US Experience in Coal Waste Utilization

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Issues with Washery Waste Use

- **Waste energy conversion system design needs skilled effort**

- **Low heating value and varying quality.**
- **Low quantity waste production.**
- **Most washery units near environmentally sensitive areas.**
- **Possible captive power plants.**
- **Unsatisfactory experience with bubbling bed combustors.**

Coal Wastes and PC boilers

- **Coal wastes are extremely difficult to burn in PC/AFBC* boilers**

  - **Low grade coal needs longer residence time in the furnace and better gas-solid interaction to insure complete combustion.**
  - **Energy required for grinding per unit heating value of the fuel increases with ash content.**
  - **Significant variations in fuel quality make the combustion optimization difficult.**

*** Poor availability reported**

Comparison of U.S. and Indian Coal Wastes

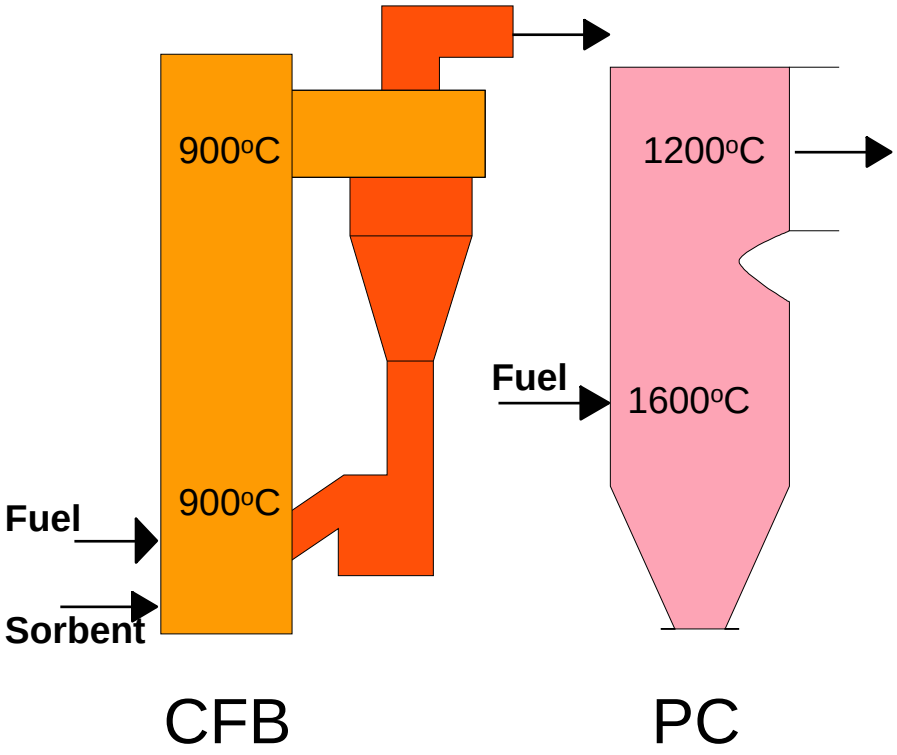
- **Fuels similar to Indian coal wastes are burned in the U.S. CFB units**

Ultimate Analysis, % by wt	Mt Carmel Fuel (anthracite culm)	Typical Indian Coal Washery Rejects+other fuel blends	Indian Coal (Typ)	
			Raw Coal	Sinks
Carbon	24.3	31.6	50.00	15.50
Sulfur	0.33	0.4	0.30	0.26
Ash	65.38	44	40.00	71.00
Moisture	4.71	16.01	3.24	7.84
Higher Heating Value, MJ/kg/ (kcal/kg)	8.3 (1973)	12.56 (3000)	19.82(4735)	7.3 (1780)

Ref: Cotton et al 20000

Comparison of PC-CFB Combustion Processes

CFB process offers better suitability for coal waste combustion



CFB Benefits

- No Flame-out Risk
- Solids Inventory Stabilizes Fuel Combustion
- Boiler Can Be Restarted Without Support Fuel
- Insensitive to Sudden Changes in Fuel Quality
- Low furnace temp... Low NOx, Low SO2

Experience With High Ash Fuels

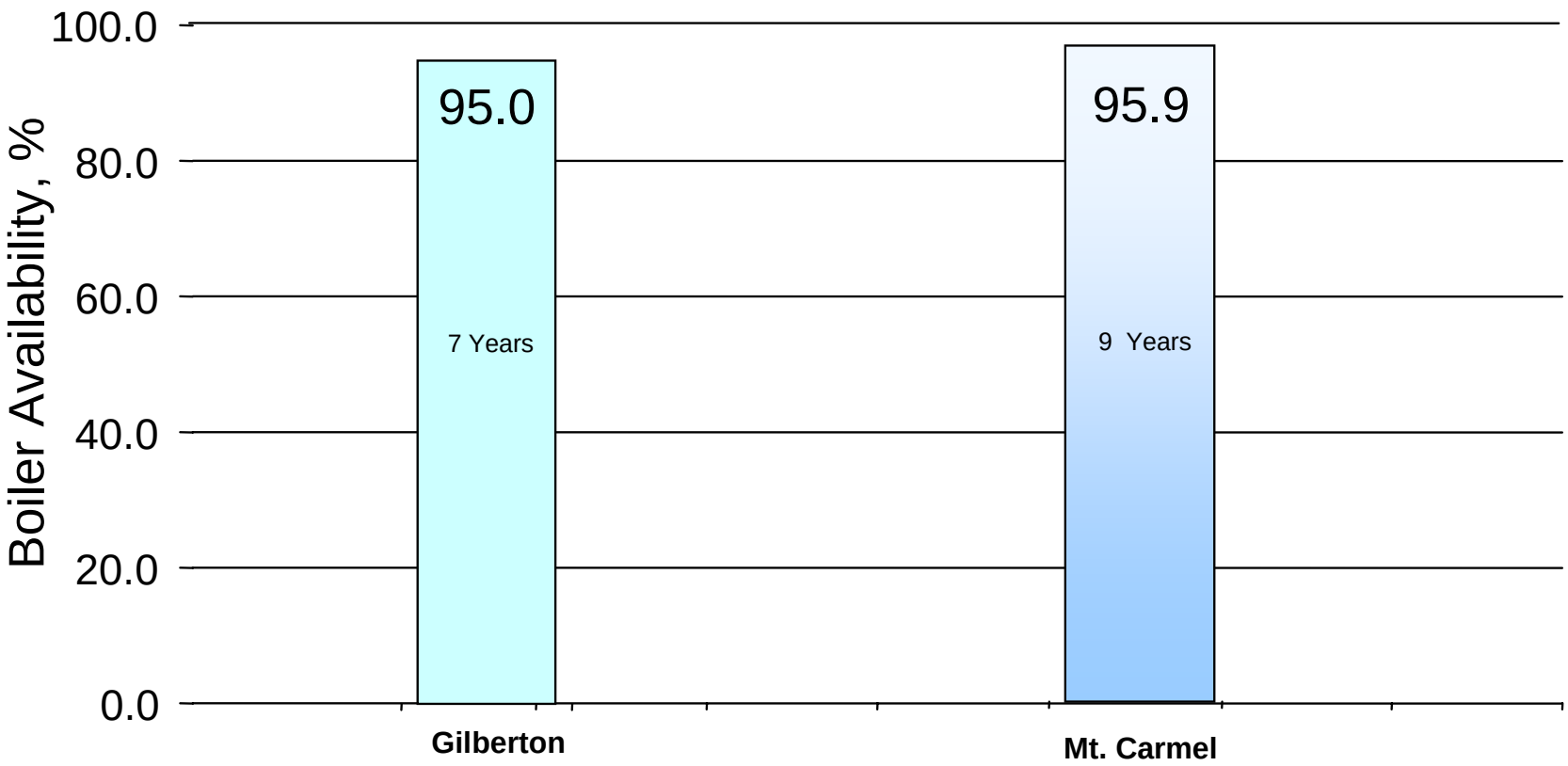
- **Boiler design know-how for very high ash fuels has been established in the U.S.**

PROJECT*	FUEL ANALYSES (%)			START-UP
	Ash	Sulfur	HHV kcal/kg	
Gilberton[1]	45	0.8	3334	1988
Mt. Carmel[1]	70	0.4	2035	1990
Ebensburg[2]	45	NA	NA	1991
Scrubgrass[3]	45	2	4000	1993
Seward[4]	Coal waste	NA	NA	2004

* Units supplied by Foster Wheeler[1], Babcock&Wilcox[2], Kvaerner[3], and Alstom[4]

CFB Boiler Availability (Typ)

- **Many units have demonstrated >95% availability.**



Conclusions and Suggested Pathway

- **CFB technology can be successfully applied to Indian coal wastes and U.S. experience can play a vital role.**

  - **CFB technology is highly suitable to get the best energy conversion from coal wastes.**
  - **Many coal waste-fired U.S. boiler units, based on CFB technology, have shown excellent availability.**
  - **The boiler efficiency and emissions while burning waste fuel can be as good as the boiler burning high quality fuel.**
  - **CFB offers high turndown and minimal use of premium fuels for start-up and low load operation.**

Thank You