Council of Enviro Excellence

Topic :-

FGD In India: Consultant's Outlook for Optimized Implementation

ENvX

3rd NATIONAL POWER-GEN ENVIRONMENT EXCELLENCE SUMMIT & AWARDS 2024

Speakers :-

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Tata Consulting Engineers Ltd.

TATA CONSULTING ENGINEERS LIMITED

ENGINEERING A BETTER TOMORROW
OVER FIVE DECADES

CEE 3rd National Power-Gen Environment Excellence Summit & Awards 2024

FGD In India: Consultant's Outlook for Optimized Implementation

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PRESENTATION AGENDA

01 India’s Power Sector Highlights, Emission Norms & Timeline

02 INDIA’s FGD Journey

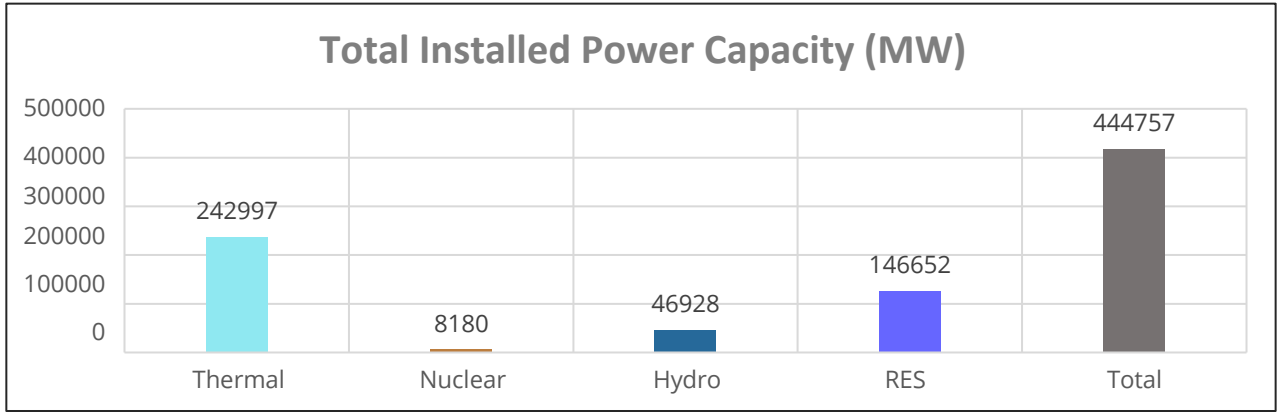
03 FGD Implementation Challenges

04 Mitigations Measures –Optimum Technology Selection

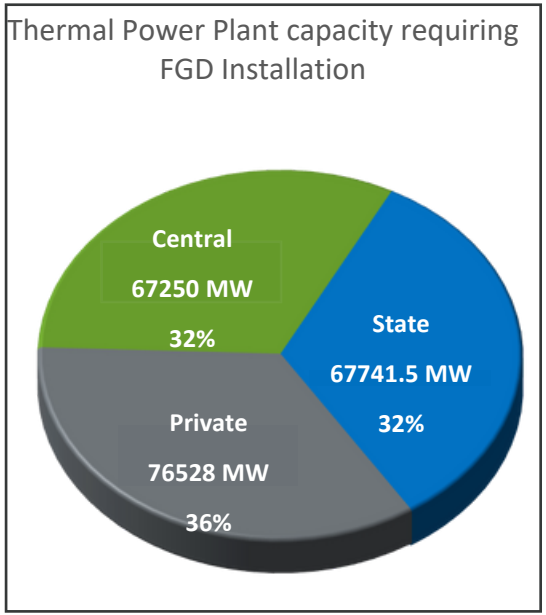
05 Case Studies –TCE’s approach

06 TCE’s Contribution in FGD Development

Power Sector Overview in India



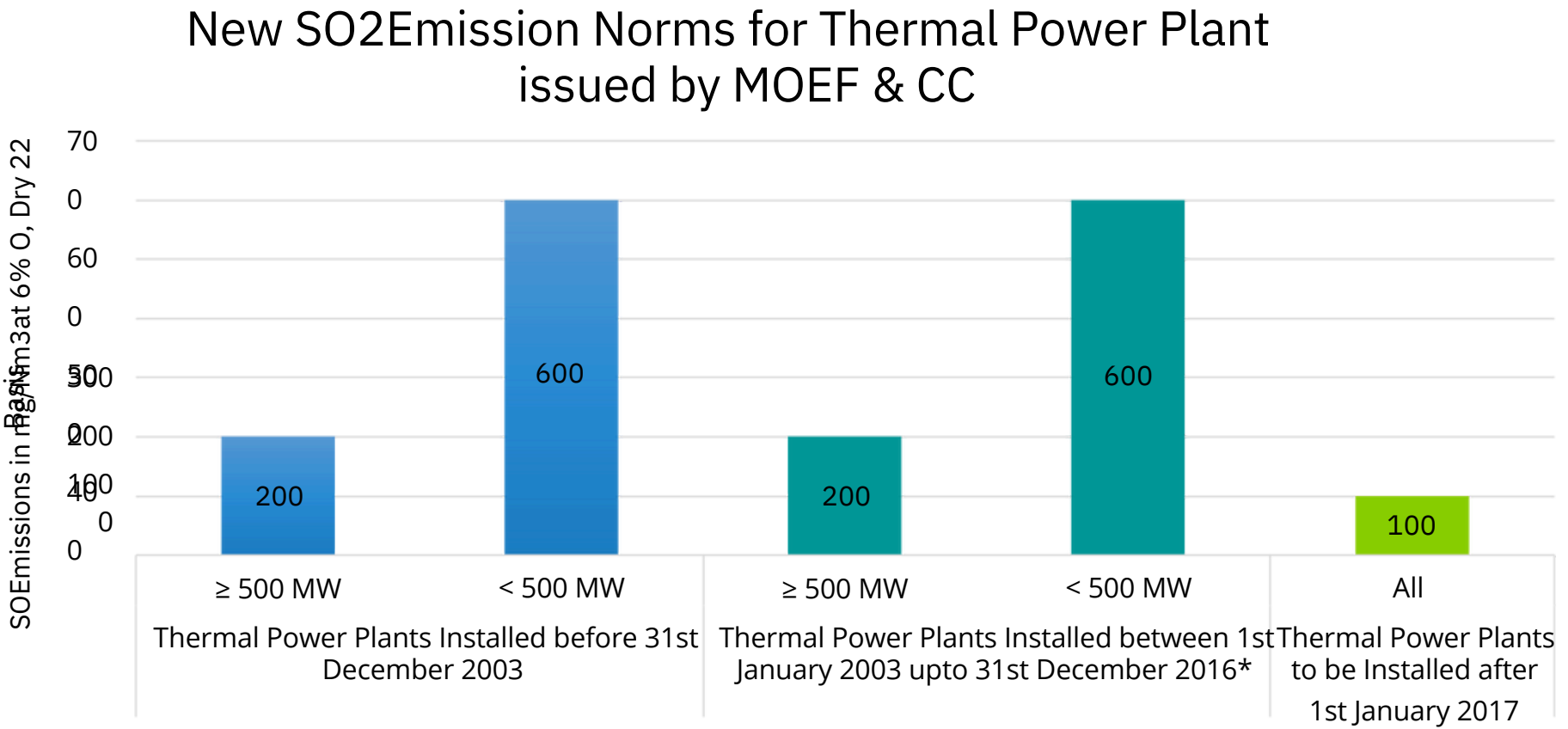
Region	Fossil Fuel Based Thermal					Non-Fossil Fuel Based				Grand Total
						Nuclear	Renewable			
	Coal	*Lignite*	*Gas*	*Diesel*	*Total*		*Hydro*	*RES*	*Total*	
Northern	56658	1580	5995	0	64233	1620	20830	39505	60335	126188
W estern	74663	1400	10806	0	86869	3240	7563	49669	57232	147341
Southern	49717	3640	6272	434	60063	3320	11827	54828	66656	130039
Eastern	28690	0	80	0	28770	0	4764	2012	6776	35546
North Eastern	1242	0	1665	36	2943	0	1944	597	2541	5484
Islands	0	0	0	120	120	0	0	40	40	160
ALL INDIA	210970	6620	24818	589	242997	8180	46928	146652	193580	444757



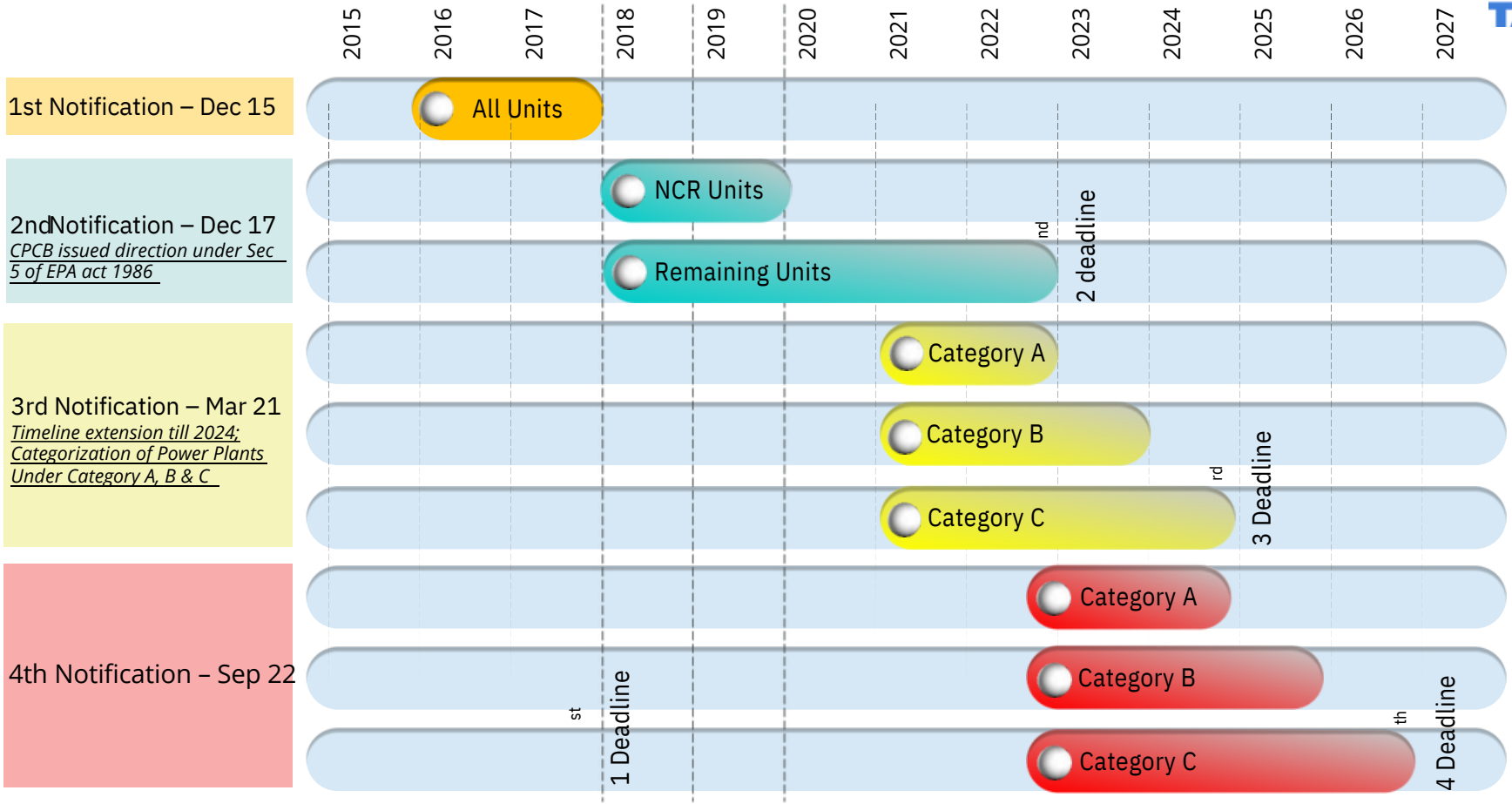
211519.5 MW

Source : CEA

SO2 Emission Norms in India



Timeline Evolution : FGD Implementation Norm

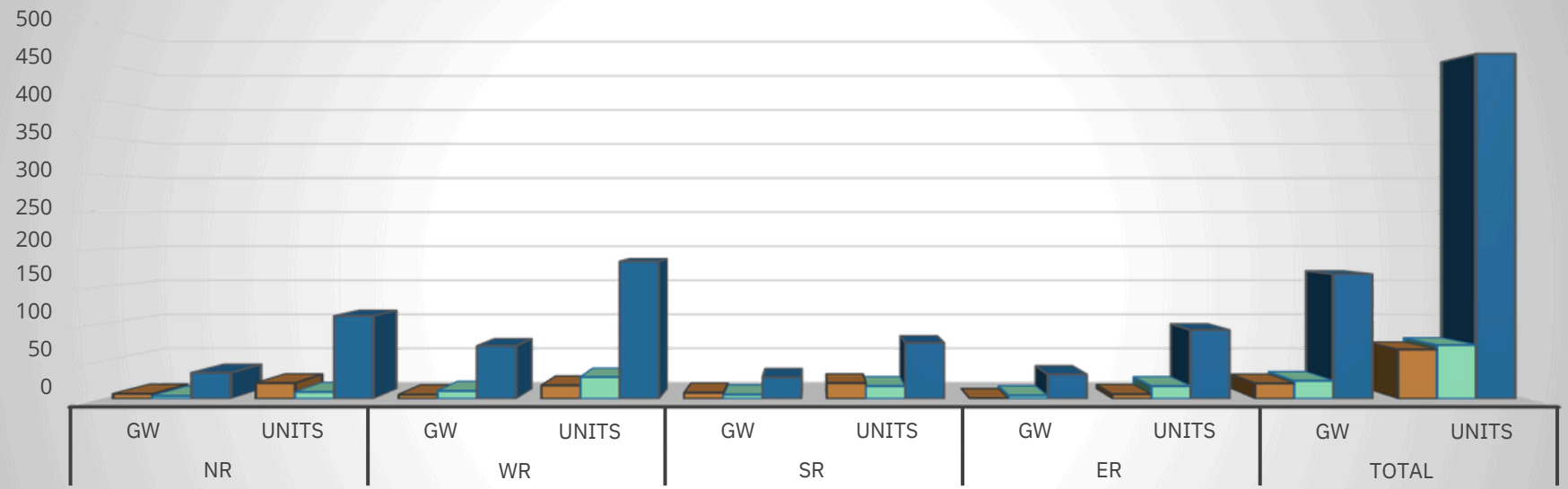


Deep dive into currentMOEF & CC timeline

Sl. No	Category	Location/Area	Timeline for compliance (Non retiring units)		Last date for retirement of units for exemption from compliance	
			Parameters other than SO2 Emission	SO2 Emission	Parameters other than SO2 Emission	SO2 Emission
1	2	3	4	5	6	7
1	Category A	With 10 km radius of National Capital Region or cities having million plus population	Upto 31st December 2022	Upto 31st December 2024	Upto 31st December 2022	Upto 31st December 2027
2	Category B	With 10 km radius of Critically Polluted Areas or Non-attainment cities	Upto 31st December 2023	Upto 31st December 2025	Upto 31st December 2025	
3	Category C	Other than those included in category A and B	Upto 31st December 2024	Upto 31st December 2026	Upto 31st December 2025	

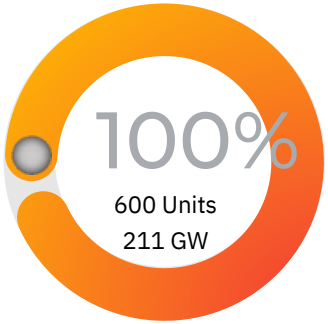
Sl. No.	Particulars	Environment compensation on the non-retiring thermal power plants after Due Date (in Rs. Per electricity generated)		
1	Non-compliant Operation beyond the Timeline	0 –180 days	181 –365 days	366 days and beyond
2	Environmental Compensation per Unit Electricity Generated	0.20	0.30	0.40

Regional Distribution in Timeline Categories

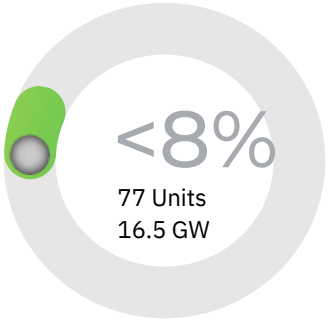


	NR		WR		SR		ER		Total	
	GW	Units	GW	Units	GW	Units	GW	Units	GW	Units
Cat A	6.59	21	5.482	18	8.13	21	0.376	6	20.578	66
Cat B	3.83	9	10.38	29	5.515	17	4.332	17	24.057	72
Cat C	34.799	111	70.834	184	28.682	75	32.57	92	166.885	462

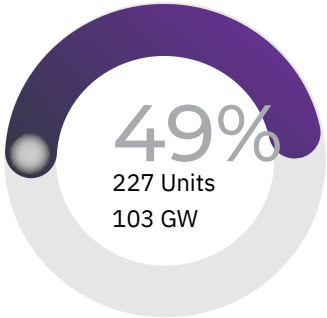
INDIA’s journey so far..



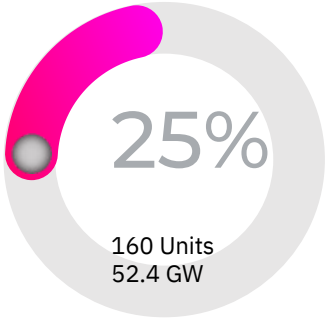
Units Requiring FGD



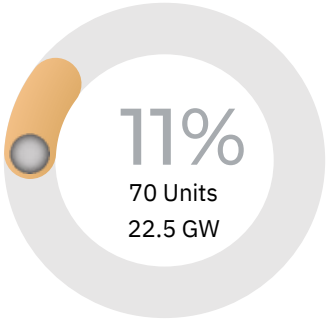
Total Installed



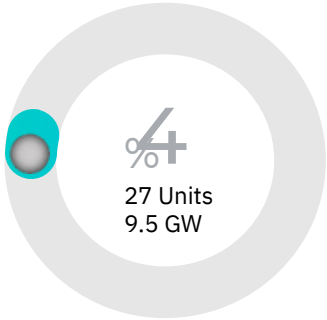
Bid Award Stage



Bid Opened Stage



Feasibility Study Phase



Completion of Tender Spec

Key Findings

6 units with 1.4 GW capacity are claimed to be compliant

Less than 8% of coal based electricity generation capacity has FGD

53 units i.e., 5.9 GW are CFBC units

Only 24 units i.e., 10.6 GW have installed Post Combustion FGD

Only 9 units out of 66 units of Category A plant has installed FGD
Remaining 15 units are of Category C

FGD Implementation –Challenges

COST ESCALATION

- *Impact of Covid 19*
- *Stressed timeline*
- *Supply demand gap due to market saturation*
- *Higher foreign exchange*
- *Unexpected price rise of raw materials*

NON-AVAILABILITY OF SUPPLIERS

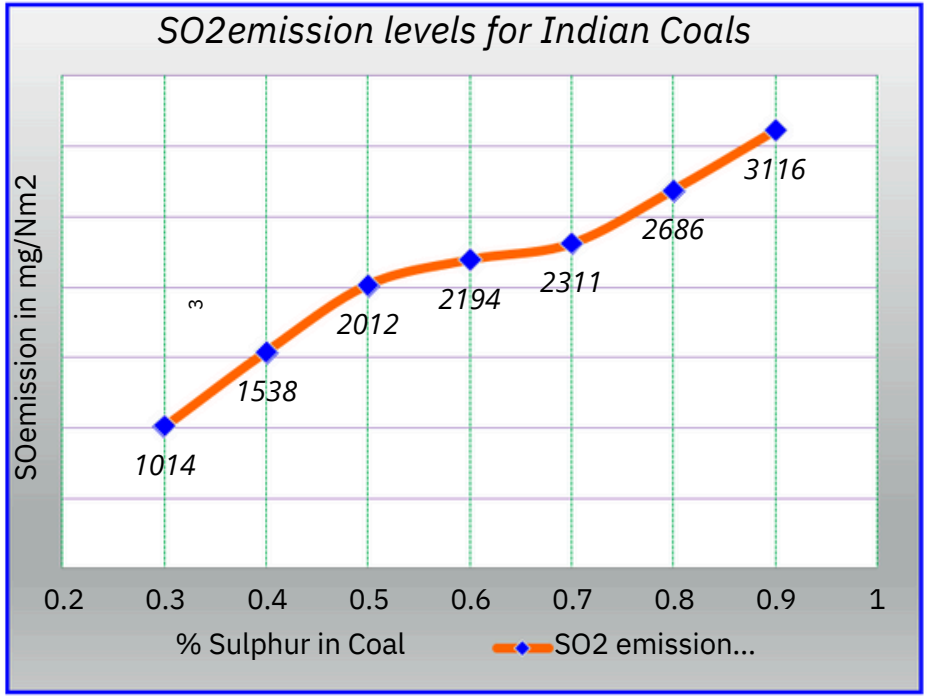
- *Inclination towards single Technology*
- *Limited Nos of Vendors*
- *Provenness Criteria*
- *Lack of trained resources*

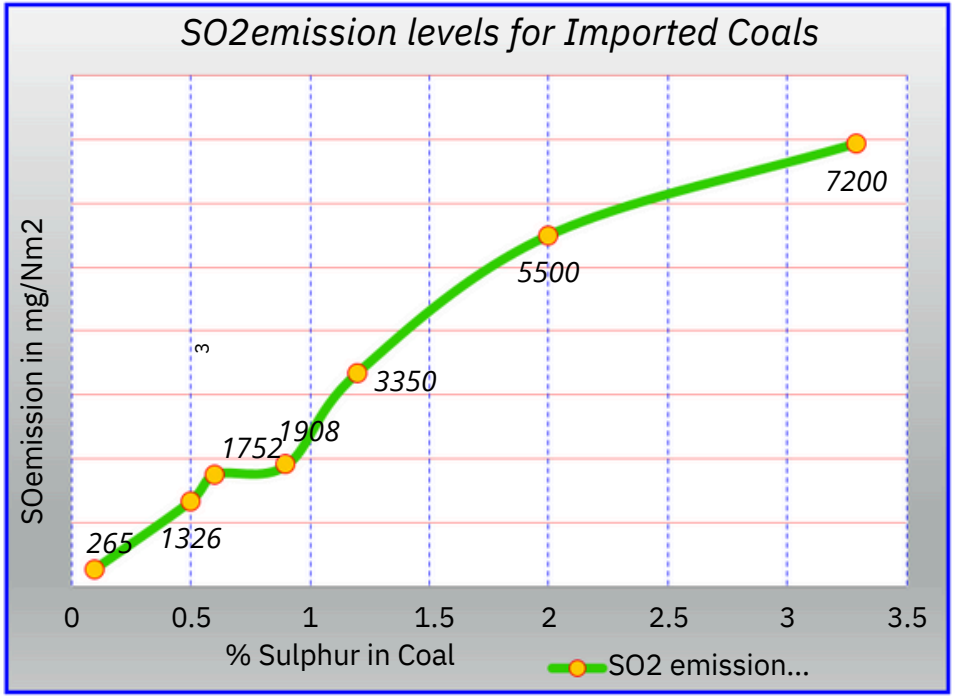
MISCELLANEOUS

- *Limitation in funding by Lenders*
- *Site execution challenge*
- *Uncertainty in long term supply of reagent; Saleability & Disposal of Byproduct*

SO2Emission Trends

Based on the different range of coal samples taken from TCE's data bank, the variation and trend of SO2 emission levels with the % Sulphur content in Indian and Imported coal have been presented :





Predominant FGD technologies in India

Description	Wet Limestone FGD	Ammonia FGD	Dry/Semi-Dry FGD	Sea Water FGD	DSI FGD
Reagent	Limestone	Ammonia	Lime	Sea water	Sodium Bicarbonate/ Trona
Byproduct	Saleable Gypsum or landfill	Ammonium Sulfate	Landfill only	Treated seawater	Ash + Na-Sulfate/ Chloride/ Fluoride
Removal efficiency	≤98%	≤98%	<95 %	≤98%	<75%
Footprint Area	Base	Smaller	Smaller	Larger	Smallest
Acid Resistant Lining in Stack	Required	Required	Required	Required	Not required
Pressure Drop in the system (without GGH)	Base	Comparable to slightly lower	More due to additional Fabric Filters	Comparable to slightly lower	Comparable to slightly lower
Absorber outlet temp (without GGH)	55-60 °C	55-60 °C	65 -85°C	55-60 °C	120-130 °C
Water Requirement	Base	Lower	Lower	Highest	Not required
Waste /Scrubbing Water Treatment	By wastewater Treatment/neutralisation	Not Required	Not Required	Oxidation & Dilution	Not Required
OPEX	Base	Comparable/ slightly Lower	Higher	Lower	Higher
CAPEX	Base	Lower	Lower	Project & layout specific	Lowest
Auxiliary Power Consumption	Base	Lower	Comparable/ slightly Lower	Project & layout specific	Lowest
Additional CO_2 emission to atmosphere	Yes	NIL	NIL	Yes	Yes

Combined SOx-NOx, Non-Thermal plasma, Multi-pollutant control, Polymer Based, Alkali & Amine based, Activated carbon based technology, Patented Catalyst based technology, etc. are some promising, technically competent technologies & can be explored based on plant specific requirements as an alternative solution with respect to the conventional ones.

Factors to be considered for FGD Technology Selection

SO2 Removal Requirement (Based on S % & Applicable Limitation)

- Removal efficiency requirement varies based on Coal S% and applicable emission norm
- Wet limestone, Wet Ammonia based technologies, Dry/Semidry FGD suitable for higher SO2 removal
- DSI technology not adequate for higher removal requirement
- For lower removal requirement, alternative non-conventional options could be explored to reduce CAPEX

Cost & Availability of Reagent; Byproduct handling (If applicable)

- Cost of reagent for DSI FGD & Dry FGD comparatively more than WLFGD technology
- Availability issue with reagent for DSI FGD
- Hazard related issues with reagent handling for AFGD
- Byproduct handling issue

Layout Space Availability & Residual Plant Life

- AFGD requires comparatively lesser area for reagent & byproduct handling
- Dry FGD requires less footprint compared to W LFGD
- DSI FGD requires minimal additional space
- Wastewater handling/treatment area not required Dry FGD, AFGD, DSI
- Sufficient space requirement for installing New wet stack not applicable for Dry & DSI FGD
- For plants with minimal residual life, technologies with lower CAPEX is envisaged

Commitment to Green Initiatives

- WLFGD, DSI FGD increase CO2 emission post FGD which doesn't happen for Dry/Semi-Dry FGD, AFGD
- AFGD with green ammonia source could be a step towards energy transition

SWFGD technology is not referred due to its limited & location specific application

Situations deciding optimum FGD Technology

W LFGD

- SO2 removal requirement up to 98%
- Sufficient layout space
- Sufficient makeup water availability
- Provision for handling FGD wastewater & byproduct
- Sufficient plant residual life
- Proven & most widely implemented technology

DRY/SEMI DRY FGD

- SO2 removal requirement up to 95%
- Sufficient layout space (Retrofitting may require ESP upgradation or Bag filter addition)
- Sufficient plant residual life
- Byproduct handling provision

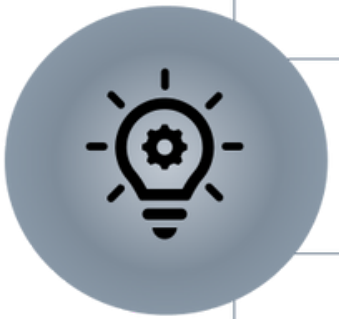
DSI FGD

- SO2 removal requirement not more than 75%
- Convenient & economical source of reagent (Sorbent)
- Comparatively lesser plant residual life
- Insufficient layout space
- Requirement of fast implementation schedule

AFGD

- SO2 removal requirement up to 98%
- Convenient & economical source of reagent (ammonia) preferably green ammonia
- Byproduct handling /utilisation provision
- Sufficient layout space
- Sufficient makeup water availability
- Green initiative for contributing to 'Net Zero journey' while complying to environmental sustainability

Addressing FGD Implementation Challenges



- Optimum technology selection considering plant specific suitability
- Split Package approach and developing market competition
- Optimum system configuration, selection of less expensive equipment (includes liner in main FGD Process & Stack-if applicable)

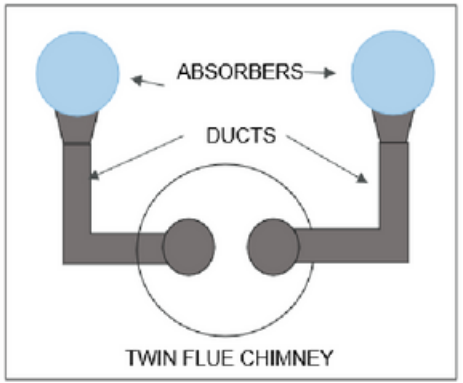
- Policy Support from regulatory authorities for sanction of funds by financ institutes
- Approval for tariff pass-through by central electricity regulatory commissior
- Policy support encouraging alternative FGD technologies

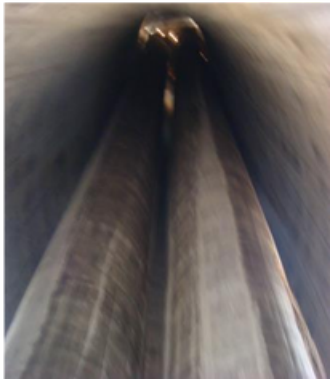
- Enhancement of production capacity and indigenous vendor development raw material and components.
- Installation of manufacturing plants within the country for major system equipment.
- To work towards “Atma-Nirbhar Bharat” mission of the Govt. of India

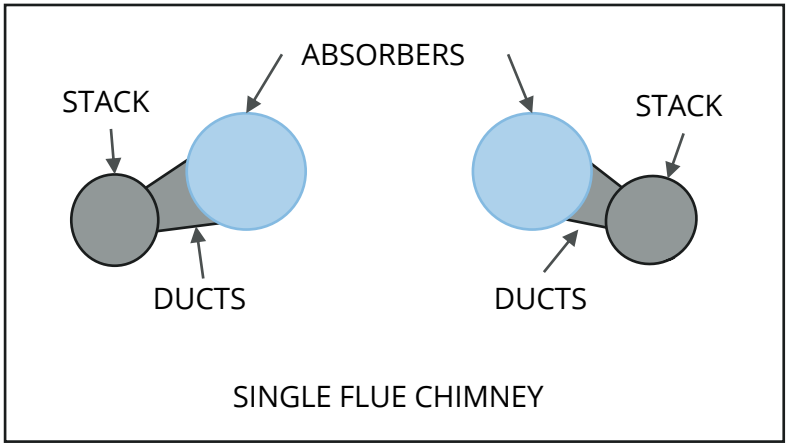
- To make proper guidelines for mining of domestic limestone; developing
- supply chain for imported limestone.
  Use of gypsum in cement, agricultural sectors for fertilizers.

Value Proposition -Case Study

- Industry Practice/ Customer Approach:
  - For two FGD absorber units, one twin flue wet stack was suggested.
- Concept Proposed by TCE:
  - Two Single Flue Wet Stacks instead of Twin Flue Stack.
- Cost Optimization/ Technical Benefit:
  - ✓ Costs would be optimized by eliminating the need for two steel flue cans.
  - ✓ Additionally, the overall stack height and diameter decrease, leading to reduced costs for the RCC (Reinforced Concrete Cement) structure.
  - ✓ For a typical configuration of 4x250 MW units, the proposed approach would result in capital expenditure (CAPEX) savings of approximately ₹50 Cr.







Value Proposition -Case Study

Problem Statement

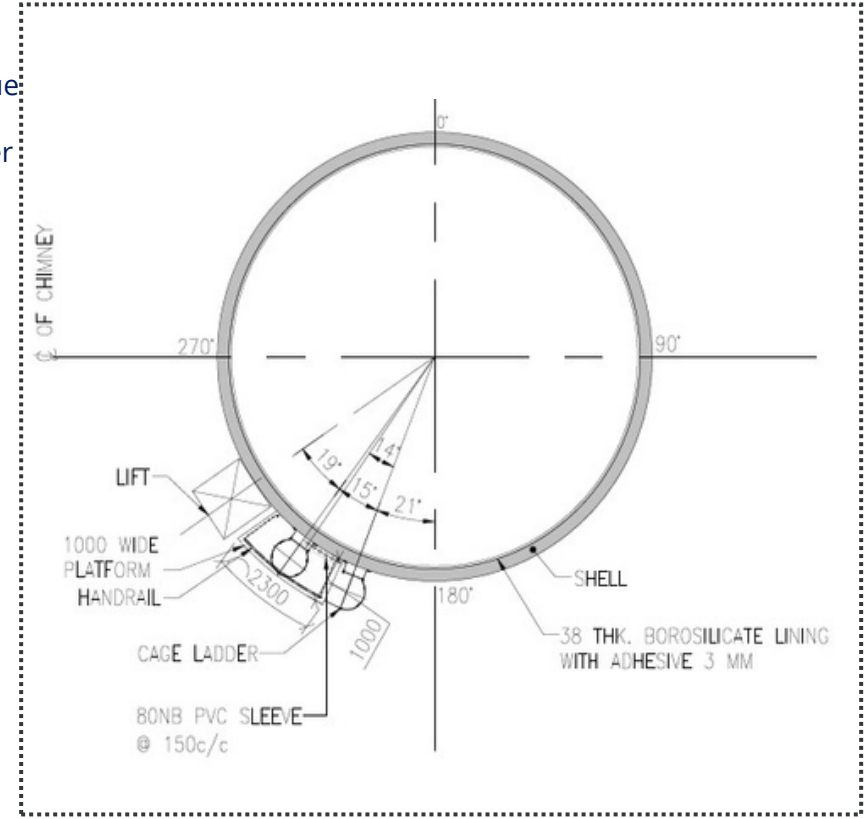
- Full height chimney linings are used since 1980s to protect the steel flue can from corrosion.
- Earlier convention was to use borosilicate / FRP / Titanium, or any other alloy pasted on steel flue can.

Proposed Concept

- Proposed borosilicate block liners directly pasted on RCC wall of Wet Stack
- Eliminated steel flue can
- Eliminated other costlier liner option

Benefit Analysis

- Savings on steel flue cans.
- Savings on liner cost as borosilicate liners having lower cost than titanium
- Savings on opex as borosilicate liners having more design life than other liners



TCE's Contribution

- *Domestic Market Leader as Engineering Consultant in Environmental Sustainability Solutions domain with extensive knowledge & experience on Indian Power Industry effectively leveraged in relatively new area of air pollution control, enabling value added service to customers First Consultant in India to introduce FGD & SOx control way back in 1980's Awarded best innovative project in entire Tata Group for introducing unique & innovative FGD Process in India (Process patent granted in 2019).*
- *Recognized as one of the top 26 innovative companies in India . Association with multiple On-going FGD Execution Projects across Technologies as Review Engineers as well as Detailed Engineering Services For providing value added comprehensive solutions with proven track-record Dedicated CFT pioneering domestic projects & supporting Customers, regulatory authorities in this field since advent of new environmental regulations in 2015*
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Feasibility/ DPR/ Basic Engineering

Pre-Award services

Procurement assistance/Technical Specifications/ Bid reviews

Post Award services

Owners Engineering /Detailed engineering for EPC & OEM

Globally Executed /Commissioned

Association with 66+ GW of Coal based Thermal Power Plants after new MOEF & CC Norms in 2015 (De-SOx, De-NOx, Mercury & Multi-Pollutant Control systems to be retrofitted *for 1st time across India in most TPPs*)

Our Clientele: New MOEF & CC Environmental Norms

Experience Synopsis after Revised MOEF & CC Norms	
Clients	Domestic Private Sector(24+Customers,50+ Plants, 145+ Units, Cumulative 66+ GW)
Services	• Owner's Engineering services from Concept to CommissioningandVenderDocumentReview • Detailed Project / Feasibility and Pre-Feasibility Reports • Basic Engineering & Procurement Assistance Services • DetailedEngineeringServicesforEPC/OEMs • Technical assistance for filing petitions, tariff revisions
Domains	• Wet Limestone based, Sea Water based, Ammonia based, Dry, Regenerative & other prevalent Flue Gas Desulfurization (FGD) / DeSOxtechnologies • Combustion Control, SCR, SNCR and other prevalent DeNOx systems CoalBlending&ESPRetrofit PlantEmissionsandWetStack • •

THANK YOU

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Thanking You on Behalf of !