



# **REDUCING CO<sub>2</sub> FOOTPRINTS OF INDIA'S COAL-BASED POWER**

**Policies for Clean  
Coal Power**

**Centre For Science and Environment  
Industrial Pollution Control Unit**



Centre for Science and Environment

# Why discuss coal?

- Coal use; and the world's dependence on it for powering its energy needs is major contributor to climate change
- Coal use in power plants and its use in millions of industrial boilers is major contributor to toxic air pollution
- It is clear that use of coal for energy must be eliminated immediately in the industrialised world – where it still continues to be used; and phased out in our world
- No question about this

# Our position: coal

We need an energy transformation; clean – for co-benefits of local and global emissions

We need the **right to energy** for all as energy poverty and inequity is not acceptable. Requires affordable sources of energy

- Given this imperatives the following:

A. Meet the 2015 emission standards in all coal power plants as per the deadline (2022)

B. Use a first run strategy to incentivize clean coal power to see energy

C. Ban/switch use of coal in individual boilers – move to gas or electricity

D. Ramp up the RE targets; not just for grid based energy but also for decentralized sources

E. Given that current coal power plant are already working far below capacity (PLF) and are expected to be curtailed even further; do not invest in new coal power plants (last few years capacity addition and commissioning is much below than past); needs to stay like this

But all this done, recognize that coal is still part of India's power needs in this decade – so what can we do to ensure that it can be more efficient and reduce GHG emissions – CO<sub>2</sub>



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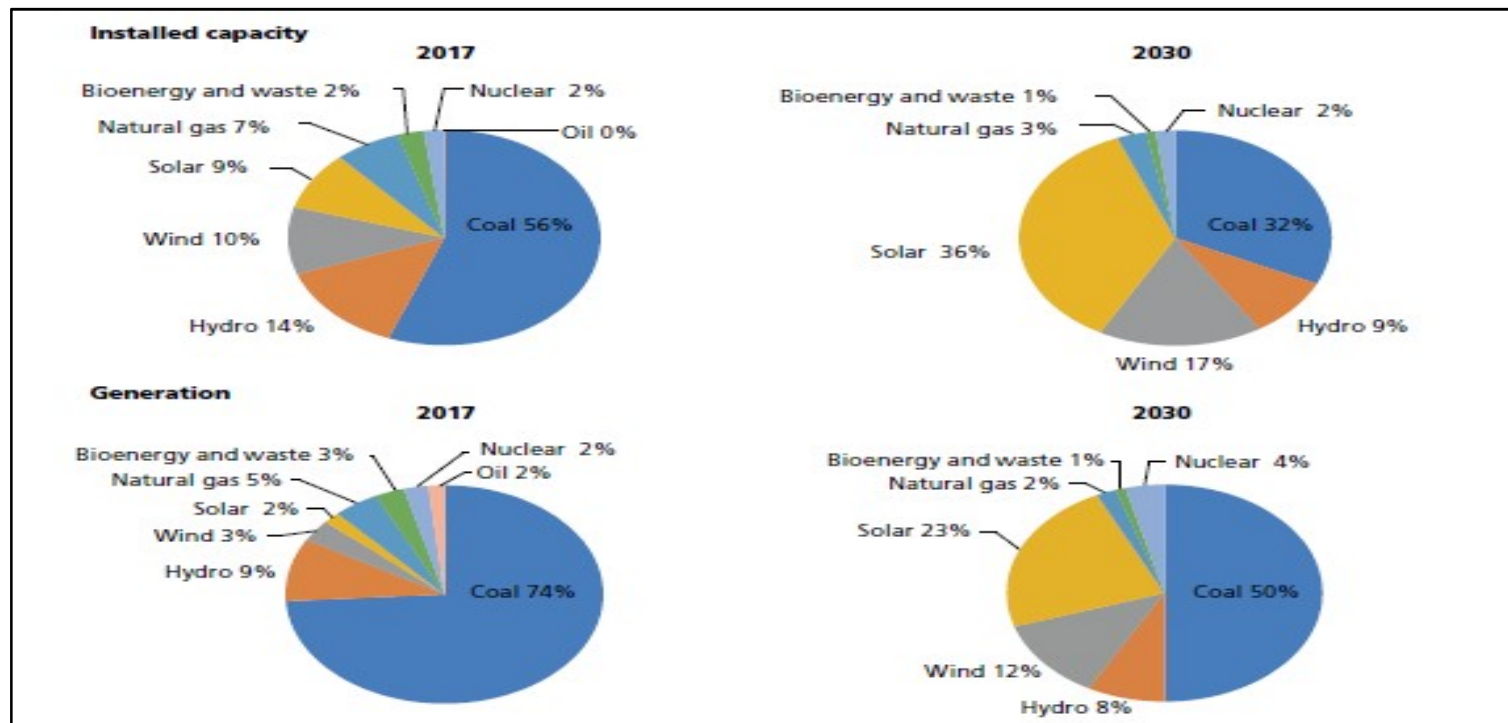
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# Coal Power: Largest contributor in CO2 emissions

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- In India, carbon dioxide (CO2) emissions from the coal-power sector have risen, from 500 million tonnes in 2005 to 1,000 million tonnes in 2015 (CSE calculation based on data).
- MoEF&CC; India generated 2600 million tonnes CO2 equivalent (2014); other recent estimate 3100 million (CO2 eq) (WRI).
- **Based on this, coal-power plants contribute contribute:**
  - Roughly one-third of India's GHG emissions,
  - 50 per cent of the country's fuel-related CO2 emissions.
- **Massive opportunity to de-carbonize – but is it possible?**

# CEA estimate: COAL will remain the king even in 2030



- Aggressive RE targets crucial
- In 2030 estimated by CEA that RE will meet 40% of electricity generation; coal will be down from 74% in 2017 to 50% in 2030. This is massive
- But coal will still be 50%.
- Decarbonizing coal is crucial. How?

# Fleet is young, need to operate it efficiently

- Our advantage:
  - Around 64 per cent (132 GW) of capacity is less than 10 year old
  - Only about 16 per cent (33 GW) is older than 25 years.

## Age distribution of India's coal fleet

*Small and subcritical capacity has a large share in the country's CO<sub>2</sub> emissions*

Capacity	Vintage (years)					Capacity (GW)	Plant load factor (per cent)	Specific CO <sub>2</sub> emissions (kg/kWh)	Annual CO <sub>2</sub> emissions (million tonnes)
	> 35	26–35	16–25	3–15	0–2				
Up to 250	9	16.15	12.95	20.78	1.95	60.83	50	1.19	317.06
> 250 and < 500 MW	0	0	0.6	14.71	2.67	17.98	50	1.05	82.69
500 MW and < 650 MW	0.5	7	7	55.29	1.7	71.49	65	1	407.06
650 MW and above (supercritical)	0	0	0	38.39	16.16	54.55	70	0.85	284.33
650 MW and above (ultra-supercritical)					1.3	1.3	70	0.75	5.98
Advance ultra-supercritical							0		
Total	9.5	23.15	20.55	129.17	22.48	206			1,097.11

Source: CSE 2020

# We need policies for **decarbonizing** coal power

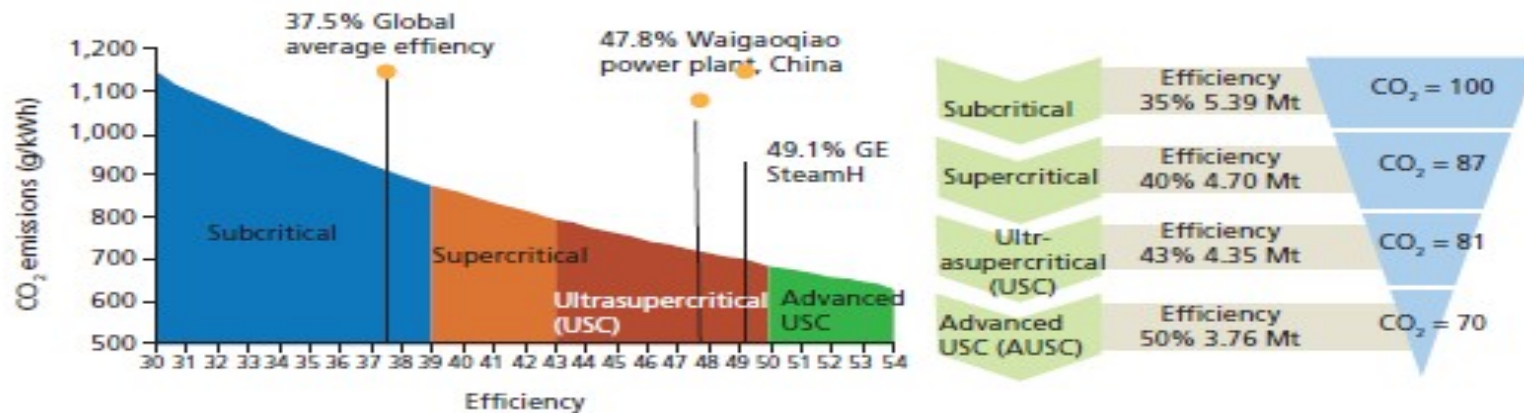
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## What needs to be done:

1. Fleet technology and efficiency
2. Plan for old capacity
3. Renovation and modernization plan for improvement of efficiency
4. Biomass co-firing
5. Coal beneficiation
6. Carbon capture and storage (CCS)
7. Other Incentives/mechanism to improve efficiency

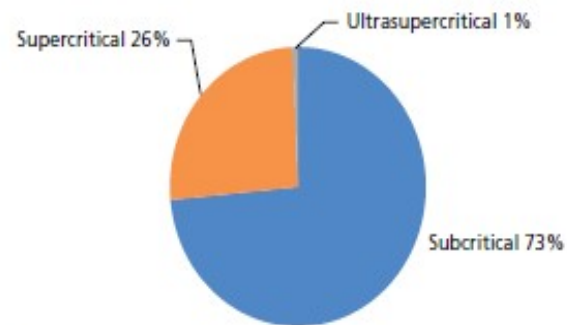


# 1. Fleet Technology and Efficiency

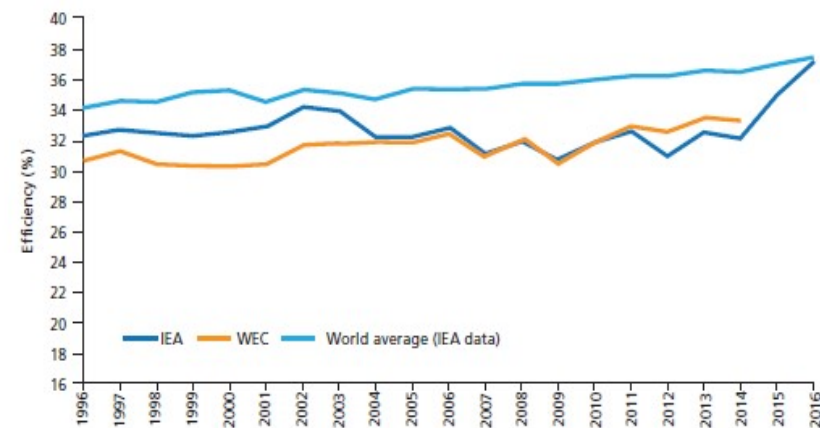


Source: IEA, 2020

Less than one-third of the capacity is supercritical



Source: CSE analysis



Source: IEA, 2020

- 1% increase in efficiency ~ 2-3% decrease in CO<sub>2</sub> emission
- Need roadmap for advance coal technology for new fleet

# New fleet must be ultra or more

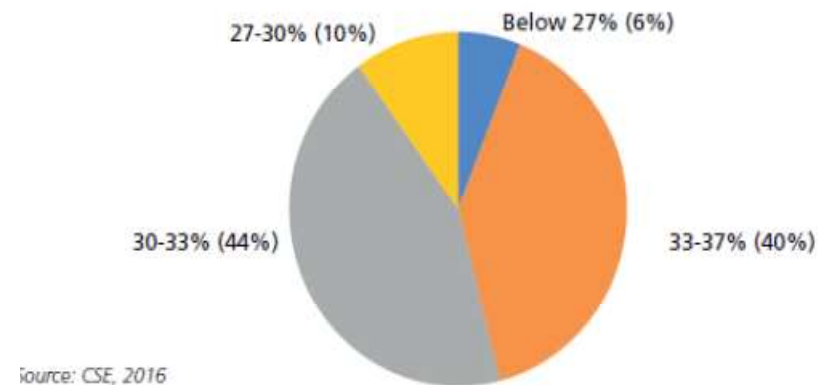
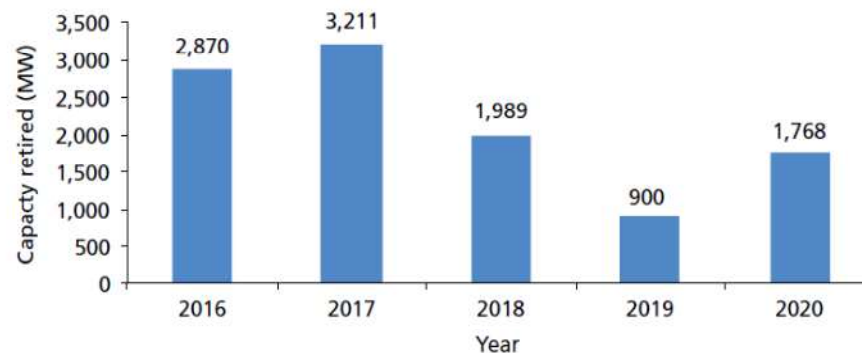
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- In this decade India will increase coal based capacity from 205 GW to 266 GW (CEA estimates)
- India will be building more (thought at lesser growth rate) and India will be retiring old plants
- The opportunity is to ensure that all TPPs are ultra-critical or advance ultra-supercritical. The cost increase is marginal, but the advantage is that we will be much more resource efficient and emission efficient.

## 2. Plan for old capacity

- In 2015, CEA identified 34.2 GW of capacity which is more than 25 years old; **60% of it was highly inefficient**
- Retirement strategy is inadequate: we have continuously missed our retirement targets
- In 2018, the NEP included a new target for the closure of 48.3 GW by 2027

*On an average, 1–2 GW capacity is retired every year. At that pace, India will not be able to retire the targeted 48 GW capacity by 2027*



Source: CSE, 2016

## 2. Plan for old capacity

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- Need deliberate plan for the old plants
- It is difficult to 'retire' plants; they have coal-linkage; have employee; have land and most importantly environmental clearance
- But need a plan for the aged plants – most polluting and most resource inefficient
- Plan must be to refurbish plants with co-firing of biomass or to work on other fuels for power generation – gas, waste etc

### 3. Renovation & Modernization

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- GOI policy on modernization needs to be implemented
- Need to maintain efficiency of young fleet (130 GW); will operate for next 15-20 years.
- But today, India's TPP is working at low plant load factor and it is estimated that in the future the PLF will go down because of increased generation from RE.
- Part load operation will impact efficiency; Increase efficiency through automation and better plant management.
- Support modification required for biomass co-firing

## 4. Biomass Co-firing: Win-Win for Power and Farmers

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- Multiple benefits- Eliminate stubble burning, replace coal, improve farmer income.
- Currently, about 230 power and combined heat and power plants using co-firing techniques
- Co-firing projects in coal-fired power plants getting wider attention than dedicated biomass plants
- Offers an advantage to developing countries since the use of agricultural residue will increase the economic value of this sector.
- CEA advisory to use 5–10 per cent blend of biomass pellets, primarily from agro-residue.
- NTPC has successfully demonstrated co-firing of 7-10 per cent blend of biomass pellets with coal at its Dadri power plant.

## 5. Carbon Capture and Storage-Below Expectation

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- Global progress on the development of CCS technology has been poor.
- Only 11 out of 189 countries have mentioned CCS technology in their INDCs, nations have not accepted CCS as a promising technology
- By 2019, less than 10 per cent of the expected CCS capacity was created.
- Only 19 operational CCS facilities; two in coal based power plant.
- **Indian Scenario**
  - Future does not look promising even for India at least till 2030
  - **Need to invest inhouse research and development to reduce the CCS cost**
  - **NTPC has initiated pilot projects but we need more indigenous work.**

## 6. Coal Beneficiation: Missed Opportunity

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- CO<sub>2</sub> emissions can be reduced by 2–3 per cent by using 34 per cent ash coal versus 42 per cent ash coal.
- MOEFCC notification, 1997- use of beneficiated coal with an ash content of not more than 34 per cent with effect from 2001.
- MOEFCC notification amendment in 2014 - extended the rule to plants located at a distance of 500–1,000 km from the pithead.
- However, in May 2020, the government decided to allow use of coal irrespective of ash content once again.



## 7. Other mechanism/incentives to improve

*Many developing countries are actively considering carbon tax and emissions trading systems*

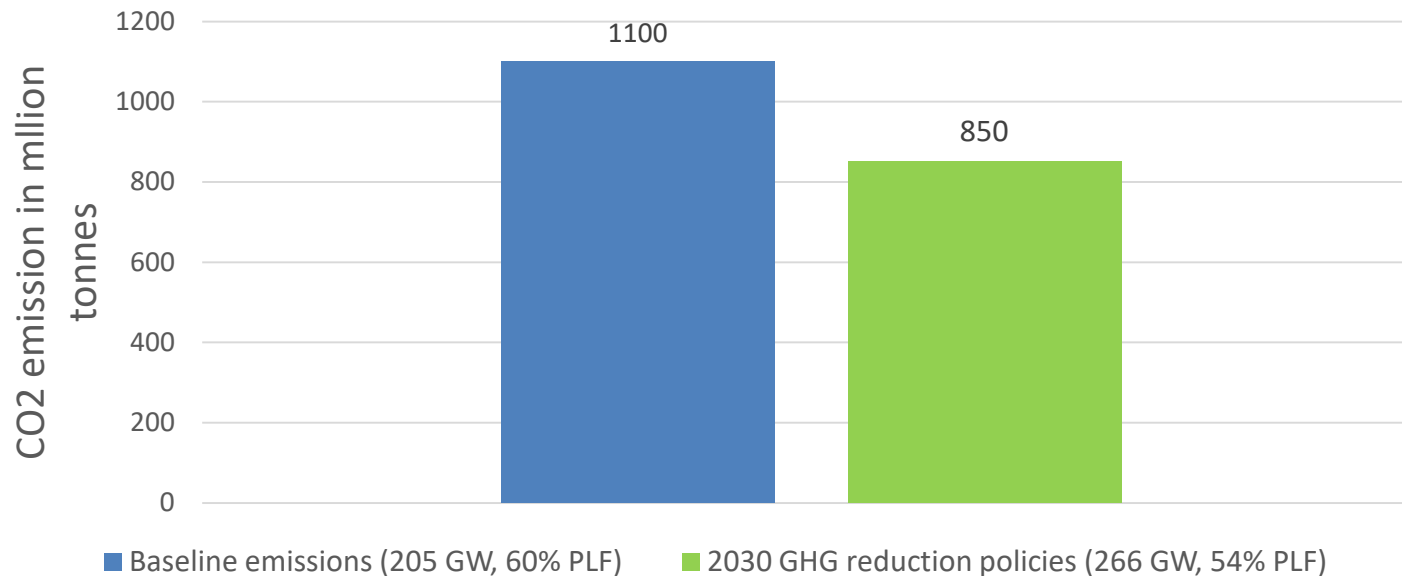
Status	Carbon taxes	Carbon trading system	Total	Scope	Countries
Implemented	30	28	58	These initiatives would cover 9 Gt CO <sub>2</sub> eq, representing 16 per cent of global GHG emissions	Mainly Europe and the US, also Argentina and South Africa
Scheduled	0	3	3	In 2020, these initiatives would cover 4 Gt CO <sub>2</sub> eq, representing 7.2 per cent of global GHG emissions	China, Germany and the US
Under consideration	Brazil, Thailand, Ukraine, Turkey, Indonesia, Taiwan, Vietnam, and some states of the US are actively considering various carbon pricing regimes				

Note: Till 1 April 2020

Source: Carbon pricing dashboard, World Bank

- **Carbon Tax;** 2010 Clean Energy Tax (Rs 50-400 per tonne Coal); Clean Energy Tax to GST compensation Tax
- **Carbon Trading;** Mature ETS needs time, China introduced ETS in 2020, pilot initiated in 2014
- Heat rate: Transparency in the disclosure of unit wise heat rates.
- Merit Order operation of its stations on the national level maximizing the electricity generation from cheaper/efficient stations before moving to other stations.
- Stringent target setting for aligning PAT cycles; Deeper analysis of the sector.

## CO2 emissions Present vs **Best Case Scenario**



### **Pathway for Best Case Scenario:**

- 1. Ultra supercritical and advance SC in all new plants; refurbished plants**
- 1. Retirement as per plan**
- 2. Biomass conversion+ Biomass cofiring**
- 3. Renovation & modernization for improved efficiency**
- 4. Carbon tax/ trading and other schemes/PAT for driving change**

# Thank you