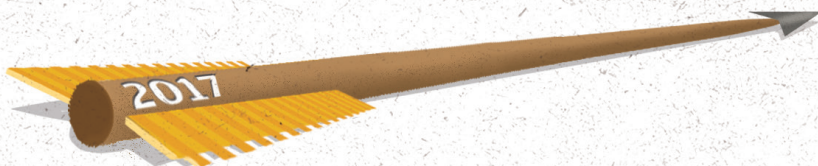




**STATUS OF COAL POWER
STATIONS IN DELHI NCR**

OFF TARGET



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Disclaimer: *The findings in this document are based on meetings with key stakeholders, coal power plant visits, petitions and court filings, as well as from public statements released periodically, such as bids and their award announcements. CSE claims no responsibility for any discrepancies in the reported data.*

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Material from this publication can be used, but with acknowledgement.

Citation: Priyavrat Bhati, Rohit Pathania, Pranav Phadke, Randhir Kr. Gupta, and Soundaram Ramanathan, June 2018, *Off Target - Status of Thermal Power Stations in Delhi NCR*, Centre for Science and Environment, New Delhi

Published by

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1. Introduction

1.1 BACKGROUND

Coal has about 57 per cent share (around 197 GW) in the total installed capacity in India; but nearly 70 per cent of electricity (977 TWh, 2017- 18) in the country still comes from coal power plants.

Coal-based thermal power industry is highly polluting- it is responsible for 60 per cent of industrial sector's PM emissions (when one includes coal mining), 45 per cent of SO₂ emissions, 30 per cent of NO_x emissions and 80 per cent of mercury emissions. In terms of water usage, the thermal power sector is estimated to be using about 24 billion cubic meters annually, which is about half of India's total domestic needs.

To combat the pollution load from coal power plants, the Ministry of Environment, Forest & Climate Change (MoEF&CC) in December 2015 announced emission control standards for coal-based thermal power plants (see Table 1.1: *Emission control standards for Indian coal power plants*).

Table 1.1: Emission control standards for Indian coal power plants (in mg/ Nm³)

New Norms are in-line with Global Standards

	PM	SO ₂	NO _x	Mercury
Units installed before Dec, 31 st , 2003	100	600 (<500MW) 200 (>=500MW)	600	0.03 (>=500MW)
Units installed between 2004 - 2016	50	600 (<500MW) 200 (>=500MW)	300	0.03
Units installed from 1 st Jan 2017	30	100	100	0.03

Source: MoEF&CC, 2015

If implemented rigorously, the new standards can drastically reduce emissions of NO_x, SO₂, and PM. As per Centre for Science and Environment (CSE) estimates, these norms can help reduce PM emissions by about 35 per cent, NO_x emission by about 70 per cent, and SO₂ emissions by more than 85 per cent by 2026-27 against a business as usual scenario with no pollution control technologies.

In addition to the air pollution control norms, water use efficiency was targeted – existing units were mandated to reduce their specific water consumption to 3.5 m³/MWh, while new units installed after January 2017 have to maintain their specific water consumption below 3.0 m³/MWh. This could potentially reduce the water consumption by about 85 per cent by 2026-27 when compared with a business as usual scenario.

1.2 FOOT DRAGGING BY THE POWER SECTOR

Existing plants were given two years (up to December 2017) to comply with these revised standards. On the other hand, plants commissioned after 1 January 2017 had to comply from the start of their operations.

At the time of their introduction, the industry raised several objections about the standards— the technology is not suitable for Indian coal; costs are too high; and adequate space for installation is not available. However, CSE research showed that these issues were manageable.

Notwithstanding the MoEF&CC's order, Central Electricity Authority (CEA) presented a plan with compliance schedule ending December 2022. However, even this plan was problematic as it was heavily back loaded with about 70 per cent capacity achieving compliance in the last two years. Second, it did not give schedule to control PM and NOx. Third, there were no intermediate milestones that would ensure that power plants will not seek another extension in 2022.

1.3 TIGHTER TIMELINES FOR DELHI NCR

The matter of non-compliance by thermal power station was raised at the National Green Tribunal through a petition filed in April 2017. CSE published two reports highlighting the lack of progress on the matter. Also, the Environment Pollution (Prevention & Control) Authority (EPCA) emphasized the need for cutting emissions from coal-based power plants in its November 2017 status report hearing in the Supreme Court (SC) regarding the pollution in Delhi-NCR region.

In December 2017, the Central Pollution Control Board (CPCB) sent Section 5 directions under Environment Protection Act to all coal-based power plants, affirming timelines for compliance mostly as per the CEA's phasing plan, i.e. timelines were essentially extended to 2022. CPCB's directions, however, made two changes to the CEA's schedule: FGD installation was accelerated till December 2019 for plants based within a radius of 300 km of Delhi-NCR; timelines for upgrading Electrostatic Precipitator (ESP), which were not detailed in CEA's plan, were given.

Given the extension by CPCB, a petition was filed in the Supreme Court against thermal power plants for not complying with the norms in December 2017 and the legality of the extensions themselves. In February 2018, EPCA, in its amicus curie filing in the SC, suggested a deadline of 2020 for nationwide compliance. Subsequently, updates have been sought from the power stations by The Supreme Court on the steps taken towards achieving compliance with the environmental norms.

Even the 2019 extension for the plants operating in the Delhi-NCR air shed may not be met. The new timelines, for this region are ambitious. The compliance will depend on the preparatory work that the power plants should have undertaken over the last two years and focused effort going forward. Some progress has reported with certain power stations having done engineering studies and some others having announced tenders.

However, there is a need to take very aggressive steps on part of the power plants, accompanied by close oversight from regulatory and monitoring agencies, to achieve the

deadline. CSE therefore felt it necessary to make an assessment of the current scenario to understand if the plants will be able to meet with the accelerated timelines. This assessment, while checking for compliance, also holds learning opportunities. It will help get insights into the preparations towards installing pollution control equipment. Also, steps taken to achieve the deadline within time can be suggested for other regions for consideration.

1.4 METHODOLOGY

CSE team engaged with different stakeholders within the region – Key personnel from Power companies, state electricity regulatory commissions' (SERCs) and state pollution control boards' (SPCBs) - to identify the steps being taken for meeting the 2019 compliance deadline issued by CPCB. The team also visited some power stations to collect primary data, and interacted with power plant officials to track actual on-ground progress. Information was also collected from regulators and filings in Supreme Court including status reports and petitions, as well as from public statements released periodically, such as bids and their award announcements.

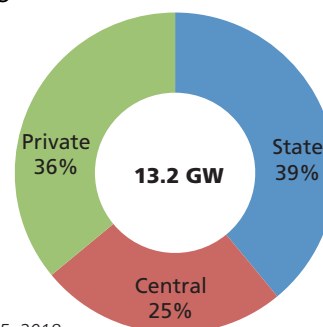
In addition to this, the team also consulted various industry experts and equipment manufacturers to identify issues pertaining to the present status, the possibility of compliance with the 2019 deadline, and subsequent measures to ensure compliance.

2. OVERALL FINDINGS

The Delhi and NCR region has an installed coal power plant capacity of about 13 GW. About 39 per cent of the installed capacity is state owned. The balance is divided between the privately owned/managed power generation companies (36%) and the central government owned NTPC (see *Graph 2.1: Sector-wise Capacity Distribution of Coal Power Plants in the region*). The plant-wise compliance measures undertaken by the power stations in the region is summarised in Annexure -I.

Graph 2.1: Sector-wise Capacity Distribution of Coal Power Plants in the region

Most power stations are owned by State and Central governments



Source: CSE, 2018

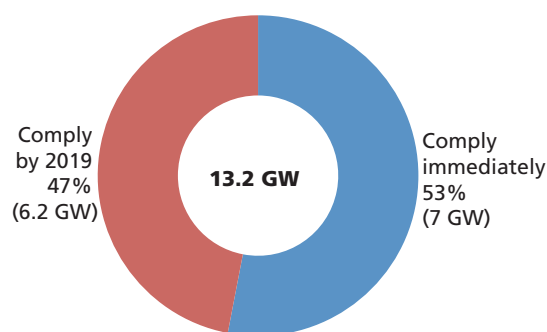
2.1 CONTROL OF PARTICULATE MATTER EMISSIONS

2.1.1 Compliance Schedule

Power plants have been asked to comply with the PM standards in two phases by the CPCB's Section 5 notices. 7GW (53 per cent) of the installed capacity was asked to comply immediately in December 2017 - the underlying implication is that these units are already in compliance; however, no credible data is available. The balance capacity (6.2 GW) has been asked to achieve compliance by December 2019 (see *Graph 2.2: PM Compliance Schedule*).

Graph 2.2: PM Compliance Schedule

50% Capacity has to be Compliant Starting 2018



Source: CSE, 2018

2.1.2 Progress update

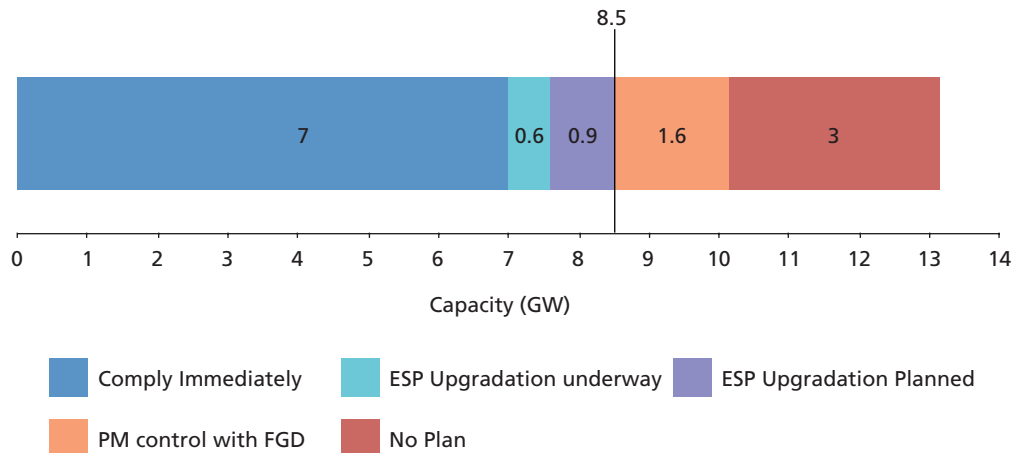
As per the discussion and plans identified by the companies, out of the 6.2 GW capacity which needs to comply by December 2019, only 0.6 GW of capacity has ESP upgradation underway, while plans are in the pipeline for another 0.9 GW. These include the Yamunanagar Power station of HPGCL, two units of the Ropar power station of PSPCL, and two units Lehra Mohabbat Power Station of PSPCL.

1.6 GW of the installed capacity (12 per cent of the region's total installed capacity) plans to meet the PM standards after installing the SO₂ control measure, particularly flue gas desulphurization (FGD) systems (see *Graph 2.3: PM Compliance Status*). This includes two other units of Lehra Mohabbat Power Station and the Hisar Power Station of HPGCL. No plans were specified by the power plants for 3 GW capacity. This includes four units

of Ropar power station of PSPCL, three units of the Panipat Thermal Power station of HPGCL and three units of Aravali Thermal Power Plant.

Graph 2.3: PM Compliance Status

4.6 GW capacity has no suitable action plan for PM compliance



Source: CSE, 2018

2.1.3 Conclusion:

Given the current status, about 8.5 GW, or about 65% of the overall installed capacity is on track to meet the deadlines given to it. Of this, 7 GW is supposed to be compliant, but there is no data to verify this; another 1.5 GW will comply by December 2019 (see *Graph 2.3: PM Compliance Status*). The balance capacity will be unable to meet the 2019 compliance deadline.

2.2 CONTROL OF SULPHUR DIOXIDE EMISSIONS

As per data received from the plants by Pollution Control Boards and our limited survey results, none of the plants in Delhi NCR region are presently compliant with the SO₂ standard. These plants will need to adopt control measures if they wish to continue operations beyond 2019.

2.2.1 Compliance Schedule

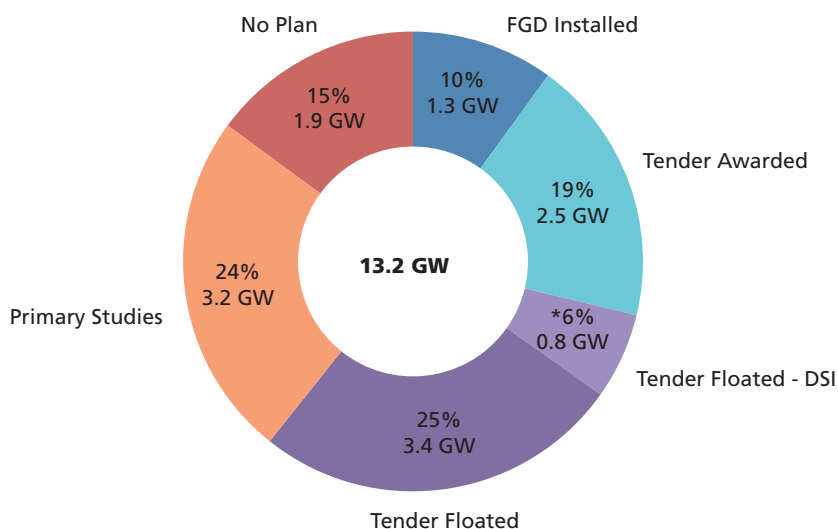
About 1.3GW (10%) of the installed capacity, specifically CLP Jhajjar, has been asked to comply with the environmental norms by January 2019. This plant has an FGD installed; however, the FGD is currently not operational. The balance 90% capacity has been given a deadline till December 2019 to achieve compliance with the SO₂ standards.

2.2.2 Progress Update

Implementation of SO₂ control measures is still at early stages across the region. Tender for setting up an FGD system has been awarded for 19% (2.4 GW) of capacity (NTPC Dadri Stage II and Aravali Power Company Limited). Another 32% (4.2 GW) capacity, comprising of Nabha Power Limited, Talwandi Sabo Private Limited, and NTPC Dadri Stage I, have floated tenders and await results – of these, Dadri Stage I has raised a tender for Dry Sorbent Injection (DSI) system. Around 24% (3.2 GW) capacity has initiated studies to identify suitable technologies (see *Graph 2.4: SO₂ Compliance Status*).

Graph 2.4: SO₂ Compliance Status

Tenders have been awarded for only 19% of the installed capacity presently



*Note: This includes NTPC Dadri Stage -I (0.8 GW) which is opting for DSI.

Source: CSE, 2018

15% of the power stations (1.9 GW) have not announced any plans for achieving compliance. These units include one unit of Panipat TPS of HPGCL, the whole of Ropar Power Station of PSPCL and Harduaganj TPS of UPRVUNL. There is continued lack of clarity on the status of these units and the action plants to be adopted for them. Discussions have been going on about retiring some of these units at Panipat and Ropar; however, nothing concrete has been announced so far. The DSI system has a construction time of around 12 months and can enable these units to achieve compliance within the deadline.

2.2.3 Conclusion

Given the present status, only CLP's Jhajjar power station (1.3 GW) and NTPC Dadri's Stage I (0.8 GW) are on track to comply with their deadlines. **11 GW or 83% of the capacity shall not be able to comply with the 2019 deadline**, unless they are able to fast track the entire process chain - from feasibility studies to construction and installation work. Installation of full FGD system is a time consuming process, taking up to two years, after the award of the contract to the shortlisted vendor. Lack of feasibility studies at this stage is an even bigger concern - this minimum step should have been completed latest by 2016, one year after the norms were announced. By now, every plant should have identified technology solutions and taken approvals from costs, and should be ready to float tenders.

2.3 CONTROLLING OXIDES OF NITROGEN

2.3.1 Compliance Schedule and Present Status

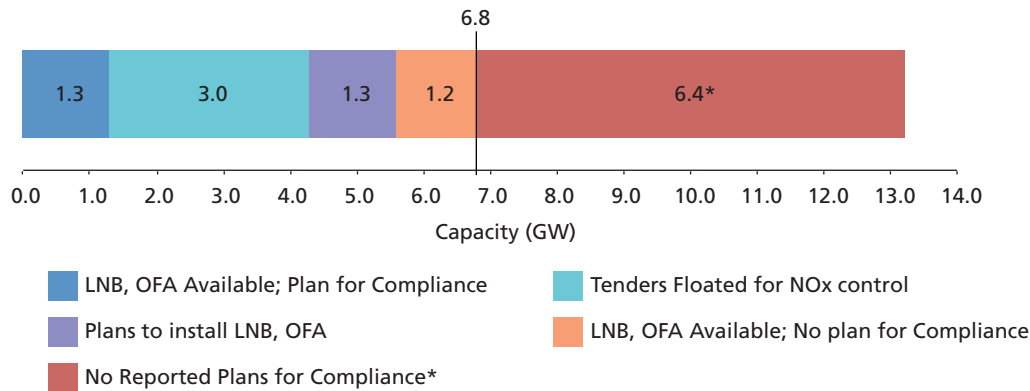
All the power stations of the region have been given a compliance deadline of December 2019 by CPCB.

Low NO_x Burners (LNBs) and other such control measures are presently installed in about 2.5 GW capacity across the region. Of this 1.3GW has started work to achieve compliance while the balance (1.2 GW) has no plans yet.

1.3 GW or 10 per cent of the capacity – Yamunanagar and Panipat power stations of HPGCL – has announced intentions to install primary control measures like Low NO_x burners (LNBs). Preliminary cost approvals have been obtained for them from the Haryana Electricity Regulatory Commission, and tenders could be announced soon. (see *Graph: 2.5: NO_x Compliance Status*).

Graph 2.5: NO_x Compliance Status

No Compliance plans have been reported by half of the installed capacity



*It is possible that some of this capacity is in compliance but no credible emissions data is available.

Source: CSE, 2018

As of now, tenders for NO_x control measures have been announced for only 3 GW of capacity. Of this, Talwandi Sabo Private Limited is opting for selective non-catalytic reduction (SNCR) system to meet the norms, while NTPC Dadri Stage II is looking to adopt primary NO_x control measures, which primarily include options like LNB, OFA dampers and combustion optimization systems.

2.3.2 Conclusions

Three categories of plants - plants that have obtained cost approvals; those that have floated tenders; or are already equipped with in-combustion NO_x control technologies like LNB and OFA dampers should be able to achieve compliance. Therefore, only 6.8 GW or 50% of the region's installed capacity may be able to meet the 2019 deadline of NO_x control.

Almost 50 per cent of the total installed capacity (6.4 GW) has not reported any plans to achieve compliance with NO_x norms. It is possible that some of this capacity is in compliance but no credible emissions data is available.

2.4 OVERALL CONCLUSIONS

Based on our survey of 13.2 GW installed Capacity in NCR Air-shed, CSE estimates that-

- **PM:** Given the current status, about 8.5 GW, or about 65% of the overall installed capacity is on track to meet the deadlines given to it. Of this, 7 GW is supposed to be in compliance right now, but there is no verifiable data, and another 1.5 GW will comply by December 2019. The balance capacity will be unable to meet the 2019 compliance deadline.

- **SO₂:** 2.1 GW Capacity is likely to meet the deadline. 11 GW or 83% of the capacity shall not be able to comply with the 2019 deadline, unless they are able to fast track their entire process chain - from feasibility studies to construction and installation work.
- **NO_x:** Half of the region's installed capacity (6.8GW) may be able to meet the 2019 deadline of NO_x control. Balance has not reported any plans to achieve compliance with NO_x norms. It is possible that some of this capacity is already in compliance but no credible emissions data/ information is available.

2.5 OTHER ISSUES

Based on the survey, CSE believes that many plants are way off target to meet the 2019 compliance deadline. Much of the preliminary work, especially feasibility studies and technology selection could have been finished between 2015, when the norms were announced, and 2017, the original deadline for compliance. There are several challenges:

- There is a lot of confusion on technology selection amongst power companies. Nearly all the power companies, particularly the key plant officials, seem unaware of the appropriate technology solutions needed for achieving the norms. For e.g. to achieve SO₂ control, most of the power stations are opting for the wet limestone-based FGD system. Smaller/older units should consider opting for cheaper technologies like DSI system which can help meeting the 600 mg/Nm³ standard; moreover, it can be commissioned in just over one year. For e.g. NTPC Dadri has floated a tender for the DSI system with sodium bicarbonate as the reagent for units 1-4 of the power station. Second, the use of FGD for additional PM control is not recommended by experts as it may impair FGD performance.
- Similarly, in the case of NO_x control SNCR/SCR technologies are being considered by power plants to comply with the higher standard of 300 mg/Nm³. Manufacturers and suppliers have repeatedly stated that primary control solutions like LNBs, OFA dampers and combustion optimizers can achieve the target. Further, plants are trying to push-back on the NO_x standard of 300 mg/Nm³. NTPC has announced a bid for two units of its Dadri Power station, asking suppliers for NO_x control systems that guarantee emissions below 400 mg/Nm³ though the applicable standard of 300 mg/Nm³.
- The accuracy of reported emissions data is also a problem. On several occasions, the data used for the technology selection in pre-feasibility reports was found to be incorrect. Companies also did not sometimes take stack and/or coal samples and check CEMs systems for accuracy, affecting the technology selection process.
- State Electricity Regulatory Commissions (SERCs) want more data to approve the cost of pollution control equipment in more than one state. They are concerned about emissions data presented by the power companies, and have sought the help of pollution monitoring bodies to understand and verify it. SERCs are also uncertain about costs, and await cost benchmarking of the technologies by CEA.
- State owned generation companies lack autonomy in decision making and are financially weak which has delayed their implementation progress.

3. THE WAY FORWARD

Steps should be taken immediately to ensure that a majority of the power stations operating in this region can achieve compliance with the norms at the earliest.

- Power companies must be asked to submit their present emissions data immediately. This should include CEMS data, verified by actual stack sample results.
- All plants should also be asked to submit engineering plans and feasibility assessments conducted so far within the next sixty days; and detailed implementation plan in the next ninety day period. This will enable regulatory agencies to assess its veracity.
- State Pollution Control Boards should oversee the technology implementation through a strict monitoring mechanism. This should be reported back to Central Pollution Control Board which should independently audit the same.
- Plants should be asked to provide quarterly updates on the milestones achieved with the various measures identified by them to meet the norms. SERCs and CERC could also be involved in this mechanism to ensure transparency about emissions data and technology requirements of the plants to expedite approvals at their end.
- A suitable penalty mechanism should be introduced as a deterrent to ensure that plants stay on track to meet the norms.
- CEA has in its various submissions and report given assessments of technology costs. ERCs may use them as guidance to expeditiously approve tariff applications by power plants. Also, CEA is undertaking the process of the development of standardized bid documents for these technologies – power companies should adopt them early once they are released.

ANNEXURE: OVERALL STATUS OF VARIOUS POWER PLANTS IN THE REGION

Thermal Plant Name	State	Unit No.	Capacity (MW)	Year of Commissioning	Measures for PM Compliance	Measures for SO ₂ Compliance	Measures for NO _x Compliance	Compliance Deadline as per CPCB
Panipat TPS	Haryana	6	210	2001	Currently controlling PM emissions with ammonia dosing. No longterm Plans	No Plans	Plans to install LNB, OFA	31/12/2019
		7	250	2004		Primary Studies		
		8	250	2005		Primary Studies		
Deenbandhu Chhotu Ram Thermal Power Plant (DCRTPP) Yamunanagar	Haryana	1	300	2007	ESP Upgradation Complete	Primary Studies	Plans to install LNB, OFA	31/12/2019
		2	300	2008	ESP Upgradation Underway	Primary Studies		
Rajiv Gandhi Thermal Power Station (RGTPP), Hisar	Haryana	1	600	2010	Plans to achieve PM compliance with the installation of FGD	Primary Studies	LNB, OFA Installed. No information on Compliance	31/12/2019
		2	600	2010		Primary Studies		
Guru Hargobind Thermal Power Station (GHTP) Lehra Mohabbat	Punjab	1	210	1997	Plans to achieve PM compliance with the installation of FGD	Primary Studies	No Reported Plans	31/12/2019
		2	210	1998				
		3	250	2008				
		4	250	2008				
Guru Gobind Singh Super Thermal Power Station (GGSSTP), Ropar	Punjab	1	210	1985	No Plans	No Plans	No Reported Plans	31/12/2019
		2	210	1985				
		3	210	1988				
		4	210	1989				
		5	210	1992				
		6	210	1993				
Harduaganj TPS	Uttar Pardesh	8	250	2011	ESP Upgradation Planned	No Plans	No Reported Plans	Immediate Compliance with PM Norms; 31/12/2019 for SO ₂ & NO _x
		9	250	2012	No Plans; Suppose to be in Compliance right now	No Plans		
National Capital Power Station (NTPC Dadri)	Uttar Pardesh	1	210	1991	No Plans; Suppose to be in Compliance right now	Tender Floated for DSI	No Reported Plans. Compliance Information Not Available	Immediate Compliance with PM Norms; 31/12/2019 for SO ₂ & NO _x
		2	210	1992				
		3	210	1993				
		4	210	1994				
		5	490	2010				
		6	490	2010				

Thermal Plant Name	State	Unit No.	Capacity (MW)	Year of Commissioning	Measures for PM Compliance	Measures for SO ₂ Compliance	Measures for NO _x Compliance	Compliance Deadline as per CPCB
Aravali Thermal Power Plant (Indira Gandhi STPS) Jhajjar	Haryana	1	500	2011	No Plans; Claims Compliance with PM Norms	Bid Awarded	No Reported Plans. Compliance Information Not Available	31/12/2019
		2	500	2011				
		3	500	2011				
Mahatma Gandhi thermal power station (CLP) Jhajjar	Haryana	1	660	2012	No Plans; Suppose to be in Compliance right now	FGD Installed, Tests Underway	LNB, OFA Installed, Combustion Optimization Measures Underway	Immediate Compliance with PM Norms; 31/1/2019 for SO ₂ , 2019 for NO _x
		2	660	2012				
Rajpura Thermal Power Plant (Nabha Power)	Punjab	1	700	2014	Information Not Available; Suppose to be in Compliance right now	Tariff Application; Tender Floated	No Reported Plans. Compliance Information Not Available	Immediate Compliance with PM Norms; 31/12/2019 for SO ₂ & NO _x
	Punjab	2	700	2014				
Talwandi Sabo Thermal Power Plant	Punjab	1	660	2013	Information Not Available; Suppose to be in Compliance right now	Tariff Application; Tender Floated	Floated a Bid Document for SNCR	Immediate Compliance with PM Norms; 31/12/2019 for SO ₂ & NO _x
	Punjab	2	660	2013				
	Punjab	3	660	2013				
Total			13210					

ACRONYMS

CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
CEMS	Continuous Emission Monitoring System
CPCB	Central Pollution Control Board
CSE	Centre for Science and Environment
DSI	Dry Sorbent Injection
ESP	Electrostatic Precipitator
FGD	Flue Gas Desulphurization
GW	Giga Watt
HPGCL	Haryana Power Generation Corporation Limited
LNB	Low NO _x Burners
MoEF&CC	Ministry of Environment, Forest & Climate Change
MOP	Ministry of Power
NCR	National Capital Region
NGT	National Green Tribunal
NO _x	Oxides of Nitrogen
OFA	Over Fire Air
PM	Particulate Matter
PSPCL	Punjab State Power Corporation Limited
RPC	Regional Power Committee
SC	Supreme Court
SERCs	State Electricity Regulatory Commissions
SNCR	Selective Non-Catalytic Reduction
SO ₂	Sulphur Dioxide
TPP	Thermal Power Plant
TPS	Thermal Power Station
TWh	Terra Watt Hours
UPRVUNL	Uttar Pradesh Rajya Vidyut Utpadan Nigam Limited



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