
Welcome
Friends

New Environment Norms Issues and Challenges

By:
Sanjeev Kumar Kassi
Director (TETD), CEA

THERMAL ENGINEERING & TECHNOLOGY
DEVELOPMENT DIVISION, CEA

INSTALLED CAPACITY (MW) AS ON 29-02-2016

Type	Capacity	Share (%)
Hydro	42703.42	14.79%
Thermal	201360.04	69.76%
Coal	175857.88	60.92%
Gas	24508.63	8.49%
Diesel	993.53	0.34%
Nuclear	5780.00	2.00%
Renewable	38821.51	13.45%
Total	288664.97	100.00%

THERMAL GENERATION ~ 80% of total generation

UNIT WISE BREAK UP OF INSTALLED CAPACITY (MW)

Unit Size	Installed Before 31.12.2003		Installed After 31.12.2003	
	No of Units	Total Capacity (MW)	No of Units	Total Capacity (MW)
Up to 250 MW	313	47, 628	110	19,014
From 250-500 MW	27	13, 500	49	15,220
More than 500 MW	-	-	137	80,495
TOTAL	340	61,128	296	1,14,729
Total Feb, 2016	Units-636 Capacity 1,75,857 MW			

EXISTING EMISSION NORMS

Emission parameter	Limiting Values
Suspended Particulate Matter (SPM)	Less than 210 MW 300 mg/Nm3 * 210 MW or more 150 mg/Nm3 *
NOx	None for coal based stations
SOx	None, stack provided for dispersion <500 MW - 220 m >=500 MW - 275 m FGD space provision for units size 500 MW and above

* Depending upon the requirement of local situations, which may warrant stricter standards as in case of protected areas the State Pollution Control Board and other implementing agencies within the provisions of the EPA, 1980 may prescribe limit of 150 mg/Nm3 irrespective of the generation capacity of the plant. Andhra Pradesh Pollution Control Board and Delhi Pollution Control Committees have stipulated stringent standards of 115 and 50 mg/Nm3 respectively for control of particulate matter emission.

EXISTING EMISSIONS

Emission parameter	Values
Suspended Particulate Matter (SPM)	within 150 mg/Nm3 with ESP
NOx *	Around 600 - 1000 mg/Nm3 without secondary NOx control system
SOx	Around 1200 mg/Nm3 without De-SOx equipment

* As per current specifications NOx emission from the unit shall not be more than 260 grams of NOx per giga joule of heat input (from thermal as well as fuel). This is equivalent to 700 mg/Nm3

NEW EMISSION NORMS (as notified on 07.12.2015)

Emission parameter	TPPs (units) installed before 31st December, 2003	TPPs (units) installed after 31st December 2003 and upto 31st December 2016	TPPs (units) to be installed from 1st January 2017
Particulate Matter	100 mg/Nm^3	50 mg/Nm^3	30 mg/Nm^3
Sulphur Dioxide (SO_2)	600 mg/Nm^3 for units less than 500MW capacity 200 mg/Nm^3 for units 500MW and above capacity	600 mg/Nm^3 for units less than 500MW capacity 200 mg/Nm^3 for units 500MW and above capacity	100 mg/Nm^3
Oxides of Nitrogen (NOx)	600 mg/Nm^3	300 mg/Nm^3	100 mg/Nm^3

To be complied within 2 years by existing stations and w.e.f 01.01.2017 for new stations

TECHNOLOGY FOR SOx and NOx control

DE-SOx / Flue-gas desulfurization (FGD)

- **WET LIME STONE PROCESS**
- SPRAY DRY SCRUBBER
- SEA WATER SCRUBBING

DE-NOx

- COMBUSTION CONTROL
- **SELECTIVE CATALYST REDUCTION (SCR)**
- SELECTIVE NON-CATALYST REDUCTION (SNCR)

BASIC PRINCIPLE - FGD

FGD process typically involve SOx scrubbing with a alkali solid or solution

$CaCO_3 + SO_2 \rightarrow CaSO_3 + H_2O$

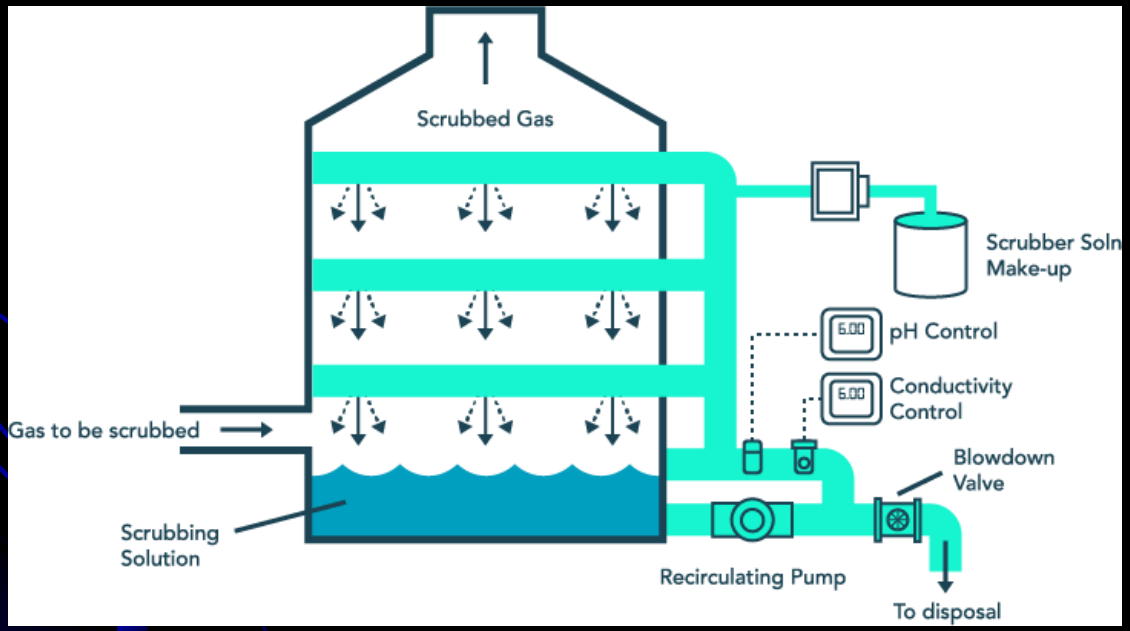
$Ca(OH)_2 + SO_2 \rightarrow CaSO_3 + H_2O$

$Mg(OH)_2 + SO_2 \rightarrow MgSO_3 + H_2O$

$2NaOH + SO_2 \rightarrow Na_2SO_3 + H_2O$

A natural alkaline usable to absorb SO_2 is seawater.

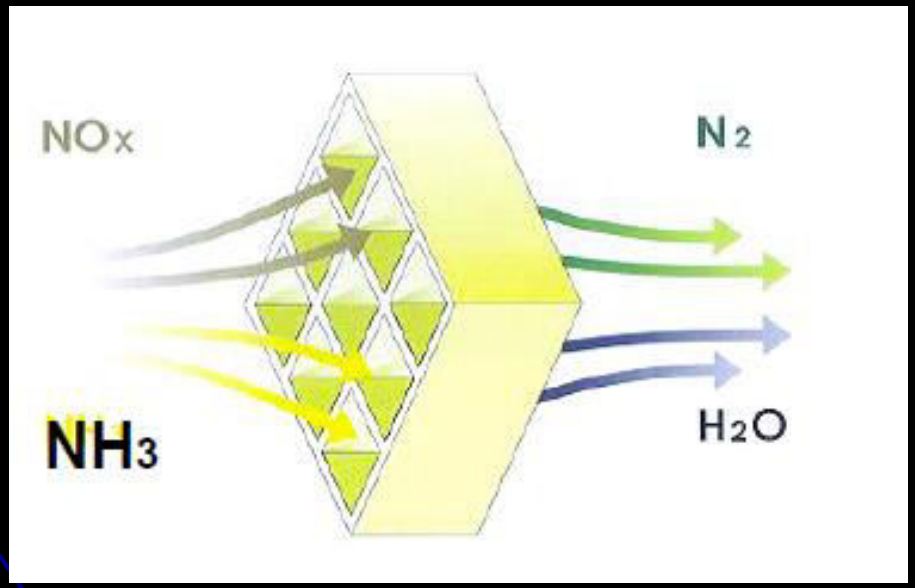
Generally Calcium based alkali are used in the form of lime or limestone. Seawater is also used wherever feasible in coastal regions.



BASIC PRINCIPLE-DeNOx

DE-NOx process typically involve reaction of NOx with ammonia

$$4\,NO + 4\,NH_3 + O_2 \rightarrow 4\,N_2 + 6\,H_2O$$
$$2\,NO_2 + 4\,NH_3 + O_2 \rightarrow 3\,N_2 + 6\,H_2O$$



Issues and Challenges – De-SOx

- ✓ About 80000 MW of total installed capacity of less than 500 MW units will be affected due to non-availability of space for FGD installation.
- ✓ Even where space is available, Flue Gas Desulphurisation installation may take around 2 to 3 years and involve plant shutdown of 4-6 months. Dismantling / Relocation of existing plant facilities may be required in certain cases, affecting plant operation
- ✓ Installation of FGD on over 2 lakh MW capacity would need limestone of around 24 MTPA and produce 34 MTPA of gypsum. These figures would progressively increase with increase in FGD installations.
- ✓ Disposal of gypsum in environmentally friendly manner.

Issues and Challenges – De-SOx

- ✓ Marketing avenues of gypsum. Some utilities having installed FGD are already facing problems of gypsum disposal
- ✓ The Auxiliary Power Consumption shall increase for FGD operation by 1.0-1.5% affecting the plant efficiency.
- ✓ The mining capacity of limestone in the country and its transportation to plants and associated challenges need to be addressed.
- ✓ Quality of Indigenous Lime Stone / suitability or arrangements for its import.

Issues and Challenges – De-NOx

- ✓ Installations of Selective Catalytic Reduction(SCR) systems and associated issues.
- ✓ Combustion control system modification may lead to NOx levels of around 600-700 mg/Nm^3
- ✓ The NOx emission limits of 300 mg/Nm^3 & 100 mg/Nm^3 cannot be met without installation of SCR System.
- ✓ Globally available SCR system for reducing NOx emissions are **not proven for Indian coal having high ash contents.** No proven and established control technology suited to our high ash Indian coals exists and pilot studies needed before deploying any technology.

Issues and Challenges – De-NOx

- ✓ Installation of DeNOx system in the existing units shall be a difficult task in view of the lay-out issues.
- ✓ Installation of SCR systems require extensive change in duct work, change of ID fan etc. for which no provision has been kept in the existing plants.
- ✓ Consumption of about 2500 tons ammonia per year for a 500 MW unit, its availability, transportation, handling & storage at plants.
- ✓ Environmental hazards of Ammonia.

Issues and Challenges – De-NOx

- ✓ Catalyst for the SCR system is very expensive and has limited life (around 3 years).
- ✓ Impact on O&M charges and increased power consumption due to increased pressure drop in the system.

Issues and Challenges – Vendor Availability

- Biggest constraint even if technical feasibility exists
- FGD & DeNOx systems have to be imported from other countries as the same is not manufactured indigenously.
- Installation of @ 20,000 MW / annum in about 2,56,000 MW capacity (1,75,200 existing+ 80,800 MW under construction) would take more than 10 years.

Issues and Challenges

- Limited time period for implementation for new and old plants.
- Newer plants will get delayed due to the new norms
- The expected capacity may not come to the grid affecting power supply and financial hardship to stations.
- The power utilities have raised their concerns and expressed their difficulties about the implementation of new environmental norms
- Two years is not sufficient for implementation in view of time required for Design and Engineering, approvals, arrangement of funds, tendering and erection, testing & commissioning.

Issues and Challenges

- The impact on power supply position due closure of most of coal based capacity due to non-fulfilment of environmental norms, as the modifications/retrofits would require long shut downs of units.

- Units operating at very low PLF of 10-20 % or have intermittent/ seasonal plant operation cannot recover the huge investment made, in their remaining life span without a steep rise in power tariff.

Issues and Challenges

- The implementation will have to be staggered for plant units to ensure power supply.
- Units under advanced stage of installation, the environmental control systems would have to be considered only as retrofits.
- Holding back commissioning of the units on account of environmental Standards may not be advisable as it could lead to contractual issues with equipment suppliers, establishment of guarantees etc.
- Delayed commissioning may lead to performance guarantee issues in the equipment later.

Issues and Challenges

- Commensurate plans would have to be taken up by other organization/ministries for mining of limestone, transportation of gypsum of requisite quality and handling ammonia & environmental approval thereon.

- CAPEX of around Rs. 1.0 Cr/MW (Rs.0.5 Cr/MW for FGD, 0.4 Cr/MW for SCR) and OPEX would have to be allowed by the Regulators in tariff which ultimately would burden the consumers.

- Huge capital requirement in the next two years to make the coal based power plants compliant with new norms

- Modification of existing PPAs to include revised tariffs

Issues and Challenges

- Due to limited supply of DeSOx systems and no supplier for proven DeNOx system, excessive outflow of foreign exchange shall take place. Also prices could increase sharply due to sudden requirements from large number of power utilities.

- As a rough estimate the power tariff may increase by 45 to 55 paise/kWh.

- Steep rise in tariff for 15-20 years old plants, as it would not be possible to recover the investment in their remaining life span.

WAY FORWARD

- Pilot studies for technology suitability for SCR systems with Indian coal – new and retrofits

- Stations specific studies for SOx control systems
  - Configurations
  - Space requirements for different areas/systems
  - Modifications etc. in other stations systems
  - Limestone availability & logistics and Gypsum disposal
  - Additional water consumption and treatments / disposal
  - Definitive cost and time estimates

- Such measures would help utilities in devising stations specific strategies for implementation


Thanks