Status of Implementation of New Environmental Norms and Way Forward

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New Norms – reasonable and needed

- **New standards are in line with the global standards**
  - In fact, China has introduced even tighter standards for metro and highly polluted areas (PM 10 mg/Nm^3, SOx 35 mg/Nm^3 and NOx 50 mg/Nm^3)
- **Under CREPS, in 2003, industry had committed to improve its env. performance**
  - meeting 100 mg/m^3 particulate matter levels;
  - SOx/NOx standards to be implemented by 2005/06
- **Progression of regulatory framework supports new standards**
  - ECs granted since 2008 required PM at 50mg/m3 for 500 MW size units
  - ECs required allotment of space for FGD installation since year 2003 – space constraint should not be an issue

New Norms

mg/Nm^3	Unit size	Installed before Dec 31st, 2003 *	Installed between 2004 and 2016 *	Installed Jan 1, 2017 onwards
PM	All	100	50	30
SO_2	<500MW	600	--	--
	>=500MW	200	200	100
NO_x	All	600	300	100
Hg	All	0.03 (>500 MW)	0.03	0.03

**** Existing plants – comply by Dec 22, 2017***

Water Use:

- Once through Cooling plants (withdraw up to 200m^3/MWh) to convert to Cooling Tower-based plants (current draw 4m^3/MWh); Global avg ~2m^3/MWh
- CT plants to cut water use to 3.5 m^3/MWh; New plants to use 2.5 m^3/MWh

mg/Nm^3	NO_x	SO_2	PM
China	50	35	10
Japan	200	Permit	50
USA	110	100	14.5
EU	200	200	30

New Norms – Benefit

Pollution load and resource use by coal-based power sector

- **Water withdrawal - 24 billion cubic metre per annum (half the amount used for domestic use)**
- **PM, SOx and NOx between 30% and 60% of all Industrial emissions**

Impact on existing capacity assuming new norms implemented

- **Water use - 3.5 BCM, 85% reduction – largely due to conversion of OTC to CT**
- **PM emissions – current 5.6 lac tonnes, cut to 2 lac tonnes, 65%**
- **SOx – current 55.6 lac tonnes cut to 7.6 lac tonnes, over 70%**
- **NOx – current 41 lac tonnes, cut to 12.3 lac tonnes, almost 85%**
- **CO_2 – 1.05 billion tonnes, half of all CO_2 from fuel burning**
  - **Meeting INDC goals depend on improving fleet efficiency - 3% improvement – 125 million tonnes cut (~10-12%)**

Implementation status - unsatisfactory

- **CSE's preliminary survey of plants: some progress, but insufficient.**
  - **Many plants are in the wait-and-watch mode**
  - **CERC has received only a handful of tariff applications**
  - **Most plants are aware of technology options**
- **Plants making good progress -**
  - **NTPC ED (Env.) told CSE all existing plants will meet PM standards by 2017 and all plants will meet or even exceed water cut targets**
  - Tata Power has done a need assessment for its plants and filed tariff applications for two of its plants.
  - HPGCL - discussions with the ERC about technology and costs.
  - Several other companies such as JSW, UPRVUNL and PSPCL have done a need assessment.
- **Plants in pipeline are continuing with construction without any amendments to their plans**
  - **Plants hope that standards will be modified**

Progress – Southern States

- Overall survey of plants by regional power committee
  - De-NOx can be done during next overhaul – in next 12 months
  - ESP augmentation/up-gradation can meet standards
  - However FGD installations by 2019-20
- Issues
  - Plants unwilling to invest even in ESP if they are not allowed to operate
  - In absence of FGD below 600 may also not be possible
  - Without SNCR/SCR under 300 may not be possible – however multiple plants able to meet (APGENCO)
- Way forward - Timeline, strategy ?

Stakeholder Workshop – CSE Organised

- **To identify issues Inhibiting progress and recommend solutions**
- **Attended by all key stakeholders:**
  - **Regulators:** CERC, State ERCs (Haryana and Odisha)
  - **Industry:** Association of Power Producers, NTPC, Tata Power, Reliance, State power plants (Punjab, Gujarat & Telangana),
  - **Suppliers** (GE, Thermax, Doosan & Mitsubishi).
  - **Industry experts** (Anil Razdan, ex-Power Secretary)

- **MAJOR CONCLUSION – TECHNOLOGY IS NOT AN IMPEDIMENT**
  - **Industry experts and manufacturers strongly emphasized that pollution control technologies (ESP, FGD, SCR) options to help achieve new standards are mature with widespread usage.**
  - **Pollution control technologies will work for high ash Indian coal and for Indian operating conditions – will be able to meet new norms.**
  - **The costs of pollution control technology are manageable.**
  - **Domestic and global capacity not a constraint. Supply can grow quickly.**

Indian Fleet

- **Age/Unit size decide techno-economically viable pollution control option**

Unit size	Unit size distribution in GW				
	+25 years	1990–2003	2004–08	2009–16*	Total
up to 250 MW	28.6	16.3	2.1	5.8	52.8
> 250 and <500 MW	-	5.4	3.8	20.8	30.0
500 MW and above	5.5	9.5	6.0	82.8	103.8
Total	34.1	31.1	11.9	109.4	186.6

Pollution control technology: Options

- ***Units over 25 years (34.1 GW capacity)***
  - shut/replaced with SC – inefficient and polluting; significant share uses excessive water; some expensive
- ***43-GW capacity (installed during 1990–2008)***
  - A significant share - upgrade ESPs and retrofit boilers
  - Basic control measures to reduce SOx (coal washing; sorbent injection, if feasible) to meet 600 mg/Nm^3 standards.
  - 500-MW units constructed before 2003 may not have space for FGD; units commissioned after 2003 can instal partial FGD.
- ***27-GW capacity*** (***small units installed after 2008)***
  - Some might be meeting meet PM and NOx norms; some may need to upgrade the ESPs. No need for FGD
- ***83-GW capacity (large units installed after 2008)***
  - Designed to meet both the new NOx and the PM standards. Most may need relatively minor renovations.
  - Need to instal FGDs to meet the SOx standards.

Pollution control technology: Costs

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

Based on estimates provided by leading global suppliers (GE-Alstom, Mitsubishi, Doosan, Andritz etc)

- **Investment needed by a plant would depend upon applicable norm, existing pollution control technology and actual emissions level**
- **Accordingly, investment may range from:**
  - **Rs 15-20 lac/MW for small, mid-life plants -need to only upgrade ESP and modify boiler.**
    - **Eg. - NTPC Badarpur 2 X 210MW units are meeting NOx, SOx (using washed, low sulphur coal) and PM (ESP upgradation – Rs 38cr)**
  - **Rs 50-60 lacs for over 500MW size, newer units (FGD needed, but little expenditure on PM and DeNOx).**
- **SCR/SNCR is not needed for existing capacity.**

Issues - Timelines

- Timelines were achievable when the norms were announced
- But little progress – pre-execution work such as technology identification and tariff application could have been done
- Meeting PM, NOx, water use norms still possible given procurement time of less than 6 months.
  - installation can be done during scheduled shut down or need less than 1 month shut down
- Procurement of FGD could take up to 24 months.

Issues – Cost/Tariff

- **Costs of pollution control equipment are manageable**
  - **HERC calculates (based on actual data from all plants in Haryana) that generation cost will rise by 22 paisa per unit.**
  - **ICRA, a rating agency, analysis indicated similar impact based on nation wide average investment.**
  - **NTPC has submitted a cost of Rs 0.52 Crore/MW to CERC for Vindhyachal V (500MW).**
- **Industry concerned if ERCs will approve these investments and about potential delays in tariff applications.**
  - **Will impede financing from banks/markets.**
  - **CERC representative conveyed capex approval is not a problem - Permitted under 'Change of Law' provisions under both Section 62 (Cost Plus) and Section 63 (Competitive Bids) of Electricity Act.**

Regulator Report - Implementation

- Committee to study implementation (CEA, CPCB, NTPC, POSOCO, mnisteries of coal, power and environment:
- ESP upgradation – studied 180 GW total capacity
  - 115 GW meets PM norms; 64GW doesn't
  - 46 GW to upgrade ESP – Rs 13 lac/MW at 9 paisa/unit assuming 5 year depreciation
  - 17 GW will instal FGD so may not need to upgrade ESP
- FGD
  - 96GW has space for FGD
  - 74GW doesn't have adequate space; 9.5GW has FGD or CFBC boiler
  - Rs 50 lac/MW investment; 32 paisa/unit assuming 15 years – appears wrong
- NOx
  - Pre-2003 wall fired or tangential boilers – excess air, combustion optimization, OFA to get below 600 mg/Nm3 – Rs 1 lac/MW
  - Post-2003 – Low Nox burner, OFA etc to get below 450 mg/Nm3 - Rs 10 lac/MW investment – 7 pais/Unit assuming 5 year

Raw Materials

- Limestone is the key raw material required for FGD.
- Around 10–12 million tonnes of limestone would be required (assuming that units larger than 500 MW will install FGD)
  - In comparison, annual consumption of limestone by the cement industry around 400 million tonnes
  - Gypsum (by product) produced by the wet FGD process can be used by the construction industry.
- 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.
  - Annual urea consumption is around 32 million tonnes

Recommendations: CEA/CERC

- CEA should act as the key technical advisor and prepare a '**Technology Guidelines**' report detailing pollution control technology options with "Benchmark Capital Costs"
- CERC should develop a simplified/expedited tariff application approval process that should also be used by state regulators.
  - CEA Cost benchmarking "concurrence" by CERC – will help plants raise financing
  - Staggered tariff increase (over 2-3 years) for consumer acceptance
  - Expedited approval if capex is at the lowest benchmark range
  - In-principle investment approval.
- CERC and SERCs should ask plants to urgently provide plant-wise assessment of capex required and tariff impact.
- POSOCO needs to work out a shut down plan to avoid power supply disruption
- **Incentives to plants that comply within timelines should be considered** (eg priority in dispatch order)

Recommendations

- Portion of National Clean Energy Fund (NCEF) should be used to support installation of pollution control equipment - coal cess of around Rs 26,000 crore would be recovered from the power sector in 2016–17
- Plants with firm retirement or replacement plans may be allowed to operate in the interim under old standards.
- Old plants that wish to continue operating should be required to meet all air pollution and water use norms. In case old plants wish to undertake life extension, which add significant years to their life, they should be required to meet tighter standards
- Incentives for old plants
  - Plants replacing old units with SC/USC units should not need fresh Environmental Clearances (ECs).
  - MoP is already allowing coal linkages to be transferred. PPA and water rights transfer to a new promoter should also be allowed

Recent Steps by CSE

- Technology report shared with all Regulators – assist CEA/CERC
- Meetings with MoEF Secretary, Chairmen of CEA, CERC and CPCB and Advisor – NITI Aayog to emphasize
  - Technology available, suitable
  - Costs manageable
  - Action Plan – cost benchmarking; track implementation
- CSE has developed a monitoring template - inputs from the industry, manufacturers, CEA and experts - to survey the implementation status of plants. Shared with CPCB, PCB and all plants
  - Emission levels, existing control and costs
  - Technology options finalized, costs, timelines
  - Tariff application, financing
  - Procurement, installation
- Policy Brief to use Coal Cess to support investment by power sector in pollution control

Action Steps - PCBs

- **Monitoring mechanism to regularly track the project implementation progress made by plants.**
  - **Quarterly progress report**
- **Develop schedule based on implementation status.**
  - **Penalties for plants that have made no progress ?**
  - **Plants under construction should meet the standards ideally from day 1 since later modification may be disruptive. Retrofitting allowed?**
  - **Basis of revision of timelines ?**