April 17, 2018: The EPCA submits Report No 84 in response to the MoEF&CC affidavit. What it says:

- It is possible to advance the deadlines. NO_x and PM norms can be met in an annual shutdown or with an advanced FGD phase-in time period, if done simultaneously.
- There is no clarity on 34,623 MW of installed capacity. These plants are not included in the phase-in plan for FGD – the ministry needs to clarify.
- There should be no relaxation in meeting water norms. Indian plants are water guzzlers; they should not be allowed to continue functioning without reducing their water consumption.
- The Court should not accept the MoEF&CC's request to allow units less than 25 years old to continue functioning without meeting the standards.
- The Court should not accept the ministry's request to allow plants over 25 years of age, where FGD and emission control is not possible, to continue functioning for a limited number of hours in a year.

May 30, 2018: The Ministry of Power sends a letter to the CEA (titled 'Mechanism for implementation of new environmental norms for TPPs.....'), which says the new norms are a "change in law" event, and the cost increase that will happen due to installation of pollution control technologies, shall be "passed through" (passed on to the consumer) in tariffs by the CERC (see Box: *Pricing – recommendations and resolution*).

June 28, 2018: The MoEF&CC revises specific water consumption norms from 2.5 to 3 m^3/MWh for plants installed after January 1, 2017. It exempts plants that are using sea water.

July 3, 2018: The MoP files an affidavit before the court, in response to EPCA's Report No 84.[8] It contends:

- The phase-in plan cannot be advanced – furthermore, simultaneous tendering may lead to spike in cost of FGD and cost of electricity could increase.
- FGD systems can help reduce PM levels. Hence, ESP upgradation may not be required in many units. Thus, PM and SO_2 compliance can be done simultaneously to lower the expenditure.
- NO_x measures will also be taken at the same time, along with FGD installation. In India, especially with respect to high ash content in coal, there are no proven technologies for such stringent NO_x norms – hence, pilot projects have been initiated. Any further decision would be taken based on the results of these projects.
- A break-up of 34,623 MW has been provided as requested by the EPCA

Pricing – recommendations and resolution

The question of financing for the investment required to meet the norms remains one of the main concerns. The additional investment to install pollution control systems will increase the cost of generation and, eventually, result in a tariff hike.

The cost of power and increase in tariffs have to be approved in India by the electricity regulatory commissions (ERCs). These are Central and state level agencies to which petitions for approval of investments and tariff hikes are made by generation companies (GENCOS). However, ambiguities exist amongst the ERCs on the provisions under which these additional capital investments for installation of emission control technologies and subsequent tariff revision can be allowed. Additionally, there are variations in the procedures adopted at various ERCs which further complicate the process.

Accordingly, the Central Electricity Regulatory Commission (CERC) and state ERCs sought guidance from the Ministry of Power on this matter. In May 2018, the ministry issued directions to the CERC under Section 107 of the Electricity Act, 2003 that the new environmental norms of 2015 qualify as a "change in law" event – this means that investments in pollution control technologies to meet the 2015 norms will be covered by tariff increase. In other words, the power plants can "pass-through" – the cost of the investment made can be passed on to the customers through an increase in tariff.

This would be applicable for all power plants, except those whose tariffs had been determined after December 2015 (after the notification of the 2015 emission standard) or their power purchase agreement was signed after the standard had been approved. In all other cases, "the additional cost implication due to installation or upgradation of various emission control systems and its operational cost to meet the new environment norms would be considered for being pass-through in tariff by the commission", says the May 30, 2018 direction from the MoP.

Individual power plants have to approach the state or Central ERC to get in-principle approval to go ahead with the investments. By March 2019, CSE had surveyed the status of these petitions at the CERC and eight SERCs (which account for 60 per cent of the TPP capacity), and found that only 20 per cent of the plants had filed for increased tariff. This should have increased subsequently, but data for it is not available.

In September 2018, the CEA made recommendations to incentivise the early installation of pollution control equipment. According to this, the increase in variable cost for installation of FGD was expected to be in the range of paise 2.71 to paise 6.68 – less than Re 1/unit. Therefore, according to the CEA, the increase in variable cost would have a minor impact on the merit order despatch.

The CEA, however, has said that there is a need to provide incentives for early adoption of pollution control systems. It points out that while the cost of implementing the pollution systems would not be considered in the merit order despatch, the CERC would devise a methodology for supplementary tariff determination, separately from normal tariff, so that installation of FGD and other systems would have no bearing on the merit order despatch till March 31, 2022 – the date when all plants have to meet the deadline.

Power ministry calls for a review of the NO_x emission norms

2018

and these pertain to plants which are already compliant with SO_2 norms or where FGD has been installed

» Plants, which have completed 25 years of operational life and where FGD installation and pollution control equipment is not possible should be allowed to operate for a limited number of hours.

» Some of the plants which were set up after 2017, received clearance before the new norms came; these units have been included in the phase-in plan. They deserve an extension of EC.

August 16, 2018: Based on the request from the CEA, MoP asks the environment secretary to review NO_x emission norms for TPPs installed after December 31, 2003, from 300 to 450 mg/Nm^3. BHEL says this is technically feasible using the combustion modification process.

September 7, 2018: The government informs the Supreme Court[9]:

» As the sector has been delicensed, the MoP cannot give any commitments on behalf of plants under the private or the public (state-run) sector. Units run by the Central government (such as NTPC and DVC) will comply by 2021, subject to appropriate revision of NO_x norms. A pilot project for NO_x control has been initiated. The Court should issue notices to the association of power generating units, a list of which has been handed over to the Court.

» However, the MoP is taking immediate steps to ensure compliance of new environment norms by December 2021 in all the plants under its administrative control – the NTPC and the Damodar Valley Corporation plants. However, this would be subject to "appropriate revision of NO_x norms by MoEF&CC".

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Merit order despatch

The EPCA has recommended that the government should make amendments in the merit order despatch – the system which gives priority to power plants for sale of electricity based on variable cost – so that it will incentivise the plants that install pollution control equipment. The reason for this is that while it is difficult to 'shut down' the non-compliant power plants because of the demand for electricity, the plants can get credit for their compliance through improvement of their rank for sale of electricity.

This approach has been used in China through the 'dispatch regulation of energy-saving electricity 2007'. According to this, priority in dispatch was given to renewable power generation first, followed by thermal power plants, but by the order of how much energy the plant consumed and its emissions. Plants with lower consumption of coal and lower emissions would go to the grid first. This system, with some variation, could be used in India. However, in its affidavit to the Court in February, the MoP has said that there is no need to make any changes to the merit order dispatch system.

November 2018: Private power producers file affidavits through their Association of Power Producers, saying:

- They cannot advance the deadline to 2020 as suggested by the EPCA – however, they are committed to adhering to the implementation schedule by 2022, as proposed by the CEA and accepted by the CPCB.
- They need assurance from CERC/SERCs on tariff increase so that they can raise funds from the market. The tariff increment of 50 paise per unit will have to be passed through by the CERC/SERCs so that the plants remain viable; also, the increase in cost would make the plants lose their positions under the merit order despatch. Therefore, this cost should be paid through the National Clean Energy Fund – the cess imposed on coal.
- The MoEF&CC should finalise regulations for disposal of surplus unutilised gypsum – waste produced from the FGD plants.
- Plants commissioned beginning February 2017 should be given more time to comply with the norms and must be brought into the ambit of the CEA phase-out plan – effectively asking for time till 2022.

December 12, 2018: Supreme Court hears the matter regarding the final agreement on the schedule for implementation by all power plants. It directs:

"The learned *Amicus* informs us that during the meeting it was agreed that in terms of the affidavit filed by the power plants, they would comply with the notified emission as per the revised schedule by 2022. With regard to any deterrence for non-compliance of notified emission norms, MoP and MoEF&CC are looking into the matter with special emphasis on relegating the non-compliant power plant to the bottom of the merit order despatch." (see Box: *Merit order despatch*).

Table 1: Standards: Amended and finalised as of 2020

Current thermal power station norms.

INDIA	PM	SO_2	NO_x	Water
Old standards	150-350	None	None	None
2015 Revised standards				
Units installed before December 31, 2003	100	600 (< 500 MW) 200 (≥ 500 MW)	600	3.5 m^3/MWh
Units installed between 2004-2016	50	600 (< 500 MW) 200 (≥ 500 MW)	300*	
Units installed from January 1, 2017	30	100	100	3 m^3/MWh

*Expected to be revised to 450 mg/Nm^3

Source: Union Ministry of Environment, Forest & Climate Change, 2020

May 17, 2019: The MoP and MoEF&CC agree in principle to revise the NO_x norms from 300 mg/Nm^3 to 450 mg/Nm^3 for TPPs installed between January 1, 2004 and December 31, 2016 (see Box: *Implications of the revision of the NO_x standard*).

August 5, 2019: The Supreme Court, taking cognisance of the minutes of the meeting of May 17, 2019, says action should be taken on the basis of the consensus that has been reached.

THE DEADLINES

On the revised deadlines for power plants commissioned up to December 2018 – to meet emission norms by 2022

- **Deadlines to meet the norms were first shifted from 2017 to 2024, and then brought forward to 2022.**
- **In the case of particulate matter (PM), about 105 GW was already complying or could comply immediately. The rest 79 GW have to comply between 2019 and 2022 – of this, about 88 per cent capacity is Central- and state-owned. Private-owned plants are in a better state: 86 per cent of capacity is either already complying or could comply immediately by 2018, according to the CPCB.**
- **In the case of sulphur dioxide (SO_2), a major capacity (about 126 GW) has been given a long deadline for 2021 and 2022. Only about 18 GW had to meet norms by 2019.**
- **About 81 per cent of state-owned capacity (51 GW) has to comply with SO_2 norms before the end of 2021; however, a large percentage will miss this deadline.**
- **In the case of NO_x, a mere 23 GW capacity has to meet the norms in 2019-2020, whereas about 161 GW has been given a deadline of 2022.**
- **Eleven coal-based power plants in Delhi-NCR had been directed to ensure compliance by December 2019, as air pollution is a severe problem in this region.**
- **In June-July 2019, the CPCB issued directions to freshwater-based once-through plants (16 GW capacity) to install cooling towers and comply with the standards by June 30, 2022.**
- **The deadline to meet the water consumption norm was December 2017 – but no firm action has been taken on non-complying plants.**

The national timelines

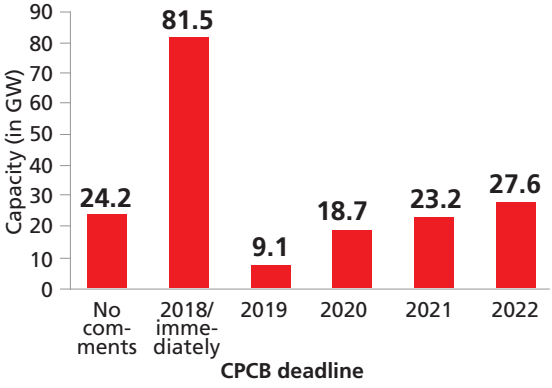
The CPCB's deadlines for meeting the norms are being discussed in these series of graphics. The unit-wise deadlines for meeting PM, SO_2 and NO_x norms have been included in Annexures. The list was compiled based on directions issued by CPCB to individual plants during 2017-2018.[1]

Timelines for meeting PM norms

Of the total 184 GW capacity for which the CPCB issued directions, 44 per cent (82 GW) had to comply either immediately or by 2018. About 13 per cent (24 GW) were not given any deadlines – both these categories (57 per cent of 185 GW capacity) largely consist of plants that are either already in compliance or may be able to comply with little investment or effort. The remaining 79 GW capacity (43 per cent) have been given deadlines to comply between 2019 and 2022.

Graph 1 & Table 1: Timelines for meeting PM norms

About 57 per cent capacity (105 GW) consisted of already complying units or those which could comply immediately. The rest 79 GW capacity have to comply between 2019 and 2022 of which about 88 per cent capacity is Centre and state owned.

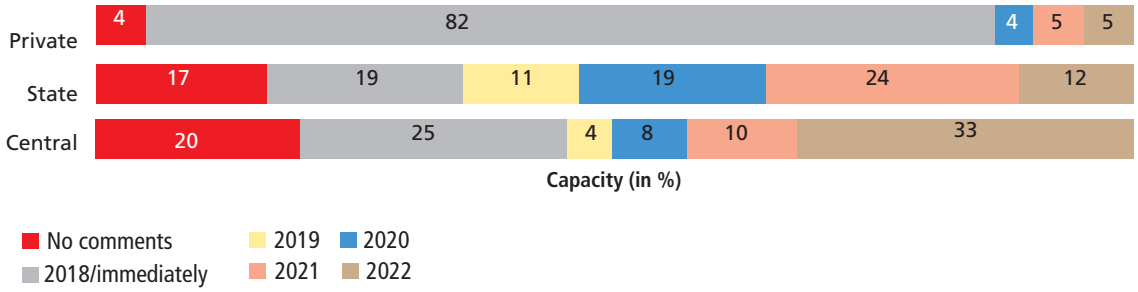


CPCB deadline	Central (in MW)	State (in MW)	Private (in MW)	Total capacity (in MW)	Total Units
No comments*	10,850	10,310	3,020	24,180	62
2018/immediately	13,340	11,480	55,898	81,468	174
2019	2,300	6,760	0	9,060	40
2020	4,150	11,475	2,440	18,065	88
2021	5,500	14,685	3,060	23,245	96
2022	17,850	7,180	2,570	27,600	91

*This category largely consists of compliant units
Source: As per directions issued by CPCB during 2017-2018

Graph 2: Ownership and timelines

Private-owned plants are in a better state, a major private-owned capacity (about 86 per cent) is either already complying or could comply immediately by 2018.



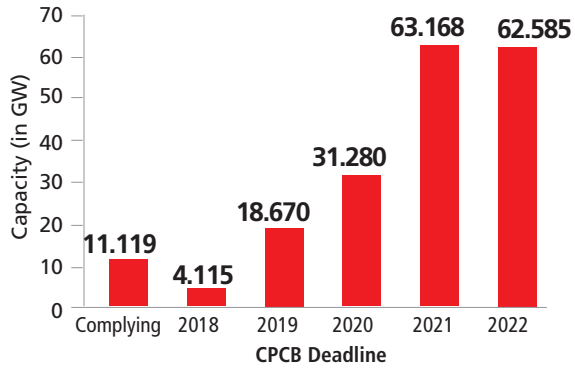
Source: As per directions issued by CPCB during 2017-2018

Timelines for meeting SO_2 norms

About 11 GW capacity (48 units) was already complying in 2017; another 5 GW capacity (39 units) was directed to comply immediately through lime injection. Already complying units either had FGD or CFBC boilers. The schedule for the rest (about 175 GW) ranged from 2019 to 2022. The schedule appears to be heavily back-loaded – about 70 per cent capacity (126 GW) has been given a deadline for the last two years, 2021 and 2022. Such long timelines may lead to poor oversight and further delays in compliance.

Graph 3 & Table 2: Timelines for meeting SO_2 norms

Deadlines are heavily back loaded a major share (126 GW) has been given a long deadline of 2021 and 2022.

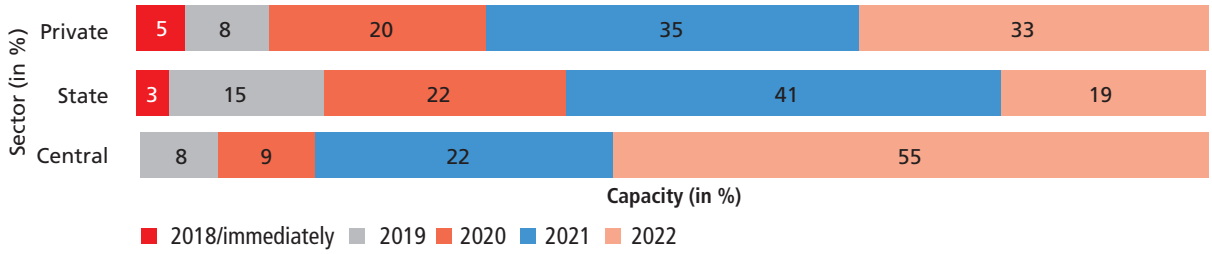


CPCB deadline	Capacity in MW: Central	State	Private	Total capacity	Total Units
2018/immediately	130	2,090	1,815	4,115	31
2019	4,120	9,330	5,220	18,670	61
2020	4,650	13,990	12,640	31,280	107
2021	15,120	25,665	22,383	63,168	168
2022	29,470	11,930	21,185	62,585	176

Source: As per directions issued by CPCB during 2017-2018

Graph 4: Location, ownership and timelines

- Only about 10 per cent capacity (18,670 MW) has to meet SO_2 norms by 2019. Of this, about 13,530 MW is located in the states neighbouring Delhi – Punjab, Haryana and Uttar Pradesh.
- A major capacity (125,753 MW; 344 units) has been given the 2021-2022 deadline.
- About 55 per cent of the total Centre-owned capacity (29470 MW) has been given a deadline of 2022.
- About 81 per cent of state-owned capacity (51,075 MW) has to comply before the end of 2021. However, looking at their progress so far, it appears that a large percentage of the state-owned capacity is going to miss the deadline.

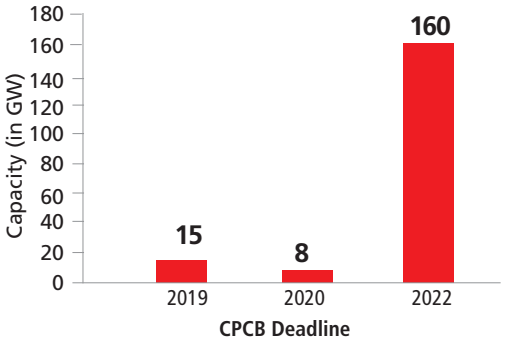


Timelines for meeting NO_x norms

CPCB gave directions to meet NO_x norms to about 183 GW capacity. Majority of this capacity (about 87 per cent) need to progressively improve operations and comply with the norms by 2022. About 15 GW capacity got a deadline of 2019 – this mainly includes plants located within 300 km radius of Delhi-NCR. A mere 13 per cent of the capacity has to meet norms in 2019-2020.

Graph 5 & Table 3: Timelines for meeting NO_x norms

A major capacity has to comply with the norms by 2022.



CPCB deadline	Central (MW)	State (MW)	Private (MW)	Total capacity (MW)	Total units
2019	**4,120**	**6,730**	**4,700**	**15,490**	**55**
2020	**1,330**	**5,590**	**1,180**	**8,100**	**60**
2022	**49,040**	**49,556**	**61,372**	**1,59,968**	**436**

Source: As per directions issued by CPCB during 2017-2018

Given the fact that many of the plants need to only optimise combustion or install low-NO_x burners (LNBs) or over fire air (OFA) systems, which can be done during annual overhauls, a major percentage can comply within the next one-two years. Despite this, a large percentage has been unnecessarily given a long deadline of 2022.

If implemented rigorously, the standards can drastically reduce emissions of NO_x, SO_2 and PM and make power plants water efficient. But CSE's research and analysis shows that even after extension of timelines, a large proportion of the capacity is going to miss the deadlines – especially for SO_2 – and this is bad for our environment.

Water consumption deadlines: ignored

The deadline to meet the water consumption norm was December 2017 – but no firm action has been taken on non-complying plants. While extension of deadlines for meeting emission norms has been granted, for which relevant justification was put forth by the ministry in court and each unit was thereafter given individual timelines, in the case of water there has never been any such discussion on compliance.

It was only in January 2019 that the CPCB asked thermal power plants to submit their specific water consumption data on a quarterly basis starting from October-December 2018. Based on the data obtained, the plants which were not meeting the specific water consumption limit, were asked to submit time-targeted action plans for achieving the limit. In June-July 2019, the CPCB issued directions to freshwater-based once-through plants (16 GW capacity) to install cooling towers and comply with the standards by June 30, 2022. The plants were also directed to submit six monthly progress reports on actions taken on compliance.

However, the status of a majority of the plants – which have already installed cooling towers – is not known. It is not clear whether other non-complying plants (apart from once-though plants) have been issued any directions.

IMPLEMENTATION: WHERE DO WE STAND

On progress of implementation and the likelihood of compliance in future – as found by a CSE survey

- **In the case of particulate matter, 97 GW capacity is complying, while upgradation is underway in another 14 GW. Total compliance and non-compliance could not be ascertained as no information was available on the status of progress of an additional 69 GW capacity.**
- **In the case of SO_2, a mere 16 GW capacity has complied; 32 GW has awarded tenders; 125 GW is still at the preliminary stages of feasibility study and tenders; and another 9 GW has no plans for installation. It is highly unlikely for units still at preliminary stages or with no plan to meet the 2022 deadline even if they awarded the tenders now.**
- **It takes at least two years for a station to complete FGD construction. Hence, a coal-based power project with a 2022 deadline should have begun construction by 2019.**
- **Centre-owned plants appear to be leading in implementation of SO_2 norms, followed by privately-owned ones. State-owned units have made no progress on implementation – only one plant has awarded tenders so far.**
- **In NO_x, current implementation progress data for a majority of the capacity is unavailable.**

CSE has surveyed the progress of implementation of the norms across the country. Based on what we found, we assessed whether the plants would be able to comply with the norms within the given deadlines. Data on the progress of implementation was collected from a variety of sources – the Central Electricity Authority's (CEA) quarterly reports,[1,2] field surveys conducted by CSE in some states, state electricity regulatory commissions (SERCs), information available in the public domain, and consultations with industry experts and equipment manufacturers.

For many plants, implementation progress data on PM and NO_x control was not available. However, FGD/DSI installation progress data could be obtained from the CEA quarterly reports. This data was further analysed to understand the future compliance likelihood of various units.

Particulate matter (PM)

In 2017-18, the CPCB sent directions to plants which were not complying with PM emission norms and set deadlines for them. However, there is no further information about these plants in the public domain. To understand what was the status with respect to PM, CSE – in its survey and assessment – has assumed that all the other plants and units that were not served the notice for compliance, are already meeting the standard or are compliant.

In addition, data has been accessed from the following sources: the NTPC, DVC and a few private thermal power plants have given submissions to the Ministry of Power (MoP) about their compliance to PM standards. The CEA provides data on the status of emission control in TPPs in the Delhi-NCR airshed, and emissions data for some plants located in other states have been obtained from the CPCB – all these have been included in the CSE assessment.

Surveys have been conducted in the key coal-based thermal power states – Madhya Pradesh, Maharashtra and Uttar Pradesh – to assess their compliance. The data from this is also included in our final assessment, so that we have a full picture of the status, what is current and what needs to be done.

Compliance and non-compliance as per deadline

» **No comments/comply immediately/2018:** About 24 GW capacity has been given no deadlines (see *Table 1: PM compliance and non-compliance – according to deadline*), and another 81 GW had to comply immediately by 2018 – both these categories (making up 57 per cent of the capacity) consist of plants that were either already complying or could easily comply with minor upgradations. As per current status, 78 per cent of this category has already complied. Status of another 20 per cent is not known.

Capacity which has to meet PM norms between 2019 and 2022

79 GW

» **Deadline (2019-22):** Another 79 GW capacity has been given a deadline between 2019 and 2022 – of this, about 16 GW has complied and ESP upgradation is planned/underway in 13 GW. Status of the major proportion (about 48 GW) is still not known (see *Table 1*). CSE also analysed the implementation progress of NTPC units separately based on the year of deadline (see *Table 2: Is NTPC meeting the PM norms?*)

Table 1: PM compliance and non-compliance – according to deadline

97 GW capacity is known to be complying and upgradation is underway in another 14 GW; there seems to be no information available on the status of progress of about 69 GW. Therefore, total compliance and non-compliance could not be ascertained. Of the 69 GW for which status is unknown, almost half (47 per cent) is state-owned. For transparency, the status of implementation should be made public for all the units.

CPCB deadline (PM)		Deadline-wise current status (MW)	
Deadline	Total capacity (MW)	Progress made	Capacity (MW)
No comments	24,180	Complying	21,390
		ESP upgradation planned/ underway	1,670
		Status not known	700
		To retire/RSD	420
2018/immediately	81,468	Complying	60,373
		Status not known	20,960
		To retire/RSD	135
2019	9,060	Complying	2,620
		ESP upgradation planned/ underway	2,220
		Status not known	3,800
		Retired	420
2020	18,065	Complying	1,430
		ESP upgradation planned/ underway	1,160
		Status not known	15,255
		To retire/RSD	220
2021	23,245	Complying	5,320
		ESP upgradation planned/ underway	6,050
		Status not known	11,455
		To retire/RSD	420
2022	27,600	Complying	6,500
		ESP upgradation planned/ underway	3,615
		Status not known	16,945
		To retire/RSD	540

Overall status irrespective of deadlines (MW)

97,633 MW (53%) Total complying

14,715 MW (8%) ESP upgradation planned/ underway

69,115 MW (38%) Status not known

2,155 MW (1%) To retire / Retired/RSD

Note: This analysis includes plants that were issued directions by the CPCB during 2017-18, RSD = Reserve shut down
Source: CSE analysis, 2020

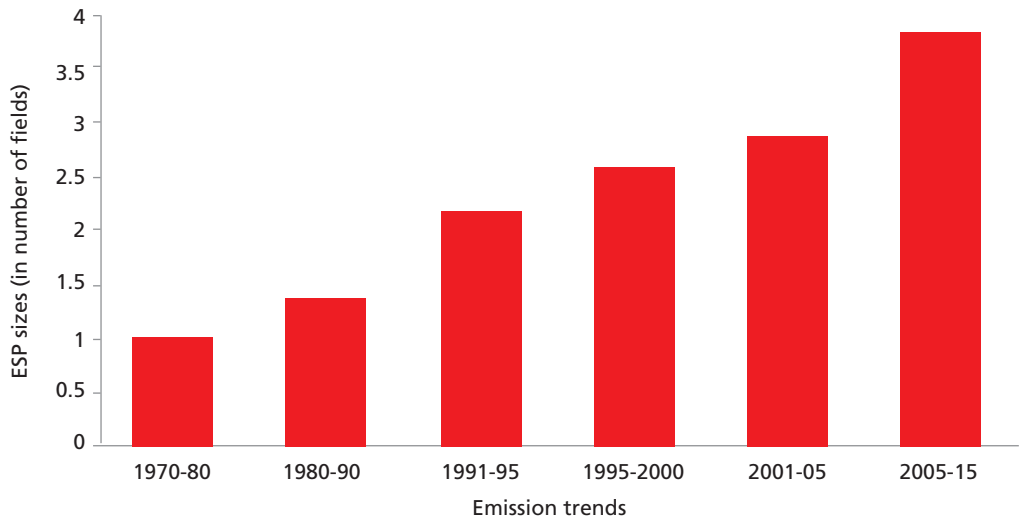
Technology for PM control

The sector is capable of achieving PM emissions norms, given the fact that a considerable proportion of plants have electrostatic precipitators (ESPs) designed to meet the norms and only minor refurbishments are needed. Only those units where performance of ESPs may have significantly deteriorated, will have to consider major overhauls. Since August 2008, environmental clearances given to power plants have been requiring them to meet the PM standard of 50 mg/Nm^3. As the norms have steadily tightened, dry ESPs have been designed with larger sizes (see *Graph: Emission trends and ESP size*s).

Renovation of ESPs cost anywhere between Rs 5-15 lakh per MW, depending on the extent of upgradation. The shutdown time for retrofitment may be up to 30 days, subject to the technique chosen for refurbishment.

- Basic upgradation may suffice for units which have exceeded their design life of 25 years since it might be preferable to retire them in the near future. However, plants with good operating performance and significant remaining life because of life extensions may consider upgrading the ESPs.
- A vast majority of the capacity installed after 2008 was required to meet a PM standard of 50 mg/Nm^3 under their ECs, the same level as the new norms. Many of these plants should already be in compliance, though some may require basic refurbishment such as optimising gas flow distribution and reducing leakages. Optimising the energy supply and control systems are other revamping techniques to improve performance without significant investments.
- Units in the pipeline should be able to meet the 30 mg/Nm^3 standard with a combination of ESPs and FGD units. In fact, an integrated design would mean that the ESP size can be made smaller than a stand-alone one for meeting the norms

Graph: Emission trends and ESP sizes in India



Source: Mitsubishi Hitachi Power Systems

Table 2: Is NTPC meeting the PM norms?

59 per cent capacity (24,570 MW) is currently complying, while the status of another 25 per cent is unknown.

» No comments/2018/immediately: Of the 18,470 MW capacity, 89 per cent is currently complying, ESP upgradation is underway in another 5 per cent and the status of the remaining 5 per cent is not known.

» Deadline (2019-22): Of the 22,990 MW capacity, 35 per cent is currently complying, ESP upgrdation is planned/underway in another 25 per cent, and status of the remaining 40 per cent is unknown.

CPCB deadline (PM)		Deadline-wise current status (MW)	
Deadline	**Total capacity (MW)**	**Progress made**	**Capacity (MW)**
No comments	10,350	Complying	8,850
		ESP upgradation planned/ underway	1,000
		Status not known	500
2018/ Immediately	8,120	Complying	7,620
		Status not known	500
2019	200	Complying	200
2020	3,440	Complying	770
		ESP upgradation planned/ underway	500
		Status not known	2,170
2021	4,000	Complying	2,000
		ESP upgradation planned/ underway	2,000
2022	15,350	Complying	5,130
		ESP upgradation planned/ underway	3,210
		Status not known	7,010

Current status irrespective of deadlines (MW)

24,570 MW (59%) Total complying

6,710 MW (16%) ESP upgradation planned/ underway

10,180 MW (25%) Status not known

Note: This analysis includes plants that were issued directions by CPCB during 2017-18
Source: CSE analysis, 2020

Sulphur dioxide (SO_2)

For SO_2 control and compliance, a large proportion of the non-compliant units are considering partial or full flue gas desulphurisation (FGD), while a few of the smaller capacity and older units are opting for DSI technology. The Central Electricity Authority (CEA) is monitoring the status of implementation of FGD in plants. It provides quarterly data on the progress made by plants to meet the standard. This gives us the most updated and authoritative information; CEA quarterly report of October 2019 has been used in this assessment.

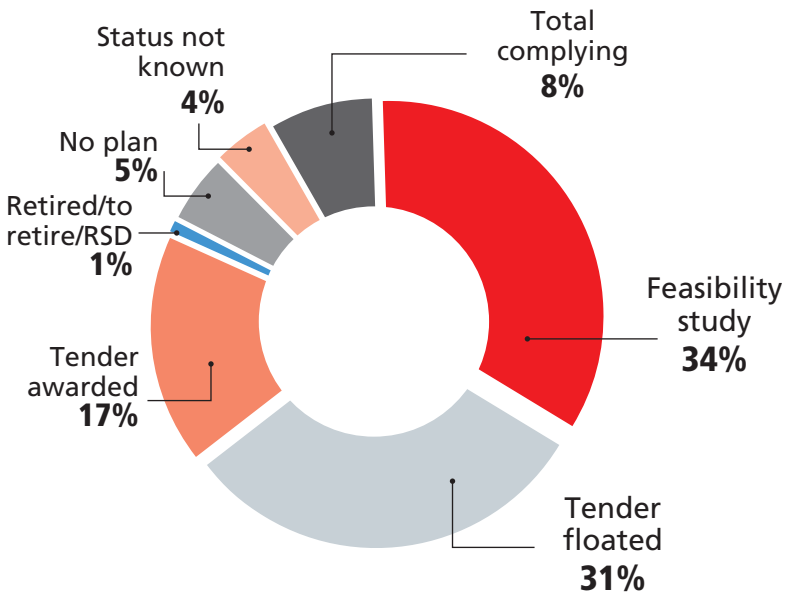
Compliance and non-compliance

» **Units complying and likely to comply by 2022:** About 11 GW capacity was already complying in 2017; an additional 5 GW has complied in the last two years – together, this constitutes only 16 GW (see *Table 3 and Graph 1*). Complying units are those that have installed either CFBC boilers or FGD for SO_2 control. Further, tenders have been awarded by another 32 GW capacity – as per the current status, these units are likely to meet the deadline by 2022. The status of about 5 GW capacity that had to comply immediately through lime injection, is not known as it is not being monitored by any authority. Together, these constitute about 53 GW capacity.

» **Units still at preliminary stages or with no plan for installation:** A major capacity of 125 GW is still at preliminary stages of feasibility study (65 GW) and tender floated (60 GW) and another 9 GW has no plan for installation (see *Table 4: Units that have no plans for implementation*) – together this consitutes 134 GW capacity. It is highly unlikely for these units to even meet the deadline by 2022 even if they award tenders now.

Graph 1: SO_2 compliance and non-compliance

About 34 per cent of the capacity is still at feasibility study, 31 per cent at tender floated stage and another 5 per cent has no plans for installation. It is highly unlikely for these units to meet the deadline even if they award tender now – this constitutes a substantial share of the total capacity that were issued deadlines in 2017-18.



Source: Centre for Science and Environment, 2020

Table 3: SO_2 compliance and non-compliance – according to deadline*

Only about 16 GW capacity has complied as per current status. Of the 18 GW capacity that had to comply in 2019, only 1.3 GW has complied. A large capacity (125 GW) is still at preliminary stages and has not yet awarded contracts. Looking at the current scenario, a major share of the capacity is going to miss the deadlines.

Already complying (in 2017)	**11,119 MW**		
CPCB deadline	**179,818 MW**		
CPCB deadline (SO_2)	**Deadline-wise current status (MW)**		
Deadline	**Total capacity (MW)**	**Progress made**	**Capacity (MW)**
2018/comply immediately through lime injection	4,115	Complying	500
		Feasibility study	500
		Status not known – these plants were required to do lime injection; their status is not clear and is not being monitored	3,115
2019	18,670	Complying	1,320
		Tender awarded	3,520
		Tender floated	8,150
		Feasibility study	3,020
		No plan	1,950
		Retired/to retire	600
		Status not known	110
2020	31,280	Complying	720
		Tender awarded	2,760
		Tender floated	6,140
		Feasibility study	12,890
		No plan	4,840
		Retired/to retire/RSD	660
		Status not known	3,270
2021	63,168	Complying	630
		Tender awarded	10,070
		Tender floated	21,465
		Feasibility study	29,683
		No plan	1,320
2022	62,585	Complying	1,740
		Tender awarded	16,250
		Tender floated	24,175
		Feasibility study	18,870
		No plan	1,050
		Status not known	500
	190,937		190,937

Current status irrespective of deadlines (MW)

16,029 MW (8%) Total complying

32,600 MW (17%) Tender awarded

59,930 MW (31%) Tender floated

64,963 MW (34%) Feasibility study

1,260 MW (1%) Retired/to retire/RSD

9,160 MW (5%) No plan

6,995 MW (4%) Status not known

Note: Above analysis includes plants that were issued directions by CPCB during 2017-18
*Progress status as of October 2019
Source: CEA, 2019 and CSE analysis, 2020

Table 4: Units that have no plans for implementation

CSE identified following 41 units from nine plants with "No plan" for implementation of which more than half of the capacity is state-owned. About 83 per cent units (32 units) are smaller capacity units of less than or equal to 250 MW. Also, more than half of the units are old with age greater than 25 years.

Unit-wise	State	Sector	Capacity (MW)	Year of commissioning
Bakreswar Unit 1-5 (WBPDCL)	West Bengal	State	1,050	2000
Bandel TPS Unit 1-5	West Bengal	State	510	1965-1982
Dr N Tata Rao TPS Unit 1-6	Andhra Pradesh	State	1,470	1979-1994
Kothagudem TPS (TSGENCO) Unit 1,2,4,5,7-10	Telangana	State	1,040	1966-1997
Lalitpur TPP (LPGCL) Unit 1-3	Uttar Pradesh	Private	1,980	2016
Neyveli TPS-I Unit 1-9	Tamil Nadu	Central	600	1962-1970
North Chennai TPS (TANGEDCO) Unit 4-5	Tamil Nadu	State	1,200	2014
Panipat TPS II Unit 5	Haryana	State	210	2001
Raikheda TPP (GMR Energy) Unit 1-2	Chhattisgarh	Private	1,370	2015-2016

Notes: Progress status as of October 2019
Source: Centre for Science and Environment, 2020

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An ownership-wise comparison

Of the 192 GW capacity for which SO_2 implementation progress data is compiled above, it has been observed that Central plants are doing much better in terms of implementation (see *Table 5 and Graph 2: Ownership-wise implementation progress for SO_2 compliance– a comparison*).

- More than half (about 57 per cent) of Central-owned capacity (31.6 GW; 73 units) has awarded tenders and another 34 per cent capacity (18.45 GW; 60 units) has floated tenders (as of October 2019).
- Out of private and state-owned plants, only one state-owned plant (comprising two units) has awarded a contract so far.

Technology for SO_2 control

Indian coal contains sulphur in the range of 0.2-0.7 per cent by weight. With this kind of sulphur content, it is estimated that coal-based power plants in India emit SO_2 in the range of 800 mg/Nm^3 to 1,600 mg/Nm^3.

SO_2 emissions can be controlled at three stages:

» Pre-combustion: Reducing sulphur content in the coal through coal washing
» During combustion: Injecting sorbents in the boiler (CFBC)
» Post-combustion: Flue gas treatment using Flue Gas Desulphurisation (FGD) system or dry sorbent injection technology (DSI)

FGD is a control device used by coal-fired power plants across the world to remove SO_2 from exhaust gases from the boiler using an alkaline reagent. The flue gas after removing SO_2 is then released into the atmosphere. The first FGD system was installed at the Battersea power station of the London Power Company in the 1930s . FGD is a mature technology today with a large number of installations across USA, Europe and China.

There are two main types of FGD systems:

Wet FGD process: Most FGDs installed across the world are of this type, with an SO_2 removal efficiency of more than 90 per cent. Based on the reagent, this is further divided into three sub categories – seawater-based FGD, ammonia-based FGD, and limestone-based FGD.

Seawater FGD systems need lesser capital investment compared to the other systems; their operating costs are also lower as they require no reagent for operation. In limestone-based systems, limestone slurry is pumped into the vessel to dissolve SO_2 in the flue gas. Gypsum is generated as waste, which can be used as a fertiliser or a construction material. The limestone-based wet FGD systems require an additional 0.2-0.3 m^3/MWh water.

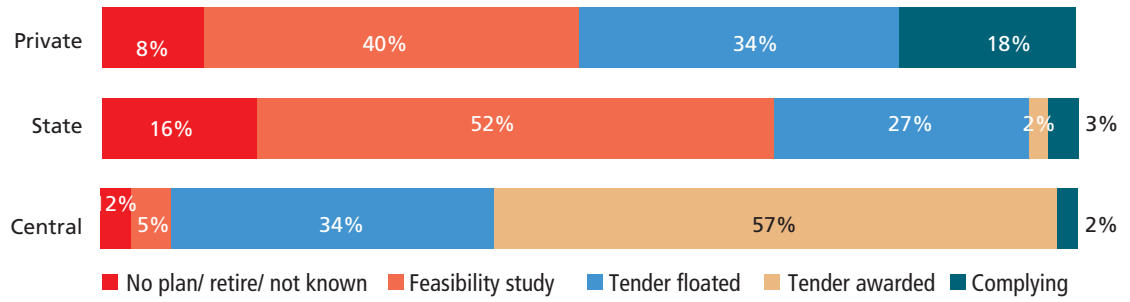
Wet FGD is techno-economically feasible for inland power stations, while ammonia-based FGDs are not very popular because the reagent (ammonia) is considerably more expensive and hazardous than limestone. There is a risk of ammonia slip – ammonia releasing into the atmosphere without any reaction taking place in the FGD system, which is a major environmental concern. Hence, limestone-based wet FGD is a preferred option because the reagent is easily available, inexpensive and can be easily handled.

Dry and semi-dry FGD process: This involves sorbent injection in furnace or duct and spray drier absorber (SDA). The reagent used is slaked lime or limestone. For small power generation units (< = 250 MW), a removal efficiency of 50-60 per cent is sufficient to meet the norms if the SO_2 emissions are in the range of 800-1,000 mg/Nm^3. In such a case, dry sorbent injection (DSI) systems can suffice. DSI utilises calcium-based (calcium hydroxide) and sodium-based (sodium bicarbonate) sorbents to remove SO_2. DSI provides a feasible alternative for units that would not find it cost-effective to invest in a wet or dry FGD system. Also, the erection and commissioning period is around one year. Sorbent injection generates extra dust loads on the electrostatic precipitator (ESP), thus necessitating some level of retrofits. Appropriate action for ESPs should, therefore, be undertaken simultaneously.

Table 5 and Graph 2: Ownership-wise implementation progress for SO_2 compliance – a comparison

None of the private owned units and only two state-owned units have awarded tenders.

Implementation progress stage	Capacity			No. of units		
	Central	State	Private	Central	State	Private
Status not known	840	4,210	1,945	4	24	20
No plan	600	6,230	3,590	9	37	9
Feasibility study	2,500	33,195	29,268	11	115	69
Tender floated	18,450	16,820	24,660	60	48	49
Tender awarded	31,600	1,000	0	73	2	0
Complying	1,000	1,875	13,154	3	10	48



Source: Centre for Science and Environment, 2020

Table 6: NTPC – is it meeting the SO_2 norms?

NTPC is doing better in terms of implementation – 60 per cent of its capacity has already awarded contracts and another 37 per cent has floated tenders. However, units that are still at tender floated stage must fast-track their process to achieve compliance by 2022. Currently, only NTPC Vindhyachal Unit 13 is operating an FGD system.

Already complying (in 2017)		500 MW	
CPCB deadline (SO_2)		Deadline-wise current status (MW)	
Deadline	Total capacity (MW)	Progress made	Capacity (MW)
2019	2020	Feasibility study	0
		Tender floated	0
		Tender awarded	2,020
2020	3,940	Feasibility study	0
		Tender floated	1,118
		Tender awarded	2,760
2021	10,570	Feasibility study	0
		Tender floated	4,500
		Tender awarded	6,070
2022	23,930	Feasibility study	0
		Tender floated	9,880
		Tender awarded	14,050
		Not known	500

Current status irrespective of deadlines (MW)

500 MW (1%) Total complying

24,900 MW (60%) Tender awarded

15,560 MW (37%) Tender floated

500 MW (1%) Not known

Note: This analysis includes plants that were issued directions by CPCB during 2017-18
Source: CSE analysis, 2020

No plan, and in polluted zones

Status of non-complying units at feasibility study/tender floated/no plan stage which are located in critically polluted or densely populated (over 400 persons/sq km) areas, and have a capacity of 500 MW and above

- About 134 GW of the non-complying capacity is at feasibility study/ tender floated/no plan stage. Of this, more than half (72 GW; 245 units) is located in critically polluted or densely populated regions.
- Of this 72 GW, about 53 GW (62 units) capacity comprises of units which are 500 MW and above.
- Since the extent of pollution is proportional to the capacity of the unit and the adverse health impact is more in critically polluted or densely populated regions, these units must fast-track their implementation process to achieve compliance.
- But since these units have not yet awarded tenders, it is highly unlikely for them to meet the compliance by 2022.

Nitrogen oxide (NO_x)

There is little information available for NO_x standard implementation. For this assessment, we have used data provided by NTPC/DVC to the Supreme Court and the surveys conducted by CSE in key states. As the notification revising the limit to 450 mg/Nm^3 has not been issued, it is assumed that the plants have to meet the 2015 standard of 300 mg/Nm^3.

Based on surveys conducted by CSE in few states, it was observed that the emissions for most of the plants normally fall within 200-400 mg/Nm^3 – these plants have installed either low NO_x burners (LNBs) or over fire air (OFA) systems or both. Therefore, with the revision of norms from 300 to 450 mg/Nm^3, such plants will be in compliance (see *Table 7 and Graph 3: NO_x emissions intensity in the surveyed states*).

Plants commissioned after January 1, 2017 have to meet a stringent norm of 100 mg/Nm^3 – this cannot be achieved by a mere installation of OFAs and low-NO_x burners. What is needed are effective technologies like SCR/SNCR. However, the power industry is unsure about the effectiveness of SCR for high dust loading (over 90 g/Nm^3) which is typical to India. Also, SCR systems require ammonia as a reagent. The availability, transportation and handling of ammonia is another bottleneck. According to the power industry, SCR equipment have been working under dust load of less than 60-70 g/Nm^3. The National Thermal Power Corporation (NTPC) has been working on pilot projects (eight SCR and two SNCR) that will have a cyclone prior to SCR/SNCR to bring down the dust levels to test its suitability for Indian coal. However, the results and status of these pilot projects have not been disclosed yet.

Table 7: Deadline-wise compliance and non-compliance for NO_x

For majority of plants compliance status is not known.

CPCB deadline (NO_x)		Deadline-wise current status	
Deadline	**Total capacity (MW)**	**Progress made**	**Capacity (MW)**
2019	15,490	Complying	3,660
		Tender awarded/ upgrading	3,800
		Tendering stage	2,800
		Retired	420
		Not known	4,810
2020	8,100	Complying	620
		Not known	7,480
2022	159,968	Complying	17,485
		Tender awarded/ upgrading	8,980
		Tendering stage	6,400
		Retire/RSD	840
		Not known	126,263
Not given deadline (this largely consists of capacity that had CFBC boilers and so were not issued directions)		–	11,000
			194,558

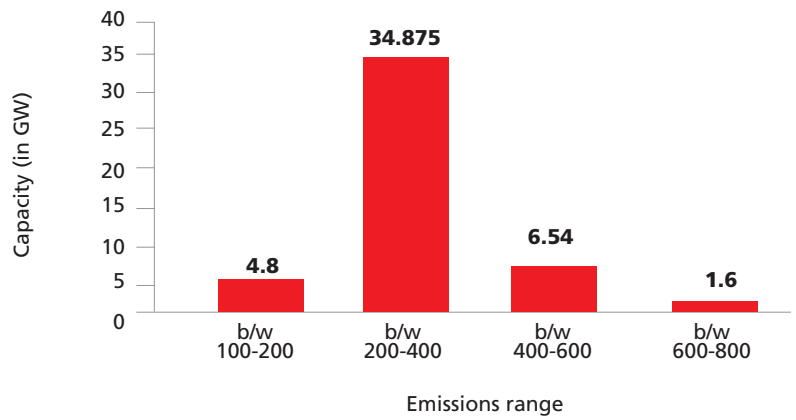
Overall status irrespective of deadlines (MW)

- **32,765 MW (17%)** Total complying
- **12,780 MW (7%)** Tender awarded
- **9,200 MW (5%)** Tendering stage
- **1,260 MW (1%)** Retire/ RSD
- **138,553 MW (71%)** Not known

Note: Above analysis includes plants that were issued directions by CPCB during 2017-18
Source: Centre for Science and Environment, 2020

Graph 3: NO_x emissions intensity in the surveyed states

About 73 per cent capacity in surveyed states had emissions between 200-400 mg/Nm^3.



Source: Centre for Science and Environment, 2019

SOUNDARAM RAMANATHAN/CSE

Table 8: NTPC – is it meeting the NO_x norms?

CPCB deadline (NO_x)		Current status	
Deadline	**Total capacity (MW)**	**Progress made**	**Capacity (MW)**
2019	3,520	Complying	1,040
		Upgrading	2,480
2020	1,120	Complying	1,120
2022	37,820	Complying	19,180
		Upgrading	8,980
		Tender stage	4,500
		Not known	5,160

Note: This analysis includes plants that were issued directions by CPCB during 2017-18
Source: CSE analysis, 2020

Overall status irrespective of deadlines (MW)

21,340 Complying

11,460 Upgrading

4,500 Tender stage

5,160 Not known

Technology for NO_x control

Primary measures for NO_x control (in-combustion control)

Primary combustion measures control and limit the production of NO_x from the combustion zone by promoting its reduction to nitrogen. These are relatively low cost NO_x control technologies and can be implemented quickly. Equipment manufacturers point out that plants commissioned after 2000 already have some form of in-combustion NO_x control.

Following are some of the most widely used in-combustion measures for NO_x control which have been identified by technology suppliers as suitable for high ash Indian coals:

» **Low NO_x burners (LNBs):** In LNBs, the initial fuel combustion occurs in a fuel-rich, oxygen-deficient zone. This is followed by a reducing atmosphere, where hydrocarbons created during coal combustion react with already formed NO_x to turn it into molecular nitrogen (N_2). After the primary combustion zone, the air required to complete combustion of coal is added. This staging reduces peak flame temperatures, resulting in lower NO_x formation.
LNBs typically achieve 30-50 per cent NO_x reduction on their own and are relatively easy to install. They are a well proven, mature technology in use for over 30 years in countries with similar control standards. In fact, in India, newer boilers are equipped with LNBs.

» **Over fire air (OFA) systems:** An OFA system controls the availability of oxygen near the burner area, minimising the formation of fuel NO_x. About 70-90 per cent of the required total combustion air is provided near the burners, creating an oxygen-deficient, fuel-rich zone, leading to partial combustion of fuel. The balance of the combustion air is then injected above the burner elevation, through the OFA nozzles into the furnace, where combustion is completed. The relatively low temperature of the secondary stage limits the production of thermal NO_x. Although a majority of existing boilers in India have stand-alone OFA systems, they are not operated properly. OFA technology can reduce NO_x formation by 20-45 per cent.

LNB and OFA systems should be used together in combination to achieve optimum NO_x reduction.

» **Combustion optimisation:** Boilers are subject to frequent load changes as well as changes in the quality of coal. Hence, there can be localised hotspots or temporary periods of incomplete combustion. This could increase NO_x, CO, unburnt carbon, and exit furnace temperature, leading to other undesired effects such as slagging (molten ash and incombustible by-products that can stick to furnace components following coal combustion). In India, a majority of boilers are tangentially fired, which are known to have lower NO_x emissions compared to wall-fired boilers. Moreover, the tangentially fired boilers incorporate devices which can tilt the burner through an arc range of -30 to +30 degrees from horizontal. Optimising this burner tilt angle can have an appreciable effect in controlling NO_x emissions. Thus, by controlling the existing boiler operating parameters

(like burner tilt, excess air, coal mill operations, etc), plants can have a measurable impact on NO_x emissions.

In addition to this, plants which have installed OFA and LNBs are initially tuned to provide optimum NO_x reduction at a given load on a particular fuel. However, the unit's NO_x performance decreases whenever a variable changes (units operating profile, load, fuel quality, etc). To assist in the maintenance of NO_x performance, combustion optimisation systems which monitor key combustion parameters – NO_x, O_2, CO, unburnt carbon and boiler efficiency – should be integrated into the boiler control systems. All these measurements, if performed accurately, can be used to control both excess air and coal flow to the individual burners resulting in optimised combustion conditions.Combustion optimisation incurs minimal cost and requires very little time for implementation (about five months). Its NO_x reduction potential is around 15-35 per cent and is dependent on the fuel type, boiler dimensions, existing burners, OFA technology and existing coal mill performance.

Several manufacturers have stressed on the fact that the majority of plants commissioned between 2003 and 2016 are already equipped with LNB and OFA. These units, whose NO_x emissions are likely to be around 300 mg/Nm^3, can achieve compliance by simply carrying out combustion optimisation.

Post-combustion NO_x control

Post-combustion control methods can reduce NO_x emissions by neutralising the NO_x in the flue gas into nitrogen via chemical reactions with or without the use of a catalyst. These technologies have higher NO_x reduction potential; however, they require higher capital and operating costs. Following are the two most widely used post-combustion NO_x control technologies:

» **Selective Non-Catalytic Reduction (SNCR):** SNCR is a method used to reduce NO_x to N2 by injecting either ammonia or urea into the boiler furnace at locations where the flue gas temperature is between 900°C-1,100°C. SNCR is a simpler post-combustion control system, which can achieve reliable NO_x reductions ranging from 25-50 per cent, and can be installed within a regular plant outage schedule.

» **Selective Catalytic Reduction (SCR):** SCR is the most effective and well-established NO_x removal technology, in use since the early 1970s. It can be applied as a stand-alone control technology, or in combination with other technologies, including SNCR, combustion optimisation and in-combustion controls such as LNB and OFA.Typically, an SCR is installed on a power plant that requires a much higher level of NO_x reduction compared to the reduction achievable through primary measures and/or SNCR. Only those units which are required to meet the strictest NO_x emission standards of less than 100 mg/Nm^3 should consider opting for this technology.

11

Coal-based power plants located in and around Delhi-NCR

Timelines for plants located near Delhi-NCR

The Delhi airshed requires hard action to combat toxic air pollution. It is for this reason that the December 2017 notices issued by the CPCB, which extended the timelines for most plants by five years, had one notable exception – power plants in the vicinity of Delhi-NCR.

These power plants were directed to ensure compliance by December 2019 for PM, SO_2 and NO_x emissions. A radius of 300 km was decided upon, based on the 2016 report of IIT Kanpur on Delhi's air pollution which states that these airshed power plants are a significant contributor to the capital's air pollution (see *Box: IIT Kanpur on Delhi's air pollution*).

In this radius, as identified by the CPCB, there are 11 coal-based plants comprising of 37 units, with a total operating capacity of 13.5 GW. Five of these are located in Haryana, four in Punjab and two in Uttar Pradesh.

Plants located near Delhi-NCR: A progress report

The 2019 deadline is past. What is the current status of these plants?

SO_2 compliance status: Only one plant is currently complying with the SO_2 norms – it has installed and operationalised FGD. The implementation progress and compliance likelihood of the plants in Delhi-NCR by 2019 has been assessed as follows:

» Total capacity assessed: 13,530 MW
» Total capacity in compliance: 1,320 MW
» Total capacity in non-compliance: 12,210 MW

94 per cent of Delhi-NCR units (10 plants) have missed the 2019 deadline for SO_2 compliance.

PM compliance status: Seven out of the 11 plants are complying with the PM norms. Non-complying plants include Guru Hargobind, Harduaganj Rajiv Gandhi and Yamunanagar. In order to be compliant, non-compliant plants must fast-track their ESP retrofit/upgradation work. The implementation progress status is provided in Table 9.

NO_x compliance status: Only three plants are currently complying.

IIT Kanpur on Delhi's air pollution

The 2016 IIT Kanpur report states that nearly 52 per cent of NO_x emissions and 90 per cent of SO_2 emissions in Delhi can be attributed to industrial point source (largely from power plants). SO_2 also contributes to secondary particles (sulfates). The report states that there are 13 thermal power plants (TPP) in the radius of 300 km of Delhi, which are expected to contribute to secondary particles. The precursor gases for sulfates are emitted from large power plants and also from refineries located in the vicinity of Delhi. The north-westerly wind transports SO_2 emitted from these power plants situated in the upwind of Delhi and transforms it into sulfates.

Table 9: Status of plants located in the vicinity of Delhi-NCR
Of the 11 plants, seven are complying with PM norms, and only one with SO_2 norms.

Plant name	District	Total units	Total capacity (in MW)	Implementation progress as of October 2019
HARYANA				
Aravali Thermal Power (Indira Gandhi TPS)	Jhajjar	3	1500	SO_2 – Tender awarded PM – Complying NO_x – Tender awarded for combustion modification
Mahatma Gandhi STPS (CLP)	Jhajjar	2	1320	SO_2 – FGD installed; Complying PM – Complying NO_x – Combustion modification done
Panipat TPS	Panipat	4	920	SO_2 – Re-tendering PM – Complying NO_x – Preliminary study
Rajiv Gandhi TPS	Hisar	2	1200	SO_2 – Tender floated PM – Complying NO_x– Preliminary study
Yamunanagar TPS	Yamunanagar	2	600	SO_2 – Tender floated PM – ESP retrofit/upgradation planned NO_x – Preliminary study
UTTAR PRADESH				
NCTPP Dadri	Gautam Budh Nagar	6	1820	SO_2 – Tender awarded; Work in progress PM – Complying NO_x – Combustion modification done;
Harduaganj TPS (UPRVUNL)	Aligarh	3	610	SO_2 – Tender floated PM – Tender floated NO_x – Tender floated
PUNJAB				
Guru Hargobind TPS (Lehra Mohabbat TPS)	Bathinda	4	920	SO_2 – Feasibility study completed PM – Non-complying NO_x – Non-complying
Rajpura TPP (Nabha Power Ltd.)	Patiala	2	1400	SO_2 – Tender floated PM – Complying NO_x – low NOx burners installed
Ropar TPS	Rupnagar	6	1260	SO_2 – Feasibility study completed PM – ESP installed in Units 3 & 4, and to be upgraded in Unit 5 & 6 NO_x – Complying
Talwandi Sabo TPP	Mansa	3	1980	SO_2 – Tender floated PM – Complying NO_x – Tender floated

420 MW

Capacity waiting to be retired (out of 2,140 MW) in Delhi and its surrounding 300-km area

Delhi-NCR plants – retirement plans

Delhi and its surrounding 300-km area had 2,140 MW (15 units in four power stations) of capacity, which was commissioned before 1990. Of this, all except 420 MW (two units in one power station) has been retired.

NTPC Badarpur: Since August 2015, the NTPC Badarpur plant had been operating at a partial load. Only two 210-MW units had been operational; since early November 2015, only one 210-MW unit has functioned. The station was inefficient and had been generating expensive power. The EPCA had advised the station to close down. Delhi's discoms and the government wanted to surrender the power allocation, but were unable to do so due to constraints in transmission lines.

A new inter-state transmission line (ISTS) was commissioned in 2018 to solve the constraint after repeated advice by the EPCA. As committed, the station retired in October 2018 after four decades of operation.

Guru Gobind Singh STPS: This Ropar power station is past its design life. The management was planning to close it down and replace it with super-critical units. However, the closure decision has been taken only for two of the units (due to uneconomic power generation). The closure spurred protests by the employee's union, though the state government managed to withstand them by offering a rehabilitation package. Apart from upgrading to meet the emission norms, the plant has to also install a cooling tower to meet the new water norms.

Guru Nanak Dev TPP: Since 2014, the plant had been operating for an average of only 15 days in a year. The monthly expenditure to maintain this came to Rs 1,300 crore. Hence, the state government, in 2017, announced closure of the plant. The plant is spread across 2,200 acre in the middle of Bhatinda city – no decision has been taken yet on alternative use of this land.

Rajghat Thermal Power Station: The Rajghat station had been in a reserve shutdown mode since 2014. Its closure was pending settlement of issues such as affixing of the residual value, employee relocation etc. In mid-2019, the Delhi government finally decided to 'officially' shut down the plant. The 45-acre land area of the power station will be used to build a 5,000-kW solar park.

THE PHASE-OUT PLAN

On the retirement plans for power plants that are over 25 years in age

- **In 2015, old power plants in India which had been in operation for over 25 years accounted for 34,720 MW capacity.**
- **The Central Electricity Authority (CEA) recommended in 2017 that out of this, 15,552 MW should be retired. The remaining capacity was to be retrofitted.**
- **The MoEF&CC in its affidavit to the Supreme Court (submitted in 2018) says that over 4,775 MW has been retired, and another 4,191 MW is in the pipeline for retirement. For the remaining, it has requested exemption from meeting the norms – the plea was declined by the Environment Pollution (Prevention and Control) Authority (EPCA).**
- **Currently, only 7,795 MW has been retired till date; another 2,535 MW is in the pipeline for retirement.**
- **Most of the older plants are owned by state power companies – governments are reluctant to 'retire' these plants.**
- **In Budget 2020, the Union finance minister said that utilities that run old TPPs would be asked to shut them if these emitted more than the "pre-set norms". But there is no plan on how this will be done.**

25

Years that a coal power station is 'economically' designed to operate for

Coal power stations are 'economically' designed to operate for 25 years. While these plants can run for 30-40 years and more, their performance deteriorates and efficiency drops steadily with time. Old power stations have to undergo life extensions, renovation and modernisation to improve their performance. But despite this, it is difficult for them to compete in efficiency with new plants. Additionally, newer plants are designed with better pollution control equipment.

In 2015, when the norms were announced, 34,720 MW of capacity had exceeded 25 years of operation. Keeping in mind the techno-economic constraints of retrofitting pollution control equipment in these plants to meet the new norms, the Central Electricity Authority (CEA) – in its report published in October 2017 – recommended that 15,552 MW should be retired.[1]

However, the CEA's National Electricity Plan, published in 2018, says that 22,716 MW of capacity is to retire in the period 2017-22.[2] But all this has changed, as it seems that 'retirement' is being pushed back – older plants, even those that do not meet emission standards will continue to run.

In June 2018, the MoP – responding to the EPCA Report No 84 – provided information on power plants and units that have completed over 25 years of operational life and where FGD installation and pollution control is not possible.[3] The ministry identified 49 such units, with a total capacity of 7,059 MW. It recommended that these plants should be allowed to operate for a limited number of hours, to meet the balancing/peaking requirement and to provide continuous power supply to the grid.

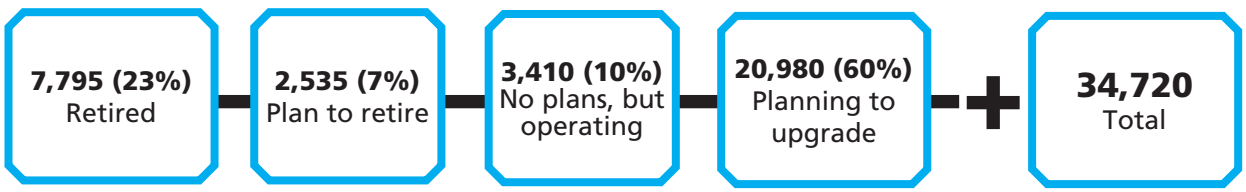
The EPCA has turned down this request, stating that allowing non-compliant power plants to continue to operate would set a dangerous precedent.

Retirement – the current status

As per the MoEF&CC affidavit presented in the Supreme Court in mid-2018[4]:

» Capacity already retired in 2017 – 4,775 MW (43 units)
» Capacity identified for retirement by March 2019 – 4,191 MW (39 units)
» Total capacity targeted to be retired by March 2019 – 8,966 MW

Figure 1: Overall picture on retirement – an overview (capacity in MW)
60 per cent of the old capacity plans to upgrade and continue operating.



Source: Centre for Science and Environment, 2020

Table 1: Retired plant capacity

23 per cent of the old capacity has retired.

Power Station	Ownership	Capacity, MW	Year of retirement
Badarpur TRS	Centre	705	2018
Bokaro 'B' TPS (DVC)	Centre	420	2017
Chandrapura STPS	State	420	2017
Chandrapura TPS (DVC)	Centre	260	2017
DPL TPS	State	220	2017
Durgapur TPS	State	340	2016
Ennore TPS	State	450	2017
Gandhinagar TPS (GSECL)	State	240	2017
Guru Nanak Dev TPS	State	440	2017
Harduaganj TPS	State	315	2017
Koradi TPS	State	200	2016
Korba-II (Korba-East)	State	200	2016
New Cossipore TPS	Private	160	2018
Neyveli TPS- I	Centre	600	2019
Obra TPS	State	94	2017
Panki TPS	State	210	2018
Parli TPS	State	210	2016
Patratu TPS	State	770	2017
Rajghat TPS	State	68	2019
Ramagundem-B TPS*	Centre	63	2015
Ropar TPS	State	420	2017
Santaldih TPS	State	480	2016
Sikka REP TPS (GSECL)	State	120	2017
Tuticorn TPS	State	150	2014
Ukai TPS	State	240	2017
Total		**7,795**	

Source: Centre for Science and Environment, 2020

Table 2: Plants that 'plan' to retire

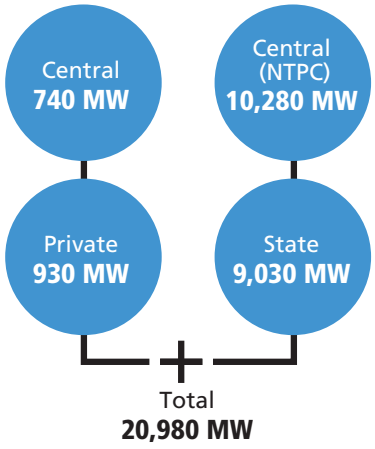
7 per cent plan to retire.

Power Station	Ownership	Capacity, MW
Barauni TPS	State	105
Bhusawal TPS	State	420
Kothagudem TPS (TSGENCO)	State	720
Parichha TPS	State	220
Satpura TPS (MPPGCL)	State	830
Titagarh TPS (C.E.S.C)	Private	240
Total		**2,535**

Source: Centre for Science and Environment, 2020

Figure 2: Ownership of old plants planning upgradation

NTPC operates the largest old fleet capacity in India.



Source: Centre for Science and Environment, 2020

Table 3: Location of old plants

75 per cent of the capacity is located in densely populated or critically polluted areas.

Location	Capacity, MW (%)
Critically polluted area (CPA) + high population density (>400 persons/sq km) regions	630 (3)
CPA only	9,500 (45)
High density	5,960 (28)
Less impact areas (<400 persons/sq.km)	4,890 (23)
Total	20,980

Source: Centre for Science and Environment, 2020

Table 4: Deadlines

One-fourth of this capacity has to meet the PM and SO_2 norms by the end of this year.

	PM	SO_2	NO_x
Comply immediately	1,770	500	
2019	620	620	620
2020	2,980	2,980	1,640
2021	6,040	7,998	
2022	7,520	8,882	18,510
No comments/ deadlines	2,050		210

Source: Centre for Science and Environment, 2020

Retired capacity

Currently, about 7,795 MW capacity is all that has been retired till date, while another 2,535 MW remains in the pipeline. The units that are in the pipeline to retire are under reserve shut-down (due to commercial and humanpower rehabilitation issues), or are barely operational. A majority of the retirement happened in 2017, says the environment ministry. Between 2018 and now, CSE finds about 3,020 MW has been retired – these include stations which did not earlier commit to retirement.

This is when the Union finance minister Nirmala Seetharaman, in her budget speech in 2020, advised old thermal power stations which cannot meet the new emission norms to close: "There are yet, thermal power plants that are old and their carbon emission levels are high. For such power plants, we propose that utilities running them would be advised to close them, if their emission is above the pre-set norms. The land so vacated can be put to alternative use."

Status of old plants that plan to 'remain'

Plants planning upgradation

» Of the 34,720 MW, 20,980 MW capacity are planning upgradation to meet the norms – 53 per cent of these are run by Centre-owned utilities, 43 per cent by states, and 4 per cent by private (see *Figure 2*).

» 75 per cent of this capacity is located in densely populated areas or critically polluted areas (see *Table 3: Location*).

» By the end of this year, 5,370 MW has to comply with PM norms, 4,100 MW should comply with SO_2 norms, and 2,260 MW with NO_x norms (see *Table 4: Deadlines*).

» Deadlines to meet water norms have not been issued yet. To meet the water norms, 9,910 MW has to install cooling towers. Cooling tower construction takes two-three years.

Compliance status with the new emission norms

Particulate matter

» One-third of the capacity already complying.
» Another one-third doing retrofits and upgradations, will meet the norms – plans are available for only 19 per cent of this capacity
» Remaining one-third unlikely to meet deadlines (see *Figure 3: Current status of PM control in stations planning upgradation*).

Sulphur dioxide

» One-fourth of the capacity issued tenders to retrofit SO_2 control systems (see *Table 5: Current status of SO_2 control in stations planning upgradation*).
» Three-fourth unlikely to meet the deadlines.

Figure 3: Current status of PM control in stations planning upgradation
One-third capacity is non-compliant and another one-third needs upgradation.

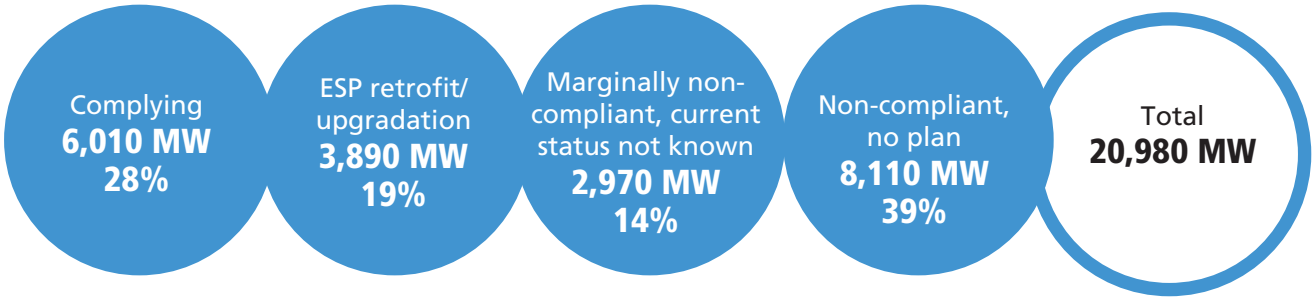


Table 5: Current status of SO_2 control in stations planning upgradation
Only 28 per cent of the capacity is likely to comply.

Deadline	Status	Capacity (MW)
2018	Complying	500
2019	Tender floated	420
	Tender awarded	200
2020	Feasibility study	630
	Tender floated	2,130
	Tender awarded	220
2021	Feasibility study	4,948
	Tender floated	3,050
2022	Feasibility study	1,682
	Tender floated	2,150
	Tender awarded	5,050
Total		20,980

Source: Centre for Science and Environment, 2020

9,910 MW

Old capacity that has to install cooling towers, but has not even begun constructing them

» Units doing feasibility study or floating tenders highly likely to miss the deadlines.
» Less than 2 GW plans to retrofit dry sorbent injection technology, while the rest have opted for the more expensive limestone-based FGD system.

Oxides of nitrogen

No information on emissions is available. However, since the norms are lenient at 600 mg/Nm^3, experts believe these stations might be able to comply with little to nil upgradation.

Water

A capacity of 9,910 MW has to install cooling towers, building which takes two-three years per tower. None of the stations have begun constructing cooling towers. It is highly unlikely that these stations will meet the water norms.

Plants that continue to operate with no plan

» Of the 34 GW, 3.4 GW is operating with neither a plan to upgrade, nor one to close down operations. Except DVC Chandrupura, a Centre-run utility, the rest are state-operated (see *Table 6: The eight with no plan*).
» Four out of five power stations not meeting PM norms.
» All eight power stations have no measures to control SO_2 emissions nor a plan to meet new emission norms.
» Three out of the eight stations are once-through cooling type (OTC) plants or water guzzlers.
» All these stations, previously at some point, had agreed to retire – they have been changing stances, buying time.

To sum up, the issue of retirement has remained indecisive and subject to flip-flops by the plants.

Table 6: Retirement: The eight with no plan

These eight plants had agreed to retire, but have not done so yet.

Power station	State	Capacity (MW)
Bandel TPS*	West Bengal	450
Chandrapura TPS (DVC)	Jharkhand	130
Dr Narla Tata Rao TPS*	Andhra Pradesh	840
Harduaganj TPS (UPRVUNL)	Uttar Pradesh	110
Korba-III (Korba-East)	Chhattisgarh	240
Mettur TPS	Tamil Nadu	840
Neyveli TPS- I	Tamil Nadu	600
Obra TPS*	Uttar Pradesh	200
Total		3,410

*Highlighted stations are once-through cooling type plants or water guzzlers
Source: Centre for Science and Environment, 2020

6

THE NEW PLANTS

On the status of plants commissioned on January 1, 2017 and after

- **Between January 2017 and October 2019, new capacity totalling 23,112 MW was added in India, with the Central sector accounting for 41 per cent of it.**
- **However, the rate of growth of new thermal power plants has significantly slowed down, and in the past few years, has remained below target. Plants have not been commissioned for one reason or another.**
- **All new plants have to meet the stringent new emission norms – but as far as meeting SO_2 standards is concerned, as per the CEA's phase-in plan, the deadline mentioned for these plants is 2022. In other words, these plants are functioning but are not compliant with the standards.**

In the past three years – since 2017 to date – the rate of capacity addition of new coal-based thermal power in the country has slowed down. Earlier (in the period 2011 to 2016), the new thermal capacity that was added had exceeded the targets that had been set. But from 2017, the target was reduced significantly – and even this truncated target was not met (see *Table 1: New thermal power – targets and capacity addition*).

Between January 2017 and October 2019, some 23,112 MW was commissioned across different states (see *Table 2: Capacity addition across different sectors*).[1] The Central sector held the maximum capacity of 41 per cent in this installation, followed by states (34 per cent) and private entities (25 per cent).

As per the MoEF&CC notification dated December 7, 2015, plants which are commissioned beginning January 1, 2017 onwards are required to meet the stringent new emission norms, which are applicable to all plants irrespective of their capacity (see *Figure 1: Emission standards*).

Table 1: New thermal power – targets and capacity addition

Targets are being missed since 2017.

Financial year	Targets (MW)	Actual capacity addition (MW)	% achievement
2012-13	15,154	20,121	132.78
2013-14	15,234	16,767	110.06
2014-15	14,988	20,830	138.98
2015-16	17,346	22,460	129.48
2016-17	13,440	11,550	85.94
2017-18	11,366	8,710	76.63
2018-19	7,266	5,781	79.56
2019-31st Dec 2019	8,566	5,445	63.56

Source: CEA monthly report
Thermal includes coal, gas and diesel fired power plants.

Table 2: Capacity addition across different sectors (in MW)

Centrally-owned plants hold the lion's share of capacity addition during 2017-19.

Ownership	2017	2018	2019	Total capacity added	Number of units
Central	3,065	2,760	3,690	9,515	17
Private	3,810	1,500	417	5,727	18
State	2,370	2,060	3,440	7,870	12
Total	**9,245**	**6,320**	**7,547**	**23,112**	**47**

Source: Central Electricity Authority

41%

Share of Centre-owned plants in new capacity added in the country

CSE PHOTO ARCHIVES

Figure 1: Emission standards
Applicable to all plants commissioned on and after January 1, 2017.

PM (mg/Nm^3)	SO_2 (mg/Nm^3)	NO_x (mg/Nm^3)	Specific water consumption (m^3/MWh)
30	**100**	**100**	**3***

*Initially, the standard was 2.5 m^3/MWh. It was revised to 3 m^3/MWh.

Pollution control technologies – implementation status

Meeting stringent norms for PM and SO_2 does not require any new innovations in technology. For PM, ESPs can meet standards of 30 mg/Nm^3. For meeting SO_2 standards of 100 mg/Nm^3, wet limestone FGD is the preferred technology. Plants installed near coastal areas could opt for sea water-based FGD. However, the NO_x standard of 100 mg/Nm^3 cannot be achieved by combustion optimisation alone – hence, new technologies like SCR/SNCR will be required.

Till December 2019, the CPCB had not issued PM, SO_2, and NO_x directions/deadlines to the plants commissioned in 2018 (except one unit) and for units comissioned in 2019.[2]

42%

Of new capacity given deadlines on SO_2

PM – implementation status

Around 14,907 MW (33 units), representing 65 per cent of the new capacity, had not been given directions or deadlines by the CPCB till November 2019 (see *Table 3: PM deadlines/directions issued to plants commissioned January 2017 onwards*). As for the remaining plants, 3 per cent needed to comply immediately, 20 per cent by 2020, and the remaining 12 per cent by 2022.

Table 3: PM deadlines/directions issued to plants commissioned January 2017 onwards

No directions or deadlines given to over 60 per cent of the plants.

Deadlines	2017	2018	2019	Total	Number of units
2020	4,400			4,700	8
2022	2,045	800		2,845	5
Comply immediately	660			660	1
No deadlines given	2,140	5,520	7,547	14,907	33
Total	9,245	6,320	7,547	23,112	47

Centre for Science and Environment analysis

SO_2 – implementation status

Till November 2019, the CPCB had issued deadlines and directions on SO_2 for 9,645 MW capacity – this was 42 per cent of the new capacity, largely consisting of the plants commissioned in 2017 (see *Table 4: Deadlines given to plants commissioned January 2017 onwards*).

Table 4: Deadlines given to plants commissioned January 2017 onwards

Over 40 per cent have received deadlines between January 2017 and November 2019.

Deadlines	Commissioning year			Total capacity	No. of units
	2017	2018	2019		
Complying (AFBC/CBFC)	250		12	262	2
No deadlines given	150	5,520	7,535	13,205	24
2020	4,550			4,550	9
2021	930			930	2
2022	3,365	800		4,165	10
Total installed	9,245	6,320	7,547	23,112	47

Notes: AFBC =Atmospheric Fluidised Bed Combustion Boilers,
CFBC = Circulating Fluidised Bed Combustion Boilers
Source: CSE analysis from CEA and CPCB reports

The CEA has included plants commissioned in 2017 and 2018 in its phasing plan: all these plants are expected to install FGD by 2022. The CEA is yet to give a phasing plan for plants commissioned in 2019 – these plants have not submitted their FGD implementation plans.

In terms of sector-wise ownership, the Centre-owned plants have made significant progress in FGD implementation, and are likely to meet their deadlines as most of their capacity is now at a later stage of implementation (tender floated/awarded/work in progress) (see *Table 5: FGD implementation status in plants commissioned post-2017*). Private and state plants are lagging behind. A major capacity of the private sector is still at a feasibility stage, whereas most of the state capacity is yet to submit FGD implementation plans.[3]

Table 5: FGD implementation status in plants commissioned post-2017

Centre-owned plants are ahead (capacity in MW).

Implementation status	Central	Private	State	Capacity in MW	No. of units
Complying		300	250	550	2
Work in progress	500			500	1
Tender awarded	4,630			4,630	7
Tender floated	695		1,460	2,155	5
Feasibility study		4,410	660	5,070	14
Plans not available	3,690	1,017	5,500	10,207	18
Total	9,515	5,727	7,870	23,112	47

Source: Centre for Science and Environment analysis

Contested clauses: Environmental clearance (EC) to new plants

Should plants commissioned from January 2017 be asked to meet the new norms immediately, or should they be given a timeframe to meet the norms? As per law, the norms should be applicable immediately for those plants that received their EC after December 7, 2015 (when the new norms came into being). Those plants that received their EC before that date could be exempted from meeting the norms immediately, since their clearance form did not contain any clauses stipulating that they should meet these norms.

Some plants which were under construction and were planning to install FGD and SCR/SNCR at the commissioning stage, have requested the court that their environmental clearance be extended. This was not granted. No further information is available on this.

3 m^3/MWh

Specific water consumption of coal-based plants commissioned January 1, 2017 onwards

NO_x – implementation status

To meet the stringent NO_x norms of 100 mg/Nm^3, Indian power plants will need to install the SCR/SNCR technology. Although a small capacity has been given a deadline of 2022, none of the plants have installed this technology yet. The MoP claims that "for stringent NO_x norms, technologies have not yet been proven in the Indian context with respect to high ash-containing Indian coal. Pilot projects at some TPPs have been initiated". On August 5, 2019, the MoP said: "Pilot project studies on new technologies for NO_x for TPPs installed after January 1, 2017, have been completed by the NTPC. NO_x emissions shall be reviewed after the submission of the final report of these pilot studies to the MoEF&CC; this will be discussed with stakeholders and presented to the court."

Till Now, no clear roadmap was available for meeting NO_x standards in new plants. The MoP is seeking an extension of environmental clearance for all these plants – therefore, these new plants will remain in breach of the standards and non-compliant.

Water – implementation status

For plants commissioned January 1, 2017 onwards, the limit for specific water consumption had been fixed at 2.5 m^3/MWh. However, in June 2018, this was revised to 3 m^3/MWh. This revision was questioned in the Supreme Court by the court's *Amicus*. In response, the MoP enlisted the following reasons for the revision of the water norms:

- For a typical 2x660 MW unit, the limit of 2.5 m^3/MWh is very stringent.
- Evaporation and blow-down from the cooling tower itself will be more than 2.3m^3/MWh. Other consumptive uses such DM water, service water, potable water, HVAC make-up and water requirement for high concentration slurry disposal (HCSD), reservoir loss and make-up for the bottom ash handling system will amount to another 0.4 m^3/MWh).
- There will be an additional water requirement towards FGD make-up, De-NO_x and gypsum washing, amounting to 0.3 m^3/MWh.
- All these water uses result in a total water requirement of 3 m^3/MWh.
- There is no information available if these post-2017 plants meet the revised water norms.

MERCURY AND WATER

On what the norms stipulate for these two elements

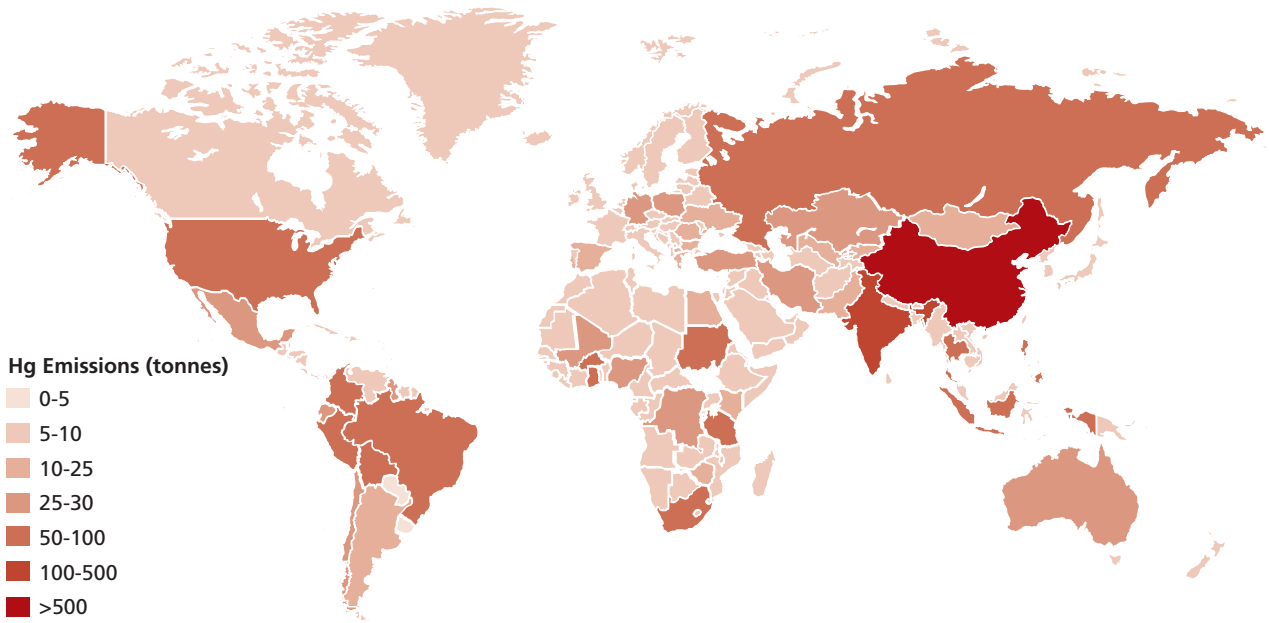
- Mercury is one of the most toxic contaminants known to humans. Coal-fired power plants are the biggest source of mercury emissions.
- India is one of the world's mercury hotspots, and coal-based power plants account for 80 per cent of the country's mercury emissions.
- India's energy sector consumed 576 million tonne of coal in 2017-18; based on this, the annual mercury release works out to be about 160 metric tonne.
- In December 2015, the environment ministry set the standard for mercury emissions from coal-based power plants at 0.03 mg/Nm^3.
- Environment ministry says all units are likely to meet mercury emission norms after installation of pollution control equipment (ESP, FGD, and SCR) as a co-benefit, within the same timelines.
- Water use by TPPs is another area of concern – 44 per cent of existing coal power plants and 45 per cent of proposed plants are located/proposed in areas with high to extremely high levels of water stress. In many cases, the very existence of these power plants is leading to water stress in the regions where they are located.
- In a business-as-usual scenario, 70 per cent of India's thermal power plants will face high water stress by 2030.
- The MoEF&CC notified water standards in 2015 for power plants. In 2018, it amended the norm and set it at 3 m^3/MWh for new plants installed after January 1, 2017. But in the absence of timelines, plants continue with business-as-usual.

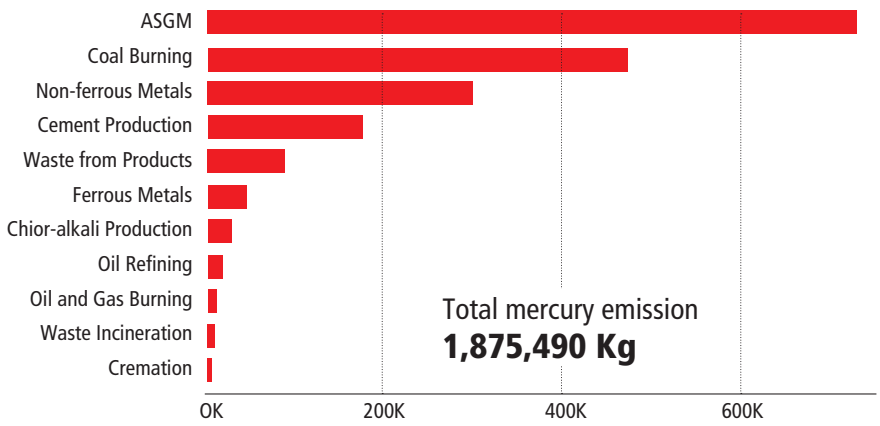
Mercury

Mercury is one of the most toxic contaminants known to humans. Estimation of mercury emissions is a complex phenomenon owing to the distributive global supply chain of upstream and downstream production and consumption. Mercury can be directly released during mercury mining, coal-based power generation, leaching from industrial processes, or use of mercury in gold mining, etc. Indirect emissions occur during production processes of things like cell phones and computers, or in consumption of mercury products. In 2005, the global production system discharged 2,655 tonnes of anthropogenic mercury into the atmosphere; in 2010, this amount was 2,446 tonnes.[1]

Figure 1: Global mercury emissions by country and sector

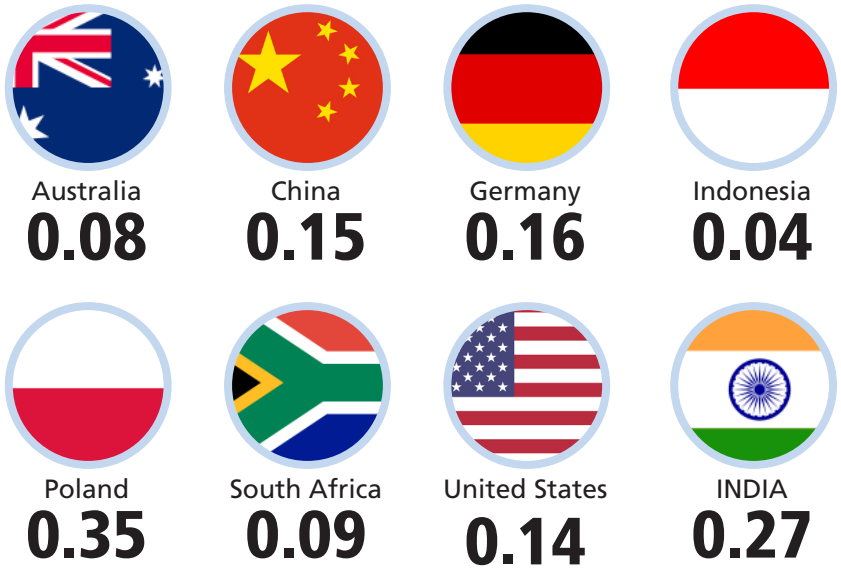
Asia and South East Asia contribute over 60 per cent of the anthropogenic mercury emissions.





Source: United Nations Environment Programme

Figure 2: Mercury in coal (mg/kg or ppm)
Average mercury level in Indian coal is more than that in other countries.



Source: Global Mercury Assessment 2013: Sources, Emissions, Releases and Environmental Transport, United Nations Environmental Programme

According to the Canadian Global Emissions Interpretation Centre (CGEIC), which has published data on the spatial distribution of mercury emissions in air, India is one of the world's mercury hotspots, with mercury being released into the air at the rate of 0.1-0.5 tonne per year[2] (see *Figure 1: Global mercury emissions by country and sector*).

Coal-based thermal power plants are the major source of mercury emissions across the world. As per the US Environment Protection Agency (USEPA), coal-based power plants in the US account for 50 per cent of the country's total mercury emissions[3]. In India, CSE's estimates suggest coal-fired plants contribute 80 per cent of the total industrial mercury emissions.[4]

Coal is the source of the mercury in power plants. Mercury content in coal produced by different coal mines varies widely (see *Figure 2: Mercury in coal*). As per a CPCB study, the mercury content in Indian coal ranges between 0.01 ppm to 1.1 ppm – with the average mercury level among various coal samples found to be 0.272 ppm[5] – more than that in USA and China, the two largest coal consuming countries. Based on this average, with coal consumption in the energy sector ranging at 576 million tonne in 2017-18 , the annual mercury release works out to be about 160 Mt.[6]

Mercury can be present in flue gas in the particulate form (Hg_p) and in gaseous form (Hg^0 and Hg^{2+}). When coal is burnt, around 58 per cent of the mercury is released from the stacks in gaseous form, 2.5 per cent in particulate form, around 32.5 per cent goes into the ash, while the remaining 7 per cent cannot be accounted for.[7]

160 MT
Annual mercury emissions from coal-fired power plants in India

Standards for mercury

Till December 2015, there were no standards in India for controlling mercury in coal-based power plants. In December 2015, the MoEF&CC set the standard at 0.03 mg/Nm^3. This standard is applicable to all units (irrespective of vintage and size), except those that were installed before 2003 and were <500 MW in size.

Other countries have moved proactively on controlling mercury emissions. China has realised significant reductions with the introduction of standards on mercury, along with stringent norms to cut down on PM, SO_2 and NO_x. Even in USA, ever since the introduction of the Mercury and Air Toxics Standards (MATS) Rule in 2011 and its full implementation in 2016, mercury emissions have reduced drastically by 81.7 per cent. The USEPA has found that the standards have helped avoid 10,863 premature deaths across the US in 2016, while creating nearly US $89.4 billion in health benefits.[8] In Texas alone, the MATS helped avoid 1,200 premature

Controlling mercury

There are two broad approaches to mercury control:

Multi-pollutant control: In this method, mercury capture is enhanced in existing/new SO_2, NO_x and PM control devices.

Indian power plants bank on conventional pollution control systems (ESPs, FGD and SCR) for the reduction of mercury in flue gas. The removal is based on mercury speciation in the flue gas. Mercury can be present in flue gas in particulate and gaseous forms (see Table: Forms of mercury in flue gas and their removal method).

Particulate-bound mercury can be absorbed by dust collectors – ESPs; gaseous Hg^{2+} is soluble in water, so it can be absorbed by wet scrubbing system, which is wet FGDs. Gaseous Hg^0 is stable and not soluble in water, and hence, goes into the atmosphere directly with the flue gas. The amount of Hg^0 released will depend on the proportion of Hg^0 and Hg^{2+} in gaseous mercury: this usually varies widely, as it primarily depends on coal types, combustion conditions, temperatures and gas composition.

Installation of SCR/SNCR systems can further reduce mercury emissions – this technology oxidises certain proportions of Hg_0 to Hg^{2+} which can then be absorbed in wet scrubbing. Overall, mercury removal efficiency with FGD and ESP is around 24 per cent. This can be increased to 38 per cent with SCR . As per other studies, for different ESP, FGD and SCR configurations, reduction in mercury can range from 31 per cent to 54 per cent depending on coal inputs .

Thus, implementation of pollution control technologies for controlling PM, SO_2 and NO_x can also control mercury emissions. But it is important to measure and estimate the emissions before making this claim.

deaths in 2016 – nearly 11 per cent of all avoided premature deaths estimated for that year – as well as US $9.7 billion in health benefits .

In February 2018, the MoEF&CC submitted to the Supreme Court that "all units are likely to meet mercury emission norms after installation of pollution control equipment (ESP, FGD and SCR) as a co-benefit". It means the timelines for meeting the mercury norms will follow the FGD installation timelines.

It is important to mention here that proper mercury emission monitoring is crucial to understand the mercury speciation in coal and flue gas, and the possible reduction in mercury from various configurations of ESPs, FGD and SCR. However, the MoEF&CC has not yet mandated sensors or other devices to measure mercury emissions in plants. A few new plants (like Rattan India Amaravati, in Nagpur, Maharashtra) have taken the initiative to install CEMS to measure their mercury emissions.

0.03 mg/Nm^3

Standard for mercury emission from coal-based thermal power plants

Table: Forms of mercury in flue gas and their removal method

Mercury species	Form	Removal method
Hg_P	Particulate-bound mercury	Can be removed by dust collector (ESPs or filter bags)
Hg^{2+}	Gaseous	Soluble in water and can be removed by wet scrubbing system; can also be absorbed by particulate-bound mercury, hence a dust collector can be used
Hg^0	Gaseous	Elemental mercury is relatively stable and insoluble in water so difficult to be collected by dust collector and wet scrub-bing system, hence goes into atmosphere directly; some proportion of the elemental mercury can be oxidised to Hg^{2+} which is water-soluble.
Hg^T	Total mercury	

44%

Of existing coal power plants located in areas of high water stress

Water

With increasing water stress in many parts of India, conflicts between industries and local communities have intensified. Forty-four per cent of existing coal power plants and 45 per cent of the proposed plants are located/proposed in areas with high to extremely high levels of water stress[9]; in many cases, the very existence of these power plants is leading to water stress in the regions where they are located.

The states in India where these plants are located include Maharashtra, Uttar Pradesh, Gujarat, Andhra Pradesh, Rajasthan, Tamil Nadu, Haryana and Punjab, among others. Due to the scarcity of water, power plants in these states are forced to shut down during certain times of the year.

Power plants account for over half of India's total domestic water requirement. The water withdrawal of a once-through plant can range from 70-200 m^3/MWh. On the other hand, plants that have cooling towers consume an average of 4 m^3/MWh (see *Box: OTC vs CT*).

To curtail water consumption of coal-based power plants, the MoEF&CC notified water standards in 2015 for power plants as follows:

- Plants installed before 2017: specific water consumption of 3.5 m^3/MW.
- Plants installed after January 1, 2017: specific water consumption of 2.5 m^3/MWh and were expected to achieve zero discharge.
- All once-through plants: to install cooling towers and achieve specific water consumption of 3.5 m^3/MWh or less.

OTC verses CT

Power plants are water guzzlers – water is the input used mainly for cooling requirements of the plants. Roughly, 80 per cent of the water demand of a thermal plant is in its cooling tower; 18 per cent in its ash handling; and 2 per cent in process and drinking.

Traditionally, plants take large amounts of freshwater, use it to cool and for their process, and then discharge it. This is the once-through-cooling system (OTC). These plants withdraw enormous amounts of water, most of which is returned to the source (with around 1 per cent lost in evaporation), but at higher temperatures than at the draw. The water withdrawal of a once-through plant can be 70-200 m^3/MWh. However, from 1999, the once-through cooling (OTC) plants have been disallowed, so India has a legacy of old and extremely polluting plants using this system. What makes it worse is that this older generation of plants is located in densely populated areas – the water they discharge exacerbates the pollution impact. About 90 per cent of the water use by this sector is by OTC-based power stations.

In the cooling tower (CT) system, the water input is much reduced and the loss is based on evaporation. Plants that use freshwater and have cooling towers consume, on an average, 4 m^3/MWh. CT systems require higher auxiliary power consumption – around 1 per cent of the gross generation – which reduces the amount of power that can be sold and increases the variable cost.

Table 1: Amendments to water consumption norms

The 2018 amendment revised the specific water consumption limit.

MoEF&CC notification (December 2015)	MoEF&CC draft notification (October 2017)	MoEF&CC notification (June 2018)
All plants with once-through cooling tower shall install cooling tower and achieve specific water consumption of 3.5 m^3/MWh within a period of two years from the date of publication of this notification.	Exempt coastal plants from these norms. EPCA in its Report 81 says coastal plants can be exempted ensuring discharge parameters.	This condition will not be applicable to seawater-based once-through plants.
All the existing CT-based plants shall reduce specific water consumption up to a maximum of 3.5 m^3/MWh within a period of two years from the date of publication of this notification.		
New plants to be installed after January 1 shall have to meet specific water consumption norm of up to 2.5 m^3/MWh and achieve zero wastewater discharge.	To increase water consumption in plants installed after January 1, 2017 from 2.5 m^3/MWh to 3 m^3/MWh. EPCA's Report 81 says specific water consumption for the new plants should not be revised.	The specific water consumption norms shall not exceed maximum of 3 m^3/MWh for new plants installed after the January 1, 2017 and these plants shall also achieve zero wastewater discharge.

Source: Ministry of Environment, Forest and Climate Change

In October 2017, the MoEF&CC issued a draft notification proposing some changes to its 2015 notification. The amendment to the notification was issued in June 2018. Through this amendment, the specific water consumption limit of 2.5 m^3/MWh for new plants installed after January 1, 2017 was revised to 3 m^3/MWh. Also, sea water-based once-through plants were exempted from conversion to cooling tower-based systems (see *Table 1: Amendments to water consumption norms*).

Old plants: to change or not?

According to data from MoP, 49 units, totalling a capacity of 15,436 MW – out of the total installed capacity of 196,667 MW (that is, less than 10 per cent) – are designed for once-through cooling water (OTC) and are without cooling towers. The ministry is seeking exemption for these units, arguing of the 15,436 MW, 12,144 MW are old plants which have exceeded operation of their design life.

It is estimated that installation of cooling towers would require an investment of Rs 20-25 lakh/MW and payback is possible, only when the age of the plant is extended – another 10-15 years. The choice is therefore to completely retrofit/refurbish the old plant so that it can meet

Rs 20-25

lakh per MW cost of installing a cooling tower

all standards – PM/SO_2/NO_x and water – or to retire these plants. The option cannot be to allow these older plants to continue to pollute.

In fact, most of the older power plants are located in critically polluted areas/and or densely populated areas. Even NTPC's Farakka, which is located in a low-population and relatively low pollution area had to close down (March 2016) because of shortage of water. Clearly, water stress will only grow.

In addition, these older plants are extremely inefficient, and so their cost of operation is already high. When the cost of emission control or water conservation is added, these plants will become unviable.

Water norms – implementation plans

Specific water consumption norms for power plants came in 2015. All plants were required to meet the norms within two years of the notification – by December 2017. As the deadline to meet the norms ended on December 7, 2017, the CPCB wrote to all power plants stating, among other things, that "the timeline for compliance of water consumption limit shall also be finalised in consultation with the plants". Since then, no such timelines have come up for the plants to follow.

In such a scenario, many plants continue to flout the norms.[10] Plants have failed to report their specific water consumption correctly to authorities. The SWC figures are self-reported by plants to pollution control boards. These, or the status, have not been verified either by the state pollution control boards or any other independent agencies. CSE has noted that specific water consumption of many plants as specified in their consent to operate was not updated according to the water consumption limit of 3.5 m^3/MWh set by the CPCB.

In addition, several consent to operate documents had errors or unclear rationale with respect to water use for domestic, ash handling and fire-fighting purposes. Huge variations have been observed in percentage of freshwater consumed for ash handling by various plants depending on the extent of recycling being carried out for ash handling and leakages in the ash water pipelines carrying ash slurry from plant to ash dykes. In such a scenario, plants might continue to under-report and operate with specific water consumption higher than the limit, leading to excessive water wastages by the sector. There is an urgent need for a robust monitoring and implementation plan for these plants.

CONCLUSIONS AND RECOMMENDATIONS

On what should be the future course of action

- Take action against plants which will not meet the deadline.
- Take action against non-complaint NCR plants.
- Decide on the older plants that cannot meet emission standards.
- Make new plants adhere to the deadline.
- Review and ensure implementation and monitoring of mercury emissions.
- Review implementation and ensure monitoring and compliance of water standard.
- Evolve systems for effective deterrence to ensure compliance.

70%

Of the installed capacity may not meet the 2022 deadline

The thermal power sector has already missed the December 2017 deadline, set by the Union Ministry of Environment, Forest and Climate Change (MoEF&CC) in its 2015 emission standard notification. Therefore, all the plants which are not compliant are in breach of the standard. The proposal to extend the deadline for implementing the December 2015 emission standards was agreed to after deliberations, and this proposal was endorsed and directions given accordingly by the Supreme Court. This much extended deadline – up to December 2022, five year delayed – should by all counts be met. This is critical, because the thermal power sector contributes massively to the pollution load in the country and the implementation of these emission norms is expected to bring down this load by 40-50 per cent[1] – which is substantial.

Implementation of the norms, therefore, is of vital importance. But what is also clear is that this is not happening at the pace it needs to. Already, four years have been lost in procrastination about the costs and the stringency of the set standards. Now that the plants are left with no option but to meet the norms, some have acted and taken the lead – but there are many laggards as well. The question is, what should be done?

1. Take strict action against the plants which will not meet the 2022 deadline

The most critical element of the upgradation is the installation of equipment for controlling SO_2 emissions. To install these equipment, plants will have to be temporarily shut down – they can use this time to also retrofit the necessary pollution control systems to comply with the PM and NO_x norms. So, it is critical to assess compliance or non-compliance from the point of view of the state of preparedness for SO_2 control.

As per the statistics in Table 1, it is clear that 39 per cent of the installed capacity will not meet the 2022 deadline. If you add to it the category of plants which have floated but not yet awarded tenders, then

Table 1: Status of SO_2 norm implementation

39 per cent of the capacity will not meet the deadline.

	Capacity (MW)	Percentage of total plants	Remarks
Compliant	16,029	8	
Feasibility study	64,963	34	Will not meet the deadline
Tenders floated	59,930	31	Will not meet the deadline, unless tenders are awarded in early 2020
Tenders awarded	32,600	17	Should meet the 2022 deadline
Retired/to retire	1,260	1	
No plans	9,160	5	Will not meet the deadline
Status not known	6,995	4	Not clear

Source: CSE analysis, 2020

the non-compliance goes up to a massive 1,34,053 MW or 70 per cent of the installed capacity! This makes nothing less than a mockery of the directions, including those issued by the Supreme Court.

In this scenario, it is critical that the government does the following:

» Issue directions to the absolute laggards – the plants that have either not even floated tenders or have no plans as yet. This direction must be punitive. It must either involve closure, or a substantial fine, or a fiscal disincentive like the downgrading of these plants in the merit order despatch (see *Table 2: The laggards in the lot*).

» Urgently review the category of plants that have not yet awarded tenders and issue them notices to speed up compliance. If the tenders are not awarded by early 2020 – which is unlikely in the current situation – then the plants will not be able to meet the 2022 deadline.

Table 2: The laggards in the lot

Companies that are lagging behind in implementation and will miss the deadline.

Power companies	Capacity (in MW)
CENTRE	
Durgapur Projects Limited (DPL)	660
Damodar Valley Corporation (DVC)	1,840
NLC India Limited	600
STATE	
Andhra Pradesh Power Generation Corporation Limited (APGENCO)	3,360
The Calcutta Electric Supply Corporation Limited	886
Chhattisgarh State Power Generation Company Limited (CSPGCL)	1,500
Gujarat State Electricity Corporation Limited (GSECL)	2,925
Haryana Power Generation Corporation Limited (HPGCL)	210
Maharashtra State Power Generation Company (MAHAGENCO)	10,170
Madhya Pradesh Power Generation Company Limited (MPPGCL)	2,050
Odisha Power Generation Company (OPGC)	420
Rajasthan Rajya Vidyut Utpadan Nigam Ltd. (RRVUNL)	3,100
Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)	2,880
Telangana State Power Generation Corporation Limited (TSGENCO)	3,840
Tenughat Vidyut Nigam Limited (TVNL)	420
Uttar Pradesh Rajya Vidyut Utpadan Nigam (UPRVUNL)	1,920
West Bengal Power Development Corporation (WBPDCL)	4,860
PRIVATE	
Adani Group	600
Avantha Power	600
Bajaj Hindustan	1,980
Bharat Aluminium Company Limited (BALCO)	600
Coal & Oil Group	1,200

Contd. on next page...

Power companies	Capacity (in MW)
Dhariwal Infrastructure	600
Essar Energy	1,800
GMR Group	3,020
GVK Group	540
Haldia Energy	600
Hinduja Group	1,040
Hirnamaye Energy	150
Ind-Barath Power Infra Limited (IBPIL)	350
Jaypee Group	1,320
KSK Energy	1,740
LANCO Infratech Limited	1,800
Nelcast Limited	1,260
Rattan India	1,080
Reliance Power	1,200
RKM Powergen Private Limited	720
Sembcorp Industries Limited	2,640
Shirpur Power	150
SKS Power Generation Limited	300
Sterlite Energy	600
TAQA	250
TATA Power	5,980
Torrent Power	362

Source: CSE analysis, 2020

2. Take action against the non-compliant NCR thermal power plants

The National Capital Region (NCR) has been identified as a critically polluted region – and as a result, the Central Pollution Control Board (CPCB), when it extended the deadline to 2022, decided that the extended deadline did not apply to the thermal plants located in this region.

After the closure of the Badarpur Power Plant, located in Delhi, and the Guru Nanak Dev Power Plant in Bhatinda (Punjab), the region (including the state of Punjab) has 13,530 MW of capacity. There is progress being made, but many units, particularly the older ones, are still lagging behind.

Currently, out of this 13,530 MW, only 1,320 MW is compliant with the SO_2 norms; tenders have been awarded for another 3,320 MW – this means that roughly 34 per cent of the capacity will meet the norms by 2022.[2]

As for the remaining capacity, the plants are still either conducting their feasibility studies or have just floated tenders, but not yet awarded them. Clearly, this needs to be expedited and strict action needs to be taken against the non-compliant plants.

3. Take urgent decisions regarding the older plants that cannot meet emission standards and should be retired/refurbished to use alternative fuels

22,716 MW

Capacity that must be retired between 2017 and 2022, says CEA

There is no clarity on the 'retirement' of older and polluting thermal power plants. In the Budget 2020, the Finance Minister has recommended that utilities that run old thermal power plants would be asked to shut them down if they "emitted more than the pre-set norms".

In 2017, the Central Electricity Authority (CEA) had recommended that of the 34,720 MW thermal power plants that were aged over 25 years (as of 2015 when the emission norms were notified), roughly half would have to be retired (15,552) and the rest retrofitted. In 2018, it revised the number upwards, recommending in its National Electricity Plan that 22,716 MW should be retired between 2017 and 2022.[3]

As of December 2019, some 7,795 MW had been retired and 2,535 MW more was in the pipeline – this accounts for roughly 30 per cent of the over-25 year old plants. Out of the 34,720 MW, 20,980 MW capacity will be upgraded to meet the new emission standards – which is a challenge, particularly when it comes to compliance with the SO_2 and water standards. The bulk of the over-25 year old 'remaining' capacity is with the National Thermal Power Corporation (NTPC) and the state power sector.[4]

It is our assessment that over 70 per cent of these older generation plants that are not scheduled for retirement, will not meet the SO_2 standards by 2022. Therefore, they will be in breach of the extended deadline.

Given the fact that these plants have completed their designed age, the question also arises whether the investment in emission technologies is feasible or cost-effective. These plants will have to pay back the investment by continuing to operate, which will be at higher costs and with higher pollution levels.

There is also the question of water. Around 10,000 MW of the older plants operate using once-through cooling systems, and it will be a challenge to install cooling towers in them. With water scarcity being a real and urgent concern, this continued non-compliance should not be treated lightly.

Therefore, the question is what should be done with older and more polluting thermal power plants. It is a difficult question to answer, because there are issues of livelihood of the workers in these plants, and issues concerning the power requirement that these plants meet. But it is equally clear that these plants, which do not and will not be able to meet the emission standards, should not be allowed to operate.

This is where governments will need to work to find alternatives – change the fuel from coal to less polluting options. These are undoubtedly limited, given that the price of natural gas is not competitive with coal. It is also unclear if the land on which the thermal power plant is located can be converted to generate renewable energy. There could also be other alternatives – from gasification plants using biomass to ultra-modern

Slowdown

In addition of new capacity in the country in the period 2018-20

municipal waste processing plants. It would be important to review the options, but it must be ensured that plants that are old or polluting or resource wasteful, do not continue to operate.

4. Post-2017 power plants must adhere to the deadline or face closure

There cannot be any excuse for delays in the case of new plants, constructed after the notification was issued in December 2015. While the older generation plants have to retrofit the emission technologies, the new-gen plants have no such reason to delay implementation of the emission standards.

However, they have. They have already got an extension on meeting the deadline till 2022. This must be non-negotiable.

The silver lining is that growth of new coal-based thermal plants seems to be slowing down: power plants remain on the books, but have not been commissioned for one reason or the other. India is adding much less capacity of coal-based power plants – down from 22,460 MW addition in 2015-16 to 5,781 MW in 2018-19. The trend remains the same in 2019-20.[5] This is partly because of the slowing down of the economy, but it is also because there is a scaling up of renewable energy sources.

But it does mean that all the new plants must adhere to stringent emission standards – so even as we close the old aged plants and the new-generation plants take over the energy supply, these must not add to the problem of pollution.

The power generation industry is asking for relaxation in the NO_x standards – set at 100mg/Nm^3 for plants built after 2017. It argues that the plants cannot meet this stringent standard. This does not speak well about the state of our domestic industry. The fact is that other countries, such as China, the EU and the US, have equivalent or even tighter standards. The technology for NO_x control exists and India's thermal power industry will have to work towards adapting and making it work.

Already, the industry has managed to get a relaxation in the standard for water consumption – from the 2.5 m^3/MWh to 3 m^3/MWh – arguing that this was too stringent and difficult to achieve. But the fact is that such standards are designed to get industry to go the extra mile, to do more than business-as-usual – to build plants for the future. This generation of thermal power stations are to last the country for the next 25 years – well into the period when climate change impacts will increase and become even more catastrophic. So, building the new-gen plant, which is resource-efficient – both in terms of the use of coal and water – cannot and should not be too much to demand.

The effort has to be two-fold: one, to build the cleanest and most efficient new-generation coal plants and two, to build power generation capacity which is cleaner than coal and less damaging to the local and global environment.

5. Review the implementation of mercury emissions. Issue directions to power companies to include regular monitoring of mercury

The 2015 emission standards for thermal power, for the first time, included norms for emissions of mercury. Mercury is present in coal in varying degrees, based on the location and the mine from where the coal is sourced. When coal is burnt, around 58 per cent of the mercury is released from the stacks in gaseous form; 2.5 per cent in particulate form; and around 32.5 per cent as ash, while the remaining is largely unaccounted for.

Indian power plants argue that they will be able to control mercury emissions when they upgrade their pollution equipment to meet the 2015 standard for other pollutants such as PM, SO_2 and NO_x. These pollution abatement devices – ESP, FGD and SCR – will also control mercury emissions.

This may well be the case. But the only way we will know whether this works is when power companies are directed to monitor mercury on regular basis. Currently, the MoEF&CC has not issued any such direction. This needs to be done – and urgently – so that there is a baseline for mercury emissions before and after the pollution control measures have been taken.

6. Review implementation of water standard; based on this, issue directions for monitoring and compliance

Water stress is an urgent reality in the country. Power plants are huge guzzlers of water. In the current system of once-through, the water is abstracted from inland water bodies and then discharged at high temperatures and with losses. Power companies are well aware of the risk of water crisis in their business – many plants have been forced to shut down because of shortage of water or conflict with local communities over its use in times of drought. Therefore, water conservation is in the best interest of the companies.

The 2015 standard has notified water consumption standard for coal-based power plants and has directed that all plants that were based on once-through cooling (OTC) should mandatorily shift to cooling towers. This would reduce water consumption anywhere from 70-200 m^3/MWh to 3.5 m^3/MWh – a huge saving for this scarce and contested resource.

Subsequently, the thermal plants based near the coast were given an exemption, because their water was drawn from the sea, where it was returned with conditions to ensure that it would not damage marine fauna and flora.

However, there is no information if the plants have adhered to this new standard. The only information that is in the public domain is based on the affidavit filed by the Ministry of Power seeking exemption for older generation power plants from making this change in technology – from OTC to cooling towers – arguing scarcity of land and lack of finances.

From OTC

To cooling towers is the change in technology that is required for reducing water consumption in this sector

Needed
Different systems for deterrence

The 2015 direction of the CPCB to all power plants only said that the timeline for compliance with the water standard would be finalised in consultation with the plants. Since then, there is no information on the implementation of this critical norm.

It is urgent that each plant should be required to file compliance with the 2015 direction on water consumption and to set up a robust monitoring system which ensures that this is being done.

7. Evolve systems for effective deterrence that will ensure compliance with the 2015 standard

It is clear that this sector which provides an essential service – that of power and electricity – is difficult to shut down. Pollution Acts have limited power to order closure. Even in times of power surplus, shutting down power plants could lead to local outages. Therefore, we need different systems for deterrence: one, in which there is both an incentive for the first movers – the plants that invest in upgrading their technologies and so reduce their emissions – and a disincentive for the laggards, who continue to pollute and compromise public health.

The cost of public health because of the air toxins must be included in the economics of electricity supply. These systems could be evolved through changes in the merit order despatch, which gives a rank to the power plants for supply of electricity in the grid based on the lowest variable cost. The other option is through stiff penalties that would also increase the variable cost of each unit of power supplied and so push down the power plant in the merit rank.

Otherwise, the polluter will not pay. We will pay with our health.

Annexures

Annexure 1: Plant-wise deadlines as per the directions issued by CPCB during 2017 and 2018

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
ANDHRA PRADESH							
Dr. N.TATA RAO TPS (APGENCO)	State	1	210	1979	2020	2020	2020
		2	210	1980	2020	2020	2020
		3	210	1989	2020	2020	2020
		4	210	1990	2020	2020	2020
		5	210	1994	2020	2020	2020
		6	210	1994	2020	2020	2020
		7	500	2009	2020	2020	2022
Meenakshi Energy Pvt. Ltd. (THAMMINAPATNAM)	Private	1	150	2012	Complying		
		2	150	2013	Complying		
Nelcast Energy Corporation Ltd. (PAINAMPURAM)	Private	1	660	2015	2021	Comply immediately	2022
		2	600	2015	2021	Comply immediately	2022
RAYALASEEMA	State	1	210	1994	2021	2021	2022
		2	210	1995	2021	2021	2022
		3	210	2007	2020	2020	2022
		4	210	2007	2021	2021	2022
		5	210	2010	2020	2020	2022
Sembcorp Gayatri Power Ltd	Private	1	660	2016	2021	Comply immediately	2022
		2	660	2017	2021	Comply immediately	2022
NTPC Simhadri	Central	1	500	2002	2022	no comments	2022
		2	500	2002	2022	no comments	2022
		3	500	2011	2022	2022	2022
		4	500	2012	2022	2022	2022
Simhapuri Energy Pvt. Ltd.	Private	1	150	2012	Complying		
		2	150	2012	Complying		
		3	150	2012	Complying		
		4	150	2012	Complying		

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
Sri Damodaram Sanjeevaiah TPS	State	1	800	2014	2020	2020	2022
		2	800	2015	2019	2019	2022
Thermal Power tech	Private	1	660	2015	2021	Comply immediately	2022
		2	660	2015	2021	Comply immediately	2022
Vizag TPP	Private	1	520	2015	2020	Comply immediately	2022
		2	520	2016	2019	Comply immediately	2022
ASSAM							
NTPC Bongaigaon	Central	1	250	2016	2022	Comply immediately	2022
		2	250	2017	2022	Comply immediately	2022
BIHAR							
NTPC Barh Super TPP	Central	4	660	2013	2021	Comply immediately	2022
		5	660	2015	2022	Comply immediately	2022
NTPC Kahalgaon Bhagalpur	Central	1	210	1992	2022	2022	2022
		2	210	1994	2022	2022	2022
		3	210	1995	2022	2022	2022
		4	210	1996	2022	2022	2022
		5	500	2007	2022	no comments	2022
		6	500	2008	2022	no comments	2022
		7	500	2009	2022	no comments	2022
NTPC MUZAFFARPUR TPS	Central	1	110	1985	2020	2020	2020
		2	110	1986	2020	2020	2020
		3	195	2015	2022	2022	2022
		4	195	2017	2022	2022	2022
NTPC NABI NAGAR TPP	Central	1	250	2016	2021	no comments	2022
		2	250	2017	2022	2022	2022
CHHATTISGARH							
Adani Korba West	Private	1	600	2014	2022	Comply immediately	2022
BALCO TPS	Private	1	300	2015	2021	2021	2022
		2	300	2016	2021	2021	2022
BANDAKHAR TPP	Private	1	300	2015	2020	Comply immediately	2022
BARADARHA TPS	Private	1	600	2014	2021	Comply immediately	2022
		2	600	2015	2020	Comply immediately	2022

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
BHILAI TPS (NSPCL)	Central	1	250	2008	2022	no comments	2022
		2	250	2009	2022	no comments	2022
BINJKOTE TPP	Private	1	300	2017	2020	2020	2022
Chakabura TPP	Private	1	30	2014	no comments		
DSPM TPS (CSPGCL)	State	1	250	2007	2021	Comply immediately	2022
		2	250	2007	2021	Comply immediately	2022
Kasaipalli power station	Private	1	135	2011	Complying		
		2	135	2012	Complying		
Katghora TPP	Private	1	35	2014	Complying		
Marwa TPP (CSPGCL)	State	1	500	2014	2021	Comply immediately	2022
		2	500	2016	2021	Comply immediately	2022
Nariyara TPP (AKALTARA) (KSK)	Private	1	600	2013	2022	Comply immediately	2022
		2	600	2013	2022	Comply immediately	2022
OP JINDAL TPS	Private	1	250	2007	2022	Comply immediately	2022
		2	250	2008	2022	Comply immediately	2022
		3	250	2008	2022	Comply immediately	2022
		4	250	2008	2022	Comply immediately	2022
PATHADI TPP	Private	2	300	2010	2021	Comply immediately	2022
		1	300	2009	2021	Comply immediately	2022
Raikheda TPP (GMR Energy)	Private	2	685	2015	2020	Comply immediately	2022
		1	685	2016	2020	Comply immediately	2022
Ratija TPS	Private	1	50	2016	Complying		
		2	50	2013	Complying		
Salora TPP	Private	1	135	2014	Complying		
NTPC Sipat	Central	1	660	2011	2022	Comply immediately	2022
		2	660	2011	2022	Comply immediately	2022
		3	660	2012	2021	Comply immediately	2022
		4	500	2007	2021	Comply immediately	2022
		5	500	2008	2021	Comply immediately	2022

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
SVPL TPP	Private	1	63	2012	Complying		
Swastik Korba Power Plant	Private	1	25	2012	Complying		
TAMNAR (JPL Jindal)	Private	1	600	2014	2021	Comply immediately	2022
		2	600	2014	2021	Comply immediately	2022
		3	600	2015	2022	Comply immediately	2022
		4	600	2015	2022	Comply immediately	2022
TRN Energy Pvt. Ltd. (Nawapara TPP)	Private	1	300		Complying		
	Private	2	300	2017	2020	2020	2022
UCHPINDA TPP (RKM Power)	Private	1	360	2015	2022	Comply immediately	2022
		3	360	2016	2021	Comply immediately	2022
Chakabura TPP	Private	2	30		Complying		
NTPC KORBA STPS	Central	1	200	1983	2022	2022	2022
		2	200	1983	2022	2022	2022
		3	200	1984	2022	no comments	2022
		4	500	1987	2022	2022	2022
		5	500	1988	2022	2022	2022
		6	500	1989	2022	-	2022
		7	500	2010	2022	-	2022
KORBA-II (Korba-East)	State	1	50	1966	2020	2020	2020
		2	50	1967	2020	2020	2020
		3	50	1968	2020	2020	2020
		4	50	1968	2020	2020	2020
KORBA-III (Korba-East)	State	1	120	1976	2020	2020	2020
		2	120	1981	2020	2020	2020
KORBA-WEST TPS (Hasdeo)	State	1	210	1983	2020	2020	2022
		2	210	1984	2020	2020	2022
		3	210	1985	2020	2020	2022
		4	210	1986	2020	2020	2022
		5	500	2013	2021	Comply immediately	2022
GUJARAT							
Adani Mundra	Private	1	330	2009	2022	Comply immediately	2022
		2	330	2010	2022	Comply immediately	2022

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
		3	330	2010	2022	Comply immediately	2022
		4	330	2010	2022	Comply immediately	2022
		5	660	2011	2022	Comply immediately	2022
		6	660	2011	2022	Comply immediately	2022
		7	660	2012	Complying	Comply immediately	2022
		8	660	2012	Complying	Comply immediately	2022
		9	660	2012	Complying	Comply immediately	2022
Akrimota (CFBC)	State	1	125	2005	Comply immediately	2020	2022
		2	125	2005	Comply immediately	2020	2022
BHAVNAGAR CFBC TPP	State	1	250	2016	Complying		
		2	250	2017	Complying		
Gandhinagar TPS (GSECL)	State	3	210	1990	2021	Comply immediately	
		4	210	1991	2021	Comply immediately	
		5	210	1998	2021	Comply immediately	
Kutch Lignite TPS (GSECL)	State	1	70	1990	2021	2021	2022
		2	70	1991	2021	2021	2022
		3	75	1997	2021	2021	2022
		4	75	2008	Complying	2020	2022
Mundra Ultra Mega TPP (TATA Power)	Private	1	800	2013	2020	Comply immediately	2022
		2	800	2013	2021	Comply immediately	2022
		3	800	2013	2021	Comply immediately	2022
		4	800	2013	2022	Comply immediately	2022
		5	800	2013	2022	Comply immediately	2022
Salaya	Private	1	600	2012	2021	Comply immediately	2022
		2	600	2012	2021	Comply immediately	2022
SIKKA REP TPS	State	3	250	2015	2022	Comply immediately	2022
		4	250	2015	2022	Comply immediately	2022

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
Surat Lignite (CFBC)	State	1	125	2000	Comply immediately	no comments	2022
		2	125	1999	Comply immediately	no comments	2022
		3	125	2010	Comply immediately	2020	2022
		4	125	2010	Comply immediately	2020	2022
Torrent TPS	Private	1	120	1978	2022	Comply immediately	2022
		2	121	1984	2022	Comply immediately	2022
		3	121	1988	2022	Comply immediately	2022
Wanakbori TPS (JECL)	State	1	210	1982	2021	2021	2022
		2	210	1983	2021	2021	2022
		3	210	1984	2021	2021	2022
		4	210	1986	2021	2021	2022
		5	210	1986	2021	2021	2022
		6	210	1987	2021	2021	2022
		7	210	1998	2021	2021	2022
UKAI TPS	State	3	200	1979	2021	2021	2022
		4	200	1979	2021	2021	2022
		5	210	1985	2021	2021	2022
		6	500	2013	2022	2022	2022
HARYANA							
Aravali (Indira Gandhi)	Central-State JV	1	500	2010	2019	2019	2019
		2	500	2010	2019	2019	2019
		3	500	2010	2019	2019	2019
Mahatma Gandhi TPS (CLP)	Private	1	660	2012	2019	Comply immediately	2019
		2	660	2012	2019	Comply immediately	2019
PANIPAT TPS	State	5	210	2001	2019	2019	2019
		6	210	2001	2019	no comments	2019
		7	250	2004	2019	2019	2019
		8	250	2005	2019	2019	2019
RAJIV GANDHI TPS	State	1	600	2010	2019	2019	2019
		2	600	2010	2019	2019	2019
YAMUNA NAGAR TPS	State	1	300	2007	2019	2019	2019
		2	300	2008	2019	2019	2019

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
JHARKHAND							
CHANDRAPURA(DVC)	Central	3	130	1964	2018	2018	2022
		7	250	2009	2022	Comply immediately	2022
		8	250	2010	2022	Comply immediately	2022
Jojobera TPS	Private	1	120	2002	no comments		
		2	120	2001	2020	2020	2020
		3	120	2002	2020	2020	2020
Koderma	Central-State JV	1	500	2011	2021	Comply immediately	2022
		2	500	2013	2021	Comply immediately	2022
MAHADEV PRASAD STPP	Private	1	270	2012	2022	Comply immediately	2022
		2	270	2013	2022	Comply immediately	2022
Maithon Right Bank TPP (Tata DVC)	Private	1	525	2011	2021	Comply immediately	2022
		2	525	2012	2022	Comply immediately	2022
Tenughat TPP (TVNL)	State	1	210	1994	2020	2020	2022
		2	210	1996	2020	no comments	2022
BOKARO TPS	Central	1	500	2016	2022	2022	2022
		3	210	1993	2020	2020	2020
KARNATAKA							
Bellary (Kuditini TPS)	State	1	500	2007	2020	Comply immediately	2022
		2	500	2012	2021	Comply immediately	2022
		3	700	2016	2021	Comply immediately	2022
NTPC Kudgi STPP	Central	1	800	2016	2022	No comments	2022
		2	800	2017	2022	2022	2022
		3	800	2018	2022	2022	2022
RAICHUR TPS	State	1	210	1985	2021	2021	2022
		2	210	1986	2021	2021	2022
		3	210	1991	2021	2021	2022
		4	210	1994	2021	2021	2022
		5	210	1999	2022	2022	2022
		6	210	1999	2022	2022	2022
		7	210	2002	2022	2022	2022
		8	250	2010	2022	2022	2022

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
TORANGALLU TPS EXT	Private	1	300	2009	2022	2022	2022
		2	300	2009	2022	2022	2022
		3	300	2000	Complying		
		4	300	2000	Complying		
Torangallu TPS	Private	1	130	1999	Complying		
		2	130	1999	Complying		
Udupi TPP (Adani)	Private	1	600	2010	2022	Comply immediately	2022
		2	600	2011	2022	Comply immediately	2022
Yermarus	State	1	800	2016	2021	no comments	2022
		2	800	2017	2022	2022	2022
MADHYA PRADESH							
AMARKANTAK EXT	State	5	210	2008	2021	2021	2022
ANUPPUR	Private	1	600	2014	2022	Comply immediately	2022
		2	600	2014	2022	Comply immediately	2022
Jhabua TPP (Avantha)	Private	1	600	2016	2020	Comply immediately	2022
MAHAN TPP	Private	1	600	2013	2020	Comply immediately	2022
Malwa TPP (SHREE SINGHAJI)	State	1	600	2013	2021	Comply immediately	2022
		2	600	2014	2021	Comply immediately	2022
NIGRIE (Jaypee)	Private	1	660	2014	2020	Comply immediately	2022
		2	660	2015	2020	Comply immediately	2022
Niwari BLA TPS	Private	1	45	2013	Complying		
Sanjay Gandhi TPS (MPPGCL)	State	1	210	1993	2021	2021	2022
		2	210	1993	2021	2021	2022
		3	210	1999	2021	2021	2022
		4	210	1999	2021	2021	2022
		5	500	2007	2021	2021	2022

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
Sasan Ultra Mega TPP	Private	1	660	2013	2021	Comply immediately	2022
		2	660	2013	2021	Comply immediately	2022
		3	660	2014	2022	Comply immediately	2022
		4	660	2014	2022	Comply immediately	2022
		5	660	2014	2021	Comply immediately	2022
		6	660	2015	2021	Comply immediately	2022
SATPURA TPS (MPPGCL)	State	10	250	2013	2021	2021	2022
		11	250	2014	2021	2021	2022
		6	200	1979	2020	2020	2020
		7	210	1980	2020	2020	2020
		8	210	1983	2020	2020	2020
		9	210	1984	2020	2020	2020
NTPC VINDHYACHAL STPS	Central	1	210	1987	2022	2022	2022
		10	500	2007	2021	2021	2022
		11	500	2012	2021	no comments	2022
		12	500	2013	2021	no comments	2022
		13	500	2015	Complying	no comments	2022
		2	210	1988	2022	2022	2022
		3	210	1989	2022	2022	2022
		4	210	1989	2022	2022	2022
		5	210	1990	2022	2022	2022
		6	210	1991	2022	2022	2022
		7	500	1999	2021	no comments	2022
		8	500	2000	2021	no comments	2022
		9	500	2006	2021	2021	2022
Bina TPS	Private	1	250	2012	Complying		
		2	250	2013	Complying		
MAHARASHTRA							
AdaniDahanu	Private	2	250	1996	Complying	no comments	2022
		1	250	1995	Complying	no comments	2022

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
Adani Tiroda	Private	1	660	2012	2022	Comply immediately	2022
		2	660	2013	2021	Comply immediately	2022
		3	660	2013	2021	Comply immediately	2022
		4	660	2014	2021	Comply immediately	2022
		5	660	2014	2021	Comply immediately	2022
BHUSAWAL TPS	State	3	210	1982	2021	no comments	2022
		4	500	2012	2021	2021	2022
		5	500	2014	2021	2021	2022
Reliance BUTIBORI TPP	Private	1	300	2012	2021	Comply immediately	2022
		2	300	2013	2021	Comply immediately	2022
CHANDRAPUR	State	3	210	1985	2021	no comments	2022
		4	210	1986	2021	no comments	2022
		5	500	1991	2021	no comments	2022
		6	500	1992	2021	no comments	2022
		7	500	1997	2021	no comments	2022
		8	500	2015	2021	2021	2022
		9	500	2016	2020	no comments	2022
DHARIWAL TPP	Private	1	300	2014	2022	Comply immediately	2022
		2	300	2014	2022	Comply immediately	2022
EMCO WARORA (GMR)	Private	1	300	2013	2022	Comply immediately	2022
		2	300	2013	2022	Comply immediately	2022
Khaparkheda (MahaGENCO)	State	1	210	1989	2021	2021	2022
		2	210	1990	2021	2021	2022
		3	210	2000	2021	2021	2022
		4	210	2001	2021	no comments	2022
		5	500	2011	2021	no comments	2022
KORADI TPS (MSPGCL)	State	10	660	2017	2020	2020	2022
		6	210	1982	2021	no comments	2022
		7	210	1983	2021	2021	2022
		8	660	2015	2021	no comments	2022
		9	660	2015	2021	no comments	2022

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
NTPC Mauda TPP	Central	1	500	2013	2022	no comments	2022
		2	500	2013	2022	2022	2022
		3	660	2016	2022	2022	2022
		4	660	2017	2020	2020	2022
NASIK TPS (MahaGENCO)	State	3	210	1979	2021	no comments	2022
		4	210	1980	2021	2021	2022
		5	210	1981	2021	2021	2022
Nasik Rattan India TPP	Private	1	270	2013	2021	2021	2022
		2	270	2014	2021	2021	2022
		3	270	2017	2022	2022	2022
		4	270	2017	2022	2022	2022
		5	270	2017	2022	2022	2022
Paras TPS (MahaGENCO)	State	3	250	2008	Comply immediately	2021	2022
		4	250	2010	Comply immediately	2021	2022
		4	210	1985	2021	2021	2022
		5	210	1987	2021	no comments	2022
		6	250	2007	2021	2021	2022
		7	250	2010	2021	2021	2022
		8	250	2016	2021	2021	2022
Ratnagiri TPS	Private	1	300	2010	Complying	no comments	2022
		2	300	2010	Complying	no comments	2022
		3	300	2011	Complying	no comments	2022
		4	300	2011	Complying	no comments	2022
Shirpur TPP	Private	1	150	2017	2022		2022
Solapur TPS (NTPC)	Central (NTPC)	1	660	2017	2020	2020	2022
Trombay TPS (TATA Power)	Private	5	500	1984	2018	2018	2022
		8	250	2009	Complying		2022
WARDHA WARORA TPP (KSK Energy)	Private	1	135	2010	2021	Comply immediately	2022
		2	135	2010	2021	Comply immediately	2022
		3	135	2011	2021	Comply immediately	2022
		4	135	2011	2021	Comply immediately	2022
Bela TPS	Private	1	270	2013	Complying		
GEPL	Private	1	125	2012	2020	2020	2020
		2	125	2012	2020	2020	2020

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
Mihan TPS	Private	1	271		Complying		
ODISHA							
DERANG TPS (JITPL)	Private	1	600	2014	2021	Comply immediately	2022
		2	600	2015	2021	Comply immediately	2022
IB VALLEY TPS	State	1	210	1994	2021	2021	2022
		2	210	1995	2021	2021	2022
Ind-Barath TPS	Private	1	350	2016	2022	2022	2022
KAMALANGA TPS (GMR)	Private	1	350	2013	2021	Comply immediately	2022
		2	350	2013	2021	Comply immediately	2022
		3	350	2014	2021	Comply immediately	2022
Sterlite Energy Ltd.	Private	1	600	2010	no comments		
		2	600	2010	2022	Comply immediately	2022
		3	600	2010	no comments		
		4	600	2010	no comments		
NTPC Talcher (Old) TPS	Central	1	60	1969	2020	2020	2020
		2	60	1967	2020	2020	2020
		3	60	1968	2020	2020	2020
		4	60	1968	2020	2020	2020
		5	110	1983	2020	2020	2020
		6	110	1982	2020	2020	2020
NTPC TalcherKaniha	Central	1	500	1995	2022	no comments	2022
		2	500	1996	2022	no comments	2022
		3	500	2003	2022	no comments	2022
		4	500	2003	2022	no comments	2022
		5	500	2004	2022	2022	2022
		6	500	2005	2022	2022	2022
PUNJAB							
GH TPS (LEH.MOH.)	State	1	210	1997	2019	2019	2019
		2	210	1998	2019	2019	2019
		3	250	2008	2019	2019	2019
		4	250	2008	2019	2019	2019

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
GOINDWAL SAHIB	Private	1	270	2016	2020	Comply immediately	2022
		2	270	2016	2020	Comply immediately	2022
Rajpura TPP	Private	1	700	2014	2019	Comply immediately	2019
		2	700	2014	2019	Comply immediately	2019
ROPAR TPS	State	1	210	1984	2019	2019	2019
		2	210	1985	2019	2019	2019
		3	210	1988	2019	2019	2019
		4	210	1989	2019	2019	2019
		5	210	1992	2019	2019	2019
		6	210	1993	2019	2019	2019
Talwandi Sabo TPP	Private	1	660	2014	2019	Comply immediately	2019
		2	660	2015	2019	Comply immediately	2019
		3	660	2016	2019	Comply immediately	2019
RAJASTHAN							
Barmer (Rajwest) TPS	Private	1	135	2009	Comply immediately	2022	2022
		2	135	2009	Comply immediately	2022	2022
		3	135	2009	Comply immediately	2022	2022
		4	135	2009	Comply immediately	2022	2022
		5	135	2009	Comply immediately	2022	2022
		6	135	2009	Comply immediately	2022	2022
		7	135	2009	Comply immediately	2021	2022
		8	135	2009	Complying	2021	2022
Barsingsar TPS	Private	1	125	2011	Complying		
		2	125	2011	Complying		
CHHABRA TPP	State	1	250	2009	2021	2021	2022
		2	250	2010	2021	2021	2022
		3	250	2013	2021	2021	2022
		4	250	2014	2021	2021	2022
		5	660	2017	2020	2020	2022

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
Kalisindh (RRVUNL)	State	1	600	2014	2021	Comply immediately	2022
		2	600	2015	2021	Comply immediately	2022
Kawai TPP (Adani Power)	Private	1	660	2013	2020	Comply immediately	2022
		2	660	2013	2020	Comply immediately	2022
KOTA TPS	State	5	210	1994	2022	2022	2022
		6	195	2003	2022	2022	2022
		7	195	2009	2022	2022	2022
SURATGARH TPS (RRVUNL)	State	1	250	1998	2022	no comments	2022
		2	250	2000	2022	no comments	2022
		3	250	2001	2022	no comments	2022
		4	250	2002	2022	no comments	2022
		5	250	2003	2022	no comments	2022
		6	250	2009	2022	2022	2022
Giral Lignite	State	1	125	2007	Complying		
		2	125	2010	Complying		
KOTA TPS	State	1	110	2001	2020	2020	2020
		2	110	2002	2020	2020	2020
		3	210	2003	2020	2020	2020
		4	210	2004	2020	2020	2020
TAMIL NADU							
ITPCL TPP	Private	1	600	2016	Complying		
		2	600	2016	Complying		
METTUR TPS	State	5	600	2014	2020	Comply immediately	2022
		1	210	1987	Comply immediately	2021	2022
		2	210	1987	Comply immediately	2021	2022
		3	210	1989	Comply immediately	2021	2022
		4	210	1990	Comply immediately	2021	2022
Muthiara TPP	Private	1	600	2014	2022	Comply immediately	2022
		2	600	2016	2022	Comply immediately	2022
NEYVELI (EXT) TPS	Central	1	210	2002	2021	Comply immediately	2022
		2	210	2003	2021	Comply immediately	2022

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
NEYVELI TPS- I	Central	1	50	1962	2019	2019	2019
		2	50	1963	2019	2019	2019
		3	50	1964	2019	2019	2019
		4	50	1965	2019	2019	2019
		5	50	1966	2019	2019	2019
		6	50	1967	2019	2019	2019
		7	100	1968	2019	2019	2019
		8	100	1969	2019	2019	2019
		9	100	1970	2019	2019	2019
NEYVELI TPS -II	Central	1	210	1988	2021	Comply immediately	2022
		2	210	1987	2021	Comply immediately	2022
		3	210	1987	2021	Comply immediately	2022
		4	210	1991	2022	Comply immediately	2022
		5	210	1991	2022	Comply immediately	2022
		6	210	1992	2022	Comply immediately	2022
		7	210	1993	2022	Comply immediately	2022
Neyveli Lignite II (Exp)	Central	1	250	2012	Complying		
		2	250	2015	Complying		
NORTH CHENNAI TPS (TanGEDCO)	State	1	210	1994	2022	2022	2022
		2	210	1995	2022	2022	2022
		3	210	1996	2022	2022	2022
		4	600	2014	2019	Comply immediately	2022
		5	600	2014	2020	Comply immediately	2022
TAQA, Neyveli	Private	2	250	2002	2020	Comply immediately	2022
Tuticorin (JV) TPP	Central	1	500	2015	2021	2021	2022
		2	500	2015	2020	2020	2022
Tuticorin (P) TPP	Private	1	150	2013	2020	2020	2020
		2	150	2013	2020	2020	2020
TUTICORIN TPS (TanGEDCO)	State	1	210	1979	2020	2020	2020
		2	210	1980	2020	2020	2020
		3	210	1982	2020	2020	2020
		4	210	1991	2020	2020	2020
		5	210	1992	2020	2020	2020

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
NTPC Vallur TPP	Central	1	500	2012	2021	Comply immediately	2022
		2	500	2013	2021	Comply immediately	2022
		3	500	2014	2021	Comply immediately	2022
TELANGANA							
Kakatiya (TSGENCO)	State	1	500	2010	2020	2020	2022
		2	600	2015	2020	no comments	2022
KOTHAGUDEM TPS	State	1	60	1966	2019	2019	2019
		10	250	1997	2020	2020	2020
		11	500	2011	2019	2019	2019
		2	60	1966	2019	2019	2019
		3	60	1967	2019	2019	2019
		4	60	1967	2019	2019	2019
		5	120	1974	2019	2019	2019
		6	120	1974	2019	2019	2019
		7	120	1977	2019	2019	2019
		8	120	1978	2019	2019	2019
		9	250	1995	2020	2020	2020
NTPC RAMAGUNDEM STPS	Central	1	200	1983	2019	2019	2019
		2	200	1984	2022	2022	2022
		3	200	1984	2022	no comments	2022
		4	500	1988	2022	2022	2022
		5	500	1989	2022	2022	2022
		6	500	1989	2022	2022	2022
		7	500	2004	2022	2022	2022
Singareni TPS (TSGENCO)	State	1	600	2016	2019	Comply immediately	2022
		2	600	2016	2019	Comply immediately	2022
UTTAR PRADESH							
ANPARA C (Lanco)	Private	1	600	2011	2022	Comply immediately	2022
		2	600	2011	2022	Comply immediately	2022

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
ANPARA	State	1	210	1987	2022	2022	2022
		2	210	1987	2022	2022	2022
		3	210	1988	2022	2022	2022
		4	500	1994	2022	2022	2022
		5	500	1994	2022	2022	2022
		6	500	2011	2021	no Comments	2022
		7	500	2012	2021	2021	2022
Bajaj Energy, Barkhera	Private	1	45	2012	Comply immediately	2021	2022
		2	45	2012	Comply immediately	2021	2022
Bajaj Energy, Khambarkhera	Private	1	45	2012	Comply immediately	2021	2022
		2	45	2012	Comply immediately	2021	2022
Bajaj Energy, Kundarki	Private	1	45	2012	Comply immediately	2021	2022
		2	45	2012	Comply immediately	2021	2022
Bajaj Energy, Maqsoodapur	Private	1	45	2012	Comply immediately	2021	2022
		2	45	2012	Comply immediately	2021	2022
Bajaj Energy, Utraula	Private	1	45	2012	Comply immediately	2021	2022
		2	45	2012	Comply immediately	2021	2022
Bara TPP	Private	1	660	2016	2020	no comments	2022
		2	660	2015	2020	no comments	2022
		3	660	2017	2020	2020	2022
NTPC DADRI	Central	1	210	1991	2019	Comply immediately	2019
		2	210	1992	2019	Comply immediately	2019
		3	210	1993	2019	Comply immediately	2019
		4	210	1994	2019	Comply immediately	2019
		5	490	2010	2019	Comply immediately	2019
		6	490	2010	2019	Comply immediately	2019
HARDUAGANJ (UPRVUNL)	State	8	250	2011	2019	Comply immediately	2019
		9	250	2012	2019	Comply immediately	2019
		7	110	1978	2019	2019	2019

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
Lalitpur TPP (LPGCL)	Private	1	660	2016	2020	Comply immediately	2022
		2	660	2016	2021	Comply immediately	2022
		3	660	2016	2021	Comply immediately	2022
OBRA TPS (UPRVUNL)	State	10	200	1979	2022	2022	2022
		11	200	1977	2022	2022	2022
		12	200	1981	2022	2022	2022
		13	200	1982	2022	2022	2022
		9	200	1980	2022	no comments	2022
		7	100	1974	2020	2020	2020
		8	100	1976	2020	2020	2020
PARICHHA TPS (UPRVUNL)	State	1	110	1984	2020	2020	2020
		2	110	1985	2020	2020	2020
		3	210	2006	2022	2022	2022
		4	210	2006	2022	2022	2022
		5	250	2012	2022	2022	2022
		6	250	2013	2021	2021	2022
NTPC RIHAND STPS	Central	1	500	1988	2022	2022	2022
		2	500	1989	2021	2021	2022
		3	500	2005	2021	2021	2022
		4	500	2005	2021	2021	2022
		5	500	2012	2021	no comments	2022
		6	500	2013	2020	no comments	2022
ROSA TPP P	Private	1	300	2010	2021	2021	2022
		2	300	2010	2021	2021	2022
		3	300	2011	2021	2021	2022
		4	300	2012	2021	2021	2022
NTPC SINGRAULI STPS	Central	1	200	1982	2021	2021	2022
		2	200	1982	2021	2021	2022
		3	200	1983	2021	2021	2022
		4	200	1983	2021	2021	2022
		5	200	1984	2021	2021	2022
		6	500	1986	2021	2021	2022
		7	500	1987	2020	2020	2022

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
NTPC UNCHAHAR TPS	Central	1	210	1988	2022	2022	2022
		2	210	1989	2022	2022	2022
		3	210	1999	2022	2022	2022
		4	210	1999	2022	2022	2022
		5	210	2006	2022	2022	2022
		6	500	2017	2020	2020	2022
NTPC Tanda	Central	1	110	1988	2020	2020	2020
		2	110	1989	2020	2020	2020
		3	110	1990	2020	2020	2020
		4	110	1998	2020	2020	2020
WEST BENGAL							
Bakreswar	State	1	210	2000	2022		2022
		2	210	2000	2022		2022
		3	210	2000	2022		2022
		4	210	2000	2022	2020	2022
		5	210	2000	2022	2020	2022
BUDGE BUDGE (CESC Ltd.)	State	1	250	1997	2022	Comply immediately	2022
		2	250	1999	2022	Comply immediately	2022
		3	250	2009	2022	Comply immediately	2022
D.P.L. TPS EXT. 8	Central	8	250	2014	2022	2022	2022
		6	110	1985	2022	2022	2022
		7	300	2007	2022	2022	2022
Durgapur steel TPS	Central-State JV	1	500	2011	2021	Comply immediately	2022
		2	500	2012	2021	Comply immediately	2022
NTPC FARAKKA STPS	Central	1	200	1986	2022	2022	2022
		2	200	1986	2022	no comments	2022
		3	200	1987	2022	no comments	2022
HALDIA TPP	Private	1	300	2015	2022	Comply immediately	2022
		2	300	2015	2022	Comply immediately	2022

Plant Name	Sector	Unit No.	Capacity (MW)	Year of Commissioning	SO_2 Deadline	PM Deadline	NO_x Deadline
KOLAGHAT TPS (WBPDCL)	State	1	210	1993	2022	2022	2022
		2	210	1990	2021	2021	2022
		3	210	1985	2021	2021	2022
		4	210	1984	2022	2022	2022
		5	210	1993	2021	2021	2022
		6	210	1991	2021	2021	2022
Mejia TPS	Central-State JV	1	210	1996	2022	2022	2022
		2	210	1997	2022	2022	2022
		3	210	1998	2022	2022	2022
		4	210	2004	2022	2022	2022
		5	250	2007	2022	2022	2022
		6	250	2007	2022	2022	2022
		7	500	2012	2021	2021	2022
		8	500	2012	2021	2021	2022
Raghunathpur (Stage) TPP	Central-State JV	1	600	2014	2022	Comply immediately	2022
		2	600	2016	2022	Comply immediately	2022
SAGARDIGHI TPS (WBPDCL)	State	1	300	2008	2020	2020	2022
		2	300	2007	2021	2021	2022
		3	500	2016	2022	no comments	2022
		4	500	2016	2020	no comments	2022
		5	250	2007	2021	2021	2022
		6	250	2011	2021	2021	2022
SOUTHERN REPL, TPS	State	1	68	1991	2022	Comply immediately	2022
		2	68	1990	2021	Comply immediately	2022
BANDEL TPS	State	2	60	1965	2020	2020	2020
		4	60	1967	2020	2020	2020
		5	210	1982	2020	2020	2020
		1	60	1965	2020	2020	2020
		3	60	1966	2020	2020	2020

Annexure 2: List of Once- through plants issued directions by CPCB in June-July 2019 to convert to cooling tower based systems and achieve specific water consumption limit by June 30, 2022

Plant name	Capacity (in MW)	District	State
Anpara TPS (Phase I & II) (UPRVUNL)	1630	Sonebhadra	Uttar Pradesh
Bandel TPS (WBPDCL)	450	Hoogly	West Bengal
Farakka STPP (NTPC)	2100	Murshidabad	West Bengal
Guru Gobind Singh STPP	920	Roopnagar	Punjab
Hasdeo TPS (CSPGCL); Unit 1-4	840	Korba	Chhattisgarh
Korba East TPS (CSPGCL); Unit 5 & 6	240	Korba	Chhattisgarh
Kota TPS (RRVUNL); Unit 1-5	850	Kota	Rajasthan
Kothagudem TPS (TSGENCO); Stage I-IV	720	Khammam	Telangana
Obra TPS (UPRVUNL)	1550	Sonebhadra	Uttar Pradesh
Parichha TPS (UPRVUNL); Unit 1 & 2	220	Jhansi	Uttar Pradesh
Rihand TPS (NTPC); Unit 1 & 2	1000	Sonebhadra	Uttar Pradesh
Sanjay Gandhi TPS (MPPGCL); Unit 1-5	1340	Umaria	Madhya Pradesh
Singrauli TPS (NTPC)	2000	Sonebhadra	Uttar Pradesh
Southern REP (CESC)	136	Kolkatta	West Bengal
Dr. N. Tata Rao TPS (APGENCO); Stage 1-3	1260	Krishna	Andhra Pradesh
Tenughat TPS; Unit 1 & 2	420	Tenughat	Jharkhand
Ukai TPS (GSECL); Unit 3-5	610	Tapi	Gujarat

Annexure 3: Plant implementation progress status for SO_2 compliance as of December 2019

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
ANDHRA PRADESH						
Dr. N.TATA RAO TPS	State	1	210	1979	2020	No plan
		2	210	1980	2020	No plan
		3	210	1989	2020	No plan
		4	210	1990	2020	No plan
		5	210	1994	2020	No plan
		6	210	1994	2020	No plan
		7	500	2009	2020	Feasibility study
Meenakshi Energy Pvt. Ltd. (THAMMINAPATNAM)	Private	1	150	2012	Complying	Complying
		2	150	2013	Complying	Complying
Nelcast Energy Corporation Ltd. (PAINAMPURAM)	Private	1	660	2015	2021	Feasibility study
		2	600	2015	2021	Feasibility study
RAYALASEEMA TPS	State	1	210	1994	2021	Complying
		2	210	1995	2021	Complying
		3	210	2007	2020	Complying
		4	210	2007	2021	Complying
		5	210	2010	2020	Complying
Sembcorp Gayatri Power Ltd	Private	1	660	2016	2021	Feasibility study
		2	660	2017	2021	Feasibility study
Simhadri	Central	1	500	2002	2022	Tender awarded
		2	500	2002	2022	Tender awarded
		3	500	2011	2022	Tender awarded
		4	500	2012	2022	Tender awarded
Simhapuri Energy Pvt. Ltd.	Private	1	150	2012	Complying	Complying
		2	150	2012	Complying	Complying
		3	150	2012	Complying	Complying
		4	150	2012	Complying	Complying
Sri Damodaram Sanjeevaiah TPS	State	1	800	2014	2020	Feasibility study
		2	800	2015	2019	Feasibility study
Thermal Powertech	Private	1	660	2015	2021	Feasibility study
		2	660	2015	2021	Feasibility study
Vizag TPP	Private	1	520	2015	2020	Feasibility study
		2	520	2016	2019	Feasibility study

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
ASSAM						
Bongaigaon (NTPC) TPP	State	1	250	2016	2022	Not known
		2	250	2017	2022	Not known
BIHAR						
Barh(NTPC) Super TPP	Central	4	660	2013	2021	Tender awarded
		5	660	2015	2022	Tender awarded
Kahalgaon(NTPC) Bhagalpur	Central	1	210	1992	2022	Tender floated
		2	210	1994	2022	Tender floated
		3	210	1995	2022	Tender floated
		4	210	1996	2022	Tender floated
		5	500	2007	2022	Tender floated
		6	500	2008	2022	Tender floated
		7	500	2009	2022	Tender floated
MUZAFFARPUR (NTPC) TPS	Central	1	110	1985	2020	Tender floated
		2	110	1986	2020	Tender floated
		3	195	2015	2022	Tender floated
		4	195	2017	2022	Tender floated
NABI NAGAR (NTPC) TPP	Central	1	250	2016	2021	Tender awarded
		2	250	2017	2022	Tender awarded
CHHATTISGARH						
AdaniKorba West	Private	1	600	2014	2022	Feasibility study
BALCO TPS	Private	1	300	2015	2021	Feasibility study
		2	300	2016	2021	Feasibility study
BANDAKHAR TPP	Private	1	300	2015	2020	Not known
		1	600	2014	2021	Tender floated
		2	600	2015	2020	Tender Floated
BHILAI TPS (NSPCL)	Central	1	250	2008	2022	Tender awarded
		2	250	2009	2022	Tender awarded
BINJKOTE TPP	Private	1	300	2017	2020	Feasibility study
Chakabura TPP	Private	1	30	2014	no comments	
		2	30		Complying	Complying
DSPM TPS	State	1	250	2007	2021	Feasibility study
DSPM TPS	State	2	250	2007	2021	Feasibility study
Kasaipalli power station	Private	1	135	2011	Complying	Complying
		2	135	2012	Complying	Complying
Katghora TPP	Private	1	35	2014	Complying	Complying

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
Marwa TPP	State	1	500	2014	2021	Feasibility study
		2	500	2016	2021	Feasibility study
Nariyara TPP (AKALTARA) (KSK)	Private	1	600	2013	2022	Feasibility study
		2	600	2013	2022	Feasibility study
OP JINDAL TPS	Private	1	250	2007	2022	Tender floated
		2	250	2008	2022	Tender floated
		3	250	2008	2022	Tender floated
		4	250	2008	2022	Tender floated
PATHADI TPP	Private	2	300	2010	2021	Feasibility study
		1	300	2009	2021	Feasibility study
Raikheda TPP (GMR Energy)	Private	2	685	2015	2020	No plan
		1	685	2016	2020	No plan
Ratija TPS	Private	1	50	2016	Complying	Complying
		2	50	2013	Complying	Complying
Salora TPP	Private	1	135	2014	Complying	Complying
Sipat (NTPC)	Central	1	660	2011	2022	Tender awarded
		2	660	2011	2022	Tender awarded
		3	660	2012	2021	Tender awarded
		4	500	2007	2021	Tender floated
		5	500	2008	2021	Tender floated
SVPL TPP	Private	1	63	2012	Complying	Complying
SwastikKorba Power Plant	Private	1	25	2012	Complying	Complying
TAMNAR (JPL Jindal)	Private	1	600	2014	2021	Tender floated
		2	600	2014	2021	Tender floated
		3	600	2015	2022	Tender floated
		4	600	2015	2022	Tender floated
		2	300	2017	2020	Complying
UCHPINDA TPP (RKM Power)	Private	1	360	2015	2022	Feasibility study
		3	360	2016	2021	Feasibility study
TRN Energy Pvt. Ltd. (Nawapara TPP)	Private	2	300		Complying	Complying

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
KORBA STPS (NTPC)	Central	1	200	1983	2022	Tender awarded
		2	200	1983	2022	Tender awarded
		3	200	1984	2022	Tender awarded
		4	500	1987	2022	Tender awarded
		5	500	1988	2022	Tender awarded
		6	500	1989	2022	Tender awarded
		7	500	2010	2022	Tender awarded
KORBA-II (Korba-East)	State	1	50	1966	2020	Retired
		2	50	1967	2020	Retired
		3	50	1968	2020	Retired
		4	50	1968	2020	Retired
KORBA-III (Korba-East)	State	1	120	1976	2020	Not known
		2	120	1981	2020	Not known
KORBA-WEST TPS (Hasdeo)	State	1	210	1983	2020	Tender floated
		2	210	1984	2020	Tender floated
		3	210	1985	2020	Tender floated
		4	210	1986	2020	Tender floated
		5	500	2013	2021	Tender floated
GUJARAT						
AdaniMundra	Private	1	330	2009	2022	Tender Floated
		2	330	2010	2022	Tender Floated
		3	330	2010	2022	Tender Floated
		4	330	2010	2022	Tender Floated
		5	660	2011	2022	Tender Floated
		6	660	2011	2022	Tender Floated
		7	660	2012	Complying	Complying
		8	660	2012	Complying	Complying
		9	660	2012	Complying	Complying
Akrimota (CFBC)	State	1	125	2005	Comply immediately	Not known
		2	125	2005	Comply immediately	Not known
BHAVNAGAR CFBC TPP	State	1	250	2016	Complying	Complying
		2	250	2016	Complying	Complying
Gandhinagar TPS (GSECL)	State	3	210	1990	2021	Feasibility study
		4	210	1991	2021	Feasibility study
		5	210	1998	2021	Feasibility study

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
Kutch Lignite TPS (GSECL)	State	1	70	1990	2021	Feasibility study
		2	70	1991	2021	Feasibility study
		3	75	1997	2021	Feasibility study
		4	75	2008	Complying	Complying
Mundra Ultra Mega TPP	Private	1	800	2013	2020	Feasibility study
		2	800	2013	2021	Feasibility study
		3	800	2013	2021	Feasibility study
		4	800	2013	2022	Feasibility study
		5	800	2013	2022	Feasibility study
Salaya	Private	1	600	2012	2021	Feasibility study
		2	600	2012	2021	Feasibility study
SIKKA REP TPS	State	3	250	2015	2022	Tender Floated
		4	250	2015	2022	Tender Floated
Surat Lignite (CFBC)	State	1	125	2000	Comply immediately	Not known
		2	125	1999	Comply immediately	Not known
		3	125	2010	Comply immediately	Not known
		4	125	2010	Comply immediately	Not known
Torrent TPS	Private	1	120	1978	2022	Feasibility study
		2	121	1984	2022	Feasibility study
		3	121	1988	2022	Feasibility study
Wanakbori TPS (JECL)	State	1	210	1982	2021	Feasibility study
		2	210	1983	2021	Feasibility study
		3	210	1984	2021	Feasibility study
		4	210	1986	2021	Feasibility study
		5	210	1986	2021	Feasibility study
		6	210	1987	2021	Feasibility study
		7	210	1998	2021	Feasibility study
UKAI TPS	State	3	200	1979	2021	Feasibility study
		4	200	1979	2021	Feasibility study
		5	210	1985	2021	Feasibility study
		6	500	2013	2022	Tender Floated
HARYANA						
Aravali (Indira Gandhi)	Central-State JV	1	500	2010	2019	Tender awarded
		2	500	2010	2019	Tender awarded
		3	500	2010	2019	Tender awarded

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
Mahatma Gandhi TPS (CLP)	Private	1	660	2012	2019	Complying
		2	660	2012	2019	Complying
RAJIV GANDHI TPS	State	1	600	2010	2019	Tender floated
		2	600	2010	2019	Tender floated
PANIPAT TPS II	State	5	210	2001	2019	No plan
		6	210	2001	2019	Tender floated
		7	250	2004	2019	Tender floated
		8	250	2005	2019	Tender floated
YAMUNA NAGAR TPS	State	1	300	2007	2019	Tender floated
		2	300	2008	2019	Tender floated
JHARKHAND						
CHANDRAPURA(DVC)	Central	3	130	1964	2018	Not known
		7	250	2009	2022	Feasibility study
		8	250	2010	2022	Feasibility study
Koderma	Central-State JV	1	500	2011	2021	Tender awarded
		2	500	2013	2021	Tender awarded
Jojobera TPS	Private	1	120	2002	no comments	
		2	120	2001	2020	Tender floated
		3	120	2002	2020	Tender floated
Maithon Right Bank TPP (Tata DVC)	Private	1	525	2011	2021	Tender Floated
		2	525	2012	2022	Tender Floated
MAHADEV PRASAD STPP	Private	1	270	2012	2022	Complying
		2	270	2013	2022	Complying
Tenughat TPP	State	1	210	1994	2020	Feasibility study
		2	210	1996	2020	Feasibility study
BOKARO 'B' TPS	Central	3	210	1993	2020	Not known
		1	500	2016	2022	Tender awarded
KARNATAKA						
Bellary (Kuditini TPS)	State	1	500	2007	2020	Tender Floated
		2	500	2012	2021	Tender Floated
		3	700	2016	2021	Tender Floated
		1	800	2016	2022	Tender awarded
Kudgi STPP (NTPC)	Central	2	800	2017	2022	Tender awarded
		3	800	2018	2022	Tender awarded

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
RAICHUR TPS	State	1	210	1985	2021	Tender Floated
		2	210	1986	2021	Tender Floated
		3	210	1991	2021	Tender Floated
		4	210	1994	2021	Tender Floated
		5	210	1999	2022	Tender Floated
		6	210	1999	2022	Tender Floated
		7	210	2002	2022	Tender Floated
		8	250	2010	2022	Tender Floated
TORANGALLU TPS EXT	Private	1	300	2009	2022	Tender Floated
		2	300	2009	2022	Tender Floated
		3	300	2000	Complying	Complying
		4	300	2000	Complying	Complying
Udupi TPP (Adani)	Private	1	600	2010	2022	Tender floated
		2	600	2011	2022	Tender floated
Yermarus	State	1	800	2016	2021	Tender floated
		2	800	2017	2022	Tender floated
MADHYA PRADESH						
AMARKANTAK EXT	State	5	210	2008	2021	Feasibility study
ANUPPUR	Private	1	600	2014	2022	Tender Floated
		2	600	2014	2022	Tender Floated
Jhabua TPP (Avantha)	Private	1	600	2016	2020	Feasibility study
MAHAN TPP	Private	1	600	2013	2020	Feasibility study
NIGRIE (Jaypee)	Private	1	660	2014	2020	Feasibility study
		2	660	2015	2020	Feasibility study
Malwa TPP (SHREE SINGHAJI)	State	1	600	2013	2021	Tender Floated
		2	600	2014	2021	Tender Floated
Sanjay Gandhi TPS (MPPGCL)	State	1	210	1993	2021	Feasibility study
		2	210	1993	2021	Feasibility study
		3	210	1999	2021	Feasibility study
		4	210	1999	2021	Feasibility study
		5	500	2007	2021	Feasibility study
Sasan Ultra Mega TPP	Private	1	660	2013	2021	Tender Floated
		2	660	2013	2021	Tender Floated
		3	660	2014	2022	Tender Floated
		4	660	2014	2022	Tender Floated
		5	660	2014	2021	Tender Floated
		6	660	2015	2021	Tender Floated

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
SATPURA TPS (MPPGCL)	State	10	250	2013	2021	Feasibility study
		11	250	2014	2021	Feasibility study
		6	200	1979	2020	Not known
		7	210	1980	2020	Not known
		8	210	1983	2020	Not known
		9	210	1984	2020	Not known
VINDHYACHAL (NTPC) STPS	Central	1	210	1987	2022	Tender awarded
		2	210	1988	2022	Tender awarded
		3	210	1989	2022	Tender awarded
		4	210	1989	2022	Tender awarded
		5	210	1990	2022	Tender awarded
		6	210	1991	2022	Tender awarded
		7	500	1999	2021	Tender awarded
		8	500	2000	2021	Tender awarded
		9	500	2006	2021	Tender awarded
		10	500	2007	2021	Tender awarded
		11	500	2012	2021	Tender awarded
		12	500	2013	2021	Tender awarded
		13	500	2015	Complying	Complying
Bina TPS	Private	1	250	2012	Complying	Complying
		2	250	2013	Complying	Complying
MAHARASHTRA						
AdaniDahanu	Private	2	250	1996	Complying	Complying
		1	250	1995	Complying	Complying
AdaniTiroda	Private	1	660	2012	2022	Tender Floated
		2	660	2013	2021	Tender Floated
		3	660	2013	2021	Tender Floated
		4	660	2014	2021	Tender Floated
		5	660	2014	2021	Tender Floated
BHUSAWAL TPS	State	3	210	1982	2021	Feasibility study
		4	500	2012	2021	Feasibility study
		5	500	2014	2021	Feasibility study
BUTIBORI TPP (Reliance)	Private	1	300	2012	2021	Tender Floated
		2	300	2013	2021	Tender Floated
CHANDRAPUR	State	3	210	1985	2021	Feasibility study
		4	210	1986	2021	Feasibility study

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
DHARIWAL TPP	Private	1	300	2014	2022	Feasibility study
		2	300	2014	2022	Feasibility study
EMCO WARORA (GMR)	Private	1	300	2013	2022	Feasibility study
		2	300	2013	2022	Feasibility study
Khaparkheda	State	1	210	1989	2021	Feasibility study
		2	210	1990	2021	Feasibility study
		3	210	2000	2021	Feasibility study
		4	210	2001	2021	Feasibility study
		5	500	2011	2021	Feasibility study
KORADI TPS	State	6	210	1982	2021	Feasibility study
		7	210	1983	2021	Feasibility study
CHANDRAPUR	State	5	500	1991	2021	Feasibility study
		6	500	1992	2021	Feasibility study
		7	500	1997	2021	Feasibility study
		8	500	2015	2021	Feasibility study
		9	500	2016	2020	Feasibility study
KORADI TPS	State	10	660	2017	2020	Feasibility study
		8	660	2015	2021	Feasibility study
		9	660	2015	2021	Feasibility study
Mauda(NTPC) TPP	Central	1	500	2013	2022	Tender awarded
		2	500	2013	2022	Tender awarded
		3	660	2016	2022	Tender awarded
		4	660	2017	2020	Tender awarded
NASIK TPS	State	3	210	1979	2021	Feasibility study
		4	210	1980	2021	Feasibility study
		5	210	1981	2021	Feasibility study
Nasik Rattan India TPP	Private	1	270	2013	2021	Tender floated
		2	270	2014	2021	Feasibility study
		3	270	2015	2022	Feasibility study
		4	270	2015	2022	Feasibility study
		5	270	2015	2022	Feasibility study
Paras TPS (MahaGENCO)	State	3	250	2008	Comply immediately	Feasibility study
		4	250	2010	Comply immediately	Feasibility study

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
PARLI TPS	State	4	210	1985	2021	Feasibility study
		5	210	1987	2021	Feasibility study
		6	250	2007	2021	Feasibility study
		7	250	2010	2021	Feasibility study
		8	250	2016	2021	Feasibility study
Ratnagiri TPS	Private	1	300	2010	Complying	Complying
		2	300	2010	Complying	Complying
		3	300	2011	Complying	Complying
		4	300	2011	Complying	Complying
Shirpur TPP	Private	1	150	2017	2022	Feasibility study
Solapur TPS (NTPC)	Central	1	660	2017	2020	Tender awarded
Trombay TPS (TATA Power)	Private	8	250	2009	Complying	Complying
		5	500	1984	2018	Complying
WARDHA WARORA TPP	Private	1	135	2010	2021	Feasibility study
		2	135	2010	2021	Feasibility study
		3	135	2011	2021	Feasibility study
		4	135	2011	2021	Feasibility study
Bela TPS	Private	1	270	2013	Complying	Complying
Mihan TPS	Private	1	271		Complying	Complying
GEPL	Private	1	125	2012	2020	Not known
		2	125	2012	2020	Not known
ODISHA						
IB VALLEY TPS	State	1	210	1994	2021	Feasibility study
		2	210	1995	2021	Feasibility study
Ind-Barath TPS	Private	1	350	2016	2022	Feasibility study
KAMALANGA TPS (GMR)	Private	1	350	2013	2021	Feasibility study
		2	350	2013	2021	Feasibility study
		3	350	2014	2021	Feasibility study
DERANG TPS (JITPL)	Private	1	600	2014	2021	Tender floated
		2	600	2015	2021	Tender Floated
Sterlite Energy Ltd.	Private	1	600	2010	no comments	-
		2	600	2010	2022	Feasibility study
		3	600	2010	no comments	-
		4	600	2010	no comments	-

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
Talcher (Old) (NTPC) TPS	Central	1	60	1969	2020	Tender Floated
		2	60	1967	2020	Tender Floated
		3	60	1968	2020	Tender Floated
		4	60	1968	2020	Tender Floated
		5	110	1983	2020	Tender Floated
		6	110	1982	2020	Tender Floated
TalcherKaniha (NTPC)	Central	1	500	1995	2022	Tender floated
		2	500	1996	2022	Tender floated
		3	500	2003	2022	Tender floated
		4	500	2003	2022	Tender floated
		5	500	2004	2022	Tender floated
		6	500	2005	2022	Tender floated
PUNJAB						
GH TPS (LEH.MOH.)	State	1	210	1997	2019	Tender floated
		2	210	1998	2019	Tender floated
		3	250	2008	2019	Tender floated
		4	250	2008	2019	Tender floated
GOINDWAL SAHIB	Private	1	270	2016	2020	Feasibility study
		2	270	2016	2020	Feasibility study
Rajpura TPP	Private	1	700	2014	2019	Tender floated
		2	700	2014	2019	Tender floated
ROPAR TPS	State	1	210	1984	2019	Retired
		2	210	1985	2019	Retired
		3	210	1988	2019	Tender floated
		4	210	1989	2019	Tender floated
		5	210	1992	2019	Tender floated
		6	210	1993	2019	Tender floated
Talwandi Sabo TPP	Private	1	660	2014	2019	Tender floated
		2	660	2015	2019	Tender floated
		3	660	2016	2019	Tender floated

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
RAJASTHAN						
Barmer (Rajwest) TPS	Private	1	135	2009	Comply immediately	Not known
		2	135	2009	Comply immediately	Not known
		3	135	2009	Comply immediately	Not known
		4	135	2009	Comply immediately	Not known
		5	135	2009	Comply immediately	Not known
		6	135	2009	Comply immediately	Not known
		7	135	2009	Comply immediately	Not known
		8	135	2009	Complying	Complying
Barsingsar TPS	Private	1	125	2011	Complying	Complying
		2	125	2011	Complying	Complying
CHHABRA TPP	State	1	250	2009	2021	Feasibility study
		2	250	2010	2021	Feasibility study
		3	250	2013	2021	Feasibility study
		4	250	2014	2021	Feasibility study
		5	660	2017	2020	Tender floated
Kalisindh (RRVUNL)	State	1	600	2014	2021	Tender floated
		2	600	2015	2021	Tender floated
Kawai TPP (Adani Power)	Private	1	660	2013	2020	Tender floated
		2	660	2013	2020	Tender floated
KOTA TPS	State	5	210	1994	2022	Feasibility study
		6	195	2003	2022	Feasibility study
		7	195	2009	2022	Feasibility study
SURATGARH TPS (RRVUNL)	State	1	250	1998	2022	Feasibility study
		2	250	2000	2022	Feasibility study
		3	250	2001	2022	Feasibility study
		4	250	2002	2022	Feasibility study
		5	250	2003	2022	Feasibility study
		6	250	2009	2022	Feasibility study
Giral Lignite	State	1	125	2007	Complying	Complying
		2	125	2010	Complying	Complying
KOTA TPS	State	1	110	2001	2020	Not known
		2	110	2002	2020	Not known
		3	210	2003	2020	Not known
		4	210	2004	2020	Not known

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
TAMIL NADU						
METTUR TPS	State	1	210	1987	Comply immediately	Not known
		2	210	1987	Comply immediately	Not known
		3	210	1989	Comply immediately	Not known
		4	210	1990	Comply immediately	Not known
		5	600	2014	2020	Not known
Muthiara TPP	Private	1	600	2014	2022	Feasibility study
		2	600	2016	2022	Feasibility study
NEYVELI (EXT) TPS	Central	1	210	2002	2021	Tender floated
		2	210	2003	2021	Tender floated
NEYVELI TPS- I	Central	1	50	1962	2019	No plan
		2	50	1963	2019	No plan
		3	50	1964	2019	No plan
		4	50	1965	2019	No plan
		5	50	1966	2019	No plan
		6	50	1967	2019	No plan
		7	100	1968	2019	No plan
		8	100	1969	2019	No plan
		9	100	1970	2019	No plan
NEYVELI TPS -II	Central	1	210	1988	2021	Tender floated
		2	210	1987	2021	Tender floated
		3	210	1987	2021	Tender floated
		4	210	1991	2022	Tender floated
		5	210	1991	2022	Tender floated
		6	210	1992	2022	Tender floated
		7	210	1993	2022	Tender floated
NORTH CHENNAI TPS	State	1	210	1994	2022	Feasibility study
		2	210	1995	2022	Feasibility study
		3	210	1996	2022	Feasibility study
		4	600	2014	2019	No plan
		5	600	2014	2020	No plan
ITPCL TPP	Private	1	600	2016	Complying	Complying
		2	600	2016	Complying	Complying
Vallur (NTPC) TPP	Central	1	500	2012	2021	Tender floated
		2	500	2013	2021	Tender floated
		3	500	2014	2021	Tender floated

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
TAQA, Neyveli	Private	2	250	2002	2020	Feasibility study
Tuticorin (JV) TPP	Central	1	500	2015	2021	Tender floated
		2	500	2015	2020	Tender floated
Tuticorin (P) TPP	Private	1	150	2013	2020	Tender floated
		2	150	2013	2020	Tender floated
TUTICORIN TPS	State	1	210	1979	2020	Feasibility study
		2	210	1980	2020	Feasibility study
		3	210	1982	2020	Feasibility study
		4	210	1991	2020	Feasibility study
		5	210	1992	2020	Feasibility study
TELANGANA						
Kakatiya	State	1	500	2010	2020	Feasibility study
		2	600	2015	2020	Feasibility study
KOTHAGUDEM TPS	State	1	60	1966	2019	No plan
		2	60	1966	2019	No plan
		3	60	1967	2019	Retired
		4	60	1967	2019	No plan
		5	120	1974	2019	No plan
		6	120	1974	2019	Rertired
		7	120	1977	2019	No plan
		8	120	1978	2019	No plan
		9	250	1995	2020	No plan
		10	250	1997	2020	No plan
		11	500	2011	2019	Feasibility study
RAMAGUNDEM STPS (NTPC)	Central	1	200	1983	2019	Tender awarded
		2	200	1984	2022	Tender awarded
		3	200	1984	2022	Tender awarded
		4	500	1988	2022	Tender awarded
		5	500	1989	2022	Tender awarded
		6	500	1989	2022	Tender awarded
		7	500	2004	2022	Tender floated
Singareni TPS	State	1	600	2016	2019	Feasibility study
		2	600	2016	2019	Feasibility study
UTTAR PRADESH						
ANPARA C (Lanco)	Private	1	600	2011	2022	Feasibility study
		2	600	2011	2022	Feasibility study

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
ANPARA	State	1	210	1987	2022	Tender floated
		2	210	1987	2022	Tender floated
		3	210	1988	2022	Tender floated
		4	500	1994	2022	Tender floated
		5	500	1994	2022	Tender floated
		6	500	2011	2021	Tender awarded
		7	500	2012	2021	Tender awarded
Bajaj Energy, Barkhera	Private	1	45	2012	Comply immediately	Not known
		2	45	2012	Comply immediately	Not known
Bajaj Energy, Khambarkhera	Private	1	45	2012	Comply immediately	Not known
		2	45	2012	Comply immediately	Not known
Bajaj Energy, Kundarki	Private	1	45	2012	Comply immediately	Not known
		2	45	2012	Comply immediately	Not known
Bajaj Energy, Maqsoodapur	Private	1	45	2012	Comply immediately	Not known
		2	45	2012	Comply immediately	Not known
Bajaj Energy, Utraula	Private	1	45	2012	Comply immediately	Not known
Bajaj Energy, Utraula	Private	2	45	2012	Comply immediately	Not known
DADRI (NCTPP)	Central	1	210	1991	2019	Tender awarded
		2	210	1992	2019	Tender awarded
		3	210	1993	2019	Tender awarded
		4	210	1994	2019	Tender awarded
		5	490	2010	2019	Tender awarded
		6	490	2010	2019	Tender awarded
HARDUAGANJ (UPRVUNL)	State	8	250	2011	2019	Tender floated
		9	250	2012	2019	Tender floated
Lalitpur TPP (LPGCL)	Private	1	660	2016	2020	No plan
		2	660	2016	2021	No plan
		3	660	2016	2021	No plan
OBRA TPS	State	10	200	1979	2022	Feasibility study
		11	200	1977	2022	Feasibility study
		12	200	1981	2022	Feasibility study
		13	200	1982	2022	Feasibility study
		9	200	1980	2022	Feasibility study

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
PARICHHA TPS	State	1	110	1984	2020	To retire
		2	110	1985	2020	To retire
		3	210	2006	2022	Feasibility study
		4	210	2006	2022	Feasibility study
		5	250	2012	2022	Feasibility study
		6	250	2013	2021	Feasibility study
ROSA TPP Ph-1	Private	1	300	2010	2021	Feasibility study
		2	300	2010	2021	Feasibility study
		3	300	2011	2021	Feasibility study
		4	300	2012	2021	Feasibility study
SINGRAULI (NTPC) STPS	Central	1	200	1982	2021	Tender floated
		2	200	1982	2021	Tender floated
		3	200	1983	2021	Tender floated
		4	200	1983	2021	Tender floated
		5	200	1984	2021	Tender floated
		6	500	1986	2021	Tender floated
		7	500	1987	2020	Tender floated
Bara TPP	Private	1	660	2016	2020	Feasibility study
		2	660	2015	2020	Feasibility study
		3	660	2017	2020	Feasibility study
RIHAND (NTPC) STPS	Central	1	500	1988	2022	Tender floated
		2	500	1989	2021	Tender floated
		3	500	2005	2021	Tender Awarded
		4	500	2005	2021	Tender Awarded
		5	500	2012	2021	Tender Awarded
		6	500	2013	2020	Tender Awarded
UNCHAHAR (NTPC) TPS	Central	1	210	1988	2022	Tender floated
		2	210	1989	2022	Tender floated
		3	210	1999	2022	Tender floated
		4	210	1999	2022	Tender floated
		5	210	2006	2022	Tender floated
		6	500	2017	2020	Tender awarded
HARDUAGANJ (UPRVUNL)	State	7	110	1978	2019	Not known
OBRA TPS	State	7	100	1974	2020	Not known
		8	100	1976	2020	Not known

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
NTPC Tanda	Central	1	110	1988	2020	Tender awarded
		2	110	1989	2020	Tender awarded
		3	110	1990	2020	Tender awarded
		4	110	1998	2020	Tender awarded
WEST BENGAL						
Bakreswar	State	1	210	2000	2022	No plan
		2	210	2000	2022	No plan
		3	210	2000	2022	No plan
		4	210	2000	2022	No plan
		5	210	2000	2022	No plan
BUDGE BUDGE	State	1	250	1997	2022	Feasibility study
		2	250	1999	2022	Feasibility study
		3	250	2009	2022	Feasibility study
D.P.L. TPS EXT.	Central	8	250	2014	2022	Feasibility study
		6	110	1985	2022	Feasibility study
		7	300	2007	2022	Feasibility study
FARAKKA (NTPC) STPS	Central	1	200	1986	2022	Tender floated
		2	200	1986	2022	Tender floated
		3	200	1987	2022	Tender floated
		4	500	1992	2022	Tender floated
		5	500	1994	2022	Tender floated
		6	500	2012	2022	Tender floated
HALDIA TPP	Private	1	300	2015	2022	Feasibility study
		2	300	2015	2022	Feasibility study
KOLAGHAT TPS	State	1	210	1993	2022	Feasibility study
		2	210	1990	2021	Feasibility study
		3	210	1985	2021	Feasibility study
		4	210	1984	2022	Feasibility study
		5	210	1993	2021	Feasibility study
		6	210	1991	2021	Feasibility study

Power Station	Sector	Unit No.	Capacity (MW)	Year of Commissioning	CPCB Deadline for SO_2 compliance	Implementation progress
Mejia TPS	Central-State JV	1	210	1996	2022	Feasibility study
		2	210	1997	2022	Feasibility study
		3	210	1998	2022	Feasibility study
		4	210	2004	2022	Feasibility study
		5	250	2007	2022	Feasibility study
		6	250	2007	2022	Feasibility study
		7	500	2012	2021	Tender awarded
		8	500	2012	2021	Tender awarded
SAGARDIGHI TPS	State	1	300	2008	2020	Feasibility study
		2	300	2007	2021	Feasibility study
		3	500	2016	2022	Feasibility study
		4	500	2016	2020	Feasibility study
SANTALDIH TPS	State	5	250	2007	2021	Feasibility study
		6	250	2011	2021	Feasibility study
SOUTHERN REPL, TPS	Private	1	68	1991	2022	Feasibility study
		2	68	1990	2021	Feasibility study
Durgapur steel TPS	Central-State JV	1	500	2011	2021	Tender awarded
		2	500	2012	2021	Tender awarded
Raghunathpur (Stage 1) TPP	Central-State JV	1	600	2014	2022	Tender awarded
		2	600	2016	2022	Tender awarded
BANDEL TPS	State	2	60	1965	2020	No plan
		4	60	1967	2020	No plan
		5	210	1982	2020	No plan
		1	60	1965	2020	No plan
		3	60	1966	2020	No plan
TITAGARH TPS	Private	1	60	1982	2020	To retire/ Reserve shutdown
		2	60	1983	2020	To retire/ Reserve shutdown
		3	60	1984	2020	To retire/ Reserve shutdown
		4	60	1985	2020	To retire/ Reserve shutdown

Source: Centre for Science & Environment (CSE) 2019

Annexure 4: Implementation progress of plants for PM/SO_2 with capacity 500 MW and above located in critically polluted or densely populated districts

Plant	District	Population Density of District (persons/sq. km)	CPA/ High density	State	Unit	Capacity (MW)	CPCB Deadline	SO_2 Implementation progress
ANPARA C (Lanco)	Sonbhadra	270	CPA	Uttar Pradesh	1	600	2022	Feasibility study
					2	600	2022	Feasibility study
					4	500	2022	Tender floated
					5	500	2022	Tender floated
Bara TPP	Allahabad	1086	High density	Uttar Pradesh	1	660	2020	Feasibility study
					2	660	2020	Feasibility study
					3	660	2020	Feasibility study
BARADARHA TPS	Janjgir-Champa	421	High density	Chhattisgarh	1	600	2021	Tender floated
					2	600	2020	Tender Floated
CHANDRAPUR	Chandrapur	192	CPA	Maharashtra	5	500	2021	Feasibility study
					6	500	2021	Feasibility study
					7	500	2021	Feasibility study
					8	500	2021	Feasibility study
					9	500	2020	Feasibility study
DERANG TPS (JITPL)	Angul	199	CPA	Odisha	1	600	2021	Tender floated
					2	600	2021	Tender Floated
Dr. N.TATA RAO TPS 7	Vijayawada	518	High density	Andhra Pradesh	7	500	2020	Feasibility study
FARAKKA STPS	Murshidabad	1334	High density	West Bengal	4	500	2022	Tender floated
					5	500	2022	Tender floated
					6	500	2022	Tender floated
Kahalgaon Bhagalpur	Bhagalpur	1180	High density	Bihar	5	500	2022	Tender floated
					6	500	2022	Tender floated
					7	500	2022	Tender floated
Khaparkheda	Nagpur	470	High density	Maharashtra	5	500	2021	Feasibility study
KORADI TPS	Nagpur	470	High density	Maharashtra	10	660	2020	Feasibility study
					8	660	2021	Feasibility study
					9	660	2021	Feasibility study
KORBA-WEST TPS (Hasdeo)	Korba	183	CPA	Chhattisgarh	5	500	2021	Tender floated
Kothagudem TPS	Paloncha	3000	High density	Telangana	11	500	2019	Feasibility study
MAHAN TPP	Singrauli	157	CPA	Madhya Pradesh	1	600	2020	Feasibility study
Maithon Right Bank TPP (Tata DVC)	Dhanbad	1284	High density	Jharkhand	1	525	2021	Tender Floated
					2	525	2022	Tender Floated

Plant	District	Population Density of District (persons/sq. km)	CPA/ High density	State	Unit	Capacity (MW)	CPCB Deadline	SO_2 Implementation progress
Marwa TPP	Janjgir	420	High density	Chhattisgarh	1	500	2021	Feasibility study
					2	500	2021	Feasibility study
Nariyara TPP (AKALTARA) (KSK)	Janjgir-Champa	421	High density	Chhattisgarh	1	600	2022	Feasibility study
					2	600	2022	Feasibility study
NIGRIE (Jaypee)	Singrauli	157	CPA	Madhya Pradesh	1	660	2020	Feasibility study
					2	660	2020	Feasibility study
RAJIV GANDHI TPS	Hisar	438	High density	Haryana	1	600	2019	Tender floated
					2	600	2019	Tender floated
Rajpura TPP	Patiala	870	High density	Punjab	1	700	2019	Tender floated
					2	700	2019	Tender floated
RIHAND STPS	Sonbhadra	270	CPA	Uttar Pradesh	1	500	2022	Tender floated
					2	500	2021	Tender floated
SAGARDIGHI TPS	Murshidabad	1334	High density	West Bengal	3	500	2022	Feasibility study
					4	500	2020	Feasibility study
					6	500	2021	Tender floated
					7	500	2020	Tender floated
Sterlite Energy Ltd.	Jharsuguda	274	CPA	Odisha	2	600	2022	Feasibility study
TalcherKaniha (NTPC)	Angul	199	CPA	Odisha	1	500	2022	Tender floated
					2	500	2022	Tender floated
					3	500	2022	Tender floated
					4	500	2022	Tender floated
					5	500	2022	Tender floated
					6	500	2022	Tender floated
Vallur TPP	Tiruvallur	1049	High density	Tamil Nadu	1	500	2021	Tender floated
					2	500	2021	Tender floated
					3	500	2021	Tender floated
Vizag TPP	Vishakhapatnam	384	CPA	Andhra Pradesh	1	520	2020	Feasibility study
					2	520	2019	Feasibility study
Yermarus	Raichur	457	High density	Karnataka	1	800	2021	Tender floated
					2	800	2022	Tender floated

Annexure 5: Current Status of implementation of plants for which Ministry of Power sought exemption in June 2018 at the Supreme Court

A. Plants whose age is less than 25 years

Brief:

Current status	Capacity in MW (%)
Retired	210 (1)
No plan but operating	1,040 (75)
Planning to upgrade	320 (24)

List:

Table: Status of stations less than 25 years which sought exemption

Station	Unit size	Capacity (MW)	Current status
BOKARO `B` TPS	1x210	210	Retired
Dr. N.TATA RAO TPS	2x210	420	No plan
GEPL TPP Ph-I	2x60	120	Not known
KOTHAGUDEM TPS (NEW)	2x250	500	No plan
ROPAR TPS	1x210	210	Tender floated
TANDA TPS	1x110	110	Tender awarded
Total		1,360	

B. Plants whose age is less than 25 years

Brief:

Current status	Capacity in MW (%)
Retired	1,259 (18)
Plan to retire	345 (5)
No plan but operating	1,500 (21)
Planning to upgrade	3,955 (56)
Total	7,059

List:

Power Station	Sector	State	Capacity in MW	RPC Deadline	October 2017 Stand	March 2018 Stand	Current Status
BADARPUR TPS	Central	Delhi	420	Closed	Retire	Exemption	Closed
GND TPS (BHATINDA)	State	Punjab	220	Closed	Retire	Exemption	Closed
HARDUAGANJ TPS	State	Uttar Pradesh	105	2019	Upgrade	Exemption	Closed
OBRA TPS	State	Uttar Pradesh	94	2018	Retire	Exemption	Closed
SABARMATI	Private	Gujarat	60	2017	Retire	Exemption	Feasibility Study
TUTICORIN TPS	State	Tamil Nadu	630	2019	Retire	Exemption	Feasibility Study
DR. N. TATA RAO TPS	State	Andhra Pradesh	840	2019	Retire	Exemption	Operating - No Plan
PSEB Ropar*	State	Punjab	420	NA	NA	NA	Closed
WBPDC Bandel	State	West Bengal	450	NA	upgrade	Retire	Operating - No Plan
DURGAPUR TPS	Central	West Bengal	210	Na	Retire	Exemption	Operating - No Plan
BARAUNI TPS	State	Bihar	210	Na	Retire	Exemption	R&M
TITAGARH TPS	Private	West Bengal	240	Na	Retire	Exemption	Reserve Shut Down
TANDA TPS	Centre	Uttar Pradesh	330	Not Available	Upgrade	Exemption	Tender Awarded
KORBA-III	State	Chhattisgarh	240	2019	Retire	Exemption	Tender Floated
KORBA-WEST TPS	State	Chhattisgarh	840	2020	Retire	Exemption	Tender Floated
MUZAFFARPUR TPS	Central	Bihar	220	2023	Retire	Exemption	Tender Floated
TALCHER (OLD) TPS	Central	Odisha	460	2023	Retire	Exemption	Tender Floated
PARICHHA TPS	State	Uttar Pradesh	220	2022	Upgrade	Exemption	Tender Floated
KOTA TPS	State	Rajasthan	640	2022	Upgrade	Exemption	Tender Specification Stage
PANIPAT TPS	State	Haryana	210	2019	Upgrade	Exemption	Tender Specification Stage
TOTAL			**7,059**				

*commissioned in 1992-93

Annexure 6: List of Power Station January 2017 Onwards

Plant	Sector	Unit	Capacity (in MW)	Year of Commissioning
ANDHRA PRADESH				
Sembcorp Energy India Ltd Nellore	Private	2	660	2017
APGENCO Rayalaseema TPS	State	6	600	2018
BIHAR				
KBUNL Muzaffarpur TPS	Central	4	195	2017
BRBCL Nabi Nagar TPP	Central	2	250	2017
NTPC Barauni TPS	Central	8	250	2018
	Central	9	250	2018
NPGCL Nabi Nagar TPP	Central	1	660	2019
BRBCL Nabi Nagar TPP	Central	3	250	2019
CHHATTISGARH				
Wardha Power Co Ltd Akaltara TPS	Private	3	600	2018
RKM Powergen Pvt Ltd Uchpinda TPP	Private	3	360	2017
	Private	4	360	2019
TRN Energy Private Limited Nawapara TPP	Private	2	300	2017
SKS Power Generation Ltd Binjkote TPP	Private	1	300	2017
	Private	2	300	2018
NTPC Lara TPP	Central	1	800	2018
GUJARAT				
Bhavnagar Energy Co. Ltd	State	2	250	2017
GSECL Wanakbori TPS	State	8	800	2019
MADHYA PRADESH				
MPPGCL Shri Singhaji TPP	State	3	660	2018
Essar Power MP Ltd Mahan TPP	Private	2	600	2018
NTPC Khargone STPP	Central	1	660	2019
BLA Power Pvt Ltd. Niwari TPP	Private	2	45	2019
MPPGCL Shri Singhaji TPP	State	4	660	2019
NTPC Gadarwara TPP	Central	1	800	2019
MAHARASHTRA				
MAHAGENCO Nagpur	State	10	660	2017
NTPC Mauda TPS	Central	4	660	2017
NTPC Solapur STPS	Central	1	660	2017
	Central	2	660	2019

Plant	Sector	Unit	Capacity (in MW)	Year of Commissioning
Sinnar Thermal Power Ltd Nasik (P) TPS	Private	2	270	2017
	Private	3	270	2017
	Private	4	270	2017
	Private	5	270	2017
Shirpur Power Pvt Ltd	Private	1	150	2017
ODISHA				
OPGCL IB Valley TPP	State	4	660	2019
	State	3	660	2019
KARNATAKA				
Raichur Power Corp. Ltd Yermarus TPP	State	2	800	2017
NTPC Kudgi STPP	Central	2	800	2017
	Central	3	800	2018
RAJASTHAN				
RRVUNL Chhabra TPP	State	5	660	2017
	State	6	660	2019
TELANGANA				
TSGENCO Kothagudem TPS	State	12	800	2018
UTTAR PRADESH				
PPGCL (Jaypee) Prayagraj TPP	Private	3	660	2017
NTPC Unchahar TPS	Central	6	500	2017
NTPC Tanda TPS	Central	5	660	2019
MUNPL Meja STPP	Central	1	660	2018
WEST BENGAL				
Hiranmaye Energy Ltd	Private	1	150	2017
	Private	2	150	2017
DPSC Ltd Dishergarh TPP	Private	1	12	2019

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Chapter 1: The Standards – An Overview

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In 2015, India introduced new emission standards and water use norms for the coal-based thermal power sector. All plants were required to meet the norms by December 2017. However, the industry began a sustained campaign to first obstruct and prevaricate, and then to dilute and delay the implementation of the norms.

The year 2022 has now been agreed to as the new deadline for implementation. When implemented, the norms can lead to a significant reduction in emissions and dip in water use by the sector. This report attempts to assess objectively whether the industry is positioned and ready to meet the norms within this deadline — and comes up with some disturbing statistics.

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