



Good Afternoon

Environmental Management Systems @ Power Plants



Presented by

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Environment Pledge

I pledge

1. To conserve & restore the Eco-System in all my life activities.
2. To Plant & Protect Native Tree Species thereby maintain Earth's bio diversity.
3. To buy & use Eco-friendly products & Encourage recycling to the maximum.
4. To reduce my carbon footprint Every day & Everywhere.
5. To spread awareness on the importance of Ecosystem restoration.

Outcomes of this Session

- Knows about EMS
- Needs latest Industrial approach.
- Needs to understand Env. Norms & Standards

Before

- Keen interest – knowing more about EMS in Industry
- Focus on the discussion

During

- Detailed understanding on EMS in industry (TPP)
- Latest industrial approach
- Appreciation of prevailing Environmental Norms & Standards
- Insights on Environmental Control Measures

After

36

Definitions

As per ISO 14001:2015

environment

surroundings in which an **organization** (3.16) operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation

NOTE Surroundings in this context extend from within an **organization** (3.16) to the global system.

Environmental Aspect & Impact

ISO 14001:2015 defines an aspect as an “element of an organization’s activities or products or services that interacts or can interact with the environment” and an impact as a “change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization’s environmental aspects.”

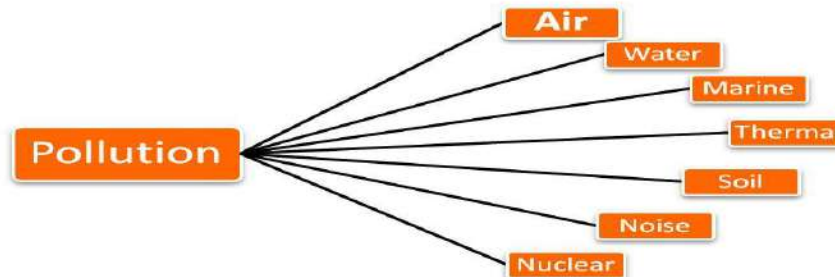
Definitions

“Environmental Law”

The Honourable Supreme Court in *K. M. Chinnappa v. Union of India* defined “**Environmental Law**” as an instrument to protect and improve the environment and control or prevent any act or omission polluting or likely to pollute the environment.

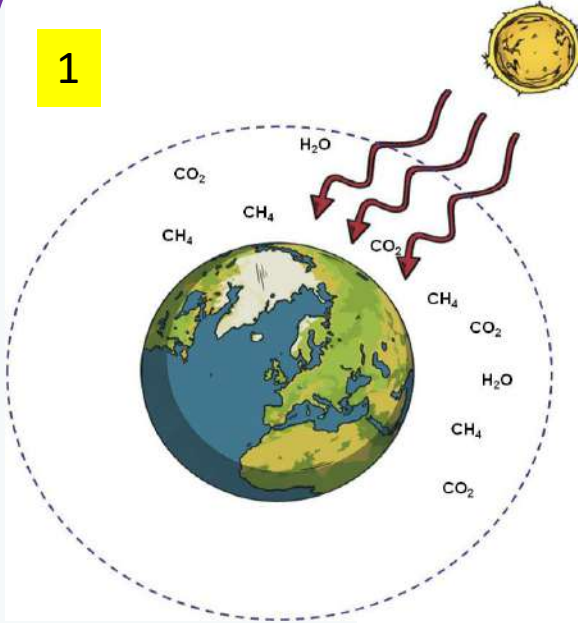
“Environmental Pollution”

The term ‘**Environmental pollution**’ refers to unfavourable alteration to our surroundings, wholly or largely as a by-product of human’s action through direct and indirect effects of changes in energy pattern, chemical and physical construction and abundance of organisms.



What is Climate Change

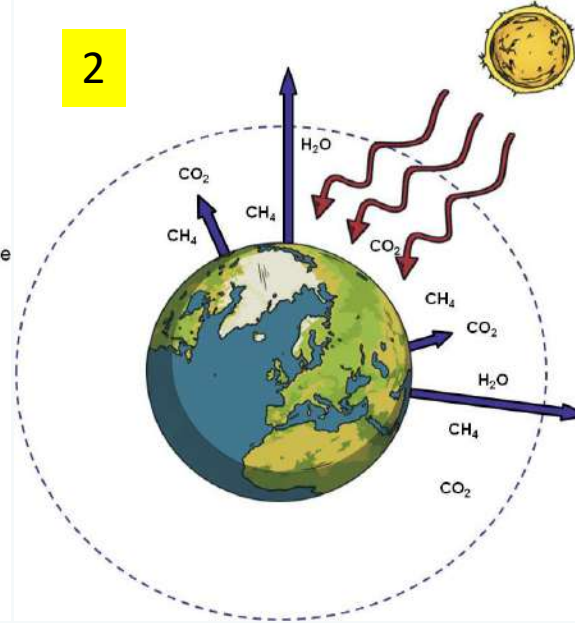
1



Carbon dioxide (CO₂), methane (CH₄) and water vapour (H₂O) are greenhouse gases that are found in the atmosphere.

Energy travels from the Sun to the Earth as short wave radiation. It does not interact strongly with the greenhouse gas molecules so it reaches the Earth's surface.

2

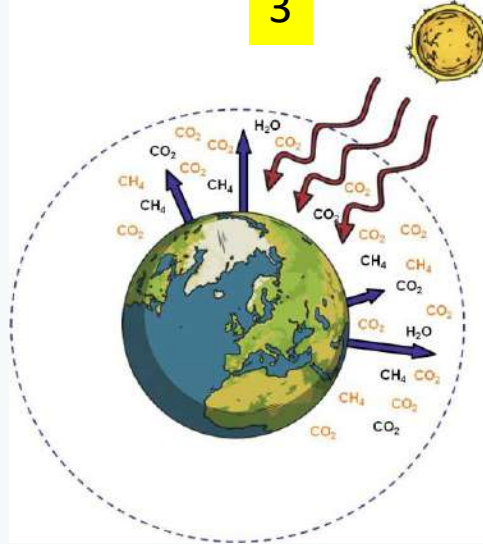


The Earth's surface emits long wavelength radiation. This does interact with the greenhouse gas molecules.

The greenhouse gas molecules absorb some of the energy, trapping it in the atmosphere.

This process keeps the Earth warm and is essential for life.

3



The higher the proportion of greenhouse gases in the atmosphere, the more radiation is absorbed.

This causes a rise in the temperature of the Earth and is known as the greenhouse effect.

This increase in temperature drives climate change.

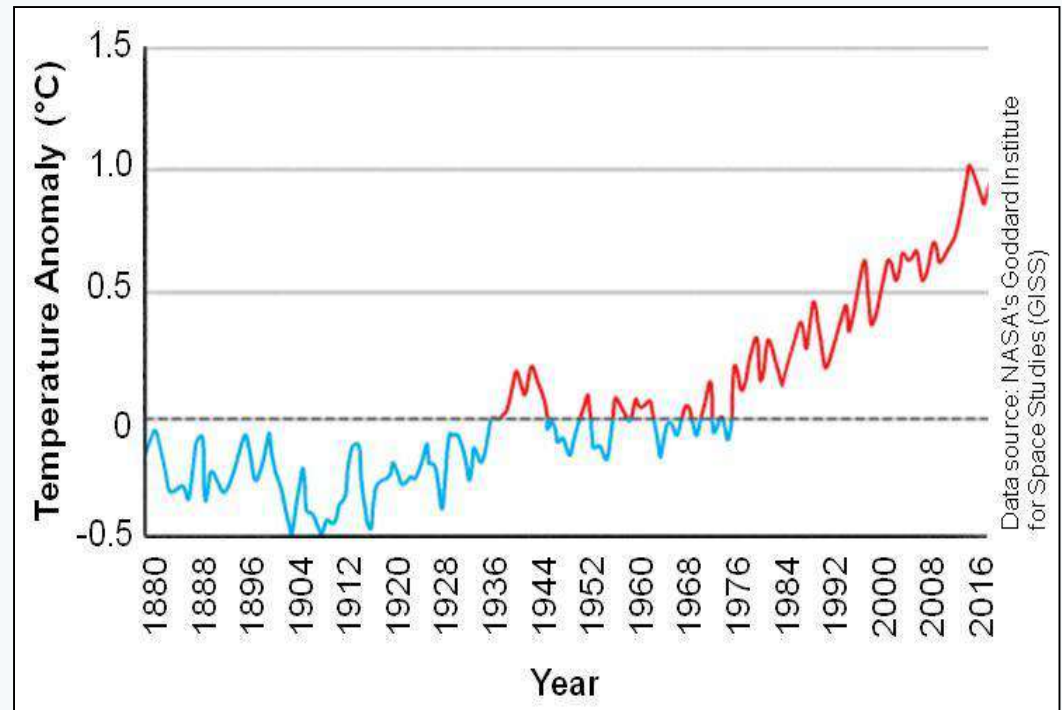
What is Climate Change

Climate change is a change in the average temperature and cycles of weather over a long period of time.

Since 1880, scientists have kept thermometer-based records of the global surface temperature.

What is happening to the global temperature?

The planet is becoming warmer; the climate is changing.



What Causes Climate Change

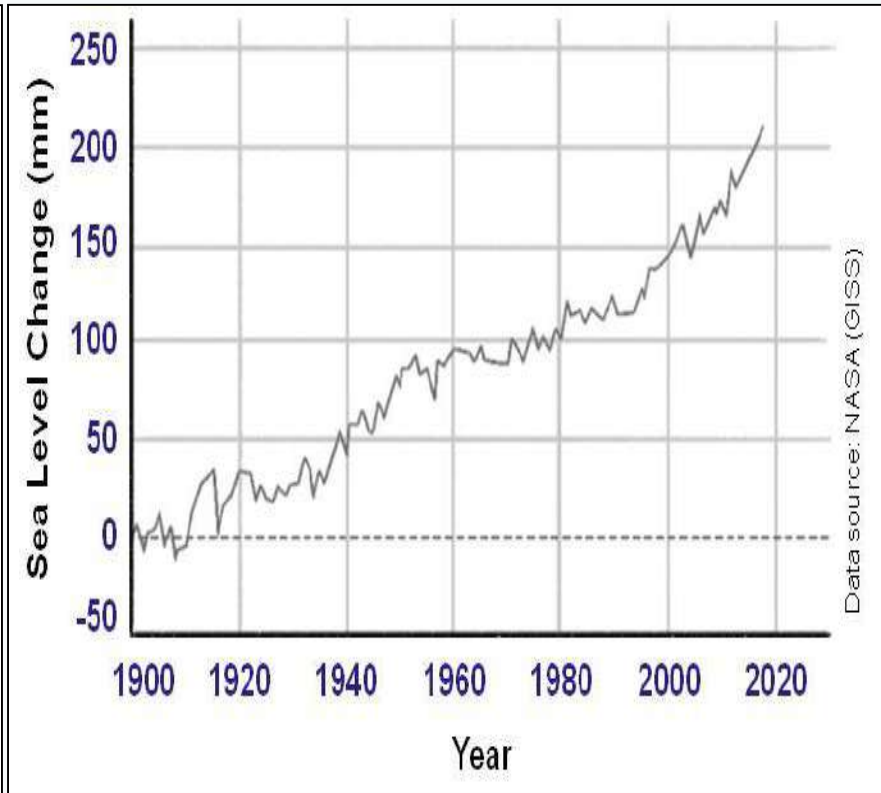
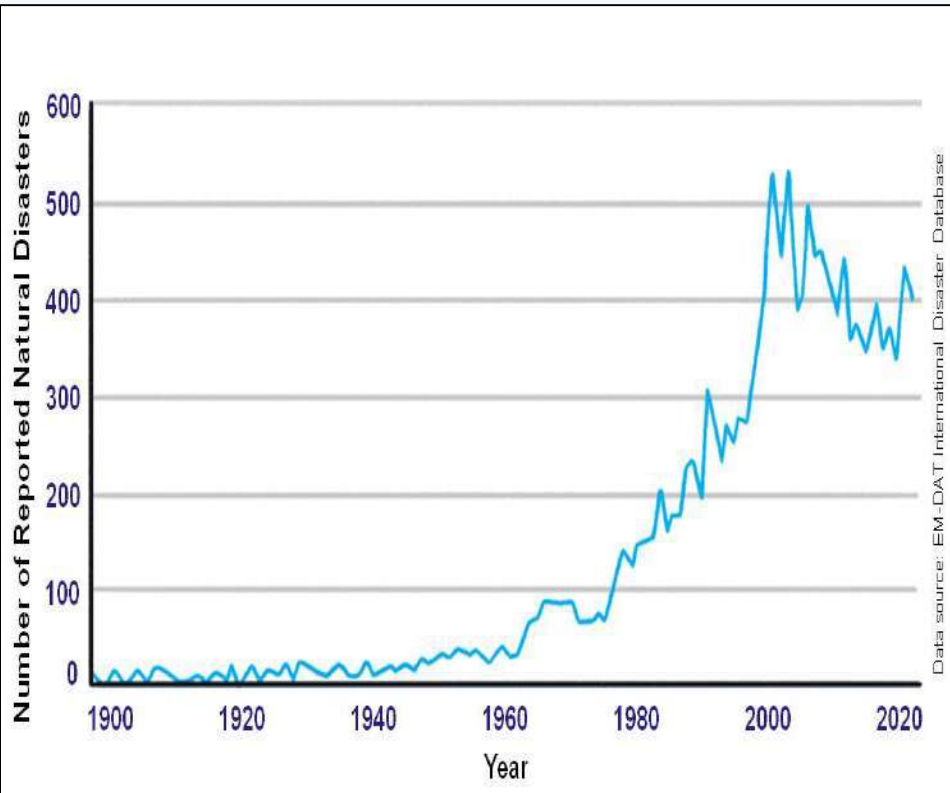
Climate change can be caused gradually by natural processes or suddenly by large events, such as a massive meteorite strike or volcanic activity.

However, **the rapid climate change we are experiencing now is due to three main human activities:**

- **Burning fossil fuels** for heating and cooking, generating electricity and powering vehicles releases carbon dioxide into the atmosphere.
- **Deforestation** (destruction of forests) releases carbon dioxide and reduces the number of trees able to capture carbon dioxide from the atmosphere.
- **Reduction of biodiversity** creates an unstable ecosystem. Nature loss leads to ecosystems that are less able to capture carbon from the atmosphere and less resilient to rising temperatures.



Why Climate Change is problem

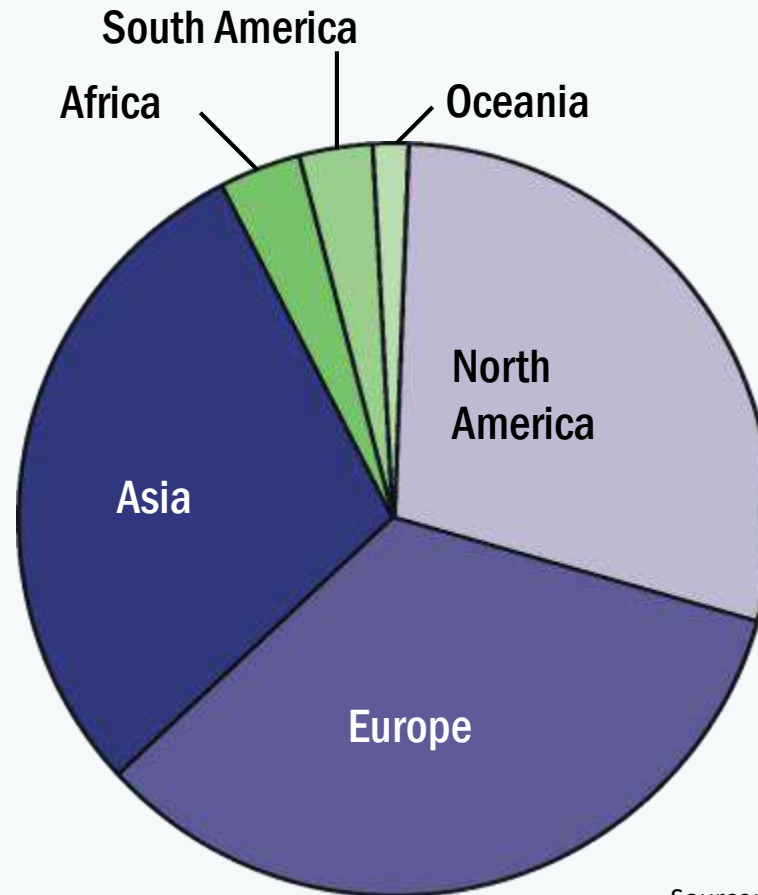


The increase in global temperatures is causing a reduction in sea ice.

This causes problems for animals that depend on the ice to hunt, mate and sleep.

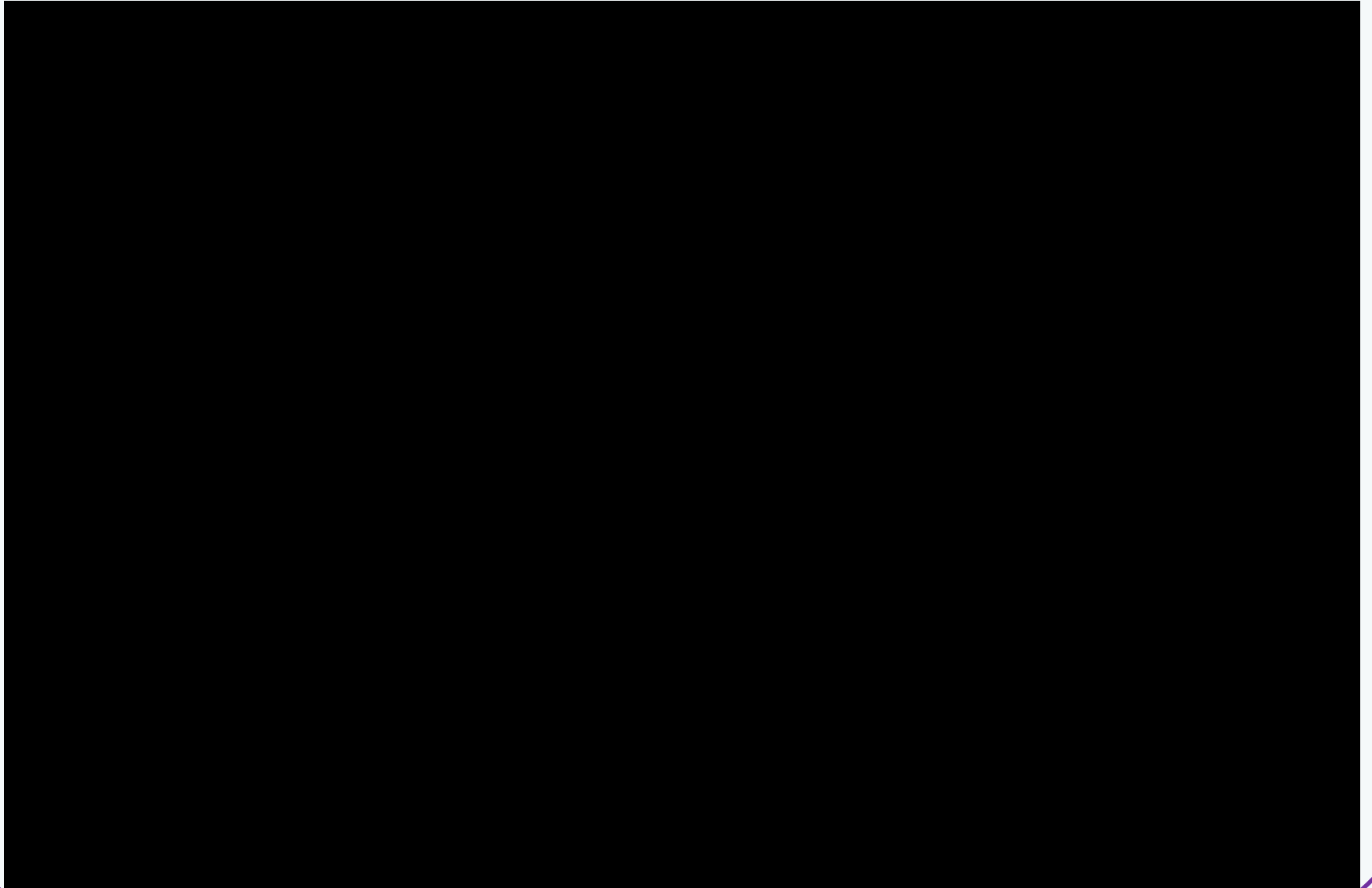
Who is Contributing to Climate Change

The 50 least developed countries are thought to have contributed 1% of the greenhouse gases that have caused global warming. The USA, the EU and Asia alone have contributed around 60%.



Source: COP26

COP – 26 India Participation



COP – 26 India Commitments

Key Notes of the Speech

First - India will take its Non-fossil energy capacity to 500 GW by 2030.

Second- India will meet 50 % of its energy requirements from renewable energy by 2030.

Third- India will reduce the total projected carbon emissions by one billion tonnes from now till 2030.

Fourth- By 2030, India will reduce the carbon intensity of its economy by less than 45 %.

Fifth- By year 2070, India will achieve the target of Net Zero.

These '**Panchamrits**' will be an unprecedented contribution of India to climate action.



COP – 26 India Commitments – Panchamrit 1 & 2

India will take its Non-fossil energy capacity to 500 GW by 2030.
 India will meet 50 % of its energy requirements from renewable energy by 2030.

		Installed capacity (GW) 2019	%	Generation (Billion Units) 2019	% of generation 2019	Installed capacity (GW) 2030	% of installed capacity 2030	Generation (Billion Units) 2030	% of generation
1	Coal and gas	228	63	1,072	80	282	36	1,393	56
2	Hydro	45	12.5	139	10.1*	61	7.5	206	8
3	Renewable	82.5	22.7	126	9.2	455	54.5	805	32
4	Nuclear	6.7	1.9	378	2.7	19	2.3	113	5
		362		1376		817		2,518	

*Including import from Bhutan

Source: Central Electricity Authority

Central Electricity Authority (CEA) projection for the country's energy mix for 2030

India's installed capacity of non-fossil energy for electricity generation

Solar + Wind + Hydel + Nuclear in 2019 = 134 GW

By 2030 the projection is 535 GW.

This will require solar energy installed capacity to go to 280 GW and wind energy to go to 140 GW.

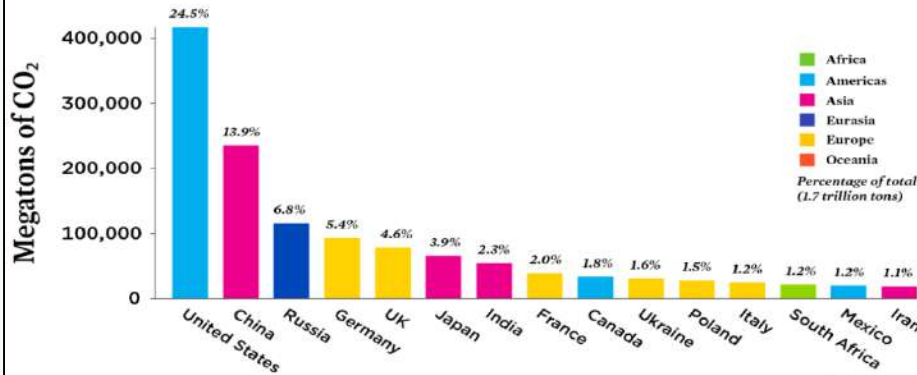
According to this, total installed capacity will be 817 GW by 2030.

COP – 26 India Commitments – Panchamrit 3

India will reduce the total projected carbon emissions by 1 Billion tonnes from 2021 to 2030.

Top CO₂ Emitting Countries, 1750-2020

(from fossil fuels and cement)

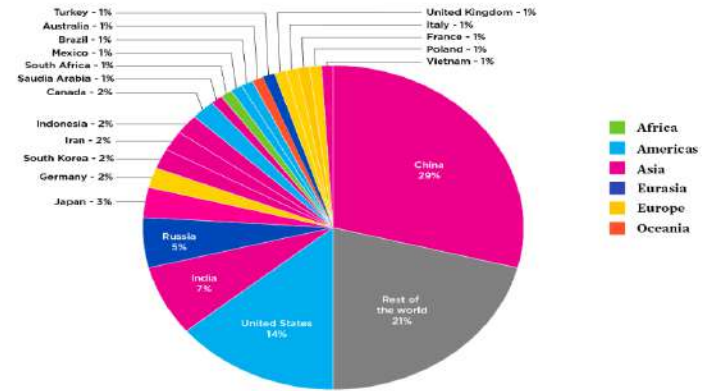


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Data: Global Carbon Project via Our World in Data

Rank	Country	CO ₂ emissions (total)
1	United States	416,738MT
2	China	235,527MT
3	Russia	115,335MT
4	Germany	92,636MT
5	United Kingdom	78,161MT
6	Japan	65,617MT
7	India	54,423MT
8	France	38,729MT
9	Canada	33,571MT
10	Ukraine	30,558MT

Top Annual CO₂ Emitting countries, 2019

(from fossil fuels)



© 2021 Union of Concerned Scientists
Data: IEA Atlas of Energy

Rank	Country	CO ₂ emissions (total)
1	China	9.90GT
2	United States	4.70GT
3	India	2.30GT
4	Russian Federation	1.60GT
5	Japan	1.10GT
6	Germany	0.64GT
7	South Korea	0.59GT
8	Islamic Republic of Iran	0.58GT
9	Indonesia	0.58GT
10	Canada	0.57GT

COP – 26 India Commitments – Panchamrit 3

India will reduce the total projected carbon emissions by 1 Billion tonnes from 2021 to 2030.

2. ELECTRIFICATION ACHIEVEMENTS

- India has been on a path to achieve 100% household electrification as envisaged under the Saubhagya scheme. As of March 2019, more than 26.2 million households were electrified under the Saubhagya scheme.
- According to the Union Budget 2021-22, **139 GW of installed capacity** and 1.41 lakh circuit km of transmission lines were **added** and 2.8 crore households were connected **in the past 6 years**.

1. THIRD-LARGEST PRODUCER AND SECOND-LARGEST CONSUMER GLOBALLY

- India is the **third-largest producer** and **second-largest consumer** of **electricity** in the **world**, with **an installed power capacity of 395 GW**, as of Jan 2022.
- **India was ranked fourth in wind power, fifth in solar power and fourth in renewable power installed capacity, as of 2020.**

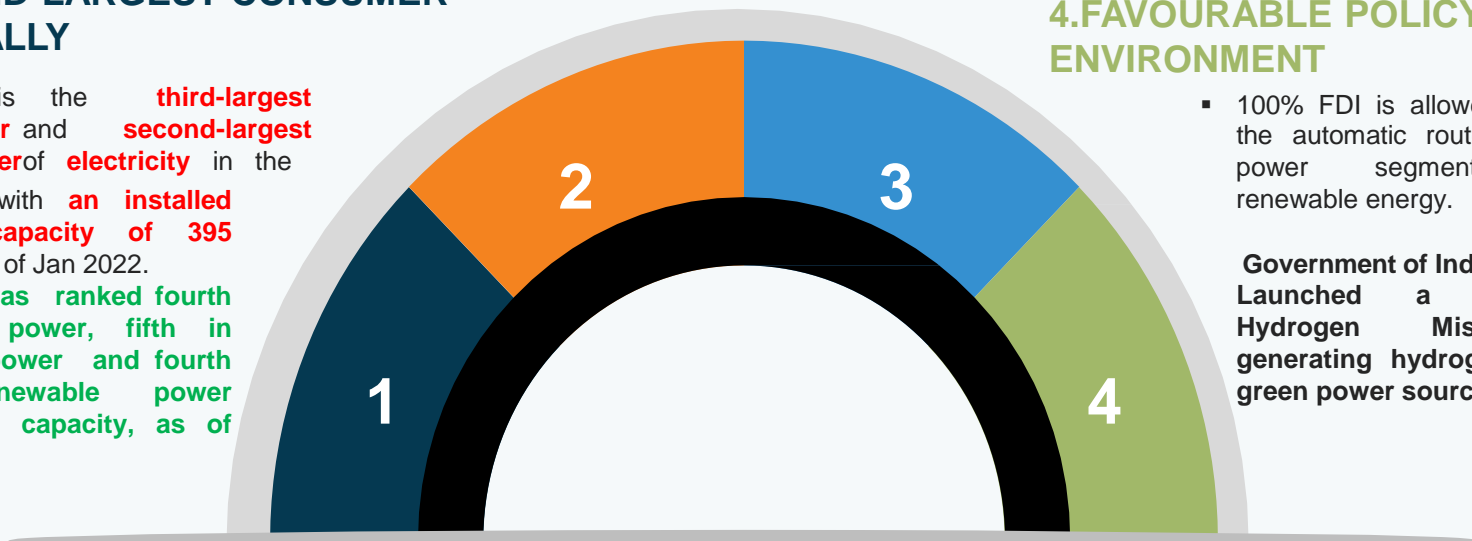
3. ROBUST GROWTH IN RENEWABLES

- **As of June 2021, India had an installed renewable energy capacity of 96.95 GW.**
- **Solar energy is estimated to contribute 114 GW, followed by 67 GW from wind power and 15 GW from biomass and hydropower by 2022.** The target for renewable energy has increased to 227 GW by 2022.
- **India is the the country among the G20 nations that is on track to achieve the targets under the Glasgow Agreement (COP 26).**

4.FAVOURABLE POLICY ENVIRONMENT

- 100% FDI is allowed under the automatic route in the power segment and renewable energy.

Government of India Launched a National Hydrogen Mission for generating hydrogen from green power sources.



Source: As per ibef.org

COP – 26 India Commitments – Panchamrit 3

India will reduce the total projected carbon emissions by 1 Billion tonnes from 2021 to 2030.

India's current CO₂ emissions (2021) are 2.88 Giga Tonne (Gt).

As per CSE's projections based on the median annual rate of change in past decade 2010-2019, India's generation in business as usual scenario will be 4.48 Gt in 2030.

As per this target, India will cut its carbon emission by 1 billion tonne (1 Gt) and therefore, our emissions in 2030 will be 3.48 Gt.

This means that India has set an ambitious goal to **cut its emissions by 22 %**.

India's target and energy plan for 2030 also implies that India will restrict its coal-based energy.

Currently, roughly 60 GW of coal thermal power is under construction and in the pipeline.

According to the CEA, India's coal capacity will be 266 GW by 2030 – which is an addition of 38 GW (which is roughly what is under construction currently).

This means India has stated that it will not invest in new coal TPPs beyond this.

COP – 26 India Commitments – Panchamrit 3

India will reduce the total projected carbon emissions by 1 Billion tonnes from 2021 to 2030.

20 TIMES N

Centre approval for only one coal-fired power plant in 2021

Move Shows 'Phase-Down' Policy Of India

Vishwa Mohan@timesgroup.com

New Delhi: India opted for 'phase-down' coal, instead of phasing it out, during the Glasgow climate summit late last year, and this got truly reflected in the country's move on clearing new coal-fired power plants in 2021 when it gave the green nod to only one such plant — the least since it joined over 185 other nations in approving the Paris Agreement on climate change in 2015.

The analysis of environmental clearance (EC) awarded to 'non-captive' coal-fired power plants in the past seven years, done by environmental research group Legal Initiative for Forest and Environment (LIFE), shows that the country had given green nod

LOSING SHEEN?

Year	EC*	CA**
2015	5	8,900
2016	5	6,360
2017	9	15,300
2018	2	1,520
2019	3	3,860
2020	3	3,060
2021	1	2,400

*EC - Environmental clearance; **CA - Capacity addition in MW. (Source: LIFE)

to five plants in 2015 which increased to as high as nine in 2017, but finally decreased to one last year. It also shows consistent decline in capacity addition since 2019.

"The low number of projects approved clearly reflects that it is becoming difficult to set up new coal-fired power plants. This could be attributed to lack of financing and competition from renewable energy," Ritwick Dutta, environmental lawyer and founder of LIFE, told TOI.

"It is a fact that banks as well as insurance companies are now moving away from

coal-fired power plants due to concerns over climate change, high risk due to social opposition and large number of stranded assets where existing power plants are not able to find takers for the power generated," he said.

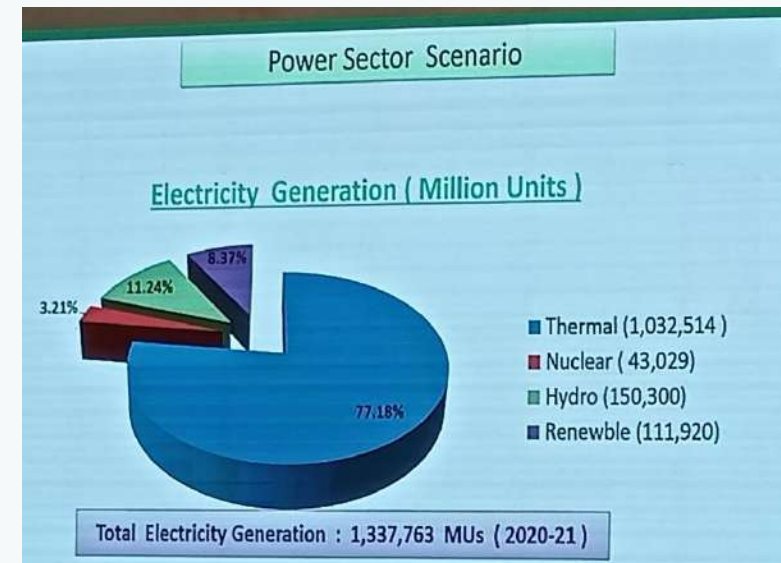
The EC granted to coal-based power plants is a useful indicator to study power generation trends in India. Prior EC is a prerequisite for commissioning construction activities. Such green nod is the foremost requirement for establishment of new as well as expansion of existing coal

power projects.

Since all other required clearances/permissions are processed only on the basis of grant or rejection of the EC to a proposed project, tracking the number and capacity of projects granted clearances gives an accurate picture of upcoming changes in power generation at the planning stage.

LIFE's research, done by its associate analyst Subirajit Goswami, shows that the capacity addition, considering only the 'non-captive' thermal power plant, through the EC was 2,400MW during January-December 2021 compared to 3,060 MW in 2020 and 3,860MW in 2019.

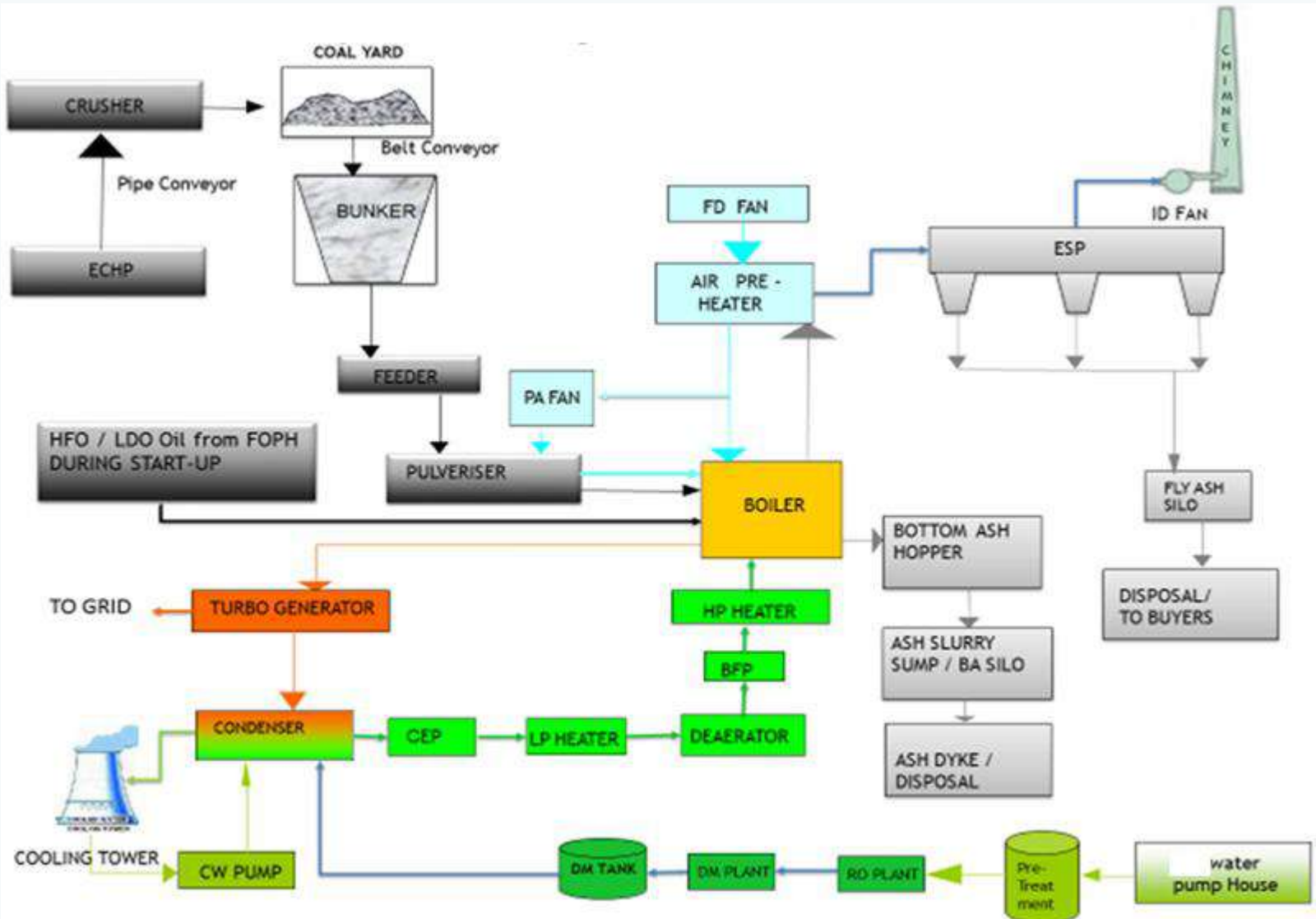
The project got the green clearance in 2021 is 3x800 MW NLC Talabira Thermal Power Project (NTTTP) based on supercritical technology at Kumbhari and Tarekela villages in district Jharsuguda and Thaloid village in district Sambalpur, Odisha by NLC India Ltd (NLCIL).



Environmental Management Systems @ TPPs



Typical Block Diagram of TPP



Air Pollution from TPPs

The main emissions from coal combustion at TPPs are:
CO₂, SO₂, NO_x, PM, CFCc, Hg etc..

CO₂, Methane, and CFCs are Green House Gases.

CO₂

Due to complete combustion of fossil fuel

Increases temperature.
GHG

SO₂

Due to oxidation of sulphur in fuel

Respiratory problems & damage to environment & property

NO_x

Due to incomplete combustion of fossil fuel

Visual & Respiratory problems

PM

Solid particle – burnt or unburnt

Respiratory problems

Air Pollution Norms for TPPs



Ministry of Environment,
Forest and Climate Change
Government of India



Based on various Gazette Notifications Standards for Stack Emissions from TPPs

S. No	Parameters	Norms (in mg/Nm ³)		
		before 31.12.2003	After 01.01.2004 & before 31.12.2016	After 01.01.2017
1.	PM	100	50	30
2.	SO ₂			
	≤ 500 MW	600	600	100
	> 500 MW	200	200	100
3.	NO _x	600	450	100
4.	Hg	0.03 (for units > 500MW)	0.03	0.03

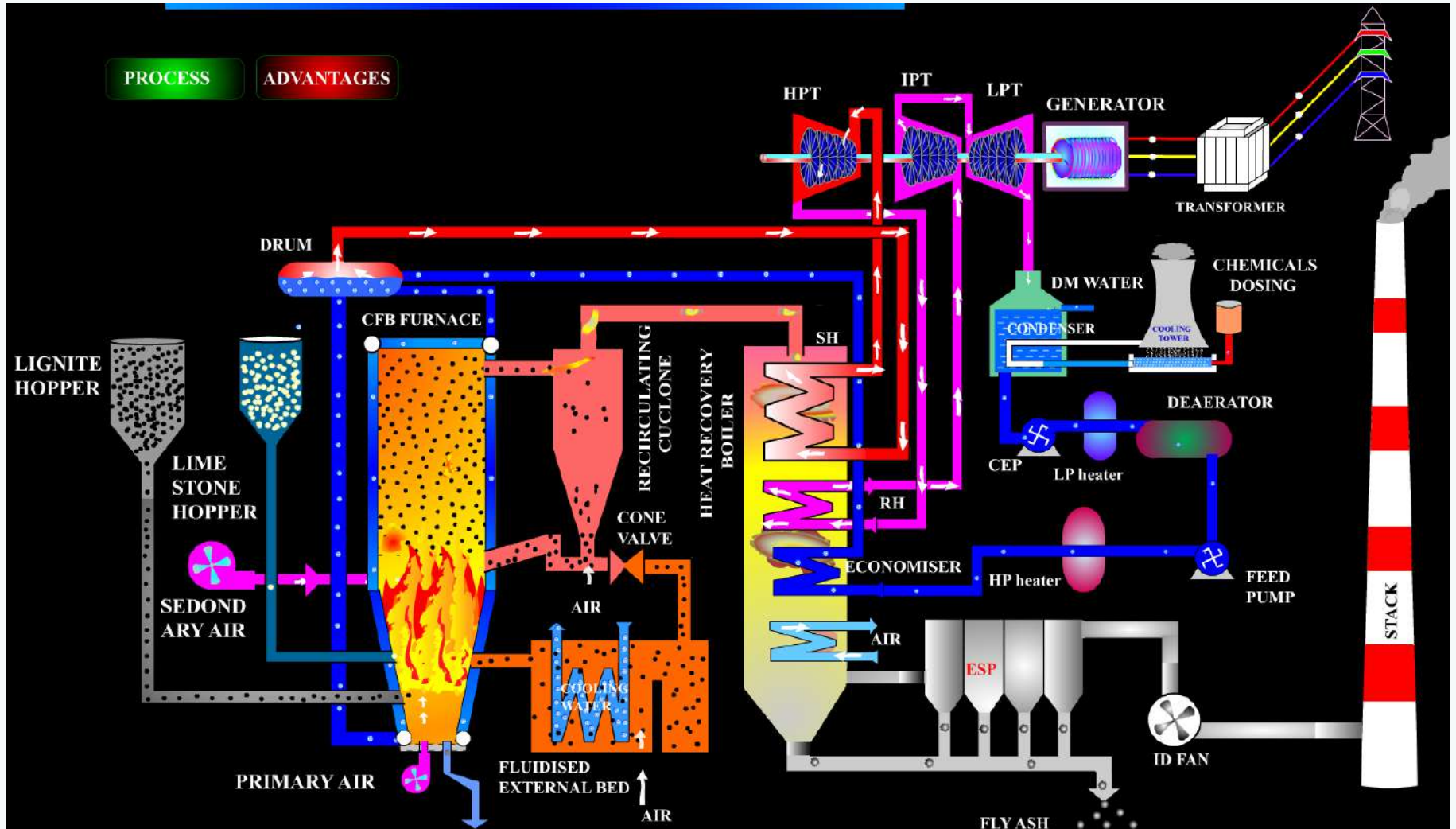
****Note: All Monitored values for SO₂, NO_x and PM shall be corrected to 6% Oxygen on Dry basis.**

Air Pollution Measures in TPPs

- Adopt Cleaner Technologies (like Super Critical / CFBC)
- Alternate fuel source
- Providing Emission reduction / control technologies
- Maintenance of Units
- Monitoring effectiveness

And the most important thing: Create awareness.

Adopting CFBC



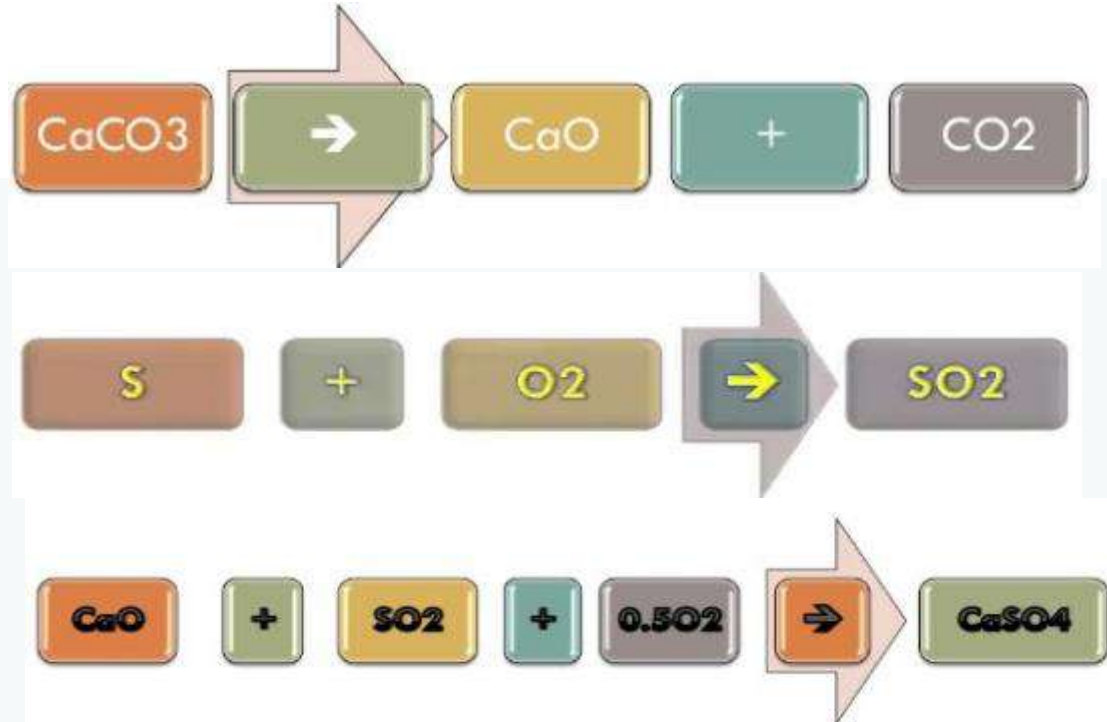
Cleaner Technology CFBC - TPP

- ❑ In FBC boilers operating at $\sim 850^{\circ}\text{C}$, there is an inherent lower production of NO_x auto-matically, as the combustion temperature is low.
- ❑ Even In PF boilers, Flame temperature reduction from 1480-1500 to 1250°C will impact NO_x generation by 10 fold.
- ❑ These boilers also offer a very convenient way of reducing the SO_x emission within the furnace enclosure by the reaction with lime stone
- ❑ This desulfurization is adopted only for coals and other solid fuels with medium to high sulphur.
- ❑ CFBC Boilers keeps an Upper hand on environmental friendliness with cheaper way of De NO_x and De SO_x capabilities.

CFBC – TPP (Low SO₂)

- ❑ Sulphur Capturing in CFBC has been done by adding Limestone (CaCO₃) or dolomite (MgCO₃) along with bed material as sulphur absorbent.
- ❑ The absorbent dosed along with fuel.
- ❑ The Capturing process is done in two different reactions, the reactions are

- ❑ Calcination
- ❑ Sulphation



10 – 15 kg Limestone per
Ton of Coal or Lignite

CFBC – TPP (Low NOx)

Three Kinds of NO_x formed in Combustion Chamber of TPP:

- Fuel NO_x
- Prompt NO_x
- Thermal NO_x

- ❑ **Fuel NO_x** forms when Nitrogen in fuel reacts with oxygen in combustion air.
 - These fuel bound Nitrogen accounts for 50% of total NO_x emission from coal and oil combustion.
- ❑ **Prompt NO_x** results when fuel hydrocarbons break down and recombine with nitrogen in air (this reaction generally takes place before the flame tip).
 - Accounts for 15-20% of total NO_x Emission.
- ❑ **Thermal NO_x** forms when Nitrogen in air reacts with Oxygen along with intense heat. These kind of Nox Rate of formation increases,
 - Exponentially with Temperature
 - And Directly Proportional to Oxygen (O₂) concentration.

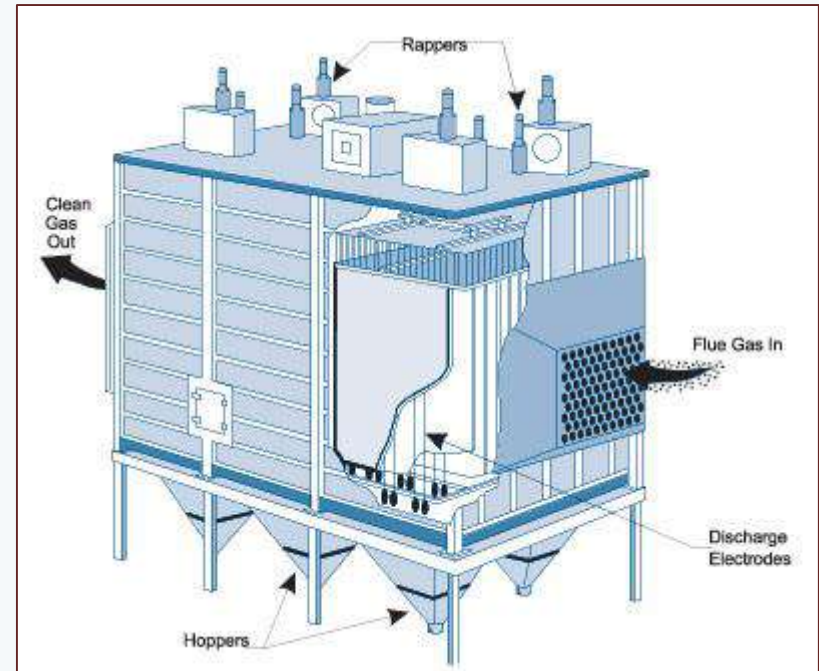
CFBC – TPP (Low NOx)

- ❑ This Fuel NOx then, Largely reduced to Elemental Nitrogen again by the Presence of the strong reducing agents in the form of
 - ❑ Char (C – Carbon) and
 - ❑ CO (Carbon Monoxide) in the bed
- ❑ In CFBC boilers the combustion happens in two stages,
- ❑ The primary Combustion in Furnace bed with primary air and secondary combustion in free board area with Secondary and Tertiary air.
 - ❑ 55 to 60 % in Furnace Bed – Primary Combustion
 - ❑ 40 to 45 % in Free board area - Secondary Combustion
- ❑ Due to this staged combustion, the furnace bed will be in Sub-Stoichiometric conditions, this will increase the active Carbon (char) and Carbon Monoxide (CO) in furnace bed.
- ❑ The Final resulting NOx emission in CFBC will be almost 50% that formed in BFBC boilers.

Air Pollution Measures in TPPs

Electrostatic Precipitator (ESP)

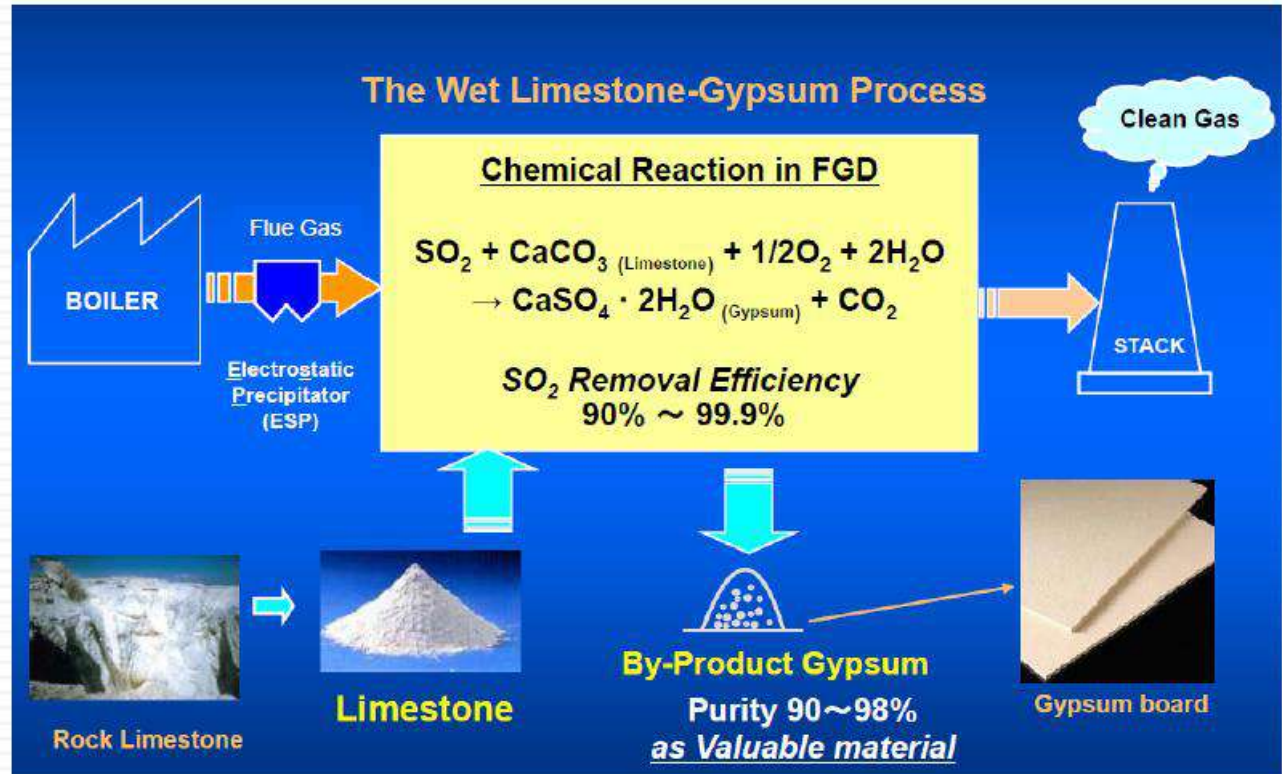
Provided to collect the Fly Ash (PM)
Reduces stress on stack emissions
Designed for efficiency 99% or above
Collected Fly Ash disposed through brick/cement manufactures or mine filling as per guidelines.



Air Pollution Measures in TPPs

Flue Gas Desulphurization

Wet system
Absorption
(Scrubber)
Gypsum
Can be used in
cement
industries



Limestone FGD - Types

	Wet	Semi-Dry	Dry
Characteristics	Slurry or solution → Reactor → Slurry or solution	Slurry or solution → Reactor → Dry powder	Dry powder → Reactor → Dry powder
Main reactor	Wet Scrubber	Semi Dry Reactor	Dry Injector
Application	Large / Medium Scale	Medium / Small Scale	Medium / Small Scale
Agents	Na, Mg, Ca compounds	Na, Mg, Ca compounds	Mg, Ca, Na compounds
Removal efficiency	$\geq 90\%$	$\approx 90\%$	40 – 90 %
Waste water treatment	necessary	unnecessary	unnecessary
Byproduct	Reuse	Landfill	Landfill
Investment cost / operation cost	High/Low	Medium/Medium	Low/High

Other FGD - Types

	Lime(stone) Scrubbing	Magnesium Scrubbing	Sodium Scrubbing	Ammonia Scrubbing
Kind of Chemical	$\text{CaCO}_3, \text{Ca(OH)}_2$	$\text{Mg(OH)}_2, \text{MgCO}_3$	$\text{NaOH}, \text{Na}_2\text{CO}_3$	$\text{NH}_3, \text{NH}_4\text{OH}$
Reactivity	Low	Medium	High	High
Overall Reaction Mechanism	$\text{CaCO}_3 + \text{SO}_2 + 2\text{H}_2\text{O} + \frac{1}{2}\text{O}_2 \rightarrow \text{CaSO}_4 \cdot 2\text{H}_2\text{O} + \text{CO}_2$	$\text{Mg(OH)}_2 + \text{SO}_2 + 11\text{H}_2\text{O} + \frac{1}{2}\text{O}_2 \rightarrow \text{MgSO}_4 \cdot 12\text{H}_2\text{O}$	$\text{NaOH} + \text{SO}_2 \rightarrow \text{Na}_2\text{SO}_3$	$2\text{NH}_3 + \text{SO}_2 + 2\text{H}_2\text{O} \rightarrow (\text{NH}_4)_2\text{SO}_4$
Phase of Product	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ (Solid)	$\text{MgSO}_4 \cdot 12\text{H}_2\text{O}$ (Slurry)	Na_2SO_3 (Solution)	$(\text{NH}_4)_2\text{SO}_4$ (Solid)
Scale Potential	High	Medium	Low	Medium
Application	Power Plant	Small Power Plant	Industrial Boiler	Power Plant
Removal Efficiency	> 90 %	> 90 %	> 95 %	> 95 %
Waste Water System	Small	Big	Big	Small
Capital Cost	High	Medium	Low	Higher than Lime
Operation Cost	Low	Medium	High	Medium

Flue Gas Desulphurization (FGD)

MOEF&CC notification dated 31.03.2021

Thereafter, MOEFF&CC notified G.S.R.243(E) dtd.31.03.2021, that the emission compliance would mean all the plant emission norms (2015) for PM/SO₂/NO_x are to be met by the specified timeline as per Category, A,B or C, any deviation in the above norms beyond the timeline would be liable for the levy of emission compensation (EC).

S.No.	Category	Location/Area	Timeline for Compliance	
			Non retiring Units	Retiring Units
(1)	(2)	(3)	(4)	(5)
1	Category A	Within 10 km radius of National Capital Region or cities having million plus population.	Upto 31st December 2022	Upto 31st December 2022
2	Category B	Within 10 km radius of Critically Polluted Areas or Non-attainment cities.	Upto 31st December 2023	Upto 31st December 2025
3	Category C	Other than those included in category A and B	Upto 31st December 2024	Upto 31st December 2025

FGD – Chemical Equations

The chemical equation pertaining to most prevalent Wet limestone FGD, DSI FGD and Sea water FGD technology are given as under for reference:

i. Wet lime FGD technology



ii. Dry Sorbent Injection (DSI) FGD technology



iii. Seawater FGD technology



New Dimension for Emission Norms

Plant Location Specific Emission Standards

Based on the ambient air quality data received from various power stations, air quality data published by CPCB, satellite images of atmospheric SO₂ from NASA and study conducted by IIT Kanpur.



Flue Gas Desulphurization (FGD)

Way Forward

- It is suggested that category C units timeline may be spread in four years i.e. 2028, 2029, 2033 & 2034 according to their distance from million plus city/critically polluted area/ Non Attainment city or on the basis of SO₂ level in ambient air. This will help in understanding the performance of the emission control equipment, their effectiveness and give a time for course of correction.
- Study may be conducted on SO₂-reduction against CO₂ increase in flue gas emission by FGD system including increase of pollution due to mining, transportation of limestone & gypsum. Accordingly exemption may be given to few thermal power plants where SO₂ level in ambient air is very less compared to permissible limit.
- A Task Force may be constituted comprising representative of MOP, MOEF&CC, NITI Aayog, CEA, CPCB, Utilities/Contractors/Manufacturers, they may review the category or create separate category for controlling SO₂ emission from chimney for smooth implementation of new environment norms considering phased manufacturing program of FGD equipment under Atma Nirbhar Bharat.

Air Pollution Measures in TPPs

Stockpile Dust Suppression system



Air Pollution Measures in TPPs

Dry Fog Dust Suppression system



Where provided ?

- Top of over ground bunker
- Crusher and Screen House
- Junction Tower
- Boiler Bunker House

Air Pollution Measures in TPPs



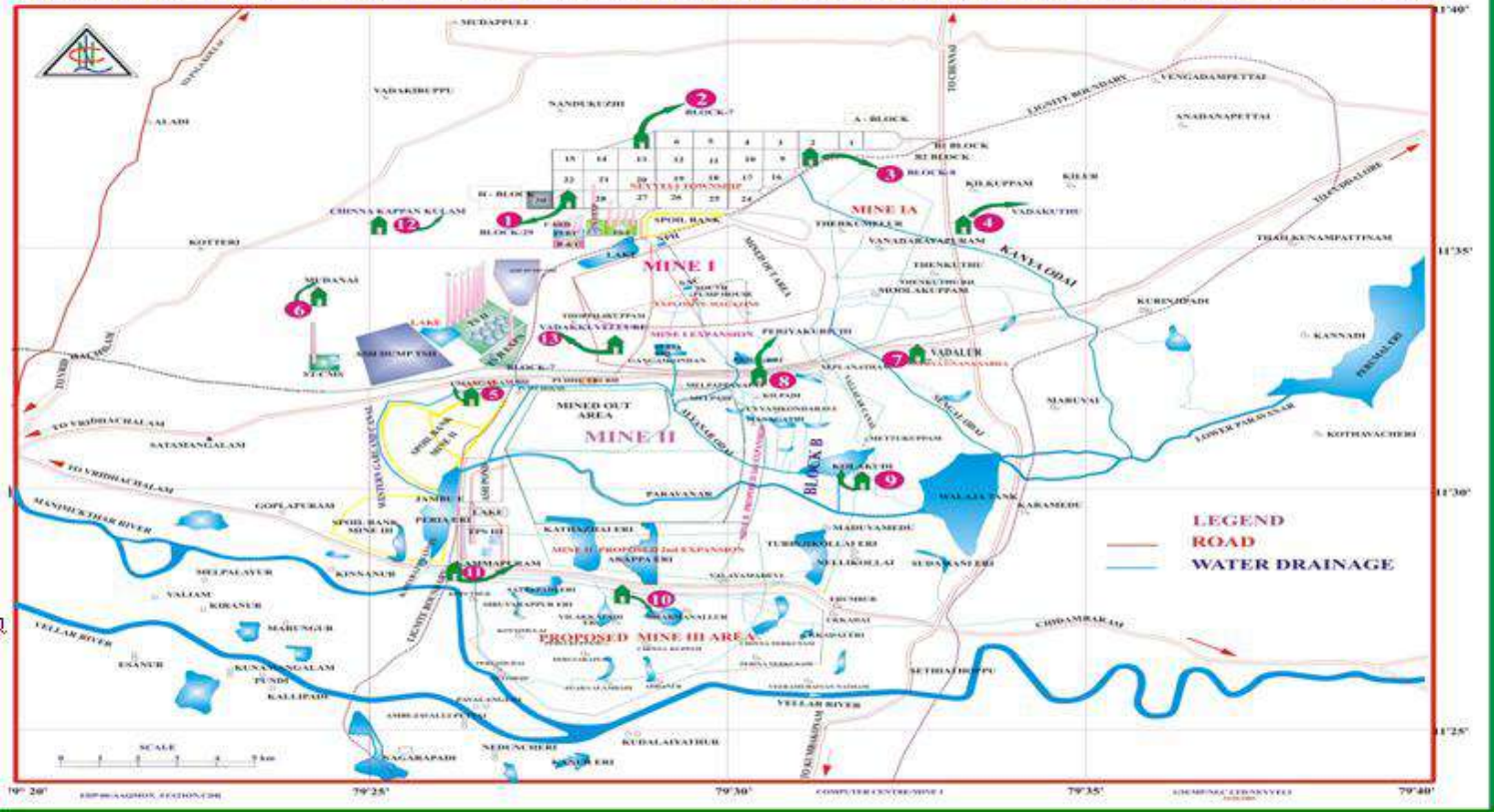
Air Quality Monitoring in TPPs

Ambient Air Quality Monitoring

NLC'S AMBIENT AIR QUALITY MONITORING STATIONS IN AND AROUND NEYVELI

Locations

1. Block-29
2. Block-6
3. Block-8
4. Vadakuthu
5. Umangalam
6. Mudanai
7. Vadalur
8. Periyakurichi
9. Kolakudi
10. Sathapadi
11. Kammapuram
12. Chinna kappankulam
13. Vadakuvellure



Air Quality Monitoring in TPPs

Air Emission connectivity with CPCB

The screenshot shows the CPCB online emission monitoring interface for NEYVELI LIGNITE CORPORATION LIMITED. The dashboard displays the following data:

Parameter	Value (mg/Nm ³)	Diagnostic Status	Time	Prescribed Standard (mg/Nm ³)
PM	50.8	Good	Sep 14, 2020 1:45:00 PM	100
SO ₂	2000.5	Good	Sep 14, 2020 1:45:00 PM	500
CO	-100	Good	Sep 14, 2020 1:45:00 PM	-

The dashboard also features a graph for PM, an SMS communication status (12 messages communicated in the last 7 days), and a 'Submit Response' button. The interface is accessed via a web browser at cpcbtdms.nic.in/industry-status?id=3839&st=live.

Air Pollution Measures in TPPs

Digital Display board at the main gate



National Ambient Air Quality Standards

Pollutant	Time Weighted Average	Concentration in Ambient Air	
		Industrial, Residential, Rural and Other Areas	Ecologically Sensitive Area (notified by Central Government)
Sulphur Dioxide (SO ₂), µg/m ³	Annual*	50	20
	24 hours**	80	80
Nitrogen Dioxide (NO ₂), µg/m ³	Annual*	40	30
	24 hours**	80	80
Particulate Matter (size less than 10 µm) or PM ₁₀ µg/m ³	Annual*	60	60
	24 hours**	100	100
Particulate Matter (size less than 2.5 µm) or PM _{2.5} µg/m ³	Annual*	40	40
	24 hours**	60	60
Ozone (O ₃) µg/m ³	8 hours*	100	100
	1 hour**	180	180
Lead (Pb) µg/m ³	Annual*	0.50	0.50
	24 hours**	1.0	1.0
Carbon Monoxide (CO) mg/m ³	8 hours*	02	02
	1 hour**	04	04
Ammonia (NH ₃) µg/m ³	Annual*	100	100
	24 hours**	400	400
Benzene (C ₆ H ₆) µg/m ³	Annual*	5	5
Benzo(a)Pyrene (BaP)- particulate phase only, ng/m ³	Annual*	1	1
Arsenic(As), ng/m ³	Annual*	6	60
Nickel (Ni), ng/m ³	Annual*	20	20

Note:

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Question on Air Pollution?

Name the disease caused by the bacterium lives in air conditioning systems / cooling towers.....

- A. Leptospirosis
- B. Legionnaires
- C. Tetanus
- D. Hepatitis



Question on Air Pollution?

Name the disease caused by the bacterium lives in air conditioning systems / cooling towers.....

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Question on Air Pollution?

Inhalation of Coal / Lignite dust may lead to

- A. Fibrosis
- B. Pneumoconiosis
- C. Byssinosis
- D. Leptospirosis



Question on Air Pollution?

Inhalation of Coal dust may lead to

- A. Fibrosis
- B. Pneumoconiosis**
- C. Byssinosis
- D. Leptospirosis



Water Pollution Norms / Standards



Water Pollution Measures in TPPs



**Ministry of Environment,
Forest and Climate Change**
Government of India



Based on various Gazette Notifications

S. No	Parameters	MoEF & CC / CPCB Norms
<u>Sewage Discharge Standards</u>		
1.	pH	6.5 – 9.0
2.	TSS	≤ 100 mg/L
3.	BOD	≤ 30 mg/L
4.	COD	≤ 250 mg/L
5.	Ammonical Nitrogen	≤ 50 mg/l
<u>Effluent Discharge Standards</u>		
1.	pH	5.5 – 9.0
2.	COD	≤ 250 mg/L
3.	TSS	≤ 100 mg/L
4.	Oil & Grease	≤ 10 mg/L

Water Pollution Measures in TPPs



**Ministry of Environment,
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Government of India



Based on various Gazette Notifications

Standards for Water Consumption for TPPs

S. No	Type / Year of Commissioning	Norms (m³/MWh)
1.	Plant with Once Through Cooling (OTC) & Existing Plants (before 31 st Dec'2016)	3.5
2.	Installed after 1 st January 2017 (should achieve zero liquid discharge - ZLD)	3.0

Water Pollution Measures in TPPs

Water Management

1. Specific Water Consumption

- Control of Water usage
- Improving Cycle of Concentration (Re-use) by dosing
- Reducing water losses



2. Sewage treatment plant
3. Effluent treatment plant
4. Quantification of Water & treated water

Effects of Water Pollution

- Cadmium causes Itai Itai disease
- Mercury causes Minamata disease
- Microorganisms causes diseases like dysentery, diarrhoea
- Excess nutrients cause eutrophication

↓
Decreases dissolved oxygen concentration

↓
Affects aquatic life



Itai Itai disease



Minamata disease

Question on Water Pollution?

Exposure to oil or oily water for a long time may lead to occupational disease called

- A. Minamata
- B. Itai Itai
- C. Acne
- D. Cirrohsis



Question on Water Pollution?

Exposure to oil or oily water for a long time may lead to occupational disease called

- A. Minamata
- B. Itai Itai
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Noise Quality Norms / Standards



The Environment (Protection) Rules'1986



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¹[SCHEDULE III]

(See rule 3)

AMBIENT AIR QUALITY STANDARDS IN RESPECT OF NOISE

Area Code	Category of Area	Limits in dB(A) Leq.	
		Day Time	Night Times
(A)	Industrial Area	75	70
(B)	Commercial Area	65	55
(C)	Residential Area	55	45
(D)	Silence Zone	50	40

Note :

1. Day time is reckoned in between 6 a.m. and 9 p.m.
2. Night time is reckoned in between 9 p.m. and 6 a.m.
3. Silence zone is defined as areas upto 100 meters around such premises as hospitals, educational institutions and courts. The Silence zones are to be declared by the Competent Authority.

Use of vehicular horns, loudspeakers and bursting of crackers shall be banned in these zones.
4. Mixed categories of areas should be declared as one of the four above mentioned categories by the Competent Authority and the corresponding standards shall apply.

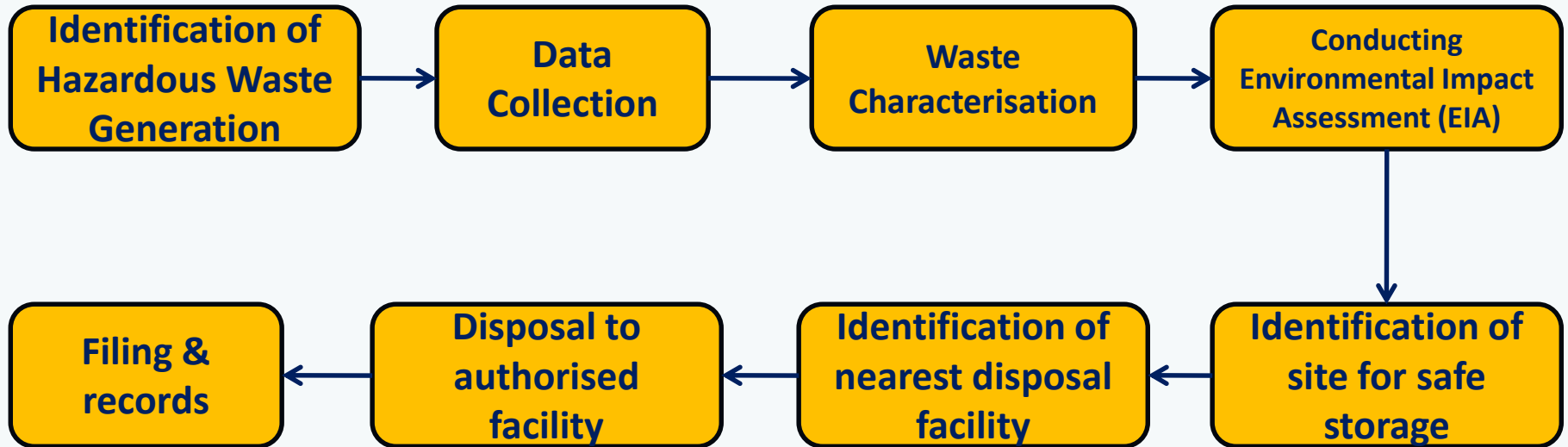
Hazardous Waste Disposal Norms



The Hazardous Wastes (Management And Handling) Rules 1989, 2000, 2008, 2016

Hazardous Waste	Category as per HWM Rules	Disposal Option		
Asbestos roof sheets for temporary sheds Asbestos Cloth / Thermal Insulation Asbestos Rope	15.1	Handover to Pollution Control Board Authorized Disposal Facility	Ion Exchange Resin	35.2 Handover to Pollution Control Board Authorized Co-Processor or Disposal Facility
Transformer Oil with Polychlorinated Biphenyls (PCB)	5.1	Removal of PCB through Central Power Research Institute and recycling of treated oil through Pollution Control Board authorized recycler	Oil Soaked Cotton Waste	5.2 Handover to Pollution Control Board Authorized Co-Processor or Disposal Facility
Industrial Used Oil / Waste Oil	5.1	Handover to Pollution Control Board Authorized Recycler or Disposal Facility	Expired Glues, Paints, organic cements, adhesive & resins	23.1 Handover to Pollution Control Board Authorized Disposal Facility
Fuel Oil Residue / Sludge	4.1	Handover to Pollution Control Board Authorized Disposal Facility	Oil and grease skimming	35.4 Handover to Pollution Control Board Authorized Disposal Facility
LDO Residue / Sludge	4.1		Sludge from waste water Treatment / Effluent Treatment Plant	35.3 Handover to Pollution Control Board Authorized Disposal Facility
Waste / Spent Oil and Barrels Chemical Contaminated Barrels Paint Tins / Containers DPT Containers	33.1	Handover to Pollution Control Board Authorized Disposal Facility		

The Hazardous Wastes (Management And Handling) Rules 1989, 2000, 2008, 2016





TAMIL NADU POLLUTION CONTROL BOARD

ONLINE HAZARDOUS WASTE MANIFEST APPLICATION



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TNPCB - Online Manifest Application



FLY ASH MANAGEMENT

Recent Regulatory Developments

Summary of Ash Generation and Utilization -2020-21 - CEA

Data received from Thermal Power Stations : 202
Installed capacity (MW) : 209990.50

Coal consumed (Million tonnes) : 686.34

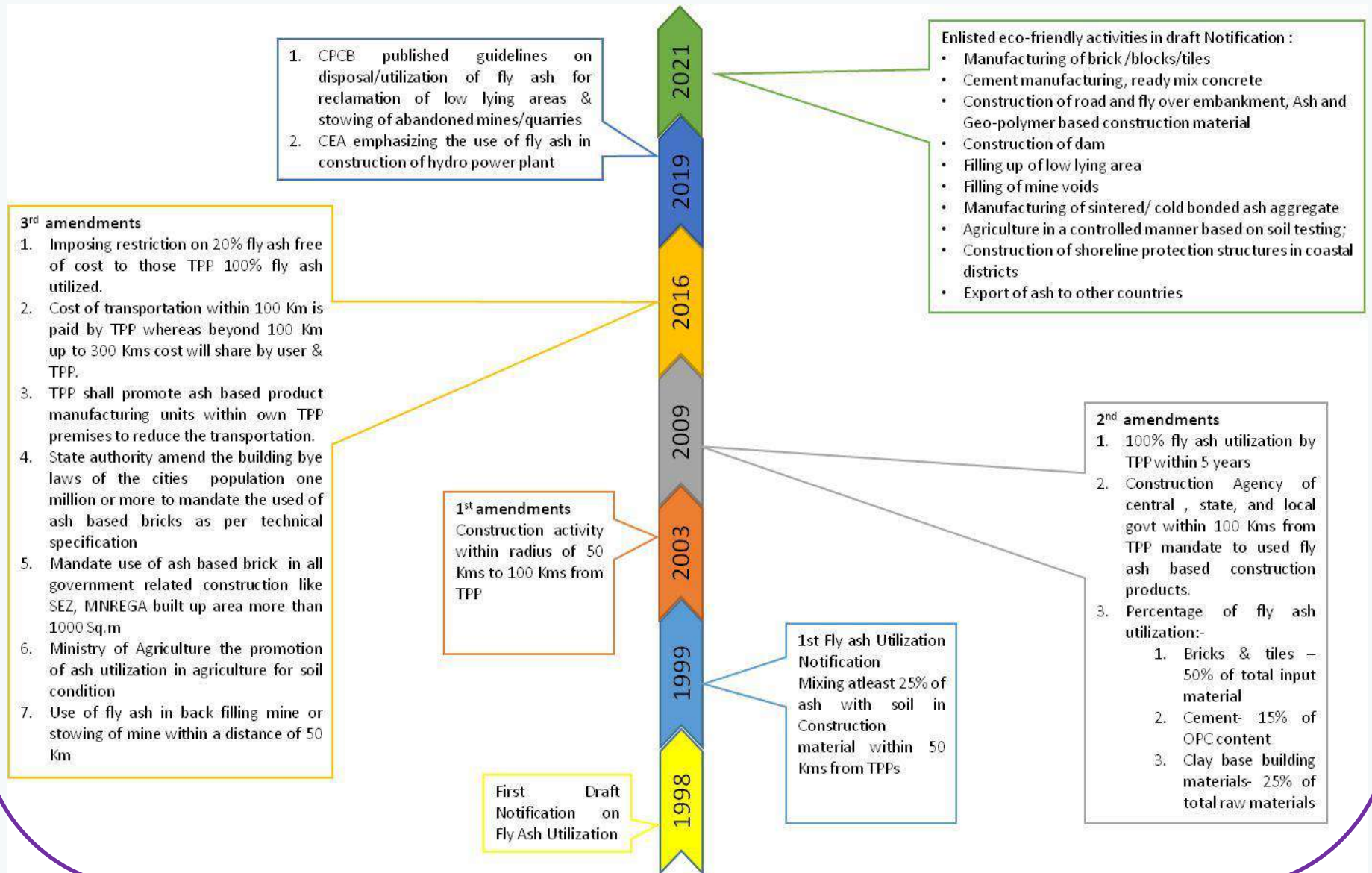
Fly Ash Generation (Million tonnes) : 232.56

Fly Ash Utilization (Million tonnes) : 214.91

Percentage Utilization : 92.41

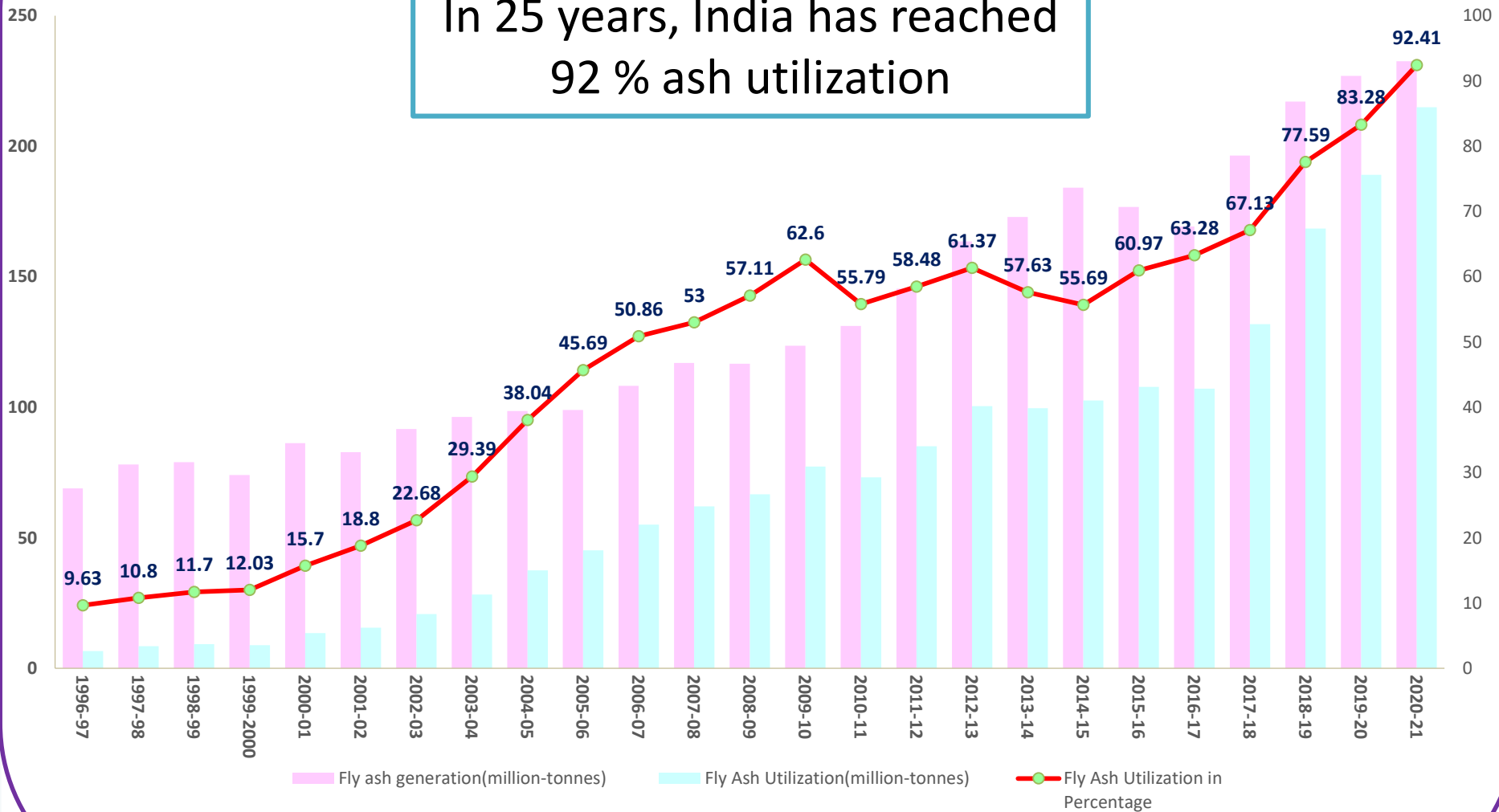
Percentage Average Ash Content (%) : 33.88

FLY ASH DISPOSAL – MoEF Notifications



FLY ASH Utilization – 1996 to 2021

In 25 years, India has reached 92 % ash utilization



https://cea.nic.in/wp-content/uploads/tcd/2021/09/Report_Ash_Yearly_2020_21.pdf

Fly Ash Dykes Breaches



Rihand Reservoir on 07.08.2019 and 06.10.2019

Six people died in Sasan Ultra Mega Power Project in Singrauli, Madhya Pradesh on April 15, 2020

Fly ash slurry from NTPC Lara TPP in Chattisgarh flew over 9 hours on Nov 23, 2020 into Sukhanara nallah and entered near by agriculture fields.

On June 15, 2021 from NTPC, Korba

ACB India, North Chennai, Vindhyachal, Essar, Talchar, Bokaro, Khaparkheda, Koradi

Fly Ash Notifications & Amendments



**Ministry of Environment,
Forest and Climate Change**
Government of India



New Delhi, the 22nd April, 2021

The ash generated from coal or lignite based Thermal Power Plants (TPP) shall be utilised only for the following eco-friendly purposes:

- I. **Manufacturing of brick /blocks/tiles;**
- II. **Cement manufacturing, ready mix concrete;**
- III. **Construction of road and fly over embankment, Ash and Geo-polymer based construction material;**
- IV. **Construction of dam;**
- V. **Filling up of low lying area;**
- VI. **Filling of mine voids;**
- VII. **Manufacturing of sintered/ cold bonded ash aggregate;**
- VIII. **Agriculture in a controlled manner based on soil testing;**
- IX. **Construction of shoreline protection structures in coastal districts;**
- X. **Export of ash to other countries;**
- XI. **Any other eco-friendly purpose as notified from time to time.**

Fly Ash Notifications & Amendments



**Ministry of Environment,
Forest and Climate Change**
Government of India



New Delhi, the 22nd April, 2021

4. Every coal/lignite based thermal power plant shall be responsible to utilise 100% ash (fly ash and bottom ash) generated during that year. However, in no case shall utilisation fall below 80 % in any year. Also, it should achieve average ash utilisation of 100% in a 3 year cycle.

Provided the three year cycle applicable for the first time is extendable by one year for the Thermal Power Plants where ash utilisation is in the range of 60-80%, and two years where ash utilisation is below 60%. For the calculation of percentage of ash utilisation, the percentage quantity of utilisation in the year 2021-22 shall be taken into account. The same has been detailed in the table below:

Utilisation percentages of Thermal Power Plants	First compliance Cycle to meet 100% utilisation	Second compliance cycle onwards, to meet 100% utilisation
>80%	3 years	3 years
60-80%	4 years	3 years
<60%	5 years	3 years

Fly Ash Notifications & Amendments



**Ministry of Environment,
Forest and Climate Change**
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New Delhi, the 22nd April, 2021

5. Unutilized accumulated ash i.e. legacy ash, which is stored before the publication of this Notification, shall be utilized progressively by the TPPs in such a manner that the utilization of legacy ash shall be completed fully within 10 years from the date of publication of this Notification. This would be over and above the utilisation targets prescribed for ash generation through current operations of that particular year.

Provided the minimum quantity of legacy ash in percentages as mentioned below shall be utilised during the corresponding year. The minimum quantity of legacy ash is to be calculated based on the annual ash generation as per installed capacity of TPP.

Year from date of publication	1 st	2 nd	3 rd -10 th
Utilisation of legacy ash (in percentage of Annual ash)	At least 20%	At least 35%	At least 50%

Provided the legacy ash utilisation is not required where ash pond/dyke has stabilised and the reclamation has taken place with greenbelt/plantation. Concerned State Pollution Control Board shall certify in this regard. Stabilisation and reclamation of an ash pond/dyke including certification by CPCB/SPCB shall be carried out within a year from the date of publication of this Notification. The ash remaining in all other ash ponds/dykes shall be utilised in progressive manner as per the above mentioned timelines.

The obligations under Para A(4) and A(5) above for achieving the ash utilisation targets shall be applicable from 1st April, 2022.

Fly Ash Notifications & Amendments



Battery Waste Management

To control the hazard associated with backyard smelting and unauthorized reprocessing of lead acid batteries.

- Battery manufactures, importers, assemblers and re-conditioners → **BuY BackK policy**
- Appropriate manufacturing technology, pollution prevention systems and suitable arrangements for waste disposal
- Importers of new batteries, dealers and organization auctioning used batteries are also under the purview of these rules.
- Only Re-processors registered with MOEF would be able to participate in sale by auction or contract. → **middlemen and backyard smelters are debarred from participation in any auction** within the country

E - Waste Management

- Mobile Phones, Tablets, Laptops , Desktops, TVs
- Printer, Scanners, DVD players, Speakers, Cameras
- Household appliances viz. Microwave, Oven, Toaster, Mixer Grinder, refrigerator, Washing Machines, ACs
- Accessories: Chargers, Earphones, Cables , Inverter Batteries, Stabilizer, UPS, CDs, Cassette, Floppy Disks



E-Waste (Management) Rule '2018

E- Waste Recycling



E- Waste Recycling

Used electronic devices have been recycled in a nationwide effort to produce the Olympic medals for the Tokyo 2020 Games. The project plans to set a precedent for future Olympic Games. The theme of **“Be better, together – for the planet and the people”** attracted donations and support from across Japan.

Project in numbers

Collection period

From 1 April 2017 to 31 March 2019

Amount of devices collected

Approx. 78,985 tons collected by municipal authorities across Japan (used small electronic devices including mobile phones).

Approx. 6.21 million used mobile phones collected by NTT Docomo shops across Japan.

Final amount of metals collected

Gold: Approx. 32kg

Silver: Approx. 3,500kg

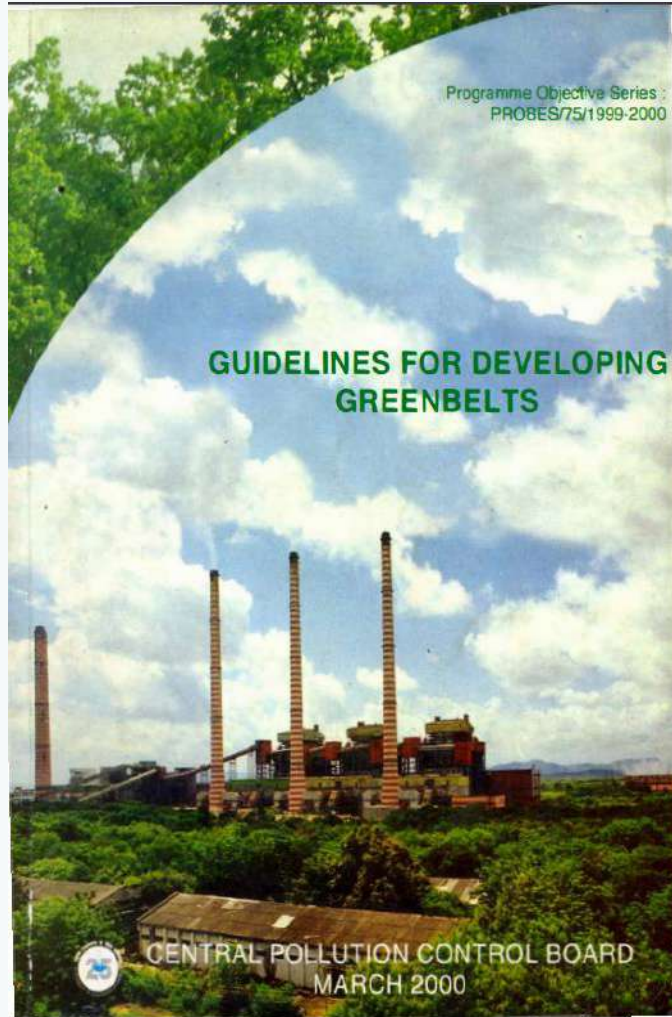
Bronze: Approx. 2,200kg

Participating municipalities

1,621 municipalities, 90% of the 1,741 wards/cities/towns/villages nationwide participated

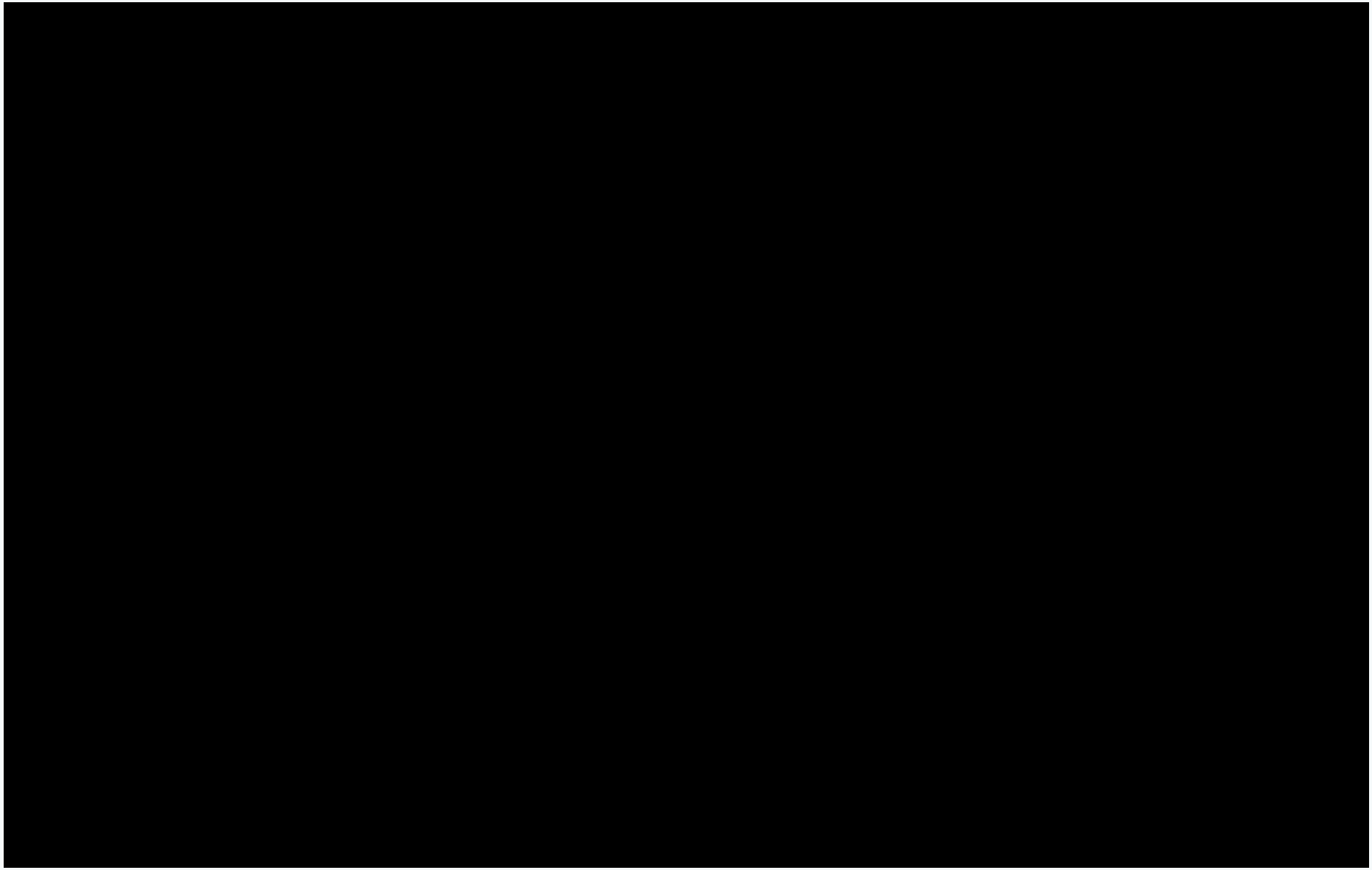


Greenbelt Development Norms



- Green belt is to be provided all around the power station boundary by planting trees and the total green area including landscaping area will be 1/3rd (about 33%) of the plant area.
- The density of Trees must be 1500 – 2000 Trees per Hectare.
- Follow the guidelines for Greenbelt Development issued by Central Pollution Control Board in March'2000.

NLCIL – A Green Paradise



Questions & Discussion...

We can make a difference



**Thank
You**

