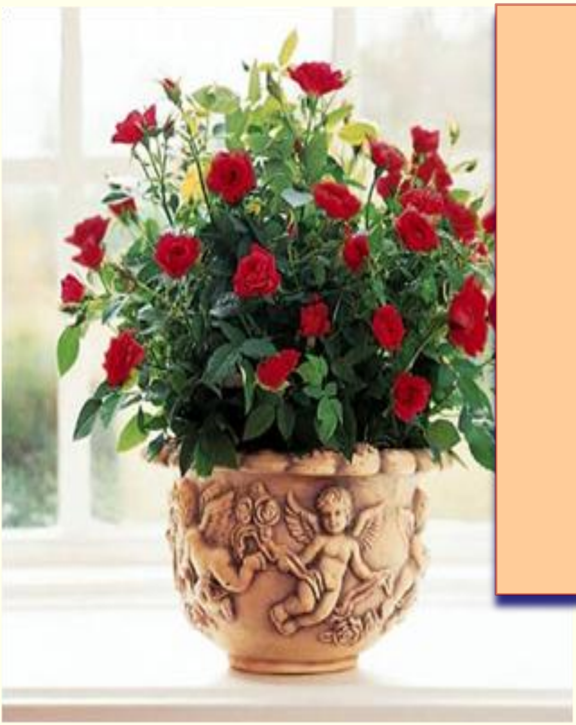
Clean Coal Technology



Presentation By

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Clean Coal Technology

- Trends in Power Plant Engineering
- Efficiency Improvement
  - ✓ Sub Critical Cycle
  - ✓ Super Critical Cycle
  - ✓ Ultra Supercritical Cycle
- Emission Control
  - ✓ Particulate
  - ✓ So_x (FGD)
  - ✓ No_x
- Alternate Fuels/ In situ control
  - ✓ CFBC/ BFBC
- Technology Development
  - ✓ IGCC
  - ✓ Oxy Combustion
  - ✓ CO_2 Separation

Collaboration, In-house R&D, Joint Development adopted, as appropriate

Trends in Power Plant Technology

- Conventional Thermal Power generation has been undergoing rapid advancement towards
  - ✓ Improving the Efficiency of Power Generation
  - ✓ Minimising atmospheric pollutants
  - ✓ CO_2 reduction, Capture and Storage

Fuels for Steam Power Plants

Coal & Lignite:

- Abundant availability
- Lower cost
- Will continue as the main fuels in many countries including India

Trend in unit sizes & Cycle parameters

Unit Size	SHO Pressure (kg/cm²(a)	SHO/RHO Temperature (Deg.C)	Year of Introduction
60 / 70 MW	96	540	1965
110 / 120 MW	139	540/540	1966
200 / 210 MW	137 / 156	540/540	1972
250 MW	156	540/540	1991
500 MW	179 179	540/540 540/568	1979 1985
600 MW	179	540/540 540/568	2008
660 MW	256	568/596	2008
700 MW	256	568/596	2010
800 MW	256	568/596	2008

Technology Development Over the Years

1960s Boiler design as per Czechoslovakian technology, 30 MW, 60 MW

1970s Technology from Combustion Engineering, USA; Unit capacities 110 MW, 210 MW – Low Pressure Steam cycle

1980s

- Pressure ratings increased to achieve higher plant efficiency; Unit capacity increased to 500 MW; Controlled circulation introduced for very high pressures
- Firing system design for Low NOx emission
- Deteriorating coal properties led to increased tube erosion and performance deviations; units redesigned for inferior coals. Tower type boilers introduced for highly erosive coals

Technology Development Over the Years

1990s

- 250 MW units developed
- 130 MW unit firing Steel plant by- product gas (Corex gas)
- Boiler efficiency improvement by designing for low exit gas temperatures

Technology Development Over the Years

2000s

- Technology tie up for Super critical steam generators with ALSTOM, France
- Introduction of IT based ‘Performance Analysis Diagnostic and Optimisation” (PADO) for monitoring Power Plant performance and optimisation
- Designs for firing Washed Coals /Imported coals developed.

Technology Options

- Pulverised Coal Combustion (PCC)
- Fluidised Bed Combustion (FBC)
- Circulating Fluidised Bed Combustion (CFBC)
- Combined Cycle Gas Turbine/co-generation Plants
- Integrated Gasification Combined Cycle (IGCC)

Pulverised Coal Combustion (PCC)

- PCC is the most commonly used method in coal-fired power plants and is based on many decades of experience.
- The technology is well developed and understood and there are thousands of units around the world.
- Boiler design - two broadly different arrangements are used for PCC boilers - conventional two-pass or single-pass tower type.

BHEL Utility Units - A Summary

Unit Rating, MW	Contracted		Commissioned	
	No.	MW	No.	MW
30	4	120	4	120
60	16	960	16	960
67.5	9	607.5	8	540
70	14	980	9	630
80	14	1120	3	240
100	6	600	6	600
110	39	4290	39	4290
120	31	3720	27	3240
125	7	875	0	0
130	2	260	2	260
150	17	2550	0	0
200	24	4800	20	4000
210	116	24360	112	23520
250	58	14500	29	7250
270	32	8640	0	0
500	83	41500	45	22500
525	6	3150	2	1050
600	20	12000	0	0
660	8	5280	0	0
700	1	700	0	0
800	4	3200	0	0
TOTAL	**511**	**134213**	**322**	**69200**

62 % Total Installed Capacity of India is Contributed by BHEL Utility Sets

BHEL Industrial Units - A Summary

Unit	Contracted	Commissioned
VU 40	46	44
VU 40 S	15	15
VU 60	35	19
MU	3	3
VP	23	16
V_2R	17	16
HRSG	161	121
AFBC	69	59
CFBC	25	9
Others	28	28
Total	423	330

Efficiency Improvement

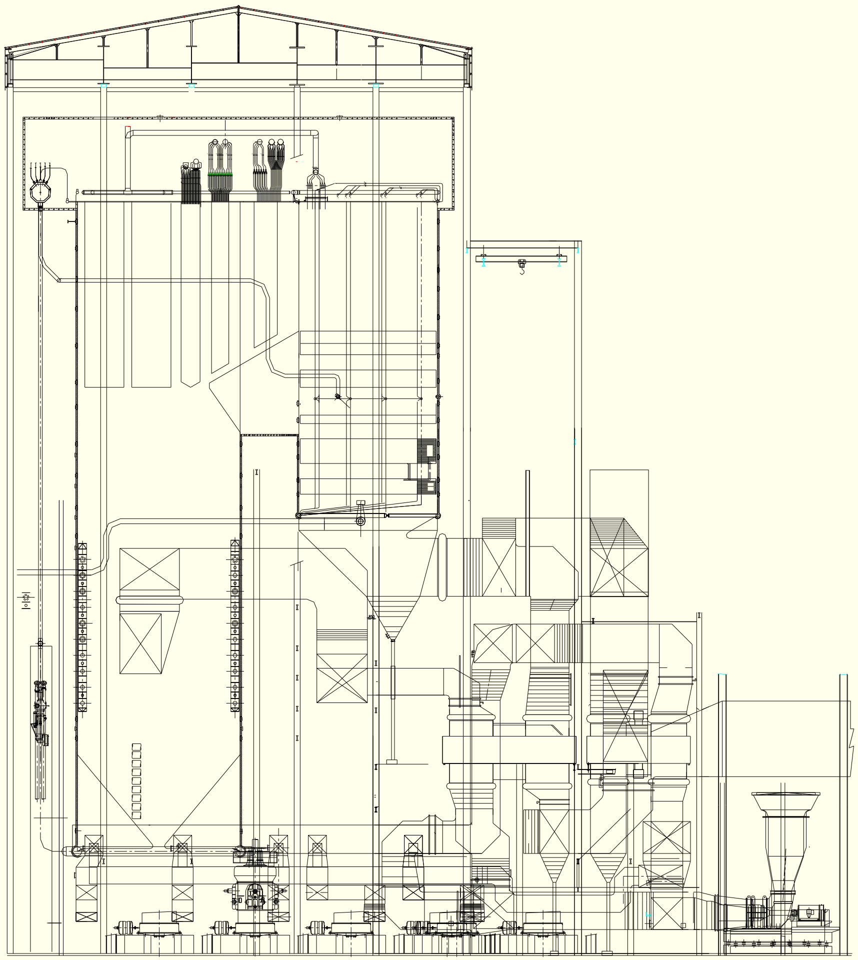
Improvement in cycle efficiency with higher steam parameters

Parameters at Turbine Inlet (kg/cm^2 / °C/ °C)	Increase in efficiency (% points)
170 / 537 / 537	Base (500MW)
170 /537 / 565	0.75
247 / 565 / 565	1.31%
247 / 565 / 593	1.64%
247 / 600 / 600	1.96%

Boiler Parameters (Sub-critical)

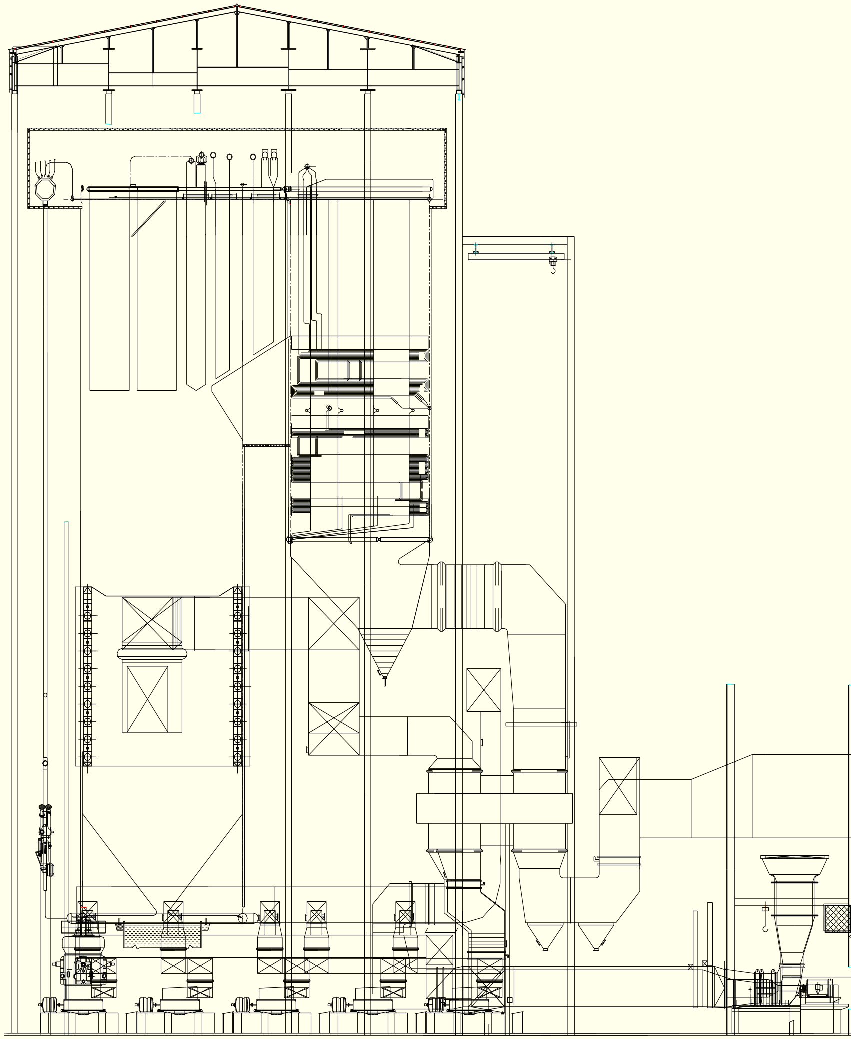
		250 MW	500 MW	500 MW	600 MW	600 MW
Steam flow at SHO	t/h	810	1625	1590	1950	2000
Steam pressure at SHO	Kg/cm^2 (g)	155	178	178	178	178
Steam temperature at SHO	^0C	540	540	540	540	540
Reheat steam flow	t/h	696.2	1389.76	1358	1665.7	1613.8
Steam temperature at RHO	^0C	540	540	568	540	568
Feed water temperature	^0C	247.2	254.6	254.5	254.6	280.3

NTPC / SIMHADRI STPP STAGE II -2 x 500 MW



Customer	NTPC Limited
Project	Simhadri STPP Stage II – 2 x 500 MW
Contract No.	0645 & 0646
Zero Date	26.03.07
Parameters at SHO / RHO	
Steam Flow Pressure Temperature	1590/1353 t/h. 178/42.7 kg/cm^2 (g) 540 / 568 °C
Fuel	Coal
Major Auxiliaries	
Mill	10 Nos. Bowl Mill, XRP 1003
Airheater	PAH - 2 Nos. 27 .5 VI 2000, SAH-2 Nos 30 VI 2000
FD Fan	2 Nos. AP 1 26/16, Axial Reaction
PA Fan	2 Nos. AP 2 20/12, Axial Reaction
ID Fan	2 Nos. NDZV 47 Sidor, Radial (VFD)
Dust Collector	4 Nos. FAA – 10 x 45H- 2 x 90135 - 2

TNEB / NORTH CHENNAI TPP 1 x 600 MW



Customer	TNEB
Project	NORTH CHENNAI TPS –1 x 600 MW
Contract No.	1600
Zero Date	19.01.08
Parameters at SHO / RHO	
Steam Flow	2000 / 1612.4 t/h.
Pressure	178/42.8 kg/cm^2 (g)
Temperature	540 / 568 °C
Fuel	Coal
Major Auxiliaries	
Mill	9 Nos. Bowl Mill, XRP 1043
Airheater	32.5 VIMT 2000, TRI-SECTOR
FD Fan	2 Nos. FAF 24.5/11.8-1, Axial Reaction
PA Fan	2 Nos. PAF 20/10.6-2, Axial Reaction
ID Fan	2 Nos. NDZV 47 Sidor,Radial [VFD]
Dust Collector	4 Nos. FAA-10x37.5M-2x112150-2

Subcritical Boilers – 500 MW

Contracts under execution Offering 540/568 Deg. C Subcritical boilers

- NCTPP Dadri 1 x 490 MW
- NTPC Simhadri - St II- Unit -3 & 4 - 2 x 500 MW
- APCPL Aravali - unit 1, 2 & 3 - 3 x 500 MW
- NTECL Vallur TPP - unit1 & 2 - 2 x 500 MW
- Mauda TPP- Unit 1 & 2 - 2 x 500 MW
- NTPL Tuticorin TPP-Unit 1 & 2 - 2 x 500 MW
- NTPC RIHAND-UNIT 5 - 2 x 500 MW
- NTPC VINDHYACHAL-UNIT 11 & 12 - 2 x 500 MW
- NTECL Vallur TPP 1 x 500 MW
- WBPDCL Sagardighi Ph. II 2 x 500 MW

Subcritical Boilers - 600 MW

Contracts under execution Offering 540/568 Deg. C Subcritical boilers

- TNEB - North Chennai 2x600 MW
- APGENCO - Kakatiya 1x600 MW
- JITPL - Jindal India 2x600 MW

Improvement in Existing Boilers

- Restoring the design level performance thru' R&M
- Improvement in PLF
- Addressing current coal quality
- Implementing current design like
  - ✓ Membrane wall furnace
  - ✓ Upgradation of Pressure Part materials
  - ✓ Regenerative Air pre heater
  - ✓ High efficiency fans
  - ✓ More reliable and Higher Efficiency ESPs

Using Advanced Steam Cycles to Improve the Environmental & Economic Performance of India's Power Generation

Once Through Supercritical Technology for Higher Unit Ratings 660 MW to 1000 MW

BHEL under license from Alstom offers Once through supercritical technology to Indian power utilities with the following benefits

- **Increased efficiency**
- **Lower Fuel consumption**
- **Lower emission levels of CO_2 NO_X SO_X**
- **Lower operating costs**
- **Greater operational flexibility**

These benefits are possible because of the higher steam pressures and temperatures which are the hallmark of the technology

Supercritical Boilers

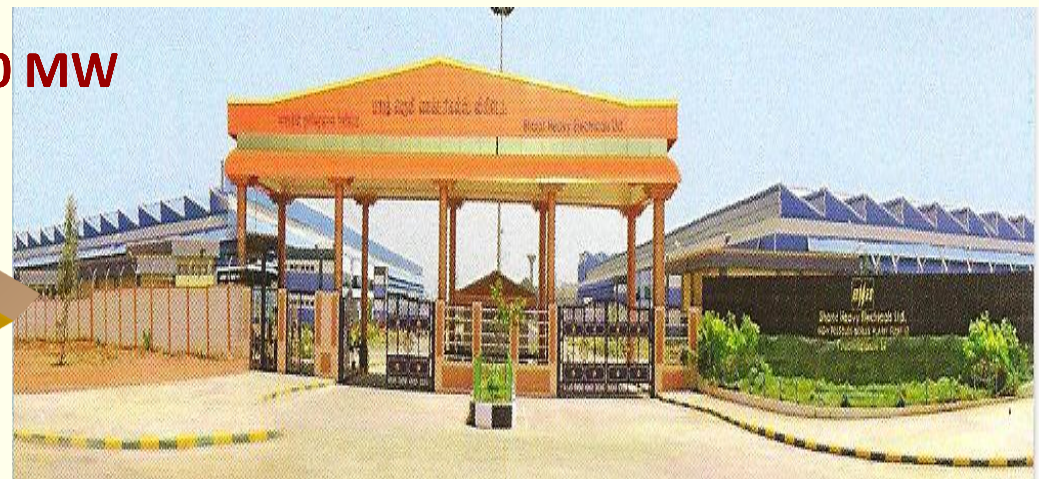
Offering 660/800 Once thro' supercritical boilers in collaboration with Alstom

Contracts under execution

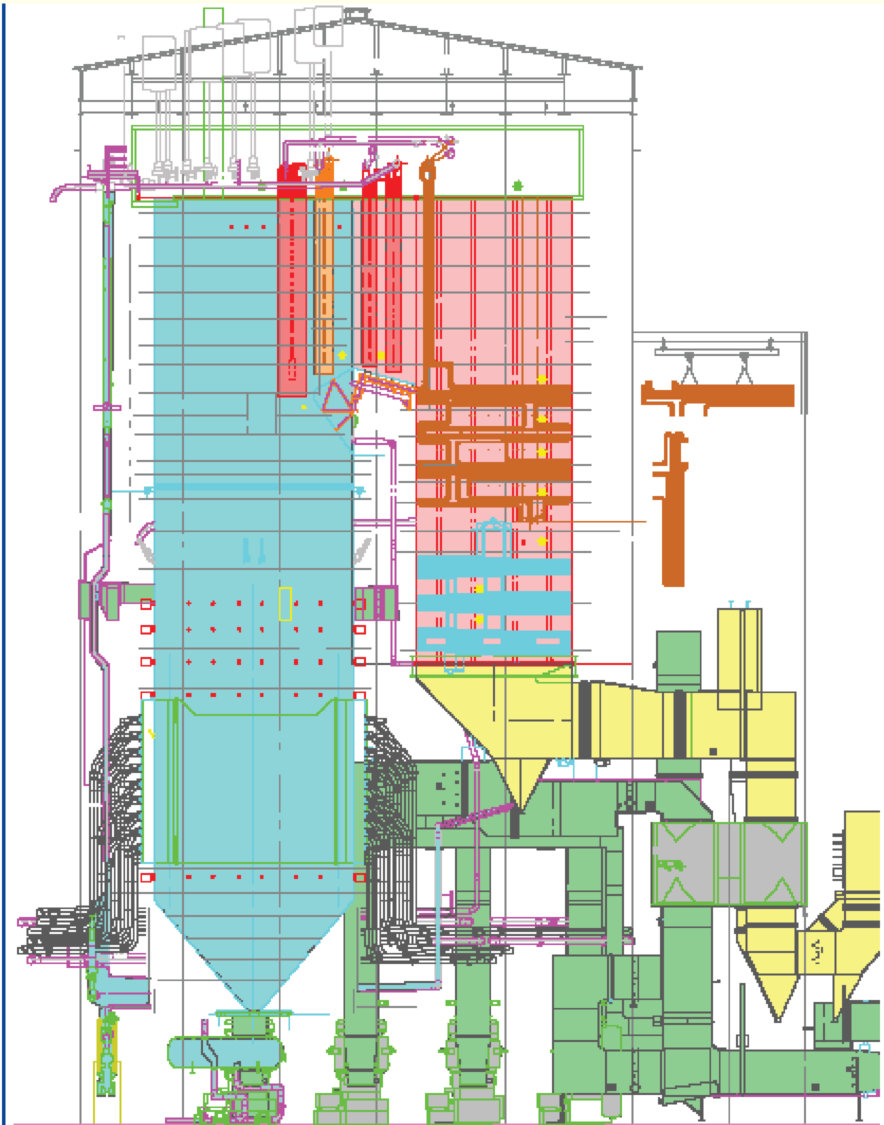
- NTPC / BARH — 2 x 660MW
- PPGCL / BARA — 3 x 660 MW
- KPCL / Bellary — 1 x 700 MW
- APPDCL / Krishnapatnam — 2 x 800 MW
- RPCL / Yermaras — 2 x 800 MW
- LPGCL/Lalithpur- BHL — 3 x 660 MW
- RPCL / Edlapur — 1 x 800 MW

14 Boilers Contracted

BHEL has geared up to meet the planned capacity addition in the country



NTPC / BARH 2 x 660MW



MODE OF OPERATION

Base load

TYPE OF CONSTRUCTION OF THE STEAM GENERATOR

Sliding pressure, supercritical, spiral wall

TECHNICAL DATA OF STEAM GENERATOR

	Guarantee
Main live steam flow	2120 T/hr
Superheater steam pressure	255 kg/cm² (g)
Superheater steam temperature	568° C
Feedwater temperature	294° C
RH steam flow	1708 T/hr
RH steam pressure	54.7 kg/cm² (g)
RH steam temperature	596° C

FUEL (AS RECEIVED)

Origin/type	Domestic unwashed coal	
	Design	Worst
Gross calorific value, kCal/kg	3300	2800
Moisture content, %	15.0	17.0
Ash content, %	40.0	42.0
Volatile matter, %	19.0	18.0
Fixed carbon, %	26.0	23.0
Hardgrove Grindability Index (HGI)	55	50

FLUE GAS EMISSION LEVEL

Nitrogen oxide (as NOx) at boiler outlet	≤260 g/GJ

IGNITION FUEL

Light diesel oil

PRESSURE RELIEF DEVICE

Separator safety valves
RH Safety valves
HTS safety valves

GRINDING AND FIRING PLANT

9 gravimetric raw coal feeders
9 HP 1103 vertical bowl mills

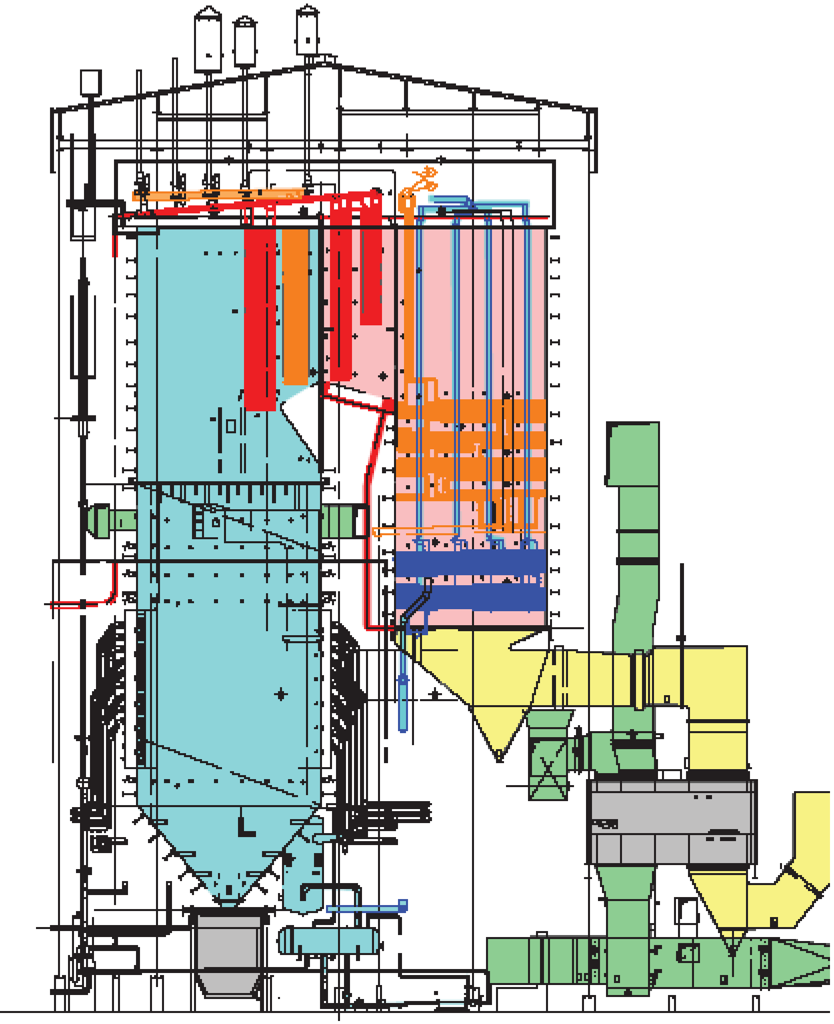
AIR AND FLUE GAS SYSTEMS

2 x 60% axial primary air fans
2 x 60% axial secondary air fans
2 x 60% axial induced draft fans

AIR HEATER

2 x bisector primary air semi-modular regenerative air heaters
2 x bisector secondary air semi-modular regenerative air heaters

APPDCL / Krishnapatnam 2 x 800 MW



MODE OF OPERATION
Base load

TYPE OF CONSTRUCTION OF THE STEAM GENERATOR
Sliding pressure, supercritical, spiral wall

TECHNICAL DATA OF STEAM GENERATOR

	Guarantee
Main live steam flow	2600 T/hr
Superheater steam pressure	255 kg/cm² (g)
Superheater steam temperature	568° C
Feedwater temperature	307° C
RH steam flow	2052 T/hr
RH steam pressure	57.9 kg/cm² (g)
RH steam temperature	596° C

FUEL (AS RECEIVED)

Origin/type — **Blend of domestic washed coal and imported coal**

	Design	Range
Gross calorific value, kCal/kg	4800	4000-5000
Moisture content, %	9.5	6-20
Ash content, %	27.5	25-34
Volatile matter, %	28.5	20-33
Fixed carbon, %	34.5	24-40
Hardgrove Grindability Index (HGI)	50	45-55

FLUE GAS EMISSION LEVEL

Nitrogen oxide (as NOx) at boiler outlet	≤260 g/GJ

IGNITION FUEL
Light diesel oil

PRESSURE RELIEF DEVICE
Separator safety valves
RH Safety valves
HTS safety valves

GRINDING AND FIRING PLANT
6 gravimetric raw coal feeders
6 HP 1203 vertical bowl mills with dynamic classifiers

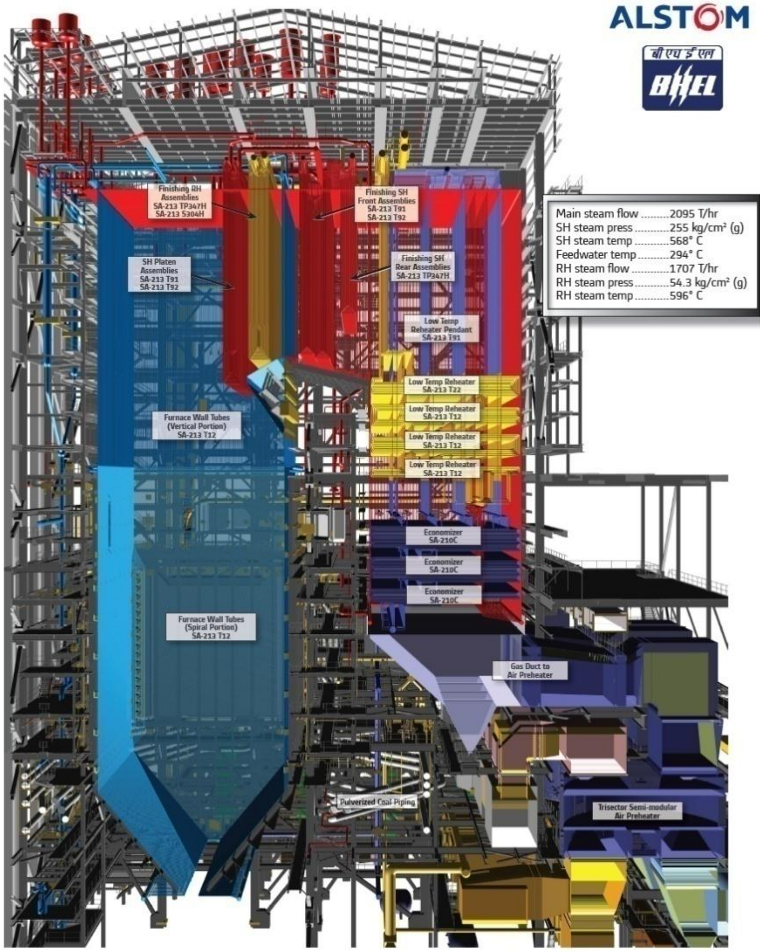
AIR AND FLUE GAS SYSTEMS
2 x 100% axial primary air fans
2 x 100% axial secondary air fans
2 x 100% axial induced draft fans

AIR HEATER
2 x trisector semi-modular regenerative air heaters

Prayagraj Power Generation Company Ltd.
A Group Company of JP Power Venture Ltd.
Phase 1
3 x 660MW at Bara

ALSTOM

बी एच ई एल BHEL



Fuel (as received)	Domestic Washed Coal	
	Design	Best/Worst
GCV, kCal/kg	4200	4500/3400
Moisture, %	10.0	7.0/11.4
Ash, %	31.0	25.5/34.3
Volatile matter, %	20.0	27.5/23.8
Fixed carbon, %	39.0	40.0/30.5
Hardgrove Grindability Index (HGI)	50	60/60

PPGCL / BARA 3 x 660 MW

MODE OF OPERATION

Base load

TYPE OF CONSTRUCTION OF THE STEAM GENERATOR

Sliding pressure, supercritical, spiral wall

TECHNICAL DATA OF STEAM GENERATOR

	Guarantee
Main live steam flow	2095 T/hr
Superheater steam pressure	255 kg/cm² (g)
Superheater steam temperature	568° C
Feedwater temperature	294° C
RH steam flow	1707 T/hr
RH steam pressure	54.3 kg/cm² (g)
RH steam temperature	596° C

FUEL (AS RECEIVED)

Origin/type	**Domestic washed coal**	
	Design	**Best/Worst**
Gross calorific value, kCal/kg	4200	4500/3400
Moisture content, %	10	7/11.4
Ash content, %	31	25.5/34.3
Volatile matter, %	20	27.5/23.8
Fixed carbon, %	39	40.0/30.5
Hardgrove Grindability Index (HGI)	50	60/60

FLUE GAS EMISSION LEVEL

Nitrogen oxide (as NOx) at boiler outlet — ≤260 g/GJ

IGNITION FUEL

Light diesel oil

PRESSURE RELIEF DEVICE

Separator safety valves
RH Safety valves
HTS safety valves

GRINDING AND FIRING PLANT

7 gravimetric raw coal feeders
7 HP 1103 vertical bowl mills

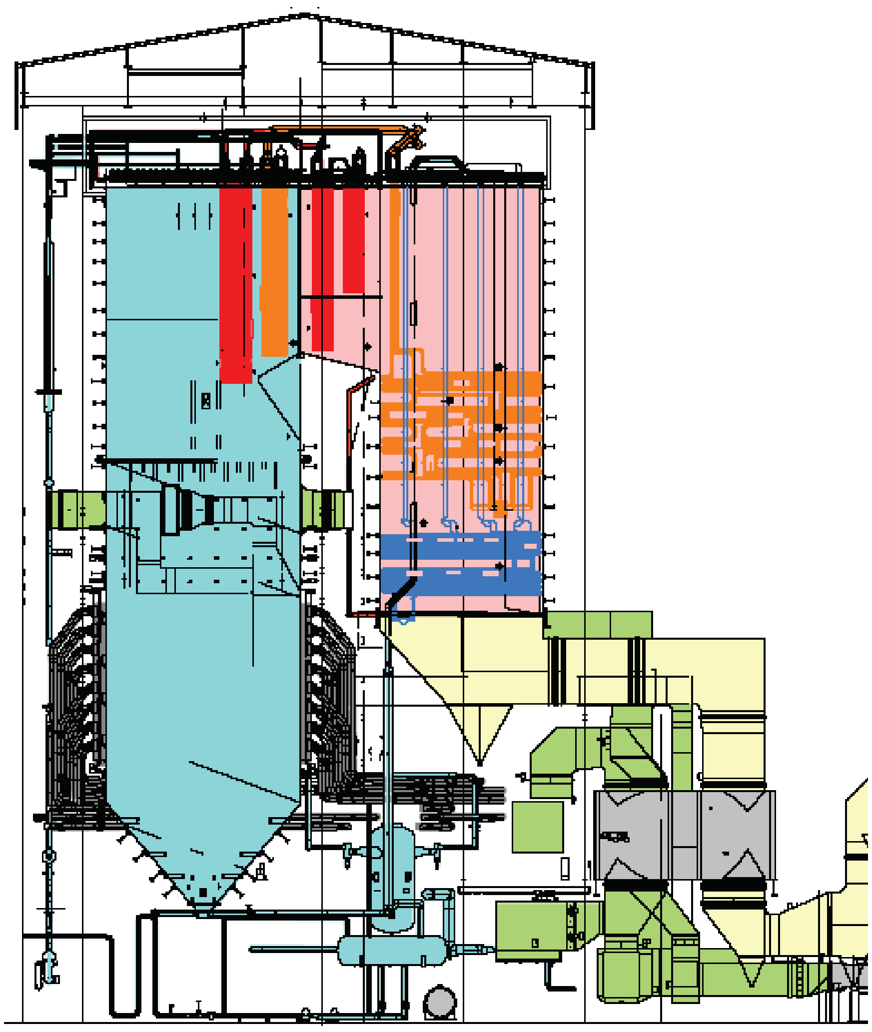
AIR AND FLUE GAS SYSTEMS

2 x 100% axial primary air fans
2 x 100% axial secondary air fans
2 x 100% axial induced draft fans

AIR HEATER

2 x trisector semi-modular regenerative air heaters

RPCL / Yermaras 2 x 800 MW



MODE OF OPERATION
Base load

TYPE OF CONSTRUCTION OF THE STEAM GENERATOR
Sliding pressure, supercritical, spiral wall

TECHNICAL DATA OF STEAM GENERATOR

	Guarantee
Main live steam flow	2592 T/hr
Superheater steam pressure	255 kg/cm² (g)
Superheater steam temperature	568° C
Feedwater temperature	294° C
RH steam flow	2069 T/hr
RH steam pressure	60.8 kg/cm² (g)
RH steam temperature	596° C

FUEL (AS RECEIVED)

Origin/type	**Domestic washed coal and imported coal**	
	Design	**Worst**
Gross calorific value, kCal/kg	4700	4100
Moisture content, %	8	12
Ash content, %	28	38
Volatile matter, %	26	20
Fixed carbon, %	38	30
Hardgrove Grindability Index (HGI)	50	50

FLUE GAS EMISSION LEVEL

Nitrogen oxide (as NOx) at boiler outlet	≤260 g/GJ

IGNITION FUEL
Light diesel oil

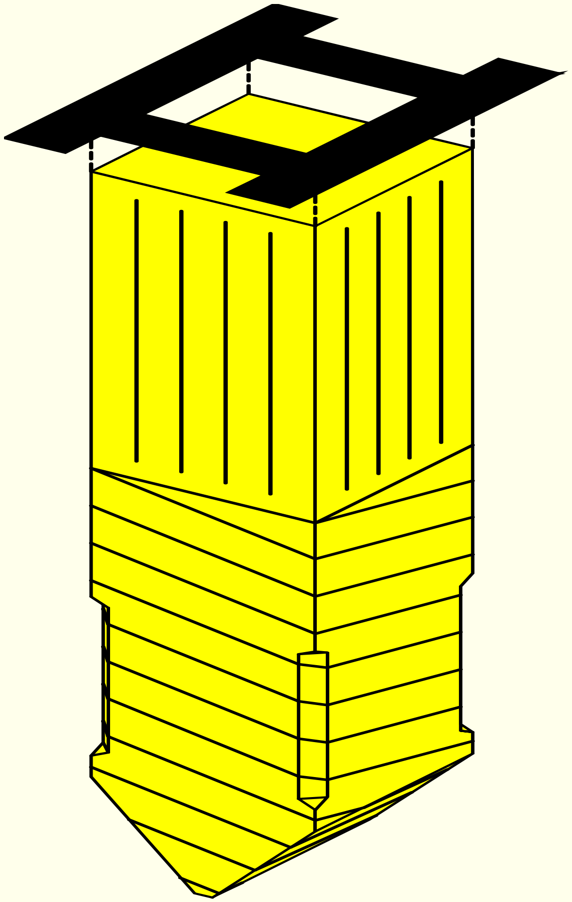
PRESSURE RELIEF DEVICE
Separator safety valves
RH Safety valves
HTS safety valves

GRINDING AND FIRING PLAN
8 gravimetric raw coal feeders
8 HP 1103 vertical bowl mills

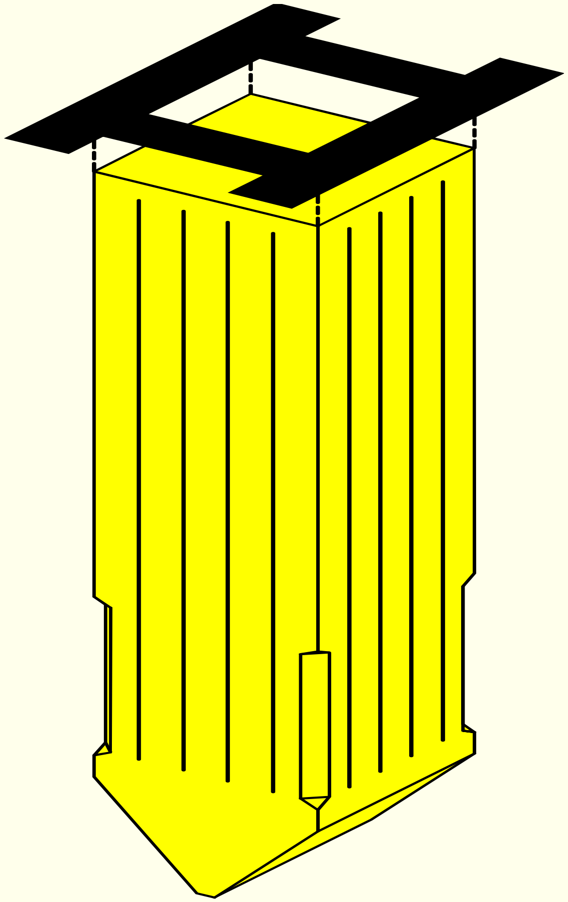
AIR AND FLUE GAS SYSTEMS
2 x 100% axial primary air fans
2 x 100% axial secondary air fan
2 x 100% axial induced draft fan

AIR HEATER
2 x trisector semi-modular regenerative air heaters

Furnace Wall Designs



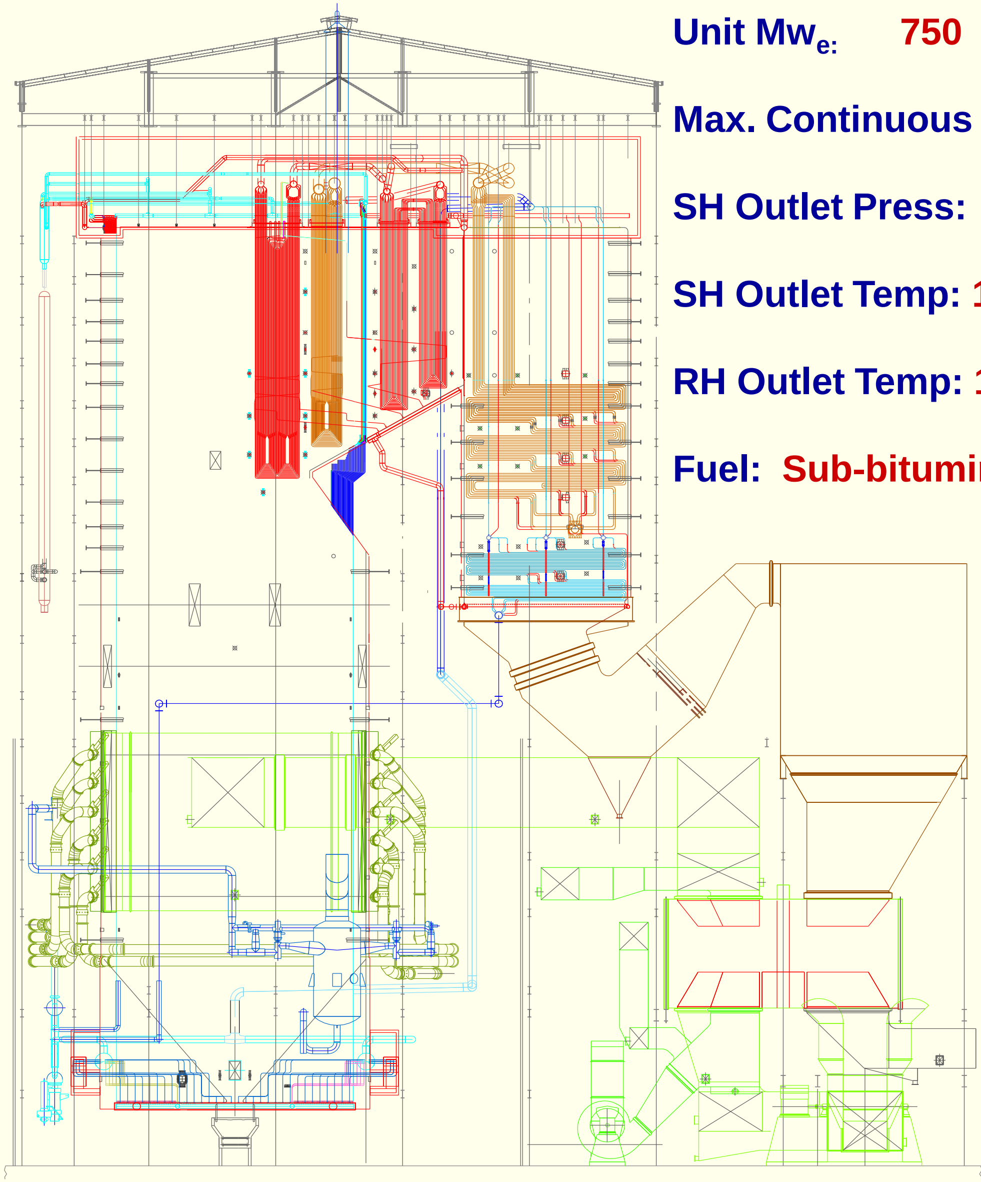
Spiral Wall Configuration



Vertical Wall Configuration


Spiral Wall
Windbox
2 2 '98

Comanche #3 Supercritical Boiler with Vertical wall



Unit Mw_{e}: 750

Max. Continuous Rating: 5,560,000 lb/hr (2522 t/hr)

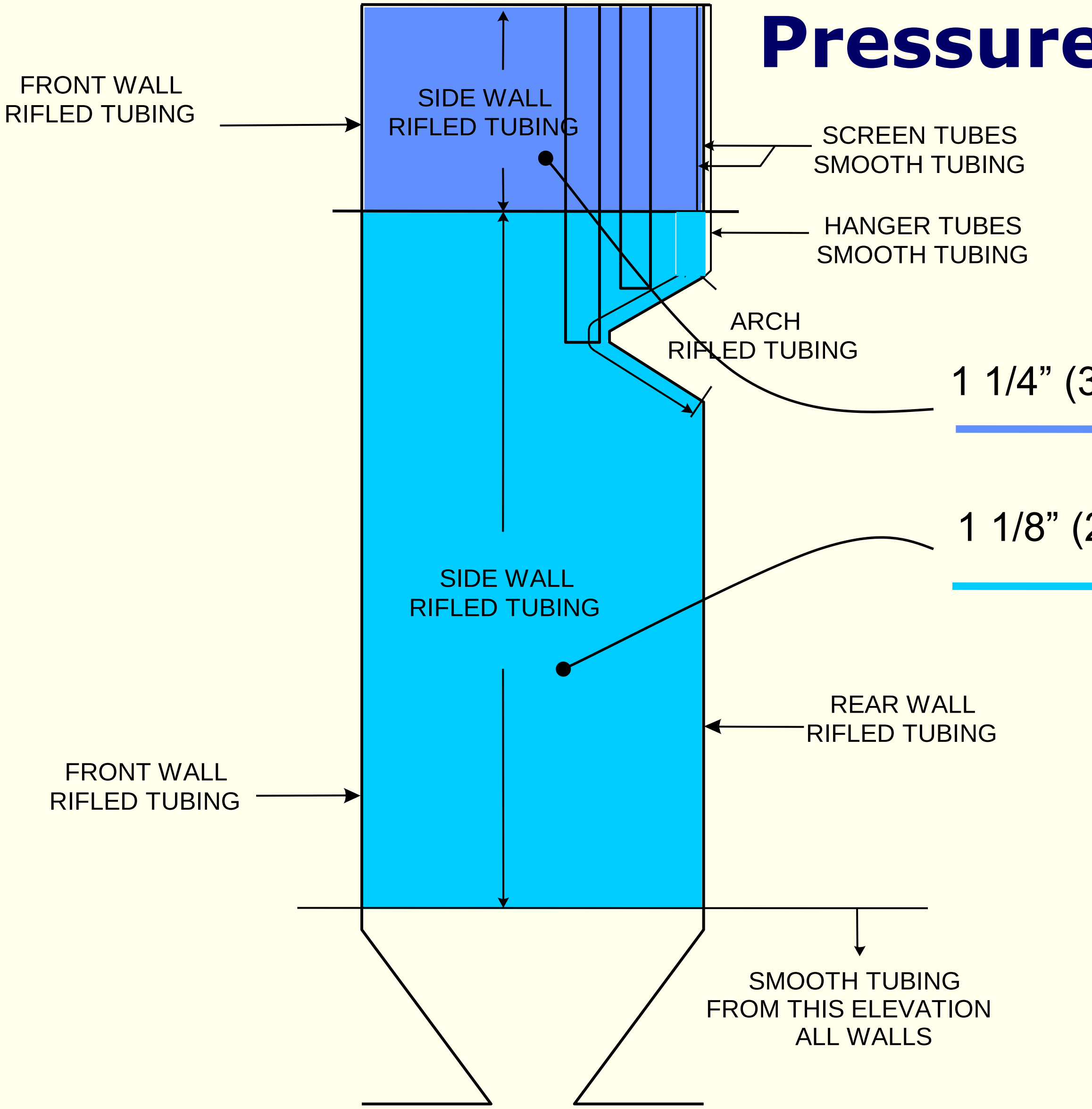
SH Outlet Press: 3800 psig (262 bar)

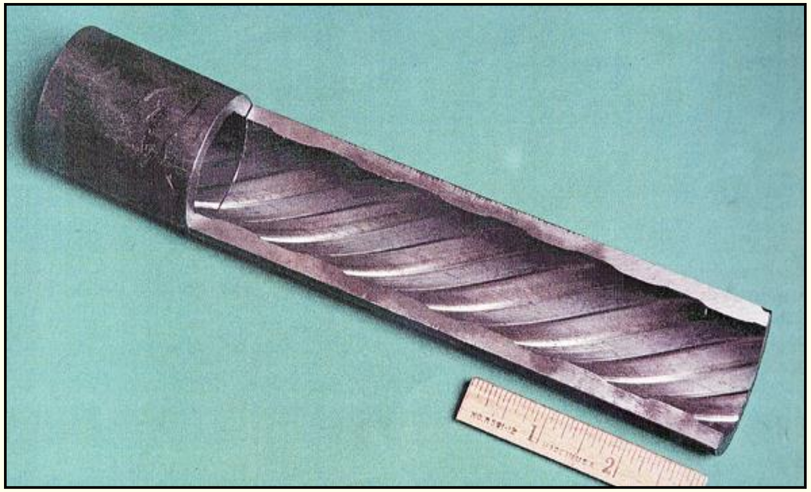
SH Outlet Temp: 1054°F (568°C)

RH Outlet Temp: 1105°F (596 °C)

Fuel: Sub-bituminous (PRB)

Vertical Wall Sliding Pressure Supercritical Design





Spiral vs. Vertical Wall Comparison

- **Spiral Furnace System Applicable for all size units**
- **Benefits from averaging of lateral heat absorption variation (each tube forms a part of each furnace wall)**
- **Simplified inlet header arrangement**
- **Large number of operating units**
- **Use of smooth bore tubing throughout entire furnace wall system**
- **One material utilized throughout entire waterwall system**
- **No individual tube orifices – Less maintenance & pluggage potential**

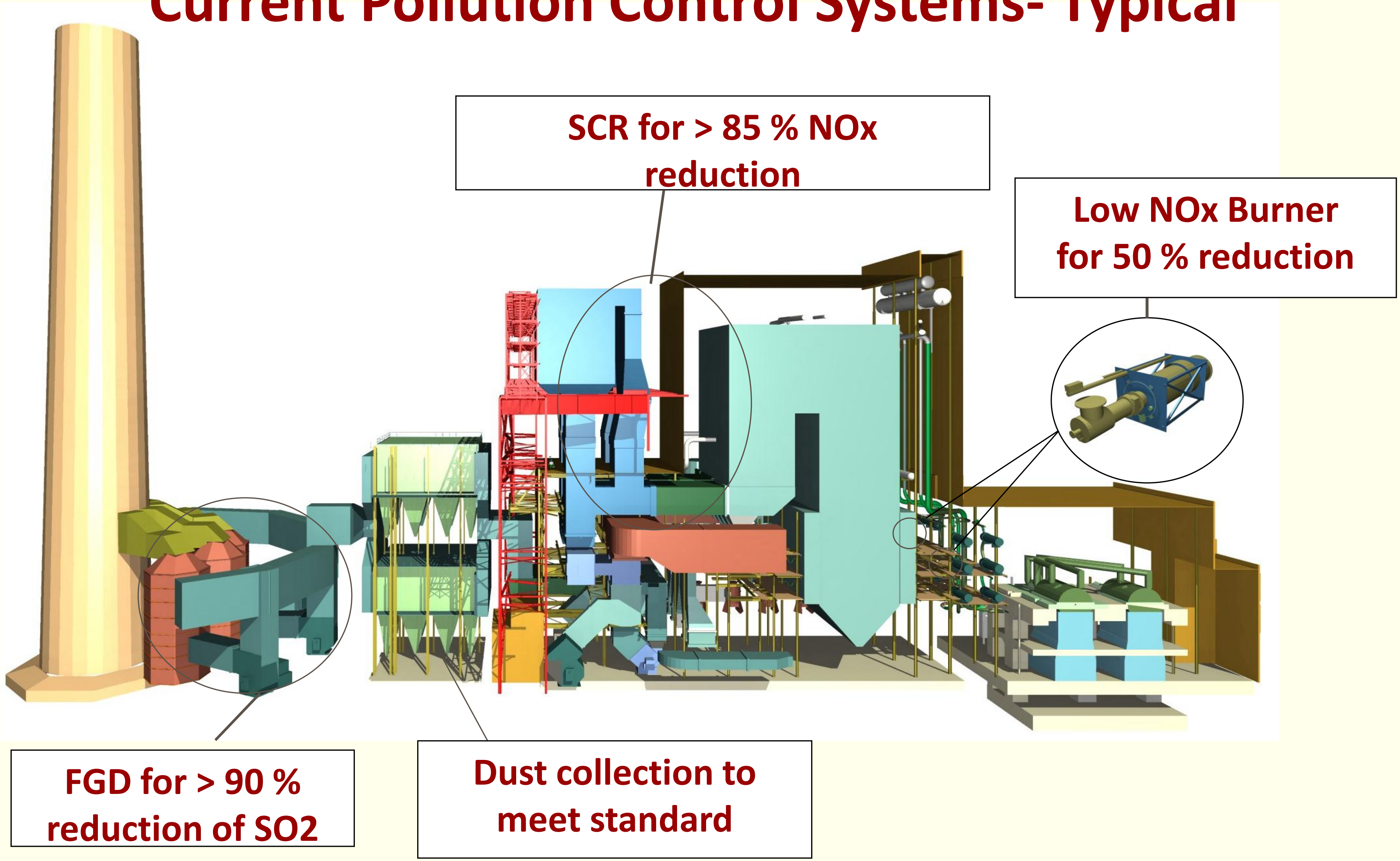
- **Vertical Furnace Wall System Limited to larger capacity units (>700 MW depending on fuel)**
- **Less complicated windbox openings**
- **Traditional furnace water wall support system**
- **Elimination of intermediate furnace wall transition header**
- **Less welding in the lower furnace wall system**
- **Easier to identify and repair tubes leaks**
- **Lower water wall system pressure drop thereby reducing required feed pump power**

Advanced Ultra Super Critical Plants

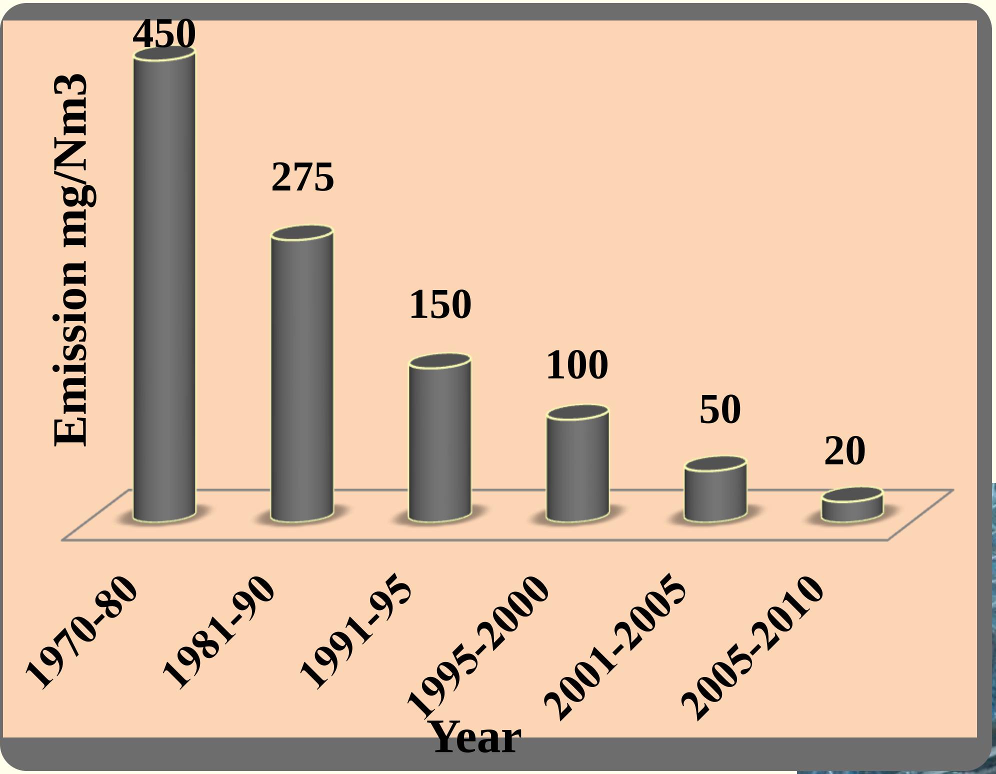
- Gearing-up to introduce Advanced Ultra supercritical boilers (AUSC)
- AUSC Boilers (300 ata, 700 °C / 700 °C) will be developed based on OTSC technology
- Test Facility (400 bar, 700 Deg. C) installed and tests are on to collect critical design data
- BHEL is one among the Five MNC's to have this facility
- Member of the National Technology Mission program to install AUSC plant by 2017

Emission Control

Current Pollution Control Systems- Typical



Particulate Emission Trend



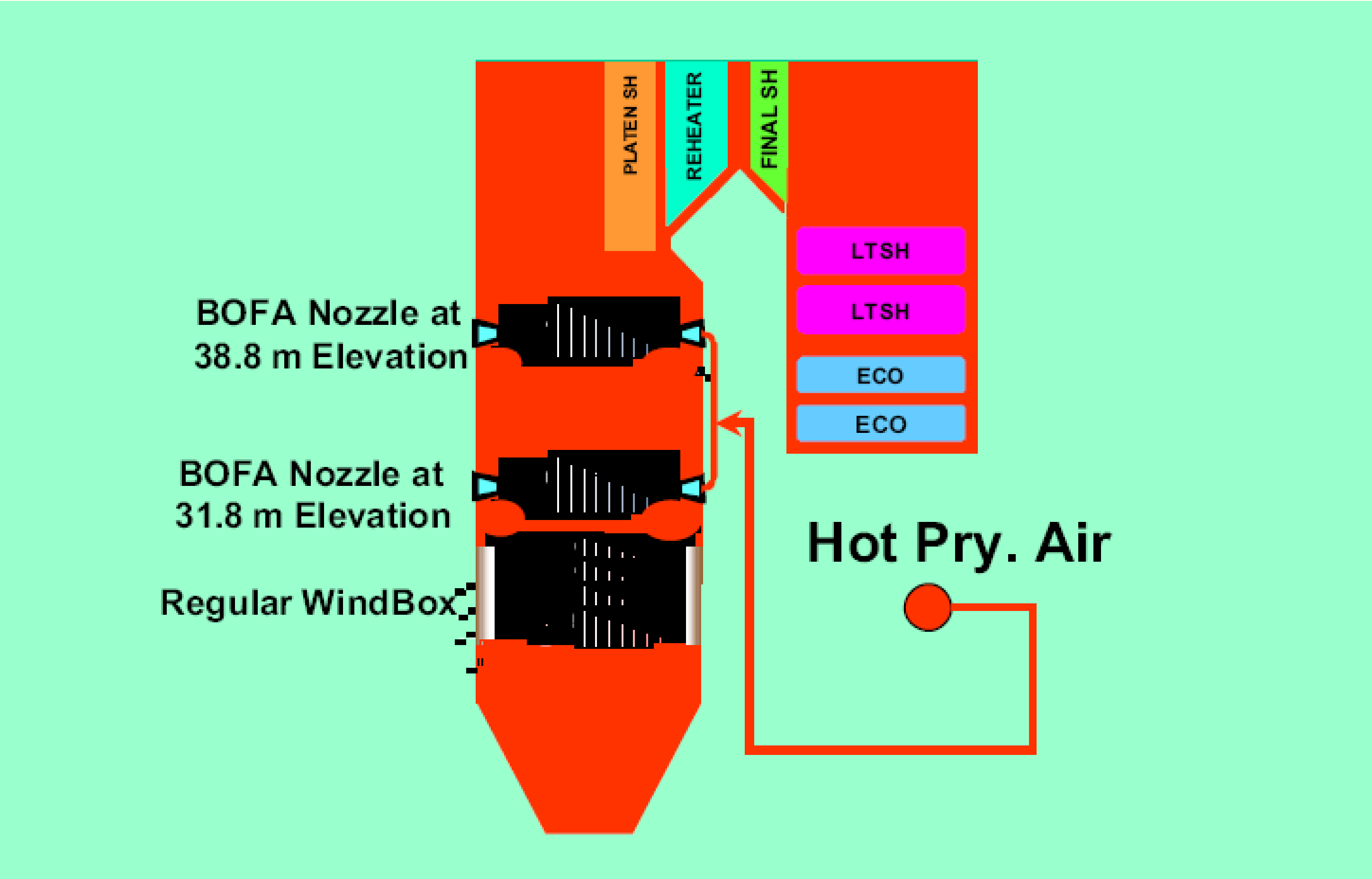
Particulate Emission

TNEB / North Chennai, 600 MW	<50 mg/Nm^3
MAHAGENCO / Bhusawal, 500 MW	<50 mg/Nm^3
KWPCL / Avantha, 600 MW	<50 mg/Nm^3
KNPCL / Vizag, 520 MW	<50 mg/Nm^3
Visa Power, 600 MW	<50 mg/Nm^3
JITPL / Derang, 600 MW	<50 mg/Nm^3
Aravali # 1,2 & 3, 500 MW	<21 mg/Nm^3
NTECL / Vallur # 1, 500 MW	<19 mg/Nm^3
Rihand # 5 & 6, 500 MW	<18 mg/Nm^3
Bongaigaon, 250 MW	<18 mg/Nm^3
Vindhyachal # 11 & 12, 500 MW	<17 mg/Nm^3

BHEL supplied Bag Filter Systems

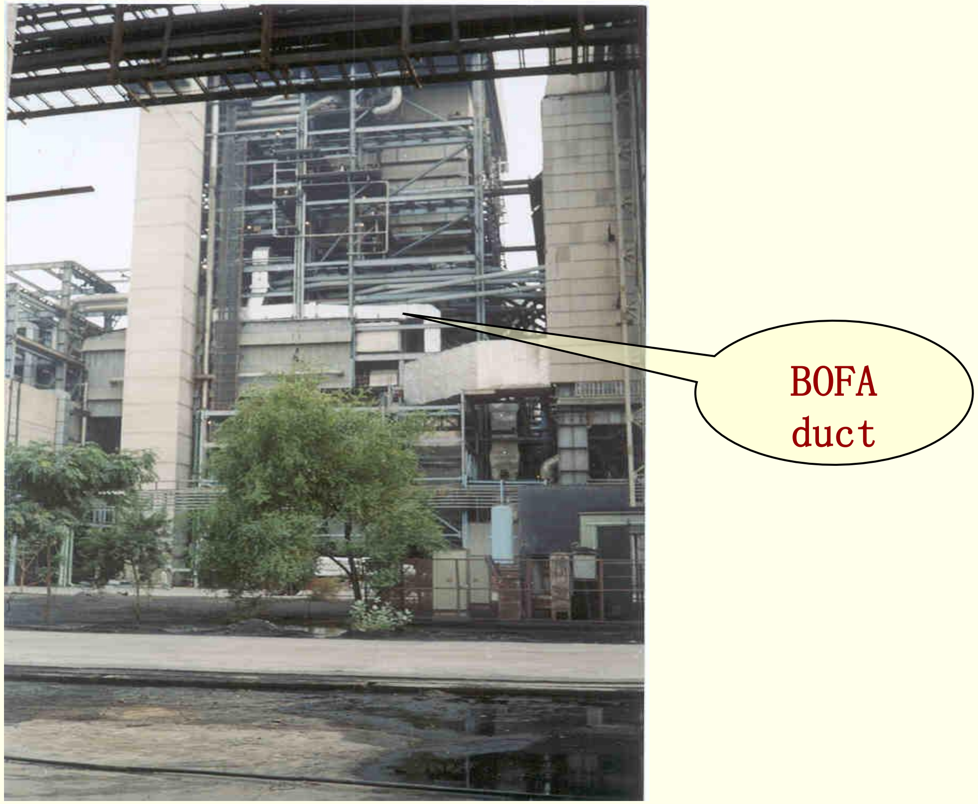
SL. NO	CUSTOMER	APPLICATION	EMISSION, mg/Nm3
01	BHEL / HARDWAR India	Electric Arc Furnaces – Fume extraction system (Water cooled hoods, Gas cooler, FF, ducts, Fan, chimney)	100
02	MAHAGENCO, India	KORADI TPS, Unit – 5, 200 MW – Coal fired boiler (Retrofit FF in ESP casing, Water spray system, Implosion protection system, ID fan, duct, Gates, furnace pressure control)	40
03	ISPAT SIDEX, ROMANIA	Cast house de -polluting system, Romania, ambient and source limits (Hoods, duct, FF, Fan, chimney)	20
04	Koniambo Nickle Project, New Caledonia	CFBC-Coal	30

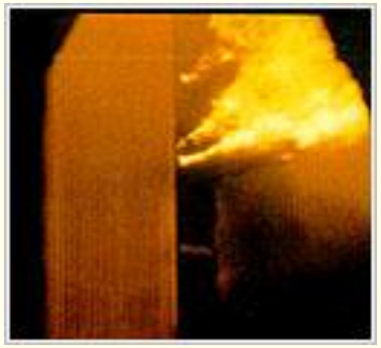
Bypass Over Fire Air (BOFA) System



Development of "Bypass Over Fire Air (BOFA) System" to reduce NO_X emission by about 40%.

NO_x Reduction

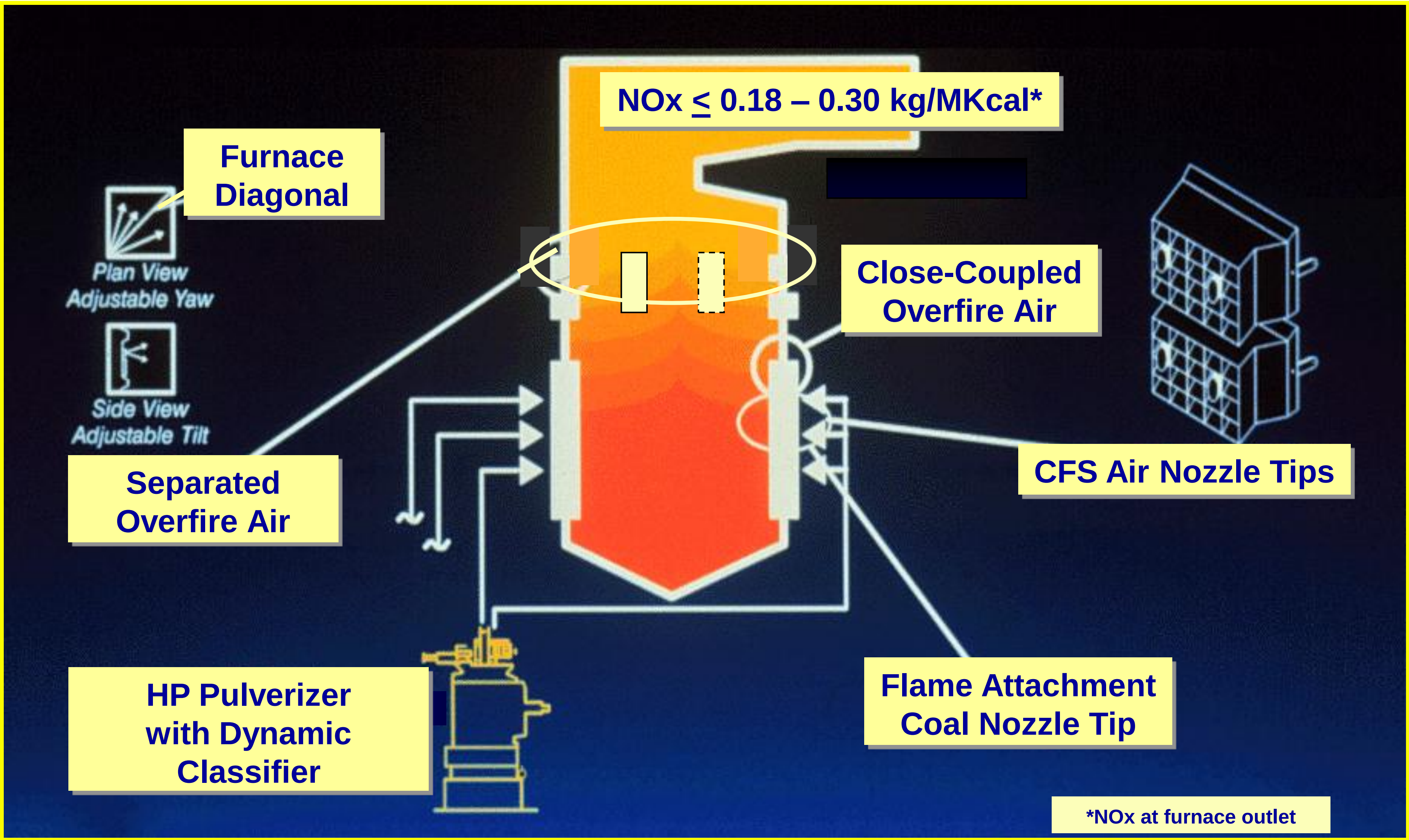




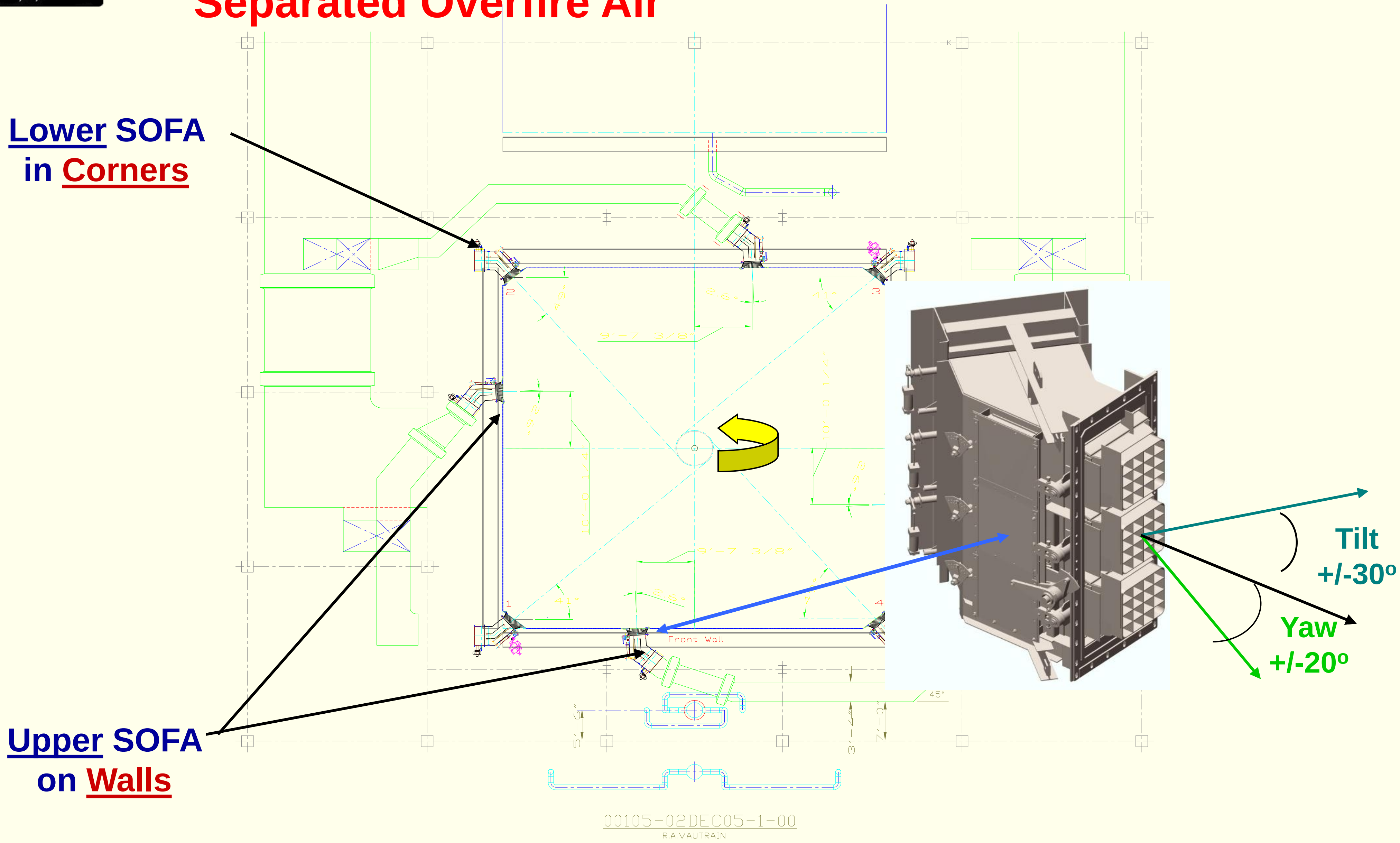
In Furnace Low Excess air Air staging

Post Combustion Selective Catalytic Reduction

Overview of Firing Systems



Separated Overfire Air



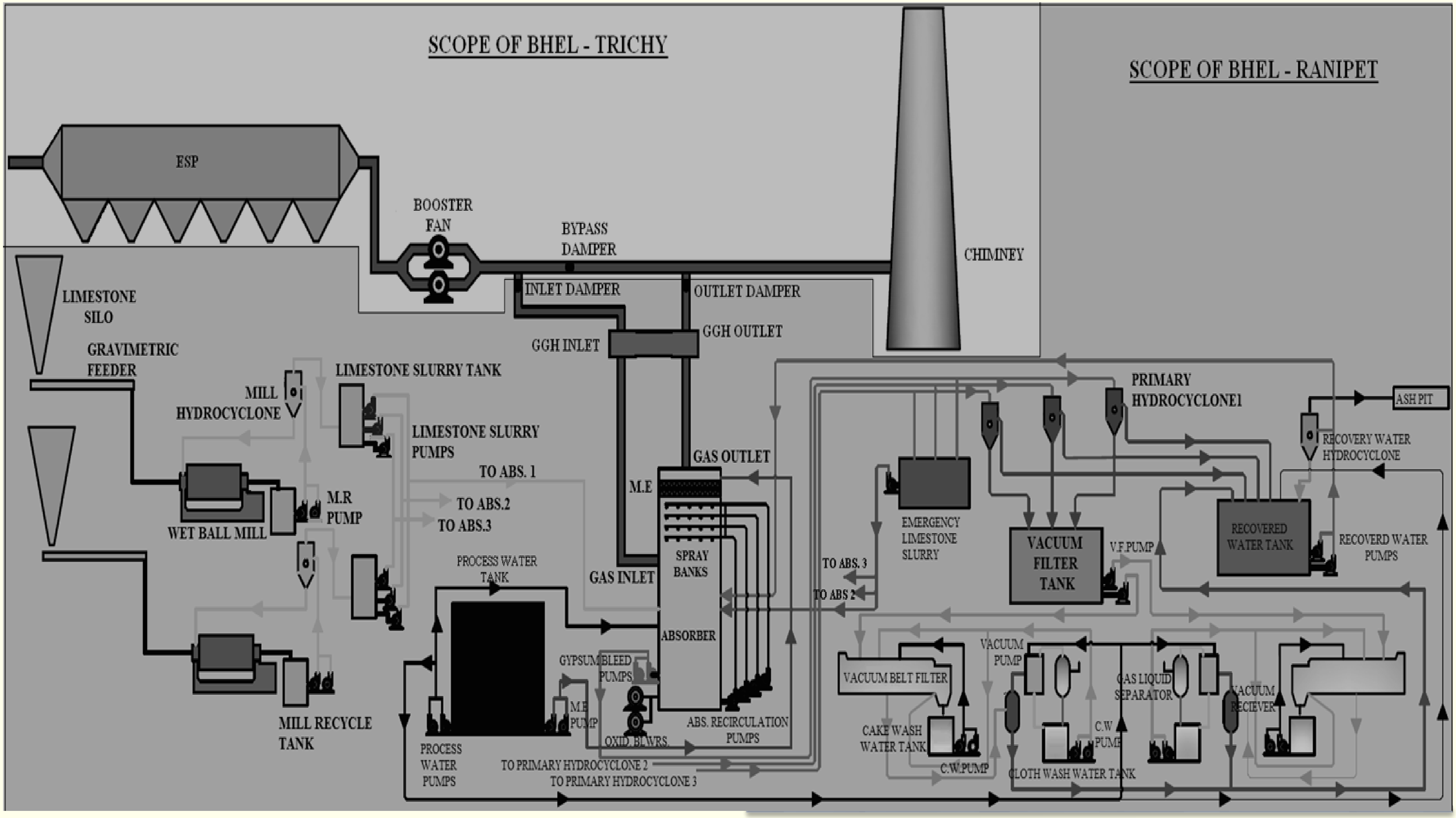
Benefits of Low NO_X Design Strategy

- Retention of all the inherent benefits of tilting tangential firing
- CFS provides waterwall cleanliness/protection from corrosion
- SOFA yaw enable greater emissions and unbalance control
- LNCFS technology yields the lowest NO_X

FGD in India – An overview

- National Ambient Air Quality Standard revised in November 2009. Industrial and Residential area are combined and the ambient air standard norms for SO_2 are reduced.
- Sulphur in Imported Coal high compared to Indian coal
- In all the 660 /800 MW Projects, space provisions are made to install FGD at later date.
- FGD retrofit a distinct possibility in future
- FGD Projects
  - ✓ Saint Gobain glass India Semi Dry – 800 mg/Nm^3
  - ✓ Trombay Unit 8 – 250 MWSea Water – 70 mg/Nm^3
  - ✓ NTP Bongaigaon 3x250 MW Wet Lime – 280 mg/Nm^3

NTPC Bongaigaon – 3x250 MW FGD



CFBC/ BFBC Boilers for Alternate Fuels

Alternate Fuels

Alternate fuels

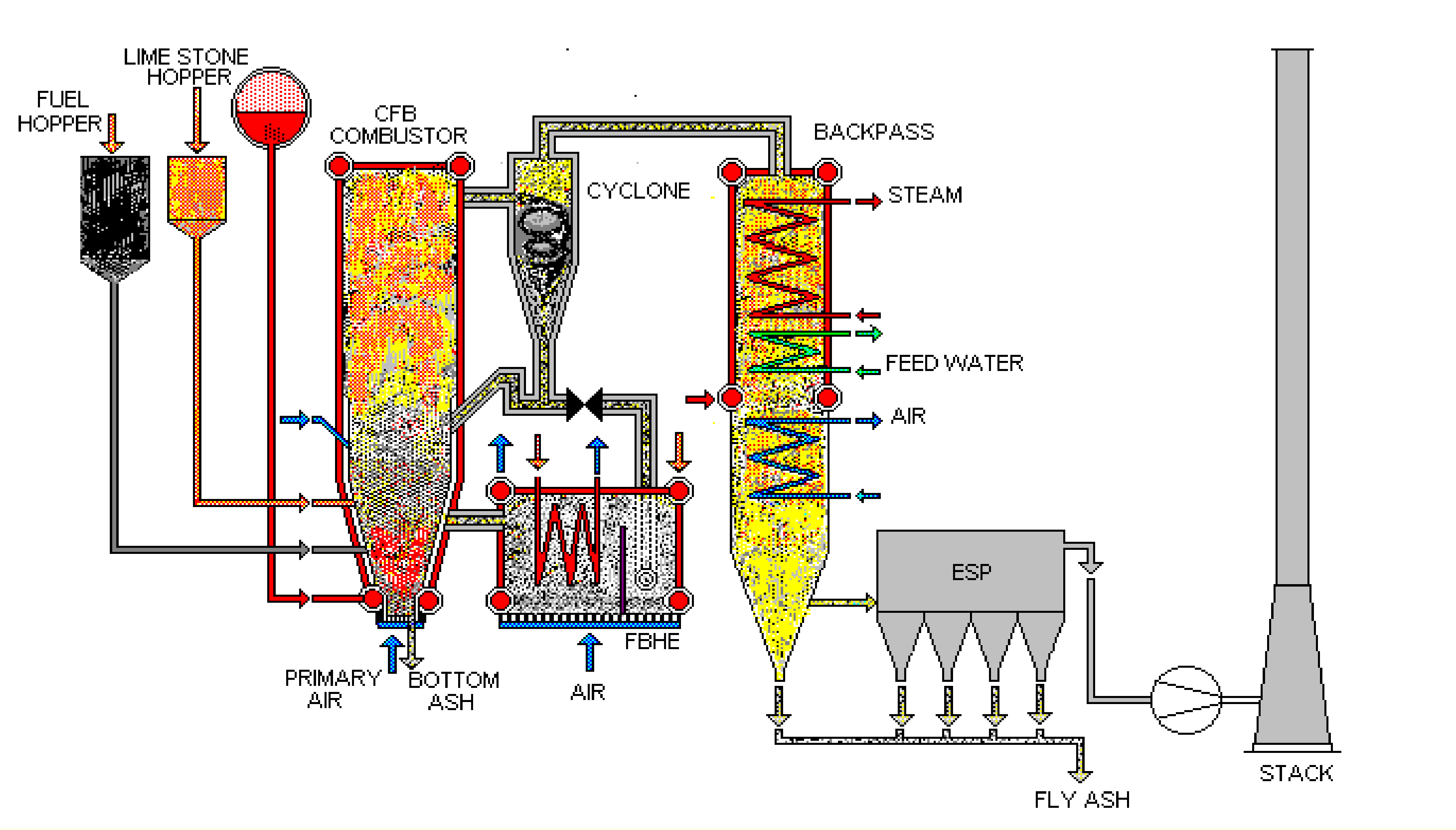
- High sulphur coals
- Coal Washery Rejects
- Waste coal from Steel plants
- Lignite
- Petcoke
- Biomas

Fluidised Bed Combustion (bubbling/circulating) Steam Generators suitable for the above fuels; The process ensures lower emission with In-situ control of Sox, NOx

About 65 BFBC , 8 of 125 MW and 4 of 250 MW CFBC

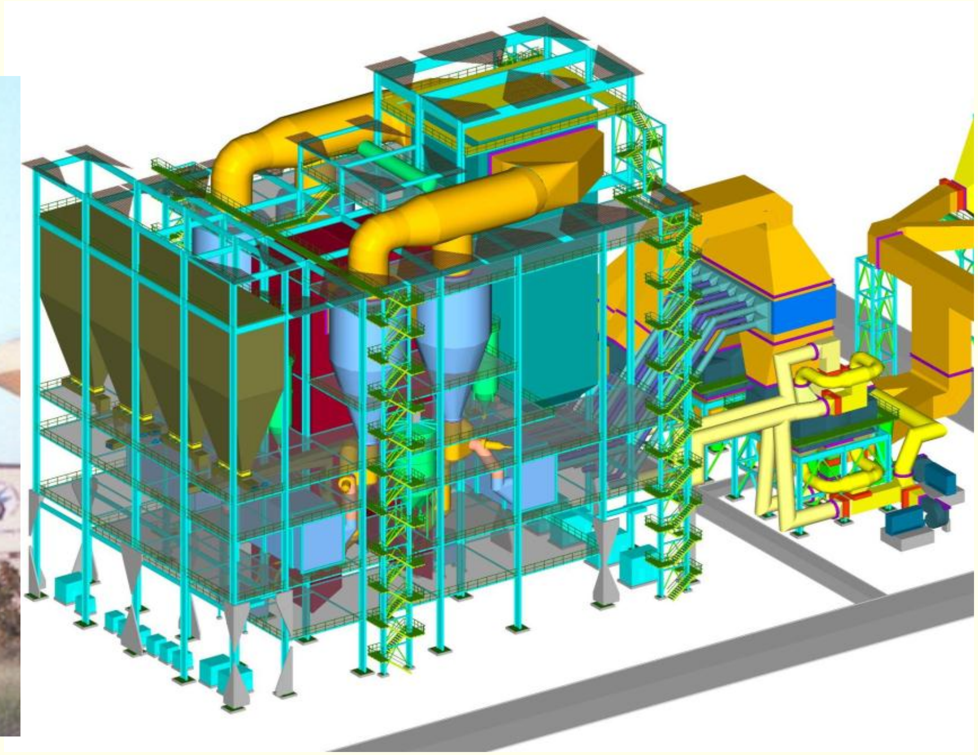
Steam Generators contracted. Two 135 MW CFBCs under export

BASIC FLOW DIAGRAM OF A CIRCULATING FLUIDIZED - BED COMBUSTION BOILER (CFBC)



Circulating Fluidised Bed Combustion Boiler

SLPP 4 x 125 MWe CFBC Boiler



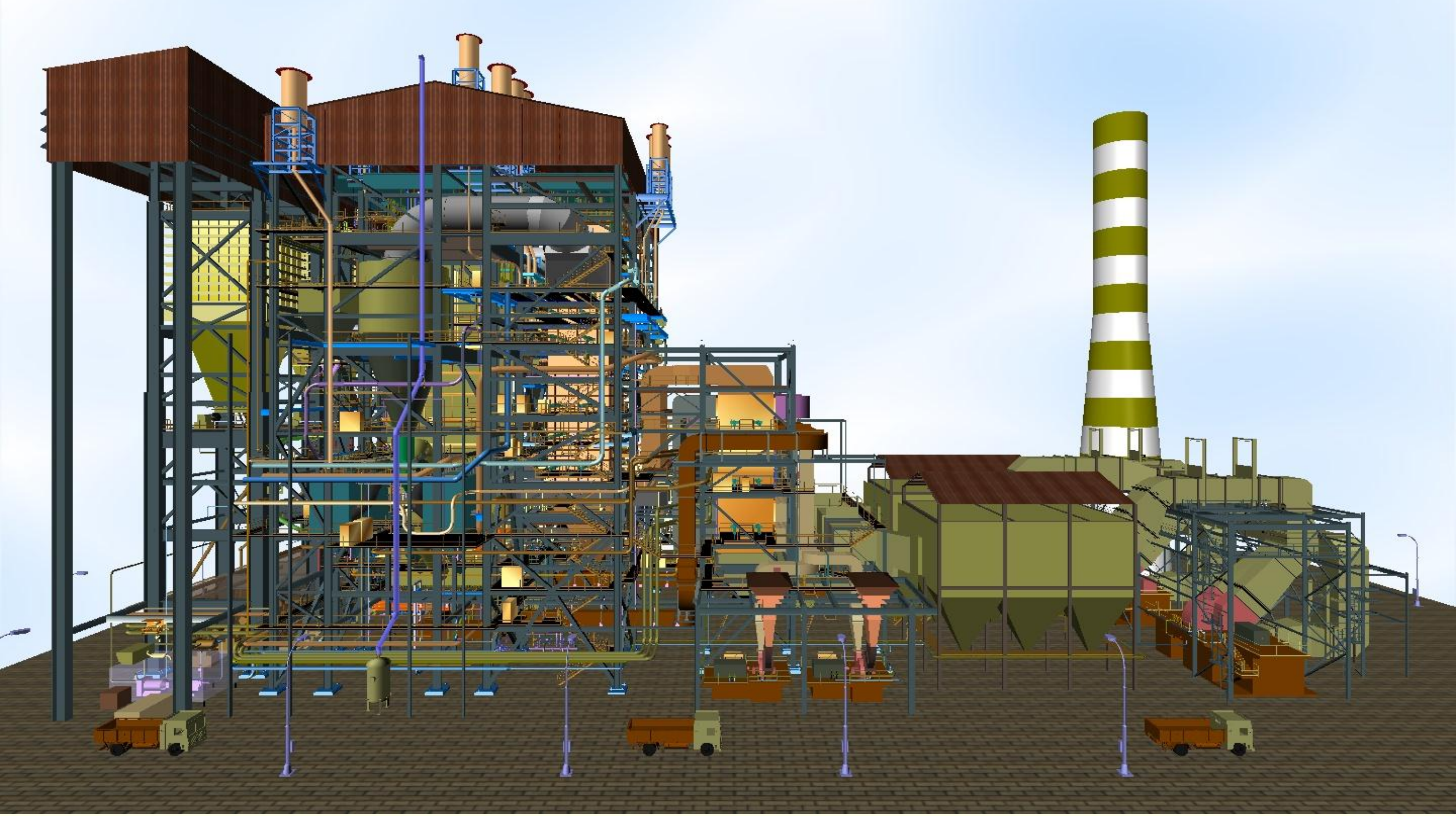
NLC-Neyveli 2 x 250 MWe CFBC Boiler

Circulating Fluidised Bed Combustion Boiler

- BILT, Bhigwan (1 x 175 t/hr)
- SLPP, Mangrol, (4 x 125 MW)
- RVUNL, Giral, (2 x 125 MW)
- GACL, (3 x 135 t/hr)
- BORL, Bina, (3 x 275 t/hr)
- NLC, Barsingsar, (2 x 125 MW)
- NLC, Neyveli, (2 x 250 MW)
- BECL, Bhavnagar, (2 x 250 MW)
- PT IBR, Indonesia, (1x120 t/hr)
- Koniambo Nickel SAS, New Caledonia, (2 x 135 MW)
- PT MSW, Indonesia, (2 x 30 MW)

27 Boilers Contracted. 19 in operation.

PDMS Model of Koniambo Nickel 2x135 MW CFBC Boiler



Bubbling Fluidised Bed Combustion Boiler

JSPL 2 x 165 tph BFBC Boiler

Bubbling Fluidised Bed Combustion Boiler

- JSPL, (3 x 180 t/hr – Largest capacity)
- JSPL, (4 x 165 t/hr – Rejects fired)
- PSEB, (1 x 10 MW - Straw fired)
- BSSL, (1 x 120 t/hr, 2 x 75 t/hr)
- TISCO, (1 x 56 t/hr, 2 x 62 t/hr, 1 x 75 t/hr)
- JAL, (1 x 125t/hr, 1x 150 t/hr)
- ACC, (4 X 40 t/hr)
- TNPL, (2 x 40 t/hr-Bagasse & Pith fired)
- PT IBR Indonesia, (3 x 17 MW)
- PT MP, Indonesia, (3 x 18 MW)

66 Boilers Contracted. 60 in operation.

Integrated Gasification Combined Cycle (IGCC)

6.2 MW IGCC Plant at CCDP

BHEL pilot scale fluidized bed gasification test facility

Coal throughput	18 T / DAY
Gasifier diameter	450 mm
Gasification media	AIR / Steam mix
Gasification temp.	1000ºC
Gasification pr.	11 kg / cm^2
Gas calorific value	1000-1100 Kcal / Nm^3

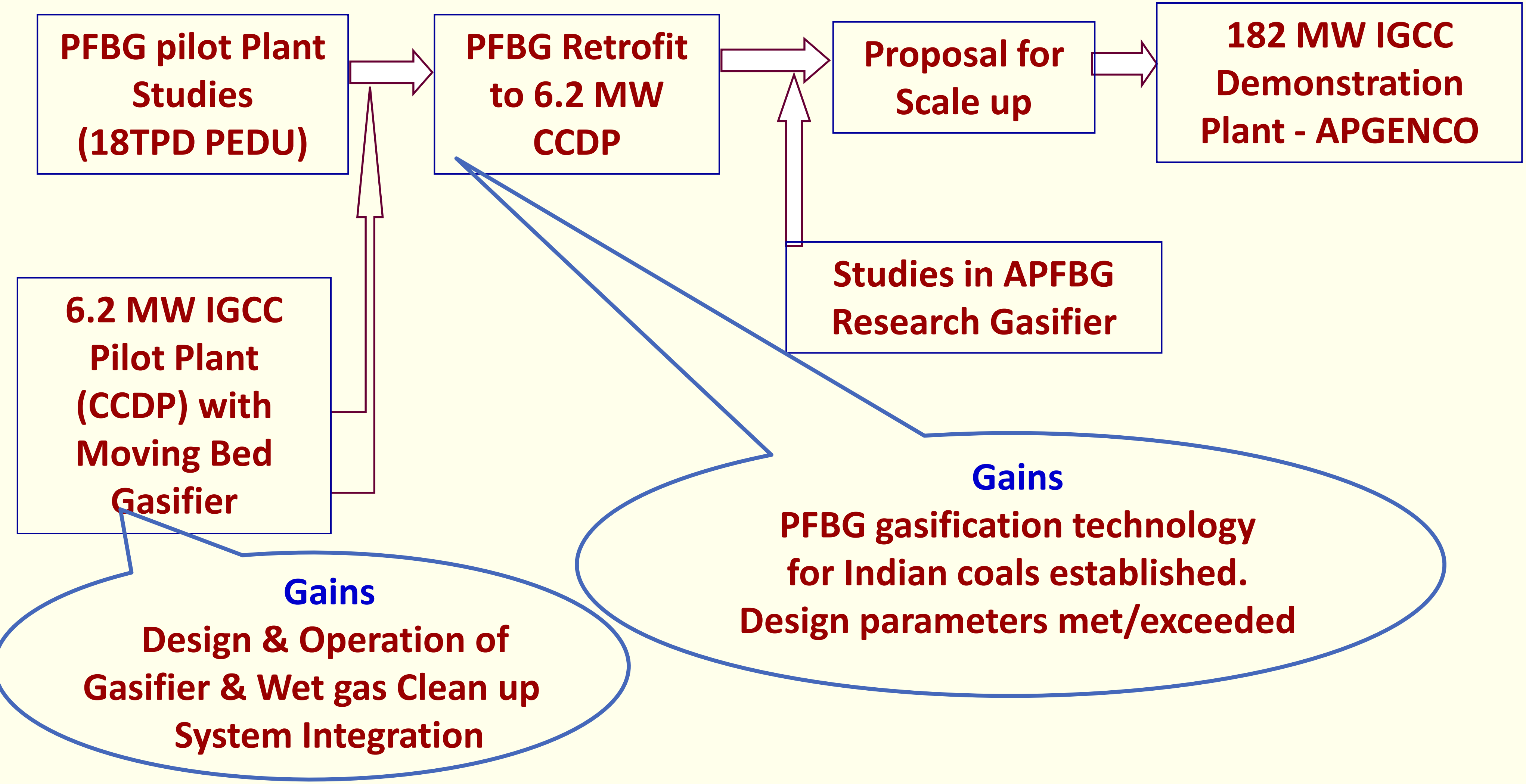
BHEL's 6.2 MW demo plant with fluidized bed technology

CAPACITY OF THE CCDP PLANT	6.2 MWe(4 MWGT+2.2MW ST)
PRESSURIZED FLUIDIZED BED GASIFICATION	150 TPD coal
COAL FEED SIZE	(0-6mm)
OPERATING PRESSURE	10 Kg/cm^2 (g) (980.65 KPa)
GASIFICATION MEDIA	Air / Steam Mix
OPERATING TEMPERATURE MAX.	1100^o C
GAS CALORIFIC VALUE (HHV)	1000 – 1200 (Kcal / Nm^3)

ADVANTAGES OF FLUIDISED BED GASIFIER

- Higher unit capacity
- Inbed sulfur removal option
- No tar or oil formation and easy gas cleaning
- No liquid effluent formation
- Ability to accept finer coals
- Capability to accept all types of coals
- Better reliability and control
- Operates in non-slagging mode unlike entrained bed gasification
- Best suited for high ash Indian coals
- Lower capital and operating cost compared to entrained bed gasifier

IGCC Development



- As the climate change is pressing for cleaner power generation and as the reliability of IGCC process is increasing, it is clearly evident that IGCC will be one of the future technologies for green power generation.
- IGCC plant cost is higher at this point of time as compared to PC boilers without gas cleaning but as the emission standard and carbon capture increases IGCC plant will have more advantage.
- Improvement and development in technologies like gas turbine, hot gas clean up, gasifier will make IGCC more competitive for power generation.
- BHEL gained lot of experience via continuous operation of the gasifier island for the past one year and is geared fully in commercializing the technology for higher size plants.

Thank U All