SHIFTING GOALPOSTS

Status of Pollution Control in Delhi–NCR Power Plants

Centre for Science and Environment

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1. BACKGROUND

Air pollution is the fifth largest cause of deaths in India, with an estimated 1.5 million deaths every year. Delhi alone loses 80 lives every day due to air pollution. Air pollution in Delhi worsens dramatically every November, post-Diwali. Delhi is enveloped by a smog blanket impacting the daily lives of people—closed schools, rationed vehicle use, increase in accidents and illnesses, and a surge in hospital admissions. A blame game follows with the finger pointing at various sources—crackers, biomass residue burning, vehicles, etc.

There is, however, little discussion about the elephant in the room—coal-based thermal power plants in the vicinity of Delhi–NCR. According to a 2016 report by IIT-Kanpur, power plants are a significant contributor to Delhi's pollution, especially for particulate matter (PM), and sulphur dioxide. The latest SAFAR Emission Inventory Report on Delhi-NCR, released on 15 October 2018 by the Ministry of Earth Sciences, Government of India, also states that13 per cent of the SO_2 in Delhi–NCR can be attributed directly to power plants.

Controlling pollution from thermal power stations has been a long-standing issue. In December 2015, the Ministry of Environment, Forest and Climate Change (MoEF&CC), notified tighter emission norms for coal-based thermal power stations. Power plants were required to comply with these norms by December 2017. However, a few days before the deadline in December 2017, the Central Pollution Control Board (CPCB), based on directions from the MoEF&CC, extended the timelines for compliance by up to five years. This was problematic for several reasons: the CEA and RPC reports and the data collected by CPCB showed that few plants were in compliance; most plants had made little progress in the preceding two years highlighting a lack of urgency; and the new schedule presented by the MoP was not based on detailed plant-level planning and was, therefore, not credible.

Meanwhile, the matter of lack of progress by the thermal power sector had reached the Supreme Court (SC) while it was hearing the Delhi air pollution case. The December 2017 notices by the CPCB, which had extended the timelines for most plants by five years had one notable element—power plants in the Delhi NCR air shed were directed to ensure compliance by December 2019. Delhi NCR region's highly polluted air, which was affecting the health of a large number of people, was the rationale for the tighter deadline.

Notwithstanding the schedule submitted by CPCB, which was backed by 'commitments' from CEA, it looked unlikely that many plants will be able to comply with the committed date. For instance, the EPCA reports submitted in April 2018, summarizing the implementation status of power plants submitted by the MoP to the SC, showed that most plants were still at preliminary stages of need assessment, or less. However, neither MoEF&CC nor the state power ministries and pollution control boards are monitoring the power stations.

During several hearings over the last year, the Supreme Court has voiced concerns about delays in the implementation process and has been critical about lack of action by the government. On December 10 2018, a petition was filed by the government in the Supreme Court that said that plants will comply as per the Revised schedule by 2022. The petition said that the deadline for the

NCR plants will be December 2019, the date in the Revised schedule.

Given the tight deadlines for the Delhi–NCR region and lack of monitoring by regulators, CSE decided to conduct a survey to assess the progress. An initial round was conducted between April and July last year, attempting to capture progress made towards meeting deadlines. The second round was carried out between August and November to see further progress towards implementation– This report summarizes the findings of the second survey.

2. TPP in Delhi–NCR air shed

Delhi–NCR air shed is defined as an area within 300 km falling in four states–Delhi, Haryana, Punjab and UP. It has 13.2 GW of coal power capacity in eleven stations with 35 operational units. All the coal stations in Punjab and Haryana are located in the north wind side of Delhi. There are also power plants in UP that fall in the NCR air shed—NTPC Dadri, and UPRVUNL Harduaganj. 13 per cent of all SO_2 emissions in Delhi NCR are attributable to coal-based power plants. 4 per cent of all PM emissions can be traced to power plants. *(see Table 1: Emissions from Power Plants)*.

Table 1: Operational power plants: More than two-thirds of the capacity is less than 10 years old

Thermal Plant	State	Ownership	Capacity (MW)	C.O.D
Panipat TPS (HPGCL), Panipat Units 6–7	Panipat, Haryana	State	710	2001–05
Deenbandhu Chhotu Ram TPP (HPGCL), Yamunanagar	Yamunanagar, Haryana	State	600	2007–08
Rajiv Gandhi TPS (HPGCL), Hisar	Hisar, Haryana	State	1,200	2010
Guru Hargobind TPS (PSPCL) Lehra Mohabbat	Bathinda, Punjab	State	920	1997–2008
Guru Gobind Singh STPS (PSPCL), Ropar	Ropar, Punjab	State	1,260	1985–93
Harduaganj TPS, Aligarh	Harduaganj, Uttar Pradesh	State	500	2011–12
National Capital Power Station (NTPC Dadri)	Dadri, Uttar Pradesh	Central	1,820	1991–2010
Aravali TPP (Indira Gandhi STPS), Jhajjar	Jhajjar, Haryana	Central	1,500	2011
Mahatma Gandhi TPS (CLP), Jhajjar	Jhajjar, Haryana	Private	1,320	2012
Rajpura TPP (Nabha Power)	Rajpura, Punjab	Private	1,400	2014
Talwandi Sabo TPP	Mansa, Punjab	Private	1,980	2013
Total			**13,210**	

DECOMMISSIONED STATIONS:

Two power stations—Guru Nanak Dev Thermal Power Plant (PSPCL) in Bathinda (440 MW), Punjab and Badarpur thermal power plant (NTPC) (720 MW) in Delhi—were in operation for more than 40 years, and are presently at various stages of decommissioning.

The decisions to close these stations vary. NTPC has been ordered by EPCA in 2017 to decommission the Badarpur power station as part of its efforts to control air pollution in Delhi. On the other hand, the government of Punjab said its plans to decommission the Bathinda power station in December 2017, stating that the generation cost of the power station was too high.

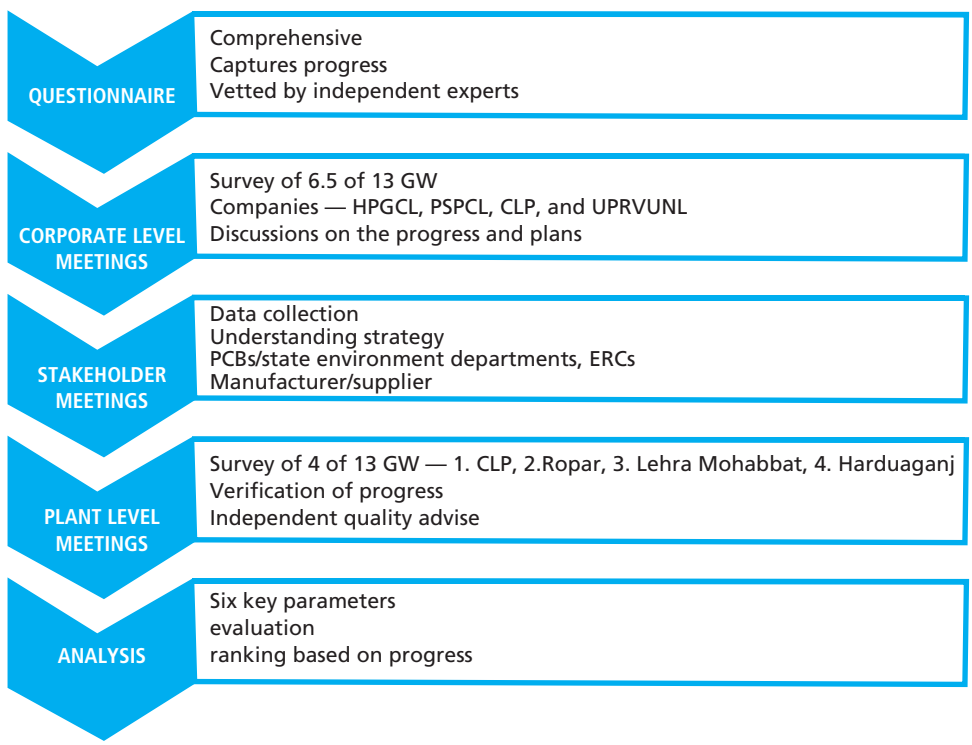
Plans to shut down power plants have been announced by the companies, and steps have been initiated towards their implementation. PSPCL has shut the power station and surrendered the coal linkage for the power station. The company plans to set up a 100 MW solar power plant at the site, and has raised an expression of interest for it. NTPC has announced plans to develop the fly ash mound areas of the Badarpur power plant into an ecological park, and most of the areas have been brought under green cover as per news reports.

A. THE SURVEY

CSE has been tracking implementation progress at the stations in the Delhi-NCR region for over a year *(see Figure 1: Delhi NCR Survey by CSE).* CSE sent a brief questionnaire (prepared under the guidance of industry experts) to evaluate plant performance including emissions and existing pollution control equipment and processes. We have tried to assess the progress towards installing pollution control equipment in terms of key milestones—feasibility assessment, technology selection and tender releases. We tried to evaluate progress in filing tariff petitions to obtain approval from regulators.

We requested the stations to provide data and let us survey the plant. We also requested meetings with senior officials at the power stations and at company corporate headquarters to get an update on the plans intended for the respective station and the status. Around half of the capacity (6.5 GW) provided data. The team visited four of those power stations that had shared data totalling to a capacity of 3.2 GW. We tested these stations to ascertain the quality of the reported emissions data. We also collected coal and ash samples and got them tested by independent laboratories to confirm the pollutant balance.

Figure 1: Delhi NCR Survey by CSE: ***Five-fold steps to evaluate progress***
Source: *Centre for Science and Environment, 2018*



For those plants that did not share information with CSE (NTPC and

private sector-owned plants) information on progress was collected through various sources: petitions filed with Electricity regulatory commissions and the interim orders issued by them; information shared by pollution control boards and/or state environment departments; progress reports issued by the Northern regional power committee; and information updates from equipment suppliers and manufacturers.

The first progress report was released in July 2018. The survey and data gathering exercise was repeated in October and November to obtain information about material developments, and is summarized in this report. Further, a tracking scale is being introduced to try and quantify progress made by various stations.

B. EMISSION LEVELS

Emissions data collected for the power stations of the region were essentially divided into three categories *(see Table 2:Category-wise Sorting of Power Plants)*:

1. Emissions were tested by the CSE team.
2. Emissions data was collected by CSE from the power stations but CSE teams could not independently verify the stack emissions.
3. Emissions data was collected from environment statements submitted to PCBs and petitions/orders of the ERCs.

Table 2: Category-wise sorting of power plants

Category 1	Category 2	Category 3
Harduaganj TPS, Aligarh PSPCL Ropar PSPCL Lehra Mohabbat PSPCL Bathinda	HPGCL Yamunanagar Rajiv Gandhi TPS (HPGCL), Hisar Mahatma Gandhi TPS (CLP), Jhajjar Panipat TPS (HPGCL), Panipat	Aravali TPP (Indira Gandhi STPS), Jhajjar NTPC Dadri Rajpura TPP (Nabha Power) Talwandi Sabo TPP

Thermal power stations of Delhi–NCR report particulate matter emissions between 50 and 150 mg/N.cu.m. Sulphur dioxide emissions for the power stations varied between 800 and 1700 mg/N.cu.m, while oxides of nitrogen emissions varied between 250 and 800 mg/N.cu.m *(see Table 3: Emission Levels, 2015–17),* particularly for plants where CSE tested stack emissions. Inaccurate data, however, continues to be a problem, especially for those power stations where data was obtained from environment statements and petitions. NTPC Dadri, NTPC Aravalli, and HPGCL Yamunanagar were found to severely understate their emission levels.

Table 3: Emission levels, 2015-17: ***Errors in emissions reporting, especially in environment statements***

Power Plant	Capacity	PM	SO_2	NO_x
Haryana				
Aravali TPP (Indira Gandhi STPS), Jhajjar	1,500	50–75	400–500	150–200
HPGCL Yamunanagar	600	150	150—200	250–300
Mahatma Gandhi TPS (CLP), Jhajjar	1,320	50	1,000–1,200	200–300
Panipat TPS (HPGCL), Panipat	710	150	800–1,000	400–500
Rajiv Gandhi TPS (HPGCL), Hisar	1,200	50	650–800	650–800

Power Plant	Capacity	PM	SO_2	NO_x
Sub-total	5,330			
Punjab				
PSPCL Ropar	1,260	50–120	800–1,100	100–300
PSPCL LehraMohabbat	920	80–140	1,200–1,700	700–800
Rajpura TPP (Nabha Power)	1,400	40–50	1,000–1,200	400–500
Talwandi Sabo TPP	1,980	50–100	1,500–1,600	500–600
Sub-total	5,560			
Uttar Pradesh				
Harduaganj TPS, Aligarh	500	50–100	800–1200	400–600
NTPC Dadri	1,820	50	400–600	200–300
Sub-total	2,320			

Source: *Centre for Science and Environment, 2018.*
Note: *Data on Bathinda and Badarpur power stations has not been included since the plants are at an advanced stage of decommissioning*

Ministry of Earth Sciences, Government of India recently released the SAFAR emission inventory for Delhi–NCR region for the period April to June 2018. Under this exercise, primary and secondary data were collected by a team of 100 people of 26 different sources of air pollution within the Delhi–NCR region. As per this inventory, power plants are the third largest source of all kinds of air pollutants in the region. They were found to be responsible for about 13 per cent of the SO_2 in the region *(see Table 4: Emissions Sources in Delhi–NCR).* The report also stated that while power plants contribute 4 per cent of the particulate matter, these emissions increased by 16 per cent between 2010 and 2018.

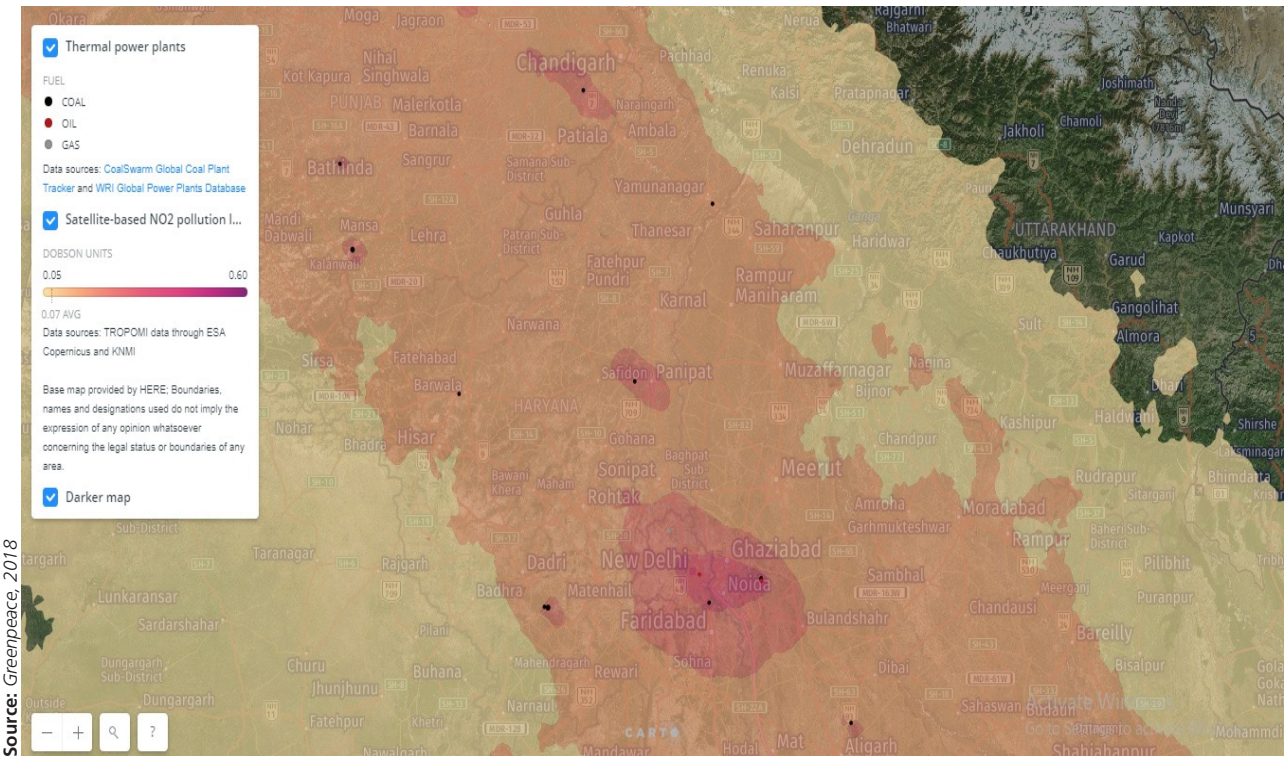
Table 4: Emissions sources in Delhi–NCR: ***Power sector is the third largest source of pollution***

SECTOR	$PM_{2.5}$	PM_{10}	CO	NO_x	VOC	SO_2
Transport	42.2	43.2	483.1	257.7	614.5	77.2
Industry	24.1	43.9	12.1	100.7	61.0	400.1
Power	3.3	12.8	0.3	8.0	0.0	81.0
Residential	6.2	8.9	34.1	2.2	0.3	1.3
Wind-blown	19.5	136.0	0.0	0.0	0.0	0.0
Others	12.4	23.6	46.2	44.0	3.5	60.2
TOTAL	**107.8**	**268.4**	**575.8**	**412.6**	**679.4**	**619.8**

Source: *SAFAR, 2018.*

Bear in mind that this does not take into account the larger region under focus; rather this is only for the city of Delhi and its immediate vicinity—the SAFAR study does not cover the radius of 300 km within which most power plants fall. For instance, satellite imagery from the European space agency for NOx emissions, when overlapped with the presence of coal power plants by Greenpeace, showed that high emission levels coincided with the presence of power plants in many of these places *(see Image 1: NOx Hotspots around Delhi NCR and coal power stations and Image 2—SO_2 Concentrations over North India).*

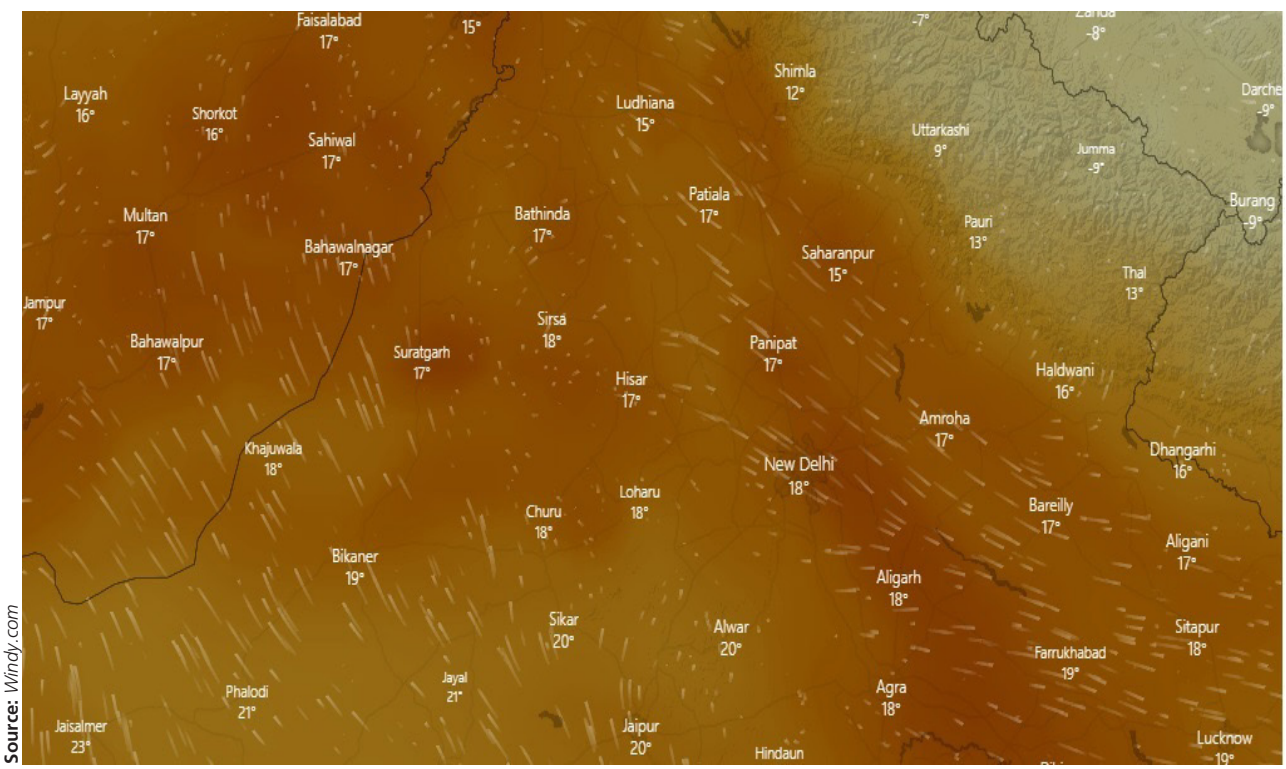
Image 1: NOx hotspots around Delhi NCR and coal power stations



Source: *Greenpeace, 2018*

High concentrations of NOx overlap with power stations in encircled places

Image 2: SO_2 Concentrations over North India

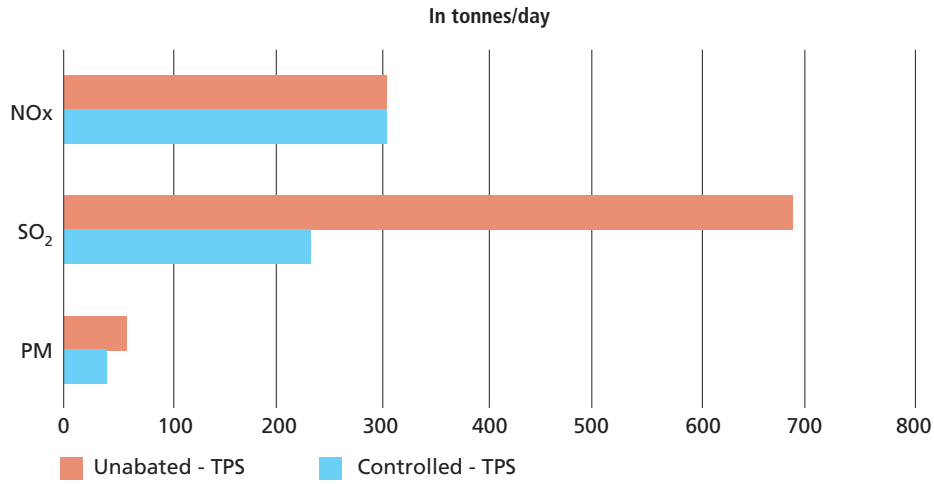


Source: *Windy.com*

Power plants are a major reason for high SO2 levels across Delhi-NCR region

If new standards are enforced, it is expected that there will be a reduction in the contribution of power plants to the pollution of the Delhi–NCR region. PM emssion will reduce by 29 per cent, SO_2 emission by 66 per cent, and NO_x emission by 21 per cent from the base load emissions of the sector *(see Graph 1: Pollution load comparison).*

Graph 1: Pollution load comparison: ***Significant reductions could be achieved in the Emissions from Thermal Power Plants***



Source: *Centre for Science and Environment, 2018.*

Judiciary takes charge, but states are nowhere in sight

The matter of delays in enforcement of thermal power standards reached the Supreme Court of India in December 2017, when CPCB filed a petition in a case regarding the air pollution of Delhi–NCR. Under this petition, the CPCB told the Court that it had directed the thermal power plants across India to comply with these standards by 2022. The abrupt decision to extend deadline by 5 years came after repeated assertions that the power plants will need to comply with the norms by December 2017. Delhi-NCR power plants were given a deadline of December 2019 for completing the implementation process.

The Court was unhappy at the lack of progress in the implementation of the standards and criticized the MoEF&CC and MoP on extending the timeline. The Court asked the MoEF&CC and MoP to provide unit-wise deadlines, including issuance and finalization of tenders, technological inputs, and implementation. The Supreme Court also asked the EPCA for its recommendations. EPCA suggested power stations should be able to meet new norms within a shorter timeframe than had been given in CPCB directions. It said that timelines for power stations located in critically polluted areas and/or heavily populated areas should be even tighter (Notably, CPCB directions of December 2017 ordered Delhi–NCR plants to comply with the norms by December 2019, perhaps in anticipation of SC's focus on Delhi region).

In response, the MoP submitted an affidavit on 6 August 2018, stating that, 'NTPC and DVC units that are 500 MW and above and situated in critically polluted/ densely populated areas are directed to ensure compliance before December 2021'. However, the MoP expressed its inability to ensure expedited compliance by state GENCOs and private power stations. The Supreme Court has asked state GENCOs and private power stations to confirm if they can provide advanced timelines and explain their position.

As far as the Delhi-NCR region is concerned, the MoP affidavit said NTPC Dadri and Aravali power plants will complete implementing by December 2019. SC has issued notices to certain private and state-owned power stations in the NCR region (Talwandi Sabo Power limited, Rajpura Power Limited, China Light and Power Jhajjar, and Haryana's Hisar Power station) to explain if they too,can meet the December 2019 deadline.

Progress across the states should have been monitored not just by the central agencies. State level agencies, particularly the environment departments and pollution control boards, should be proactively involved in the process. However, state pollution control boards have shown little interest in keeping track of the progress of thermal power stations, and were mostly unaware of the developments. For instance, the Environment Department in Haryana was unaware of the court proceedings and said that the MoEF&CC and CPCB had not kept them in the loop in their communications with the power stations operating in the state.

C. First Review

In July 2018, CSE released the first progress report. It highlighted that little progress had been made by plants in the Delhi–NCR region to meet the 2019 deadline. Overall, more than 80 per cent of the power generation capacity around Delhi had done little preparation towards meeting the norms:

- **SO_2:** 11 GW or 83 per cent of the capacity was far from complying with the 2019 deadline, unless they are able to fast track their entire project management process—from feasibility studies to construction and installation work.
- **NOx:** Half of the region's installed capacity (6.8GW) may be able to comply with NO_x norms by the 2019 deadline. The balance did not report 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 was available.
- **PM:** 8.5 GW or about 65 per cent of the overall installed capacity was on track to meet the deadlines given to it. Of this, 7 GW is supposedly compliant right now. However, data quality being poor, it is very difficult to accept the veracity of these claims. Another 1.5 GW would comply by December 2019.

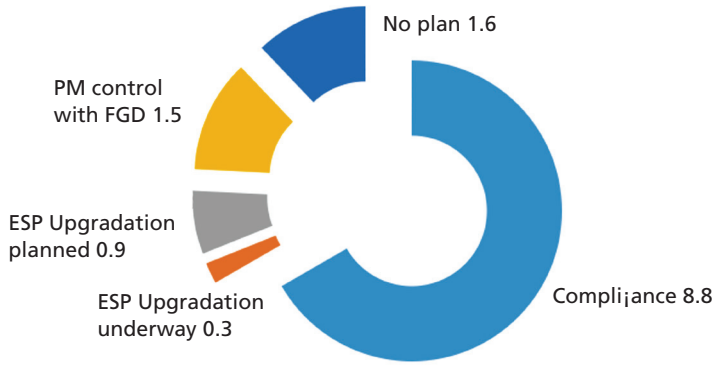
D. CURRENT PROGRESS

Since July 2018, there has been little progress. Given the current pace, almost three-fourths of the total capacity in the region may be unable to complete the implementation process by December 2019. Of this, 10 per cent (1.3 GW) capacity already has the necessary pollution controls in place. Thus, effectively, only 17 per cent of the installed capacity (2.3GW) has plans to take material steps to achieve compliance by December 2019.

PM compliance—Manageable challenge

67% of the installed capacity (8.8GW) is compliant with norms. Another 9% (1.2 GW) capacity is at various stages of ESP upgradation and maybe able to comply with the December 2019 deadline. The remainder 24% (3.2 GW) capacity will not be able to comply with the deadline—these plants have no concrete plans in place *(see Graph 2: PM Compliance Status for Thermal Power Stations of Delhi–NCR).*

Graph 2: PM compliance status for thermal power stations of Delhi–NCR (Capacity in GW): ***Around two-thirds of the plants report compliance***



Source: *Centre for Science and Environment, 2018.*

ONGOING UPGRADES, BUT SOME ARE NOT AIMING FOR COMPLIANCE

Few plants are currently undertaking ESP upgrades in the region *(see Table 5: PM Control Status at Power Stations).* Haryana Power Generation Company Limited (HPGCL) has completed an upgrade of the electrostatic precipitator (ESP) at one of its units in Yamunanagar power station. Work is ongoing on the second unit's ESP and shall be completed along with the next scheduled overhaul of the plant in 2019.

Punjab State Power Corporation Limited (PSPCL) planned upgrades for ESPs at the Ropar power plant and Lehra Mohabbat power stations. Visits to the two power stations showed that the ESP upgrade had been completed. However, the upgrades were found to be insufficient—the present ESP standards were still not being met by the power stations. For its Lehra Mohabbat power station, PSPCL has stated that it will rely on the planned flue gas desulphurization (FGD) system, to meet the PM standards.

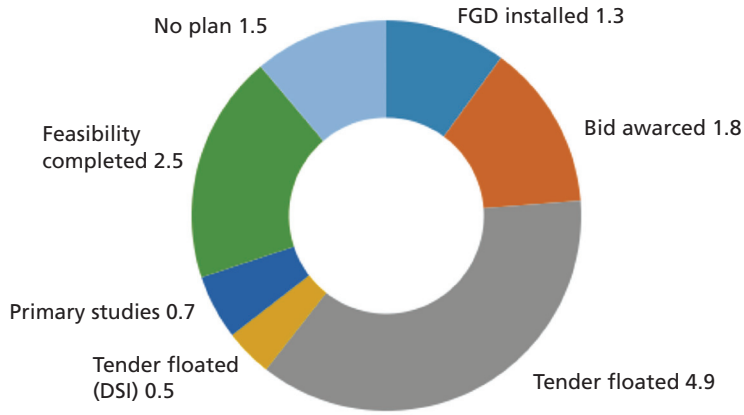
Table 5: PM control status at power stations: ***Very few plants have plans for ESP upgrades***

Thermal Plant	State	Ownership	Unit No.	Capacity (MW)	C.O.D	Measures for PM Compliance
Panipat TPS (HPGCL), Panipat	Haryana	State	6	210	2001	Carried out ESP overhauling. Claims all ESP fields now functional. Also undertaking flue gas conditioning with ammonia to reduce resistivity of PM. Since FGD will reduce some PM emissions, the decision to upgrade ESP to be taken after installation of FGD.
			7	250	2004	
			8	250	2005	
Deenbandhu Chhotu Ram TPP (HPGCL), Yamunanagar	Haryana	State	1	300	2007	ESP upgradation complete. Done by GE. Compliance status not known.
			2	300	2008	ESP upgradation underway by GE. Will be completed in 2019.
Rajiv Gandhi TPS (HPGCL), Hisar	Haryana	State	1	600	2010	Undertaking overhauling of existing ESP to get all fields operational. Necessary action for retrofittting/ upgrading of ESP, if required, shall be taken after installation of FGD.
			2	600	2010	
Guru Hargobind TPS (PSPCL) Lehra Mohabbat	Punjab	State	1	210	1997	Upgrades have been completed. The standards of compliance to be achieved under the upgrade is inconsistent with the present standards.
			2	210	1998	
			3	250	2008	
			4	250	2008	
Guru Gobind Singh STPS (PSPCL) , Ropar	Punjab	State	1	210	1985	Upgrades have been completed. The standards of compliance to be achieved under the upgrade is inconsistent with the present standards.
			2	210	1985	
			3	210	1988	
			4	210	1989	
			5	210	1992	
			6	210	1993	
Harduaganj TPS, Aligarh	Uttar Pradesh	State	8	250	2011	Claims compliance with PM norms
			9	250	2012	
National Capital Power Station (NTPC Dadri)	Uttar Pradesh	Central	1	210	1991	Claims compliance with PM norms
			2	210	1992	
			3	210	1993	
			4	210	1994	
			5	490	2010	
			6	490	2010	
Aravali TPP (Indira Gandhi STPS), Jhajjar	Haryana	Central	1	500	2011	Claims compliance with PM norms
			2	500	2011	
			3	500	2011	
Mahatma GandhiTPS (CLP), Jhajjar	Haryana	Private	1	660	2012	Claims compliance with PM norms
			2	660	2012	
Rajpura TPP (Nabha Power)	Punjab	Private	1	700	2014	Claims compliance with PM norms
	Punjab		2	700	2014	
Talwandi Sabo TPP	Punjab	Private	1	660	2013	Claims compliance with PM norms
	Punjab		2	660	2013	
	Punjab		3	660	2013	
Total				**13210**		

SO_2 compliance remains the biggest challenge

Only 27% of the installed capacity in the region (3.6 GW) of capacity may achieve compliance with the SOx norms by the December 2019 deadline. Of this, 1.3 GW (10% of the NCR's total installed capacity) already has an FGD installed *(see Graph 3: SO_2 Compliance Status for thermal Power Stations in Delhi–NCR).* 1.8 GW has awarded tender: In addition, Harduaganj has announced a tender for DSI and may meet the deadline.

Graph 3: SO_2 Compliance status for thermal power stations in Delhi–NCR: ***Half of the capacity in the Delhi–NCR is at various stages of tendering***



Source: *Centre for Science and Environment, 2018*

The balance 73 per cent (9.6 GW) capacity will find it extremely difficult to comply with the norms within the December 2019 deadline. Tendering is in process for 36 per cent of the installed capacity (4.9 GW). 2.9 GW of capacity has completed feasibility studies and plants are awiting internal approval. Primary studies are ongoing for 24 per cent (0.7 GW) capacity. 14 per cent (1.4 GW) has no plans yet to achieve compliance *(see Table 6: SO_2 Control Status at Power Stations).*

Table 6: SO_2 Control status at power stations: ***Nearly three-fourths of the plants will miss the implementation deadline***

Thermal Plant	State	Ownership	Unit No.	Capacity (MW)	C.O.D	Measures for SO_2 Compliance
Panipat TPS (HPGCL), Panipat	Haryana	State	6	210	2001	No SO_2 compliance plans currently in place proposed for the unit.
			7	250	2004	Feasibility study underway
			8	250	2005	
Deenbandhu Chhotu Ram TPP (HPGCL), Yamunanagar	Haryana	State	1	300	2007	Feasibility study completed. Internal approvals and decision pending.
			2	300	2008	
Rajiv Gandhi TPS (HPGCL), Hisar	Haryana	State	1	600	2010	Feasibility study completed. Internal approvals underway, decision pending.
			2	600	2010	
Guru Hargobind TPS (PSPCL) Lehra Mohabbat	Punjab	State	1	210	1997	The company's website claims that work has been initiated for the installation of FGD for Stage–I & II Units.
			2	210	1998	
			3	250	2008	
			4	250	2008	
Guru Gobind Singh STPS (PSPCL) , Ropar	Punjab	State	1	210	1985	Internal approvals underway. The final decision from the company board is still pending.
			2	210	1985	
			3	210	1988	
			4	210	1989	
			5	210	1992	
			6	210	1993	
Harduaganj TPS, Aligarh	Uttar Pradesh	State	8	250	2011	Tenders for DSI released. To be closed by 18 December 2018.
			9	250	2012	
National Capital Power Station (NTPC Dadri)	Uttar Pradesh	Central	1	210	1991	Tender for DSI was awarded in October 2018. The company has an 11–12 month commissioning schedule. Capital cost emerging for the project is around Rs 9lakh/ MW
			2	210	1992	
			3	210	1993	
			4	210	1994	
			5	490	2010	Tender was awarded in February 2018 to BHEL. FGD work is in progress.
			6	490	2010	
Aravali TPP (Indira Gandhi STPS), Jhajjar	Haryana	Central	1	500	2011	Bid was awarded on 30 Jan 2018 to Reliance Infra for FGD. However, the award was canceled, and retendering has started.
			2	500	2011	
			3	500	2011	
Mahatma GandhiTPS (CLP), Jhajjar	Haryana	Private	1	660	2012	Plant already has an FGD system in place. Company is undertaking trials before it starts continuous operations
			2	660	2012	
Rajpura TPP (Nabha Power)	Punjab	Private	1	700	2014	Company has not awarded the tender to build FGD so far. CEA gave technical clearance to the project, and PSERC has asked the company to go ahead with the project.
			2	700	2014	
Talwandi Sabo TPP	Punjab	Private	1	660	2013	Tender to build FGD has not been awarded yet. CEA gave technical clearance to the project, and PSERC has asked the company to go ahead with the project.
			2	660	2013	
			3	660	2013	
Total				**13210**		

RECENT DEVELOPMENTS IN SOX COMPLIANCE

DSI—viable and cheap alternatibe

NTPC's Dadri Power station is opting for a Direct sorbent injection (DSI) system to achieve SO_2 compliance for its stage I units. These units have a relatively lax standard to achieve, for which DSI is ideal as per several technology suppliers. The tender has been awarded to an Indian subsidiary of United Conveyor Corporation (UCC), an American company that specializes in injection systems and fly ash handling.

Increasingly, this technology is seeing acceptance across power companies. UPRVUNL has invited bids for DSI installations at its Harduaganj power station (0.5GW). This makes the company the first state GENCO to opt for this SO_2 control technology. The company has clubbed the bid invite with a DSI bid invite issued for the Parichha power station (falls outside the NCR). Installation time needed for DSI systems is anywhere between 12–18 months. The company is pushing for an accelerated completion deadline hoping that it is able to achieve the December 2019 deadline.

Tender cancellation

The Aravalli power plant's tender award for the FGD, awarded in January 2018 to Reliance Infrastructure, has been cancelled. Discussions with market players have revealed that NTPC cancelled the award, as Reliance Infrastructure was unable to provide bank guarantee for the FGD. This raises serious questions about the selection criteria adopted through which the tender order, pegged at Rs 567 crore, was awarded in the first place.

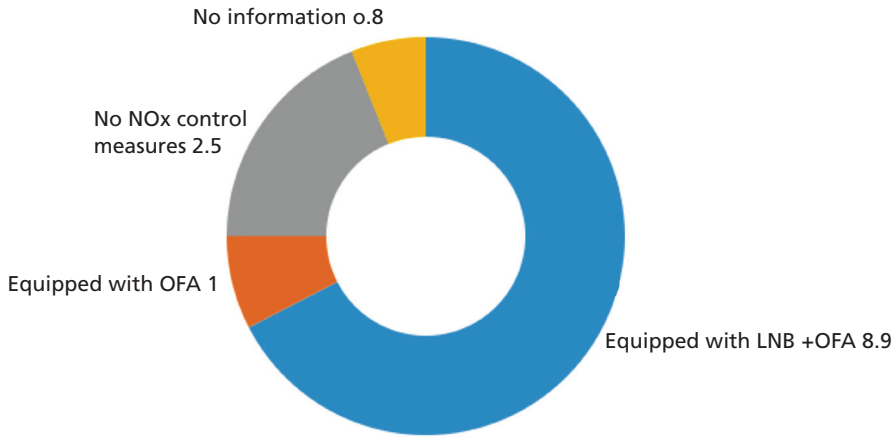
Hurdles in tariff petitions

Private power stations in Punjab–Talwandi Sabo and Nabha Power–announced tenders for FGDs in January 2018 and approached the Punjab State Electricity Regulatory Commission (PSERC) for in-principle approval of their preliminary cost estimates. However, the PSERC has still not granted any approval; instead, it asked the companies to first obtain approval from Central Electricity Authority (CEA), regarding technology, complete the installation and commissioning process, and then approach the Commission for cost/tariff approval. This process is problematic—privately owned power stations will find it difficult to raise money without assurance of cost approval. Financial institutions are asking power plants to demonstrate that the ERCs will allow tariff increments before the project is financed. ERCs should not be asking plants to obtain CEA technology approvals, as it will lead to delays in the overall clearance process. As such, the processes to approve such costs are already in place—in fact, ERCs usually undertake their own due diligence and review of technology costs before granting approvals. Also, in May 2018 MOP clarified that investments on account of new environmental standards constitute change of law under Tariff guidelines and should be allowed to be passed through. In effect, this MOP ruling gave ERC the clarity to approve the investments.

STATE GENCOS LAGGING BEHIND

While private sector and NTPC plants have made some progress, state GENCOS of Haryana and Punjab continue to lag behind. HPGCL has told CSE that it has completed the Detailed Project Reports (DPRs) for the SO_2 control requirements of their power plants. This study was awarded to NTPC Consulting. The company is now proceeding to initiate the tender and bid processes for their Hisar thermal power station first. HPGCL has, however, categorically said

Graph 4: NOx—Present status: ***Around two-thirds the capacity is equipped with LNB+OFA to control NOx***



Source: *Centre for Science and Environment, 2018*

that the company shall not be able to complete the implementation process before 2022. This raises serious questions about the credibility of the timelines committed by the MoP/MoEF&CC to the Supreme Court. Plants ,therefore, need to be closely monitored with strict penalties in case of delays to ensure compliance by December 2019. PSPCL's progress is even worse—it has yet to complete the feasibility study for their power stations at Lehra Mohabbat and Ropar *(see Graph 4: NOx—Present status).*

NOx control — Manageable but little progress made

For NO_x control, 67% (8.9GW) of the installed capacity have primary control measures—Low NO_x burners and over-fire air dampers—installed in their plants. Another 7.5% (1 GW) capacity have basic control measures, and intend to install low NO_x burners. Therefore, we believe that almost three-fourths of the capacity may be able to comply with new NOx norms by December 2019. 24 % (3.2 GW) capacity have no controls installed presently, nor do they have any plans to install NOx control equipment. The data on NOx control installations was collected with the assistance of MoEF&CC and CPCB, who had asked CSE to review the status of NOx emissions from power stations in the region and suggest what could be done to achieve compliance at the earliest *(See Table 7: Plant Wise Update as obtained by MoEF&CC).*

Table 7: Plant wise update and Action Plan suggested by CSE to MoEF&CC: ***Almost two-thirds of the plants have the necessary equipment to achieve NOx compliance***

Thermal Plant	State	Unit No.	Capacity (MW)	Year of Commissioning	Present Status
Aravali TPP (Indira Gandhi STPS), Jhajjar	Haryana	1	500	2011	Plant already has ultra-low NOx Burners, OFA & SOFA Dampers. Emissions are close to norms. Stack monitoring is required to ensure compliance.
		2	500	2011	
		3	500	2011	
Mahatma Gandhi TPS (CLP), Jhajjar	Haryana	1	660	2012	Plant is undertaking combustion optimization to keep emissions below 300. Should be able to expedite the process & achieve compliance before winter.
		2	660	2012	
Rajpura TPP (Nabha Power) (L&T), Patiala	Punjab	1	700	2014	Compliance status unknown. Plant in a PPT claims its emissions are less than 300. Stack monitoring is required to ensure compliance.
	Punjab	2	700	2014	

National Capital Power Station (NTPC Dadri)*	Uttar Pradesh	5	490	2010	Has floated tender for Combustion Modification. Current systems seem insufficient to achieve compliance. Can be asked to carry out maximum possible reduction with existing measures before winter.
		6	490	2010	
Talwandi Sabo TPP (Vedanta), Mansa	Punjab	1	660	2013	Has floated tender for SNCR. The plant claims that current systems are insufficient to achieve compliance. Emissions data is required to check how far off they are from compliance. Can be asked to carry out maximum possible reduction by primary measures before winter.
	Punjab	2	660	2013	
	Punjab	3	660	2013	
Deenbandhu Chhotu Ram TPP (DCRTPP), (HPGCL), Yamunanagar	Haryana	1	300	2007	Plant claims current systems are insufficient to achieve compliance. Emissions data is required to check how far off they are from compliance. Can be asked to carry out maximum possible reduction by existing measures before winter.
		2	300	2008	
Rajiv Gandhi TPS (RGTPS), (HPGCL), Hisar	Haryana	1	600	2010	
		2	600	2010	
Guru Hargobind TPS (GHTP) (PSPCL) Lehra Mohabbat	Punjab	3	250	2008	Based on emissions, both plants are not complying with norms. They do not have any plans in place for compliance. Should be asked to at least provide a detailed plan for implementation.
		4	250	2008	
Harduaganj TPS, Aligarh (UPRVUNL)	Uttar Pradesh	8	250	2011	
		9	250	2012	
Panipat TPS (HPGCL), Panipat	Haryana	6	210	2001	Plant says unit is already being run only as backup. Can be temporarily shut down in winter.
		7	250	2004	Current Emissions data required. Difficult to implement technologies before winter; will take ~ 8 months to install LNB+OFA
		8	250	2005	
Guru Hargobind TPS (GHTP) (PSPCL) Lehra Mohabbat	Punjab	1	210	1997	Plant located beyond 250 KM from Delhi; hence may not have significant impact on Delhi's air quality. Difficult to implement technologies before winter; will take ~ 8 months to install LNB+OFA
		2	210	1998	
Guru Gobind Singh STPS (GGSSTP), (PSPCL), Ropar	Punjab	1	210	1985	Plant already past its useful life. Average Plant PLF between Oct 2017 and Jan 2018 was 13%. Can be used only as backup/retire/given temporary shutdown during winter. Although plant is located more than 250 km from Delhi, this may have a significant impact on Delhi's air quality.
		2	210	1985	
		3	210	1988	
		4	210	1989	Based on CEMS data are close to their compliance limit of 600. Can be asked to optimize combustion to achieve compliance. Units 1–3 are past their useful life; can be used as backup/temporary shutdown.
		5	210	1992	
		6	210	1993	
National Capital Power Station (NTPC Dadri)	Uttar Pradesh	1	210	1991	
		2	210	1992	
		3	210	1993	
		4	210	1994	

POWER PLANTS SEEK LOOSER STANDARDS

Some suppliers have stated that the primary NOx control measures that most plants already have in place should suffice in case they are run properly. However, power companies claim existing NOx controls are inadequate and have asked that the NO_x standard be relaxed. In the affidavit submitted to the Supreme Court, MoP has sought a relaxation of the NO_x standard from 300 to 400 mg/Nm^3. The matter is still under consideration of the Supreme Court, and a decision is pending.

NTPC has awarded tender for its Dadri Plant stage II units to improve the combustion efficiency, a primary measure which cuts NO_x emissions. Talwandi Sabo has announced a tender for an SNCR system with the same assertion.

No other bids for primary combustion control measures or SNCR/SCR systems have been announced by any other power station so far.

No plans to shut old plants

Closure of old units is another important step that can help to cut back on the pollution from thermal power plants. Nearly 19 per cent of the total capacity operational in the region (2.5 GW capacity) is over 25 years old. These units are owned by either the state- owned generation companies or NTPC. The annual Plant load factors (PLFs) of the plants owned by state-owned generation companies are low *(see Table 8: Average PLFs of Old Units of State Gencos in Delhi–NCR).*

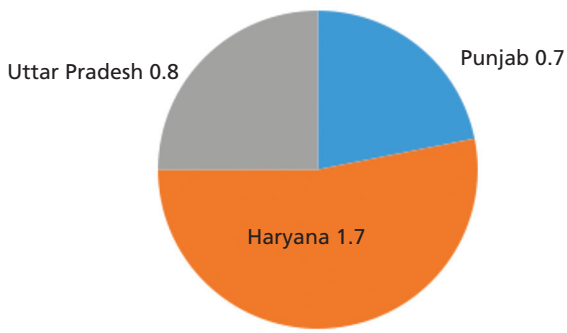
Table 8: Average PLFs of old units of state gencos in Delhi–NCR: ***Low PLFs are a characteristic of old generation units***

Thermal Plant Name	State	Plant load factors (2017–18) as reported to the SERC (Per cent)
Guru Hargobind TPS (GHTP) (PSPCL) Lehra Mohabbat	Punjab	35
Guru Gobind Singh STPS (GGSSTP), (PSPCL) , Ropar	Punjab	25
Panipat TPS (HPGCL), Panipat	Haryana	35

**Recently PTPS reported high PLFs of over 80%. This was due to the non-supply from Adani Mundra power station on account of a contractual dispute with the state distribution companies of Haryana*

Graph 5: Distribution of old generation units in Delhi–NCR: ***Most of these units are concentrated in Punjab and Haryana***

Source: *Centre for Science and Environment, 2018*



Badarpur (NTPC) and Bathinda (PSPCL) power stations in the region were decommissioned recently and two units at Ropar (PSPCL) are also scheduled to be decommissioned. Some discussion is ongoing with the state gencos about this step, as there are several units that can be closed down. In the absence of any firm decommissioning plans, regulators should ask these units to be used as backup after necessary retrofits. However, it would be sensible that state-owned generation companies in Haryana and Punjab consider decommissioning these units, given their higher costs of generation as well *(see Graph 5: Distribution of old generation units in Delhi–NCR).*

CONCLUSIONS

67 per cent of the installed capacity (8.8GW) is compliant with PM norms. Another 9 per cent (1.2 GW) capacity is close to completing ESP upgrades; however, not all of them will be able to comply with the December 2019 deadline without additional control options. The remainder 24 per cent (3.2 GW) capacity will not be able to comply with the deadline—these plants have no concrete plans in place.

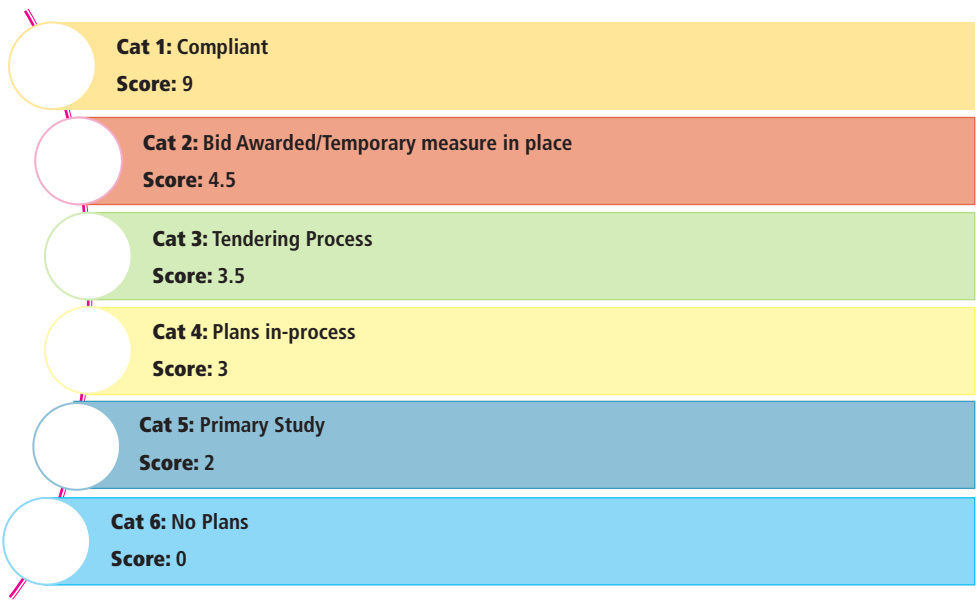
Only 27 per cent of the installed capacity in the region (3.6 GW) of capacity may achieve compliance with the SO_2 norms by the December 2019 deadline. Of this, 1.3 GW (10 per cent of the NCR's total installed capacity) already has an FGD installed. A mere 17% has made creditable progress. 73 per cent of the capacity will not be able to comply with the standards by December 2019.

For NO_x control, - 67 per cent (8.9 GW) of the installed capacity have primary control measures—Low NO_x burners and over-fire air dampers—installed in their plants. Another 7.5 per cent (1 GW) capacity have basic control measures, and intends to install low NO_x burners. These plants may be able to comply with the standards by December 2019. The balance 24 per cent (3.2 GW) capacity have no controls installed presently, nor do they have any plans to install NOx control equipment, and will certainly miss the deadline.

CSE developed a tracker to monitor the progress of power stations located in the Delhi–NCR region, all of which need to meet the revised norms by December 2019. Progress has been assessed as detailed below 1) no plans, 2) undertaking primary studies, 3) technology selection/bid documents, 4) tendering process underway, 5) bids awarded or some temporary measures being taken, 6) report compliance. Each of these indicates a certain stage of progress in the implementation scheme. Scores were assigned to each of these categories for PM, SO_2 and NO_x compliance *(see Figure 2: Categories and Ranking).*

Figure 2: Categories and scores: ***Scores were assigned to categories based on the consequent progress they can lead to***

Source: *Centre for Science and Environment, 2018*



Weighted average was then taken to determine the percentage progress of

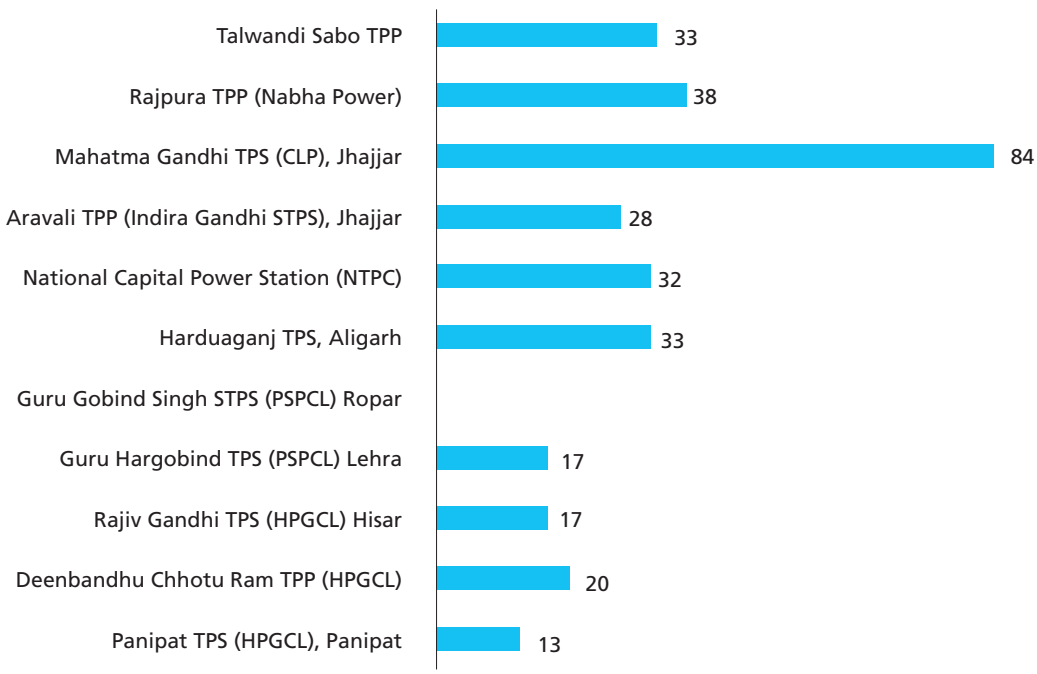
stations in achieving compliance with the revised environmental norms. Measures to curb sulphur dioxide were assigned 80 per cent weightage, NO_x control measures 15 per cent, and PM control measures five per cent weightage. Sulphur dioxide control measure was allotted a higher weightage due to the following reasons:

1. Share of pollutants in health impact—with installation of sulphur dioxide control measures mortality and morbidity rates can be brought down between 68 and 78 per cent (Coal kills, 2014)
2. Share of expected costs—80 per cent of the costs would be spent on sulphur dioxide control systems to meet the revised environmental norms
3. SO_2 control systems, especially FGD, will need the most time for installation.
4. Thermal power plants are the third largest source of SO_2 pollution in the Delhi–NCR region.

The standards were first announced in 2015, and the deadline for the power stations in Delhi–NCR was 2019. Four years should have been more than sufficient time to complete the implementation process. Based on our tracker methodology, however, the average progress across the Delhi–NCR power plants is a mere 30 per cent. Given this scenario, it is unlikely that the power stations of Delhi–NCR will miss the December 2019 deadline *(see Graph 6: Power Stations—Progress: In the last 11 months, the average progress has just been 30 per cent).*

Graph 6: Power Stations—Progress: ***In the last 11 months, the average progress has just been 30 per cent***

Source: *Centre for Science and Environment, 2018*



STRONG REGULATORY ACTION NEEDED

Since it seems likely that many plants will not be in compliance by the 2019 deadline, concrete steps should be immediately taken to minimize delays:

- All plants should be asked to submit feasibility assessments, engineering plans, and detailed implementation plans immediately to the regulatory agencies, both at the central and state levels. This will assist the agencies in keeping track of the developments taking place continuously.
- State and Central Pollution control boards, should take regular updates from power plants.
- State power ministry and MoP should independently monitor progress to prevent any further slips.
- Plants would need approvals in advance to secure financing for projects, else the projects will be delayed further. ERCs should urgently grant in-principle approval on pending petitions.
- Penalties should be imposed by the regulators/government for any delay beyond December 2019. In addition, non-compliant plants should be pushed at the bottom of the merit order dispatch, which governs scheduling of power from plants.
- A formal policy on closure of old thermal power generation units should be adopted by the state governments, to identify plants that should be closed, take steps to address potential issues, and set a clear timeline.

OTHER LESSONS

In addition, several important takeaways have emerged that are useful for stakeholders in other parts of the country that are planning and implementing measures to comply with the new emission norms.

A. Measure emission levels correctly

- Emissions data quality continues to be a serious proble. This has major impact on the technology selection process; hence, it is imperative that the problem is fixed at the earliest. Also, CEMs systems need to be fixed to ensure correct data is reported.

B. Appropriate technology

- The standards to be met for a significant proportion of capacity are relatively lax. Overestimation of technology requirements should be avoided. For instance, SNCR/SCR installations should not be required to meet the NOx emission norms, and primary combustion control technologies may suffice. Similarly, wet-limestone based FGDs to meet 600 mg/N.cu.m could be an over estimate—dry sorbent injection technology must be explored.
- Methods to reduce emissions apart from pollution control technologies (PCTs) like biomass co-firing should be encouraged. NTPC Dadri has started the exercise, while PSPCL is mulling the idea of running its Bathinda power station using biomass as fuel. This serves the twin objectives of controlling stubble burning while reducing emissions from thermal power stations, to some extent.

C. Appropriate planning

- PM and NOx control could be prioritized by the power stations. Most plants are already reporting PM compliance and in any case are designed sufficiently to achieve PM norms. This shows that minor upgrades are needed at best for PM control. Similarly, a large number of plants have primary NOx control measures and need minimal additions. Such types

of retrofits will not even affect major shutdowns on power stations, and can overlap annual overhaul schedules of power stations—hence, they should be aggressively pursued.

- Group tenders for FGD technology can help to economize technology costs and reduce time for installations. NTPC has obtained competitive bid rates as it conducted tenders in lots for its power stations.
- GENCOS should seriously consider shutting down old power generation units—installations for these units can be a costly affair, and small residual life leaves little period for recovery through tariff increments.

ANNEXURE: COMPLIANCE POSITION OF POWER STATIONS IN DELHI-NCR

Power Plant	State	Capacity MW	PM Compliance by 2019	SO_2 compliance by 2019	Nox compliance by 2019
Guru Gobind Singh STPS (PSPCL), Ropar	Punjab	1,260			
Harduaganj TPS, Aligarh	UP	500			
Panipat TPS (HPGCL), Panipat	Haryana	710			
Rajiv Gandhi TPS (HPGCL), Hisar	Haryana	1,200			
Guru Hargobind TPS (PSPCL) Lehra Mohabbat	Punjab	920			
Deenbandhu Chhotu Ram TPP (HPGCL), Yamunanagar	Haryana	600			
National Capital Power Station (NTPC Dadri)	UP	1,820			
Rajpura TPP (Nabha Power)	Punjab	1,400			
Talwandi Sabo TPP	Punjab	1,980			
Aravali TPP (Indira Gandhi STPS), Jhajjar	Haryana	1,500			
Mahatma Gandhi TPS (CLP), Jhajjar	Haryana	1,320			

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