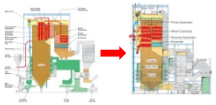
Worldwide Pollution Control Association

Gulf Power Coal to Gas Seminar

May 30-31, 2012

Visit our website at www.wpca.info

Gas Conversion Fundamentals



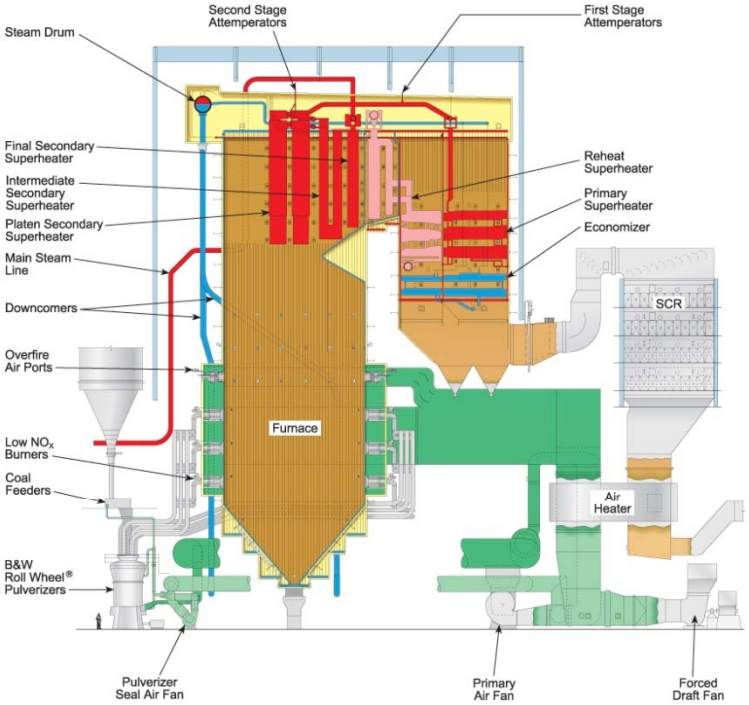
Don Ryan
Division Mgr, BWSC Engineering

Gas Conversion Fundamentals

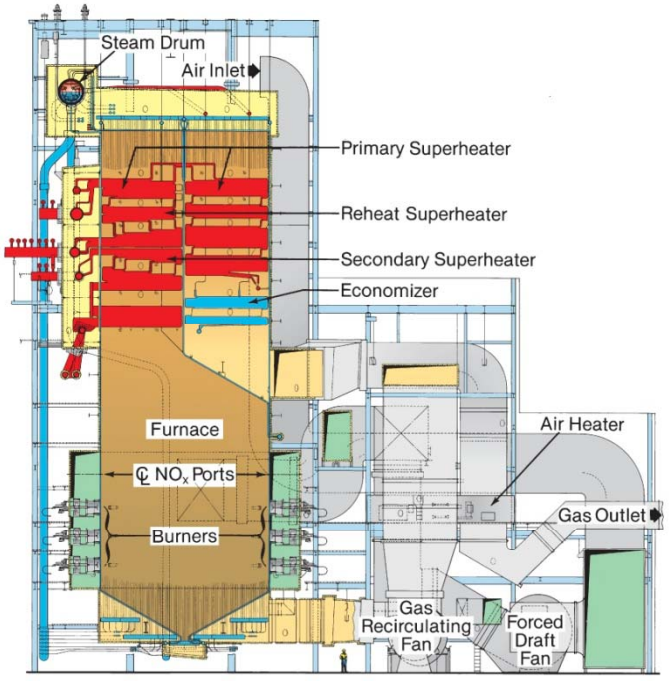
So you want to Convert this…

Into

This?



Typical PC Boiler

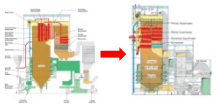


Typical Gas Boiler

Gas Conversion Fundamentals

Typical Fuel Analysis Comparison

Proximate (% by wt)	**Bituminous**	**PRB**	**Natural Gas**	
Moisture	3.5	27.22	90.0	CH_3 (% by vol)
Volatile	35.7	29.90	5.0	C_2H_6 (% by vol)
Fixed Carbon	51.8	37.17	5.0	N_2 (% by vol)
Ash	9.0	5.71		
Ultimate (% by wt)				
Carbon	72.8	49.99	69.20	
Hydrogen	4.8	3.62	22.65	
Sulfur	2.2	0.33		
Oxygen	6.2	12.43		
Nitrogen	1.5	0.70	8.08	
Moisture	3.5	27.22		
Ash	9.0	5.71		
HHV (btu/lb)	13080	8772	21800	

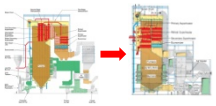


Gas Conversion Fundamentals

Typical Flue Gas Property Comparison

@ constant excess air

% by wt.	Bituminous	PRB	Natural Gas
O_2	2.92	2.80	2.98
CO_2	21.34	21.42	13.01
N	70.48	67.59	72.41
H_2O	4.91	8.12	11.60
SO_2	0.35	0.07	0.00
Specific Heat	0.272	0.278	0.286

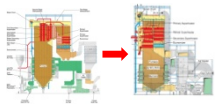


Gas Conversion Fundamentals

Typical Efficiency Comparison

(Constant X-Air and AH Outlet Temps)

	Bituminous	PRB	Natural Gas
Losses (%)			
Dry Gas	4.82	4.78	4.20
Water from Fuel	4.07	7.83	10.62
Moist in Air	0.11	0.11	0.11
Unburned Combustible	0.30	0.15	0
Radiation	0.17	0.17	0.17
Unaccounted For	1.50	1.50	1.00
Total Losses	10.97	14.54	16.10
Boiler Efficiency	89.03	85.46	83.9



Gas Conversion Fundamentals

Other Performance Parameters

	Bituminous	PRB	Natural Gas
Fuel Input	Base	1.05x	1.08x
Air Wt.	Base	1.04x	0.98x
Gas Wt.	Base	1.08x	0.96x
FEGT	Base	+50-100F	+30F
Surface Effectiveness			
Furnace	Base	Base	1.08x
Convection	Base	(.8-.95)x	1.2x