



Relevance of CFBC Technology

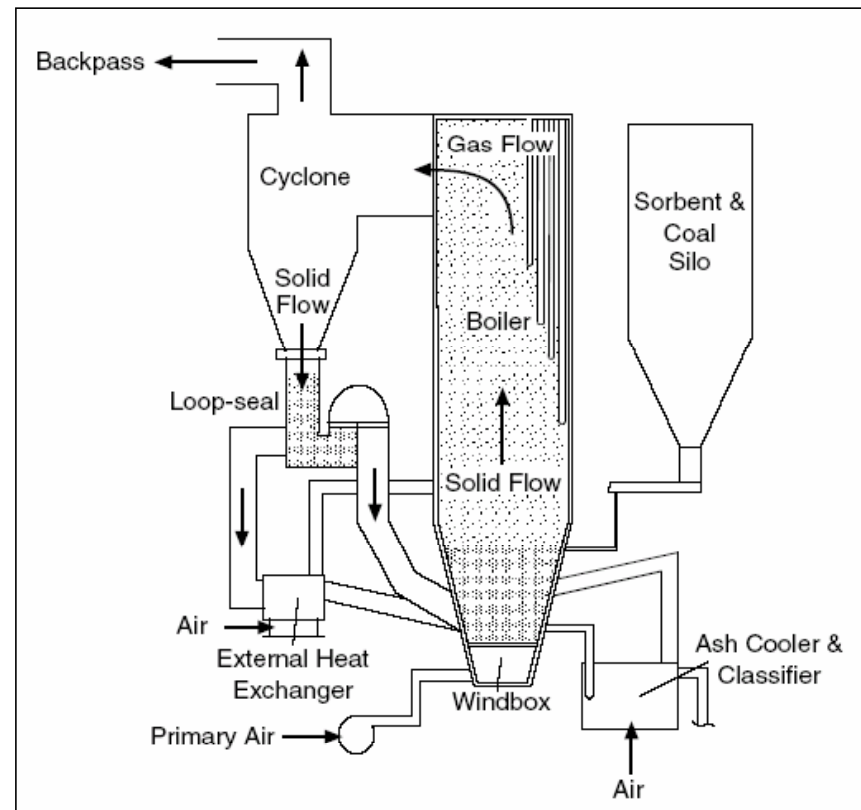


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CFBC Technology

- Mr. Fritz Winkler of Germany invented Bubbling fluidized bed process.
- Bubbling fluidized bed technology pursued and promoted by Mr. Douglas Elliott in 1960's.
- Steam Generation from Bio-mass fired BFB boilers began in 1982 with the commissioning of 10TPH rice husk fired BFB boiler in India.
- Mr. Warren Lewis and Mr. Edwin Gilliland conceived the CFB technology which is fast fluidized bed process.

CFBC Technology



Schematic Diagram of CFBC Boiler

[Video](#)

Comparison with Other Technology

Characteristics	Stoker	Bubbling	Circulating	Pulverized
Height of Bed or fuel burning zone(m)	0.20	1 - 2	10 - 30	27-45
Superficial Velocity (m/sec)	1-2	1.5-2.5	3 - 5	4 - 6
Excess Air(%)	20-30	20-25	10 -20	15-30
Grate heat release rate(MW/m ²)	0.5-1.5	0.5-1.5	3.0-4.5	4 - 6
Coal size(mm)	32 - 6	6 - 0	6 - 0	<1.1
Turn down ratio	4:1	3:1	3-4:1	3:1
Combustion efficiency(%)	85-90	90-96	95-99.5	99-99.5
Nitrogen oxides(ppm)	400-600	300-400	50-200	400-600
Sulphur dioxide capture in furnace(%)	None	80-90	80-90	None

Advantages of CFBC Technology

Fuel Flexibility

Coal	Coal Residue	Wood Residue	Sludge	Municipal Waste	Petroleum Product	Gas	Agricultural Waste
Anthracite	Bituminous	Bark	Paper mill	Refuse	Oil	Off gas	Straw
Bituminous	Gob	Wood chips	De-inking	Derived fuel	Delayed coke	Natural	Olive waste
Sub-bituminous	Anthracite	Saw dust	Municipal Gasifier fines	Garbage	Fluid	Other Gases	Husk
Lignite	Culm	Forest residue		Waste Paper	Coke		
	Coal slurry	Demolition waste		Shredded tires	Oil shale		
	Mill rejects						
	washery waste						

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Advantages of CFBC Technology

High Combustion Efficiency

- The combustion efficiency of a CFB boiler is generally in the range of 97.5% to 99.5%
- Better gas-solid mixing
- Higher burning rate (especially for coarser particles)

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Advantages of CFBC Technology

In-Situ Sulphur Removal

- Low combustion temperature (800 to 900°C) allows to absorb the sulphur as solid calcium sulphate (Fed with Limestone)
- No add-on equipment as in PC boiler
- Sulphur capture efficiency of 80 to 90%

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Advantages of CFBC Technology

Nitrogen Oxide Emissions

- Low furnace temperature reduces NO_x generation.
- Low emission of nitric oxide (NO) is a major attractive feature of both CFB boilers
- NO emission is in the range of 50 to 150 ppm

Relevance of CFBC Technology

Environment norms

Parameter	Standards
TPPs (units) installed before 31 st Dcember,2003	
Particulate matter	100 mg/Nm ³
Sulphur dioxide(SO ₂)	600 mg/Nm ³ (units smaller than 500MW capacity units) 200 mg/Nm ³ (units having capacity than 500MW & above)
Oxides of nitrogen(NO _x)	600 mg/Nm ³
Mercury(Hg)	0.03 mg/Nm ³ (units having capacity than 500MW & above)
TPPs (units) installed after 1 st January,2003, up to 31 st December,2016	
Particulate matter	50 mg/Nm ³
Sulphur dioxide(SO ₂)	600 mg/Nm ³ (units smaller than 500MW capacity units) 200 mg/Nm ³ (units having capacity than 500MW & above)
Oxides of nitrogen(NO _x)	300 mg/Nm ³
Mercury(Hg)	0.03 mg/Nm ³ (units having capacity than 500MW & above)

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Relevance of CFBC Technology

Environment norms

TPPs (units) installed from 1 st January,2017	
Particulate matter	30mg/Nm ³
Sulphur dioxide (SO ₂)	100mg/Nm ³
Oxides of nitrogen (NOx)	100mg/Nm ³
Mercury(Hg)	0.03mg/Nm ³

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Relevance of CFBC Technology

- Coal reserves of India is 298.91 billion tonnes as on 1st April 2013 *
- Lignite reserves of India is 43.22 billion tonnes as on 1st April 2013 *
- The anticipated coal washer rejects @ 20% of 40% of total coal reserves is 23.91 billion tonnes
- CFBC boiler is suitable for variety of fuels like lignite, coal washer rejects, pet coke etc
- Suitable for controlling / reducing SO_x and NO_x emissions.
- Availability of super critical CFBC boilers with higher cycle efficiencies.

* As per Indian Mineral Yearbook 2013.

Relevance of CFBC Technology

First Super Critical CFBC Boiler at Baima Power Plant in China

Table 2. CFB boiler performance test result: Performance test

<i>Parameter</i>	<i>Units</i>	<i>Design</i>	<i>Test Measurement</i>
Power Load	MW	600	601
Steam Pressure	MPa	25.39	24.81
Steam Temperature	°C	571 ⁺³ ₋₅	570
Furnace Temperature	°C	890	~890
Boiler Efficiency	%	>91.01	91.52
SO_x Emissions	mg/Nm ³	<380	192.04
De-SO_x Efficiency	%	96.7	97.12
NO_x Emissions	mg/Nm ³	<160	111.94
Particulate Emissions	mg/Nm ³	30	9.34



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Challenges of CFBC

- Lower PLF in comparison to PC Boilers
- Erosion of Pressure Parts
- Refractory intensive

THANK YOU