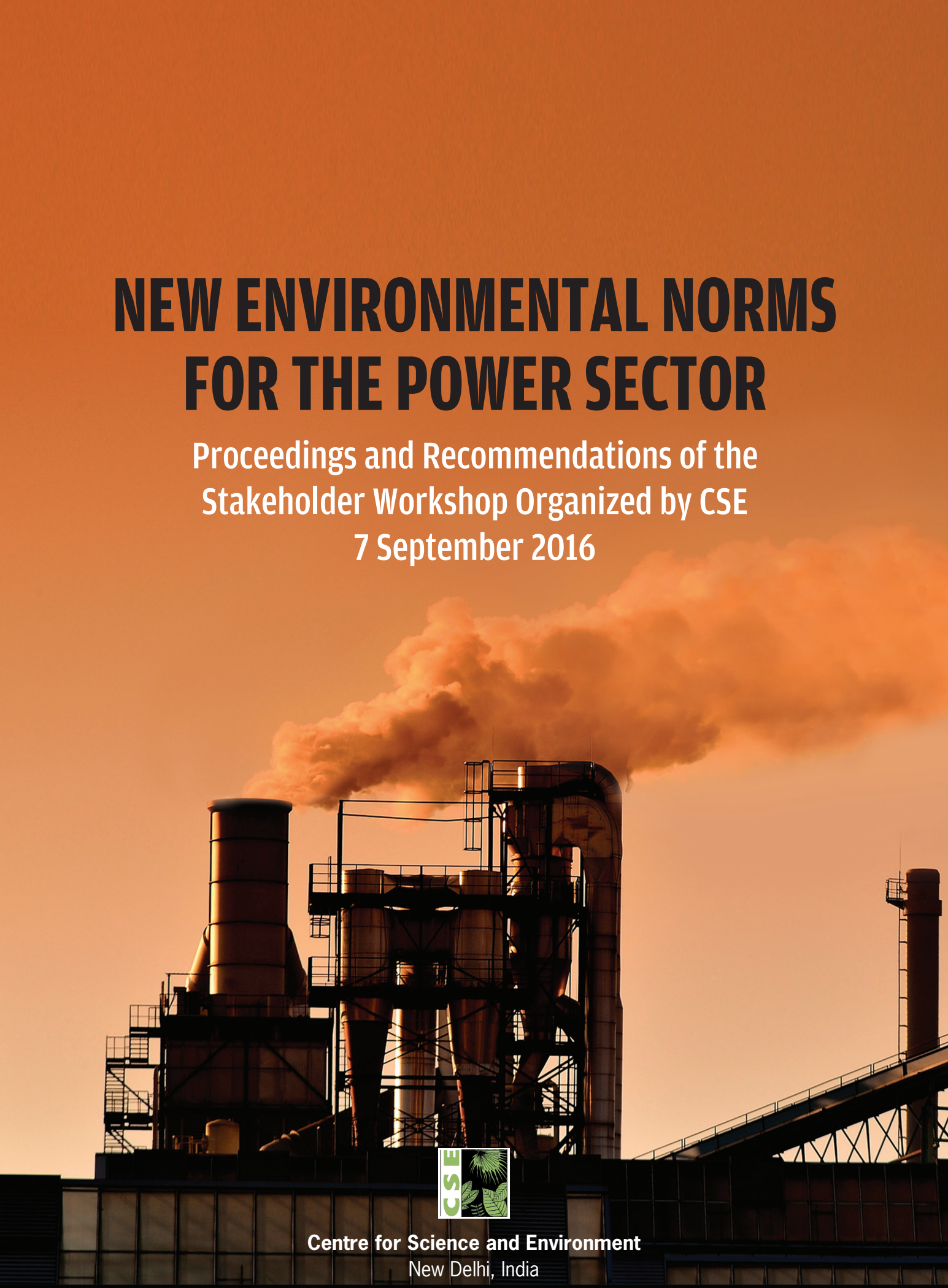
# NEW ENVIRONMENTAL NORMS FOR THE POWER SECTOR

## Proceedings and Recommendations of the Stakeholder Workshop Organized by CSE 7 September 2016



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# ACRONYMS

| | |
|---|---|
| $SO_2$ | Sulphur dioxide |
| NOx | Oxides of nitrogen |
| SPM | Standard particulate matter |
| kWh | Kilowatt hour |
| MWh | Megawatt hour |
| PPA | Power Purchase Agreement |
| FGD | Flue gas desulphurization |
| SCR | Selective Catalyst Reduction |
| SNCR | Selective Non-Catalyst Reduction |
| CEA | Central Electricity Authority |
| CERC | Central Electricity Regulatory Commission |
| POSOCO | Power System Operation Corporation Limited |
| CPCB | Central Pollution Control Board |
| MoP | Ministry of Power |
| NTPC | National Thermal Power Corporation Ltd |
| MoEF&CC | Ministry of Environment, Forest & Climate Change |
| HERC | Haryana Electricity Regulatory Commission |

# EXECUTIVE SUMMARY

In December 2015, the Ministry of Environment, Forest & Climate Change (MoEF&CC) announced tighter standards for coal-based thermal power plants. Centre for Science and Environment's (CSE) preliminary survey of power companies and manufacturers revealed, however, that little progress has been made towards the implementation.

CSE felt it would be important to invite key stakeholders to share and address the issues to push the implementation of revised environmental standards. Accordingly, it organized a conference on '*New Environmental Norms: The Way Forward*' on 7 September 2016.

The conference was very well attended, with around fifty participants. Anil Razdan, ex-Power Secretary, gave the keynote address. Speakers from the power industry, including Ashish Basu, Chairman, Association of Power Producers; Alind Rastogi, Executive Director, NTPC; and Sanjay Sagar, CEO, JSW Energy, detailed the implementation challenges and progress made by the industry. Senior officials from CERC and state ERCs talked about investments and cost recovery. Attendants comprised senior officials from state generating companies of Punjab, Gujarat and Telangana and leading private power companies, including Tata Power, Reliance and CESC. Major global pollution control technology suppliers, including GE, Thermax, Mitsubishi and Doosan, also participated in the conference.

One major conclusion of the conference was that technology availability or suitability for Indian coal was not the impediment—electrostatic precipitators (ESPs) can be augmented to achieve norms; flue gas desulphurization (FGD), to control SOx, is a mature technology; suppliers are confident that Selective Catalyst Reduction (SCR) technology will work for Indian coal to control NOx.

Moreover, the costs of pollution control technology are manageable (see Table 1: *Cost of pollution-control technology*). The exact investment needed by a plant would depend on the combination of upgradation and new installation required, which in turn would depend on existing abatement technology, actual emissions, applicable norms and age of the plant. Based on the projected capital expenditures given by the plants in Haryana, the State Electricity Regulatory Commission (HERC) estimated a generation tariff impact of around 22 paisa per unit. ICRA, a ratings company, estimated a similar impact on the cost of generation.

**Table 1: Cost of pollution-control technology**

| Technology required | Approx. cost |
|---|---|
| ESP upgradation | Rs 5–15 lakh/MW |
| Partial FGD | Rs 25–30 lakh/MW |
| FGD | Rs 50–60 lakh/MW |
| De-NOx | Rs 10–15 lakh/MW |
| SCR/SNCR | Rs 20–25 lakh/MW |

However, some legitimate concerns need to be addressed. Commercial issues—financing for the investment required and cost recovery through tariff increase—remain unresolved. Therefore, concerted action steps from all policymakers/regulators—various Electricity Regulatory Commissions (ERC), Central Electricity Authority (CEA)/Ministry of Power (MoP) and MoEF&CC/Central Pollution Control Board (CPCB)—are critical to achieve timely implementation.

Timelines are tight but were achievable when the norms were announced. However, little progress has been made over the last nine months during which pre-execution work (need assessment, cost estimates and tariff application) could have easily been done. Meeting PM, NOx and water use norms is still possible given procurement time of less than 6 months; installation can be done during scheduled shut down or may need less than one month of shut down. However, procurement and installation of FGD could take up to 24 months. Additional time may now be needed for some plants. Plants under construction need to change construction plans and procure equipment to meet the new norms from 1 January 2017, which would be a challenge. MoEF may therefore need to revisit implementation schedule.

## Immediate action steps

1. MoEF should survey the implementation status of power plants to assess compliance with the new norms and develop a revised schedule. Revision of timelines should be on a case-by-case basis backed by strong commitments, clear evidence of progress (contract with vendor etc.) and bank guarantees. Plants under construction should meet the standards on the commissioning date since modification at a later may be disruptive; however, retrofitting to meet the norms within the next one to two years may be permitted if there are techno-economic benefits. Plants with firm retirement or replacement plans may be allowed to operate in the interim.

2. CEA should act as the key technical advisor and prepare a 'Technology Guidelines' document that details technological options to control pollutants, their suitability for Indian coal, life cycle and O&M costs. Capital cost benchmarking for the options should be done. Work that has already been done by industry leaders, such as NTPC can be used.

3. CERC should prepare a simplified tariff application for in-principle capital expenditure (capex) and preliminary tariff approval that should also be used by state regulators. ERCs should ask plants to urgently provide unit-wise assessment of capex required and tariff impact.

4. CERC could consider uniform tariff increases based on minimum capital costs that are in accordance with CEA guidance. (Final tariff approvals can be modified to account for approved costs.) The tariff increases could be staggered to make them acceptable to discoms/consumers.

5. CEA and CPCB should develop a monitoring mechanism and regularly track the progress made by individual plants in installing equipment. The quarterly progress report should be made available in the public domain.

6 CEA and POSOCO need to prepare a scheduled shut-down plan for the entire fleet for installation of pollution control equipment to avoid supply disruption.

## Policy recommendations

1. Government should divert a portion of National Clean Energy Fund (NCEF)—a coal cess of around Rs 23,000 crore would be recovered from the power sector in 2016–17—to support installation of pollution control equipment. Support could come in the form of subsidized loans, credit enhancement or even equity component of the investment required.

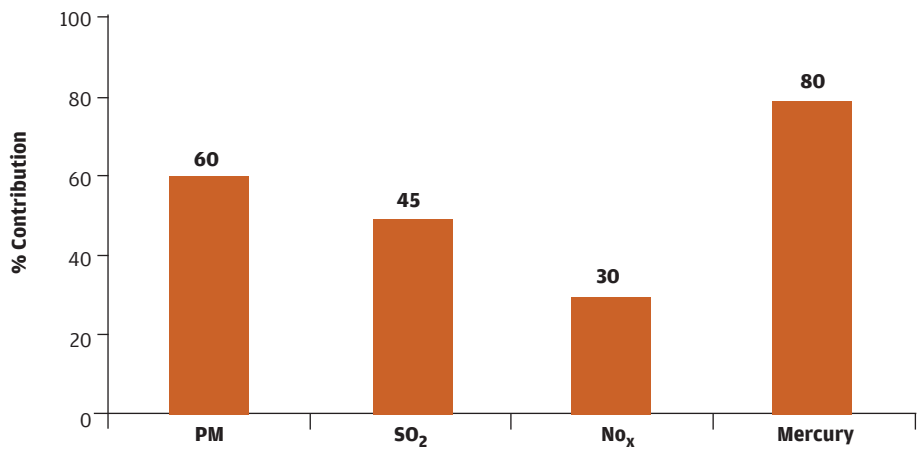
2. The government should work on an expedited plan to retire or replace old capacity based on operating and environmental performance and incremental investment required to comply with new norms. Incentives should be given for replacing the units with SC units— for e.g., they may not need Environmental Clearances (ECs). New investors can be encouraged to come in by giving them coal linkages and PPAs associated with the old plants.

3. Incentives should be considered for plants that meet norms by the deadline. For e.g. 'merit order dispatch' preference could be given to these plants.

# INTRODUCTION

Coal is central to India's energy needs. It contributes around 75 per cent of India's current electricity generation and, according to NITI Aayog projections, will remain the dominant source of power for the next couple of decades. Coal is abundantly available and provides a reliable, cheap baseload power. But the coal-based thermal power industry is responsible for a significant share of emissions of the industrial sector in India and it therefore has an outsized impact on air pollution (see Graph 1: *Contribution of coal-based power sector to industrial emissions*). Cleaning the sector will have vast benefits for the environment and on human health.

**Graph 1: Contribution of coal-based power sector to industrial emissions**




*Source: Centre for Science and Environment, 2014–15*

Recognizing the central role thermal power plays in worsening air quality, the Ministry of Environment, Forest & Climate Change (MoEF&CC) announced in December 2015 tighter standards for coal-based thermal power plants. The new standards aim to drastically cut emissions of particulate matter (PM), sulphur dioxide (SO2), oxides of nitrogen (NOx) and mercury. In addition, the new norms also require power plants to sharply curtail freshwater use.

Based on extensive discussions with industry experts, equipment suppliers and power plants, followed by a roundtable with stakeholders in July 2016, CSE believes that the standards are practical and achievable; techno-economically feasible pollution control options are widely available. We believe, however, that some issues need to be quickly addressed to achieve compliance with the revised standards.

CSE felt it would be helpful to invite all the stakeholders—power generation companies; equipment manufacturers; environment, tariff and power regulators; and industry experts—to share and address the issues to push the implementation of revised environmental standards. Accordingly, CSE organized a conference on '*New Environmental Norms: The Way Forward*' at India Habitat Centre on 7 September 2016.

## Expediting implementation of new norms

MoEF&CC has given a tight albeit achievable deadline to meet the new standards (see Table 2: *Standards*). Existing plants were given two years (December 2017); plants commissioned after 1 January 2017 will have to comply from the start of their operations.

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**Table 2: Standards (in mg/Nm$^3$)**

| | PM | $SO_2$ | $NO_x$ | Mercury |
|---|---|---|---|---|
| Current standards | 150–350 | none | none | none |
| New standards | | | | |
| Units installed till 2003 | 100 | <500 MW—600<br>>=500 MW—200 | 600 | >=500 MW—0.03 |
| Units installed between 2004 and 2016 | 50 | <500 MW—600<br>>=500 MW—200 | 300 | 0.03 |
| Units installed after Jan 2017 | 30 | 100 | 100 | 0.03 |

CSE's preliminary survey of power companies and manufacturers over the last three months revealed, however, that little progress has been made towards the implementation of new standards. The plants raised several issues for not making sufficient progress. Many plants have insufficient knowledge or experience of advanced pollution control technologies. Plants expressed concern that the pollution control technologies were unsuitable for high-ash Indian coal and manufacturer capacity is insufficient to meet the projected demand; some think space—for the installation of pollution control equipments and storage of raw material—would be a constraint. Most plants believed that the costs to instal pollution control equipment were high with little clarity on cost recovery. They also felt the timelines were tight.

Accordingly, the conference had the following objectives:

- To arrive at an understanding of various technology solutions to meet new standards and address issues of suitability for Indian coal, cost and supplier capacity.
- To understand regulatory bottlenecks (tariff increase and capital investment approvals) and financial issues, discuss cost recovery and financial support ideas.
- To understand any other issues, such as supplier capacity, raw material availability, waste management etc.
- Key stakeholders agree on implementation timelines and environment and power regulators devise a monitoring and enforcement plan.

## New standards: rationale

The new standards were based on CPCB and MoEF&CC's extensive consultations with experts and industry studies. The norms considered a range of factors: age and size of the units and available pollution control technologies. CPCB analysed reported data emissions—all plants report PM and several plants also tracked SOx and NOx emissions to assess norms that are achievable. Norms in other major countries, including China, provided a peer benchmark.

Environmental clearances given since 2003 required units larger than 500 MW to keep space for future installation of flue gas desulphurization (FGD); therefore space availability isn't an issue for these units. Also, ECs after 2008 required plants to meet PM of 50 mg/Nm$^3$, which means that plants that became operational after 2008 should be able to meet this standard.

Finally, the power sector had itself agreed to improve its environmental performance under the voluntary 2003 Charter on Corporate Responsibility for Environmental Protection (CREPS), which included meeting tighter PM emissions standards (100 mg/Nm$^3$) and implementing SOx/NOx standards by 2005–06. The sector failed to act on its voluntary commitment. In fact, a 2015 CSE study revealed that almost two thirds of coal-based thermal power plants failed to comply with even the prevailing loose standards.

# POLLUTION-CONTROL TECHNOLOGY

Many large-scale manufacturers, including BHEL, Mitsubishi and GE-Alstom, have strongly emphasized that pollution control technologies options are widely available and can easily meet even the tightest standards that have been proposed. We have detailed below an overview of various options based on the size and vintage of units, required emission levels that need to be achieved, indicative range of investment needed and installation time required.

The two most important parameters to decide what pollution-control options are most appropriate are age and size of the unit. The Indian fleet can be broken into the following categories based on these parameters:

**Table 3: Unit size distribution in India (MW)**

| Unit size | Capacity in MW | | | | |
|---|---|---|---|---|---|
| | +25 years | 1990–2003 | 2004–08 | 2009–16* | Total |
| up to 250 MW | 28,610 | 16,292 | 2,070 | 5,816 | 52,788 |
| > 250 and <500 MW | – | 5,350 | 3,850 | 20,810 | 30,010 |
| 500 MW and above | 5,500 | 9,500 | 5,980 | 82,814 | 1,03,794 |
| Total | 34,110 | 31,142 | 11,900 | 1,09,440 | 1,86,592 |

*Note: * As on 31 August 2016*

## Technology options and costs

Investments in plants/units that have exceeded their design life of 25 years (34.1 GW capacity) must be made carefully considering their efficiency and availability. Most of them should probably be expeditiously shut. Basic upgradation targeting mainly PM control may, however, suffice in the interim. This relaxation must be accompanied by a clear plan to decommission units and, in a few cases, replace them with new supercritical units. Units with good operating performance, low cost of generation and recent R&M that has extended remaining life may be allowed to invest so they can meet the new standards.

### Particulate matter (PM)

a) Units commissioned between 1990 and 2008 (43.0 GW total capacity) may need to upgrade the ESP to meet the PM norms of 100 and 50 mg/Nm$^3$. In some cases it may involve adding fields in series or parallel or increasing the height of ESP. The cost of these renovations would be around Rs 15 lakh/MW.

b) Most units installed after 2008 (109.4 GW capacity) were required to meet PM norms of 50 mg/Nm$^3$ by the environment clearances. Therefore, a basic performance revamp may suffice for these units. However, some units were required to meet 100–150 mg/Nm$^3$ and others are poorly performing—an investment of at most Rs 10 lakh/MW may be required for these units.

c) Units in pipeline should be able to meet the 30 mg/Nm$^3$ PM standard with a combination of ESP and FGD. In fact an integrated design would mean that the ESP size can be made smaller than a standalone one for meeting the norm.

### Sulphur dioxide ($SO_2$)

a) Units of size less than 500 MW installed between 1990 and 2016 (54.2 GW capacity) need to meet the SOx norm of 600 mg/Nm$^3$. These units may choose economical options such as partial FGD or sorbent injection. The cost is estimated to be around Rs 25–30 lakh/MW (assuming FGD for half the plant capacity).

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b) Units of size 500 MW and more, installed between 1990 and 2016 (98.3 GW capacity), have to instal limestone-based wet FGD or lime-based dry FGD, depending on raw material and water availability. The costs are estimated to be Rs 50–60 lakh/MW.

FGD is a mature technology for controlling SOx. It is used in many countries and has been shown to be effective for a wide range of coal qualities and operating conditions. China has installed FGD in over 91.4 per cent of its fleet in recent years.

c) Upcoming units can meet the SOx standard by installing FGD.

**Oxides of nitrogen (NOx)**

a) Minimal measures are needed to meet emissions of less than 600 mg/Nm$^3$ for the 31.1 GW of capacity installed between 1990 and 2003 on a case-to-case basis. Some units are already meeting these levels, according to data reported by the plants to CPCB. We have conservatively estimated an investment of Rs 10 lakh per MW.

b) A capacity of 121.3 GW that was installed after 2003 has to reduce emissions to 300 mg/Nm$^3$. According to CPCB, some plants are already meeting these values. Manufacturers, including BHEL, have already been supplying boilers that meet these emissions. Those plants whose emissions exceed the norms will need to choose from several options including burner modification, over fire air supply (OFA) etc., depending on the base level of emissions and technical constraints. The costs for these upgrades will be around Rs 10–15 lakh/MW. In rare cases, plants may need to instal SNCR or SCR. These would cost Rs 20–25 lakh/MW.

c) Upcoming units need to meet the NOx emissions of 100 mg/Nm$^3$. SCR and SNCR technologies have been used globally to cut NOx to these levels. Some industry players, however, feel that the technology's effectiveness needs to be established for Indian coal (high ash, chemical composition and physical characteristics). NTPC will run five pilot programmes to assess the technology. Suppliers are confident that the technology will work with possibly minor tweaks.

**Table 4: Investment required for pollution-control technology**

| Technology required | Capacity in GW | Approx. cost (in Rs crores) |
|---|---|---|
| ESP upgradation | 152.4 | Rs 5–15 lakh/MW |
| Partial FGD | 54.2 | Rs 25–30 lakh/MW |
| FGD | 98.2 | Rs 50–60 lakh/MW |
| De-NOx | 152.4 | Rs 10–15 lakh/MW |
| SCR/SNCR | Upcoming | Rs 20–25 lakh/MW |

An existing plant would obviously not require all pollution-control equipment to be installed. For example, many new plants, installed after 2008, may not require to do anything for PM and NOx control. The exact investment required by a plant would depend upon a number of factors— age, size and technology of units; currently installed pollution-control equipment and their maintenance status; actual emissions; and applicable norms.

**Tariff impact:** Haryana SERC estimated generation tariff impact of 22 paisa and consumer tariff impact of 26 paisa per unit based on submissions by power plants in Haryana. ICRA, a rating agency, analysis indicated similar impact on tariff based on average investment by plants.

## TIMELINES

Power producers have expressed apprehensions about complying with the new standards within timelines given in the notification (December 2017 for existing plants and January 2017 for new plants):

a) Plants contend that pre-execution activities (technology finalization, cost estimates, in-principle tariff approval and financial tie-ups) could take up to nine months and design, procurement and installation can take another two years.

Some of the delay was avoidable; indeed, plants like NTPC, Tata Power have completed some of the pre-execution work. Design and procurement of most pollution control equipment would take less than six months; installation can be done during the scheduled maintenance downtime or may need less than a month of downtime. FGD installation is the most time-consuming process, taking up to two years (see Table 5: *Time required to instal different pollution-control equipments*). MoEF may need to revise timelines based on a survey of progress. Extensions should be on a case-by-case basis subject to plants giving firm commitments backed by bank guaranty and evidencing progress (signed contracts with vendors).

b) Regulatory support is required to ensure timely implementation, including tariff increase approvals; POSOCO/CEA coordination is essential to shut plants for upgrades in a planned manner. Technology benchmarking by CEA and simplified tariff applications and expedited in-principle approvals by ERCs would shorten implementation timelines.

c) Power plants believe supplier capacity to execute this scale of projects is limited and costs may rise due to supply shortage. However, manufacturers claim that global supply will quickly rise to meet demand—historically, prices for FGD etc. fell as supply increased in the international markets.

d) Plants under construction need to change their construction plans, raise additional financing, and order and instal new equipments. They may need time beyond 1 January 2017 to comply with the new standards and their additional costs also need to be considered by regulators. Many plants in the pipeline are planning retrofit at a later stage but this is not a judicious plan. Plants must be asked to upgrade at the construction stage itself to comply on the commissioning date. Time extension for compliance and retrofitting can be considered on a case-by-case basis if it is techo-economically advantageous.

**Table 5: Time required to instal different pollution-control equipments**

| Technology | Construction time | Downtime |
|---|---|---|
| Electrostatic precipitator (ESP) | ~ 3–6 months | ~ 20–30 days |
| Flue gas desulphurization (FGD) | ~ 18–24 months | ~ 30–90 days |
| Selective Catalyst Reduction (SCR) | ~ 5 months | ~ 30 days |
| Selective Non-Catalyst Reduction (SNCR) | ~ 4 months | ~ 7 days |
| Low NOx burner, OFA etc. | ~ 1 month | ~ 15–20 days |

## FINANCING AND REGULATORY IMPEDIMENTS

Financing for investment required to meet the norms remains one of the main concerns—the investment required and its impact on cost of generation. Uncertainty over the recoverability of cost and time taken for tariff approval were additional concerns. This issue is exacerbated by the weak financial health of discoms which, in turn, has already affected the power generators.

a) The power producers argue that tariff increase could be in the range of Rs 0.5–0.75 per unit; however, HERC calculates (based on actual data from plants) that cost impact will be around 22 paisa per unit.

b) Applications to CERC have requested capex ranging between Rs 1.15 and 2.5 crore/ MW with tariff increase ranging between 45 and 90 paisa per unit. The wide range in the applications shows that it would be very important for regulators to establish clear guidelines. CEA/CERC should give guidance on technology options, pollution control performance and costs benchmarks. While capex is project-specific, broad guidelines will help in assessment and approvals.

c) CERC should devise simplified documentation requirements to streamline in-principle capex and tariff-approval applications. Tariff increases are politically challenging even if permitted under law. Regulators may need to devise mechanism to stagger tariff increases. But, plants need an assured rate increase to help raise financing for the capex and to avoid cash flow problems.

d) CERC believes approval of capex is fundamentally not a problem since it is permitted under 'Change of Law' provisions in PPAs under both Section 62 of Electricity Act, 2003 (Cost Plus) and Section 63 (Competitive Bids). Change in operational parameters such as station heat rate and auxiliary power consumption can be managed.

## STATUS UPDATE—NTPC

a. National Thermal Power Corporation (NTPC) has shown commendable leadership in the implementation of new standards. The company expects most plants to meet PM emission standards by 2017.

b. The company also expects to be able to meet the water standard (3.5 $m^3$/ MWh) in most plants by 2017. In fact, it is planning to go further than the mandate and convert a number of its plants to Zero Waste Discharge.

c. The company has undertaken the detailed engineering assessment for De-SOx and De-NOx. A number of plants are finalizing specifications for tender documents.

d. NTPC will award five pilot projects by December 2016 to assess SCR technology (controlling NOx) for Indian coal. The results will pave the way for the Indian power industry to instal SCR. The company is also confident that its upcoming plants will be able to meet the tightest standards. It is also advising other power plants on assessing technology needs.

## RAW MATERIALS

a. Limestone is the key raw material required for FGD. Based on the assumption that only units larger than 500 MW will instal FGD and smaller units can instal partial FGD, around 10–12 million tonnes of limestone is required, which is a small fraction of cement industry's limestone use. Moreover, gypsum (byproduct) produced by the wet FGD process can be used by the construction industry.

b. The De-NOx process will require ammonia or urea particularly for new plants. Currently, both are imported. The annual requirement for ammonia is estimated to be 5 million tonne and for urea 7 million tonnes.

# ANNEXURE 1: AGENDA OF THE CONFERENCE

| | |
|---|---|
| **Welcome address**<br>Priyavrat Bhati, Programme Director, Centre for Science and Environment | |
| **Overview of challenge and recommendation for regulatory measures**<br>Anil Razdan, Retd Secretary, Ministry of Power | |
| **Session 1: Panel discussion on challenges in compliance with the standards**<br>Moderated by Chandra Bhushan, Deputy Director General, CSE | |
| Summary of challenges and impediments; Progress report on installation plans | Mr Ashish Basu, Chairman, Association of Power Producers (APP) |
| Constraints faced by power stations specially private plants and potential solutions | Sanjay Sagar, Jt Managing Director & CEO, JSW Energy Limited |
| State-owned plants' perspectives with a focus on challenges for plants in pipeline | Mr M.K.V. Rama Rao, Managing Director, HPGCL |
| Challenges faced by NTPC and overview of their plans for existing and pipeline plants | Mr Alind Rastogi, Executive Director, NTPC Ltd |
| Issues for coastal and old power stations and recommendations | Ms Taruna Saxena, Group Head—Corp, Env. & Climate Change, Tata Power |
| Captive power station's concerns | Mr Razack Baig, Sr Vice President (Project), Ultratech Cement Ltd |
| **Session 2 : Regulatory approvals—capex, tariff, etc.** | |
| Mechanisms to expedite tariff revision petitions | S.C. Srivastava, Chief Engineer, Central Electricity Regulatory Commission |
| Challenges faced by SERC—cross subsidy, cost recovery etc., tariff petitions | M.S. Puri, Member, Haryana State Electricity Regulatory Commission |
| | A.K. Das, Member, Orissa State Electricity Regulatory Commission |
| **Session 3: Equipment availability** | |
| Technology availability and applicability for Indian coal power stations | K. Rajavel, Corporate Advisor, Mitsubishi Hitachi Power Systems |
| FGD solutions to meet the 600 mg/Nm$^3$ $SO_X$ norms. | Ajith Apte, Managing Director, Transparent Technology |
| ASCR or HYBRID De-Nox Technology | K. Viswanathan, Head—Engineering, ISGEC Heavy Engineering Limited |
| **Session 4: Ensuring raw material availability and waste management** | |
| Overview: Raw material availability and waste management | Alind Rastogi, Executive Director—Environment, NTPC |
| Limestone availability for FGD and managing waste | Razack Baig, Sr Vice President (Project), Ultratech Cement Ltd |
| Supply constraints: Urea availability for coal power stations | Dr S. Nand, Deputy Director General, Fertilizers Association of India |
| Liquid ammonia handling: regulatory approvals | R.A. Gujar, Dy Chief Controller of Explosives, Petroleum and Explosives Safety Organization |
| Catalyst management | B. Krishnakumar, General Manager, ISGEC |
| **Session 5: Way forward** | |
| Investment requirements, funding sources | Himanshu Gupta, Sales Director, GE India |
| Financing mechanisms | Mr Sabyasachi Majumdar, Senior Vice-President, ICRA Limited |
| CSE's perspective | Chandra Bhushan, Deputy Director General, CSE |

# ANNEXURE 2: LIST OF PARTICIPANTS

| Name | Designation | Organization |
|---|---|---|
| Mr M.S. Puri | Member | Haryana Electricity Regulatory Commission |
| Ms Suman Jain | Group Head | Isgec Heavy Engineering Ltd |
| Mr Vijay Chaudhry | SBU Head | Thermax Limited |
| Mr Ashis Basu | CEO-Corporate | GMR Energy Limited |
| Mr Ajit U. Apte | Managing Director | Transparent Technologies Private Limited |
| Mr Partha Kundu | General Manager/ Sales & Marketing | KC Cottrell India Pvt. Ltd |
| Mr Abhishek Chatterjee | Asst. Director General | Association of Power Producers |
| Mr Avadhesh B Jaiswal | Executive Engineer | Gujarat State Electricity Corporation Ltd |
| Mr Charat Hora | Regional General Manager-BD | Black & Veatch Private Limited |
| Mr Bijan Mishra | Sr. Vice President- Environment | Reliance Power Limited |
| Mr S C Shrivastava | Chief Engineering | Central Electricity Regulatory Commission |
| Mr A K Das | Member | Odisha Electricity Regulatory Commission |
| Mr. S.K. Puri | General Manager/O & M | Punjab State Power Corporation Ltd |
| Mr Mohit Bhargava | General Manager | NTPC Limited |
| Mr J.P. Debroy | Dy. General Manager—Corporate Operation Services | JSW Energy Limited |
| Mr P.R. Ekambaram | Superintending Engineer | Telangana State Power Generation Corporation Ltd |
| Mr Devdatt M. Shukla | Superintending Engineer | Gujarat State Electricity Corporation Ltd |
| Dr K.V. Reddy | Vice President & Corporate Head-Environment | UltraTech Cement Limited |
| Mr Razack Baig | Vice President & Head- Power Projects | Ultra Tech Cement Limited |
| Mr Prabhat Verma | Dy. General Manager Marketing & Sales Power Service | Doosan Power systems India Pvt Ltd |
| Mr Suraj Chaudhry | Sr. Manager Sales and Proposals Power Service | Doosan Power systems India Pvt Ltd |
| Mr Anil Razdan | Retd. Power Secretary | |
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| Mr Rajiv Gupta | Associate Vice President | Isgec Heavy Engineering Ltd |
| Mr Souvik Dutta | General Manager | CESC Limited |
| Mr G.J. Despande | Director-Technical | JSW Energy Limited |
| Mr Piyush Goyal | Head—Corporate Advocacy | The Tata Power Company Limited |
| Mr M. Farrukh Aamir | Specialist—Corporate Regulations | The Tata Power Company Limited |
| Mr S. Laxmi Narayana | Superintending Engineer | Telangana State Power Generation Corporation Ltd |
| Mr K. Rajavel | Corporate Advisor | Mitsubishi Hitachi Power systems Ltd |
| Mr Sanjay Moza | Sr General Manager | Mitsubishi Hitachi Power systems Ltd |
| Mr Asheesh Agarwal | Senior Market Advisor | Royal Norwegian Embassy |
| Mr B. Krishna Kumar | General Manager—Marketing / Proposal/ Estimation | Isgec Heavy Engineering Ltd |
| Mr Richard Budin | Managing Director—Head of Operations | Yara Environmental Technologies AB |
| Mr K.Viswanathan | Head Engg (Utility Boilers) | Isgec Heavy Engineering Ltd |
| Mr Sandeep Singh | Senior Manager—Marketing | Andritz India Pvt. Ltd |
| Mr A.K. Pmysty | | GMR Energy Limited |
| Mr Harish Upperla | Executive—Air pollution control | Andritz India Pvt. Ltd |
| Ms Taruna Saxena | Group Head-Corp. Environment & Climate Change | The Tata Power Company Limited |
| Mr Randhir Singh | | PSPCL Patiala |
| Mr Atsushi Kato | Deputy General Manager | Mitsubishi Hitachi Power systems Ltd |
| Mr Sanjay Sagar | Jt MD & CEO | JSW Energy Ltd |
| Mr Jaishankar Balan | Senior Manager | JSW Energy Ltd |
| Dr S.K. Jain | Additional General Manager | NTPC Ltd |
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