Kvaerner Power

47th International Energy Agency Workshop on large scale FBC, Zlotniki, Poland
“Co-combustion of biomass with coal in CFB boilers”

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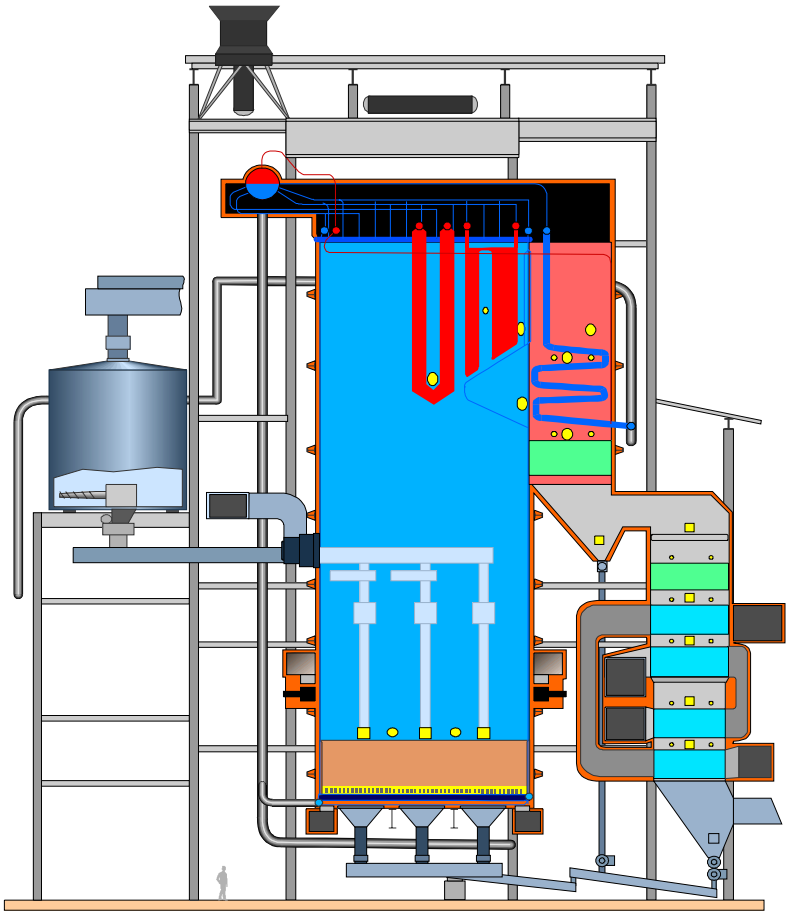
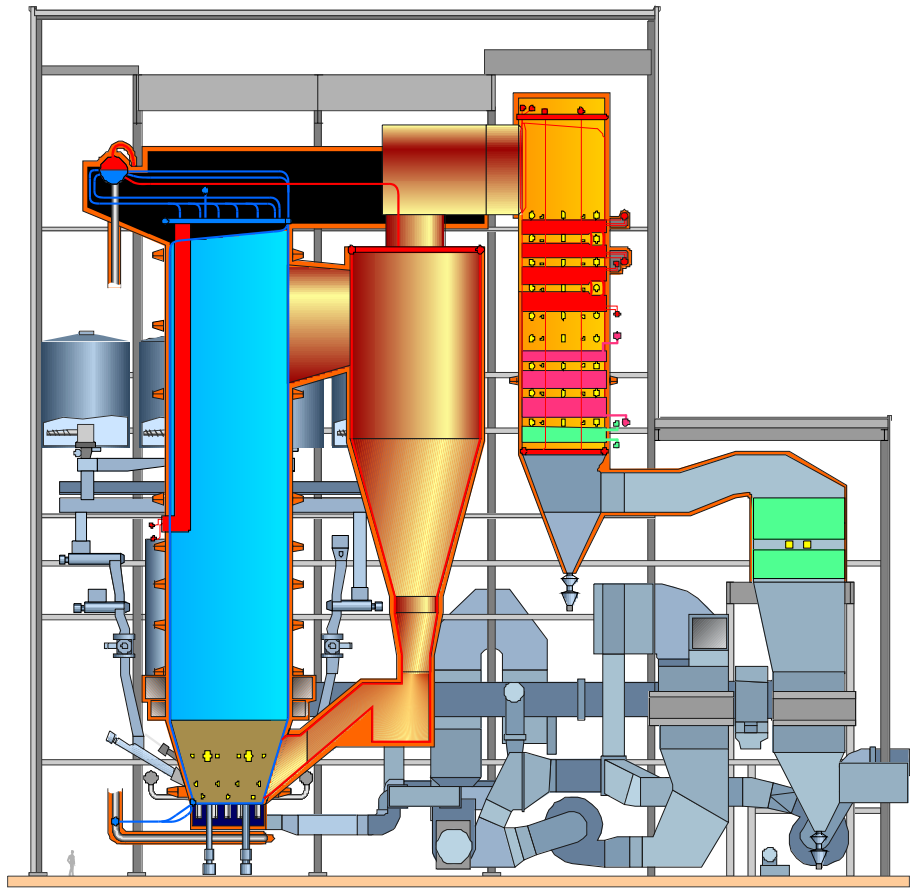
Fluidized Bed Boilers

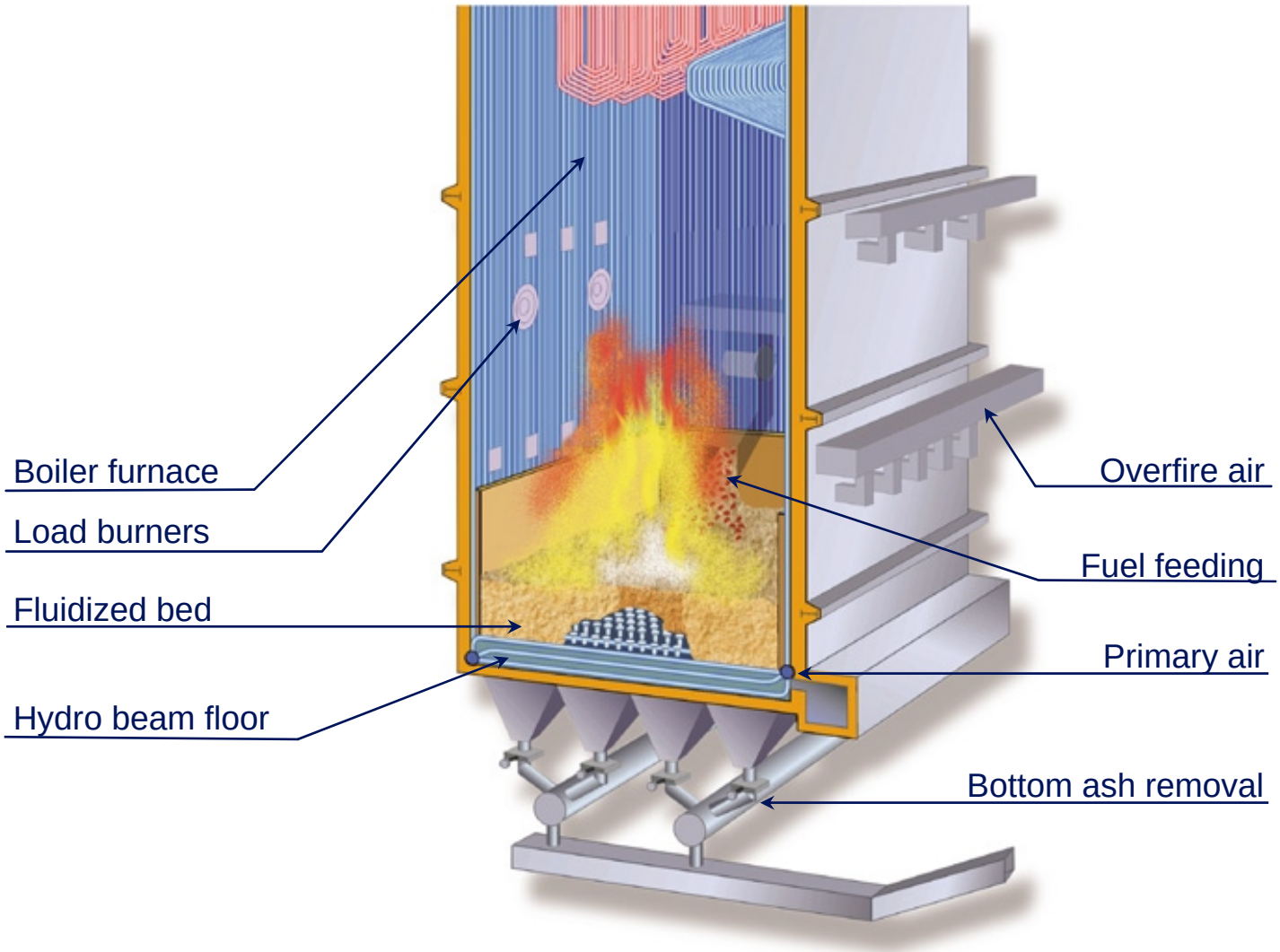
Experience

- 120 BFBs
- up to 300 MW_{th}
- 60 CFBs
- up to 600 MW_{th}



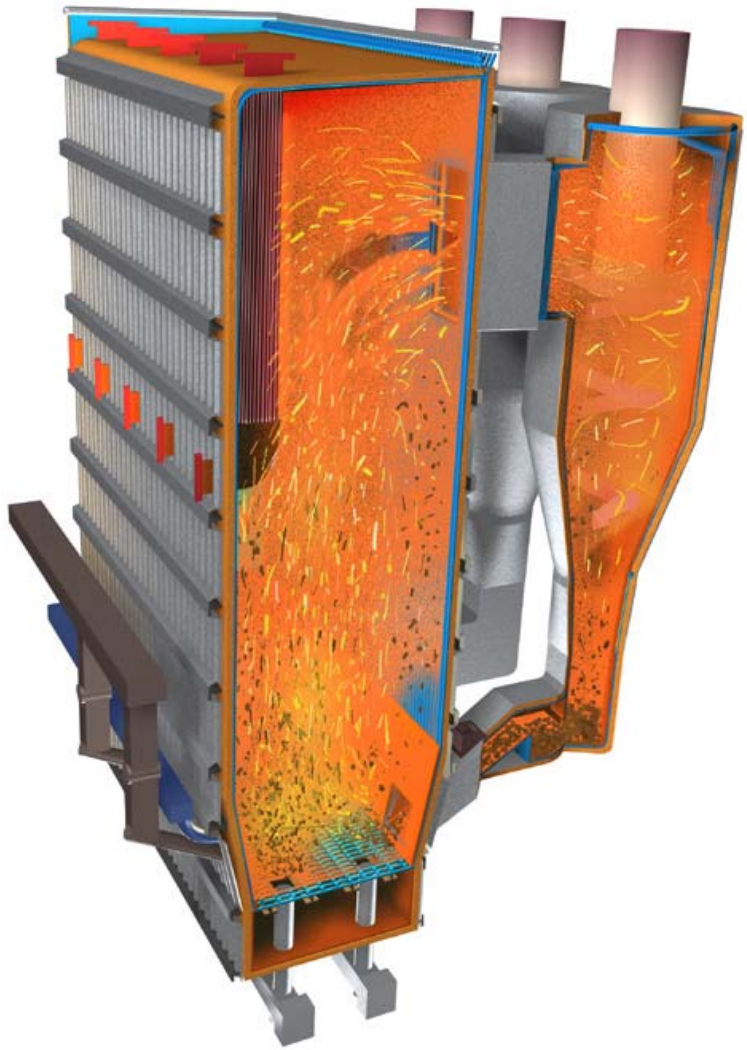


BFB Technology



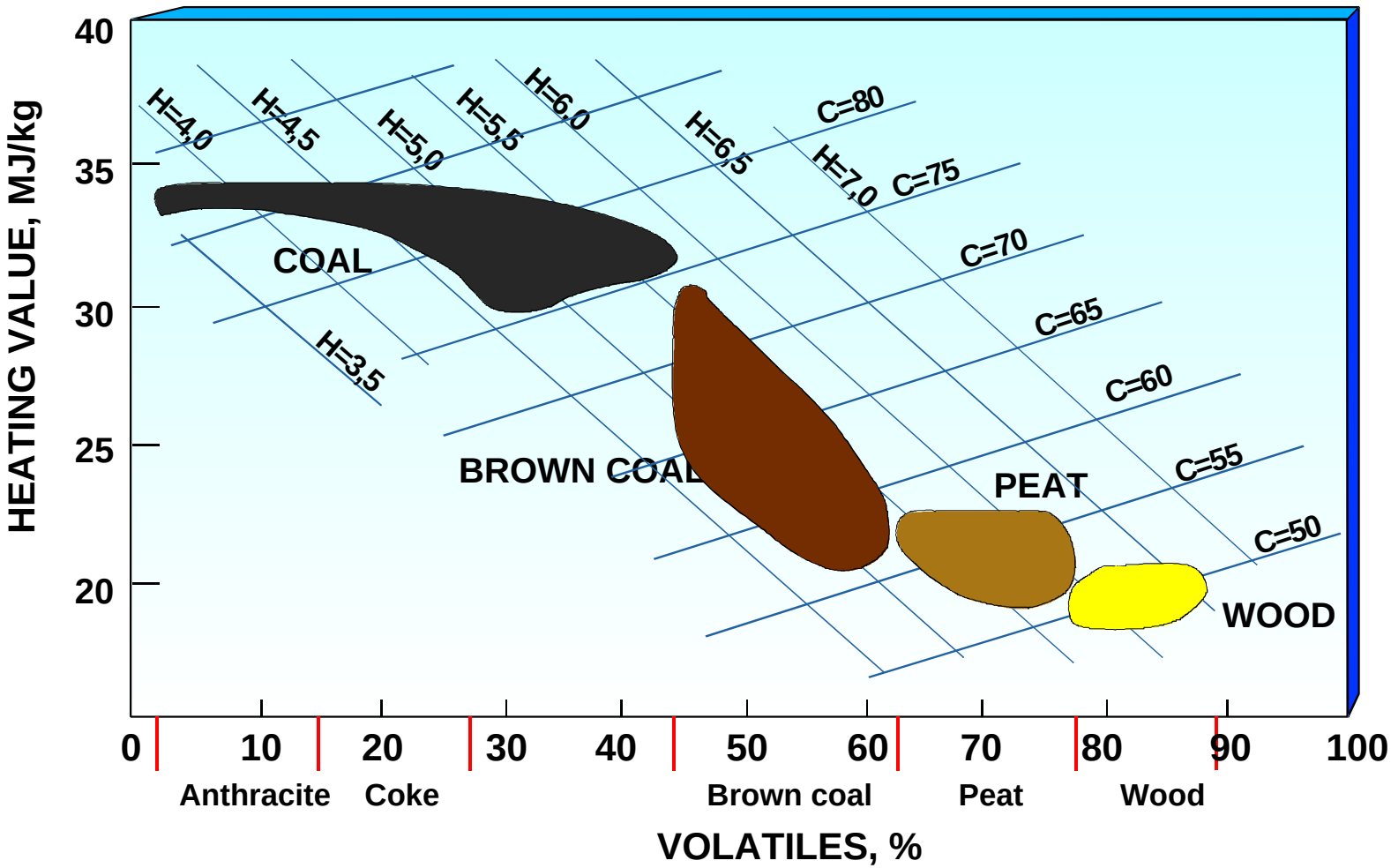
CFB Technology

- Over-bed fuel feeding
- Staged combustion
- Excellent mixing
- Long solids retention time
- In-furnace sulphur removal
- HYBEX™ floor



Fluidized Bed Boilers

Fuel characteristics



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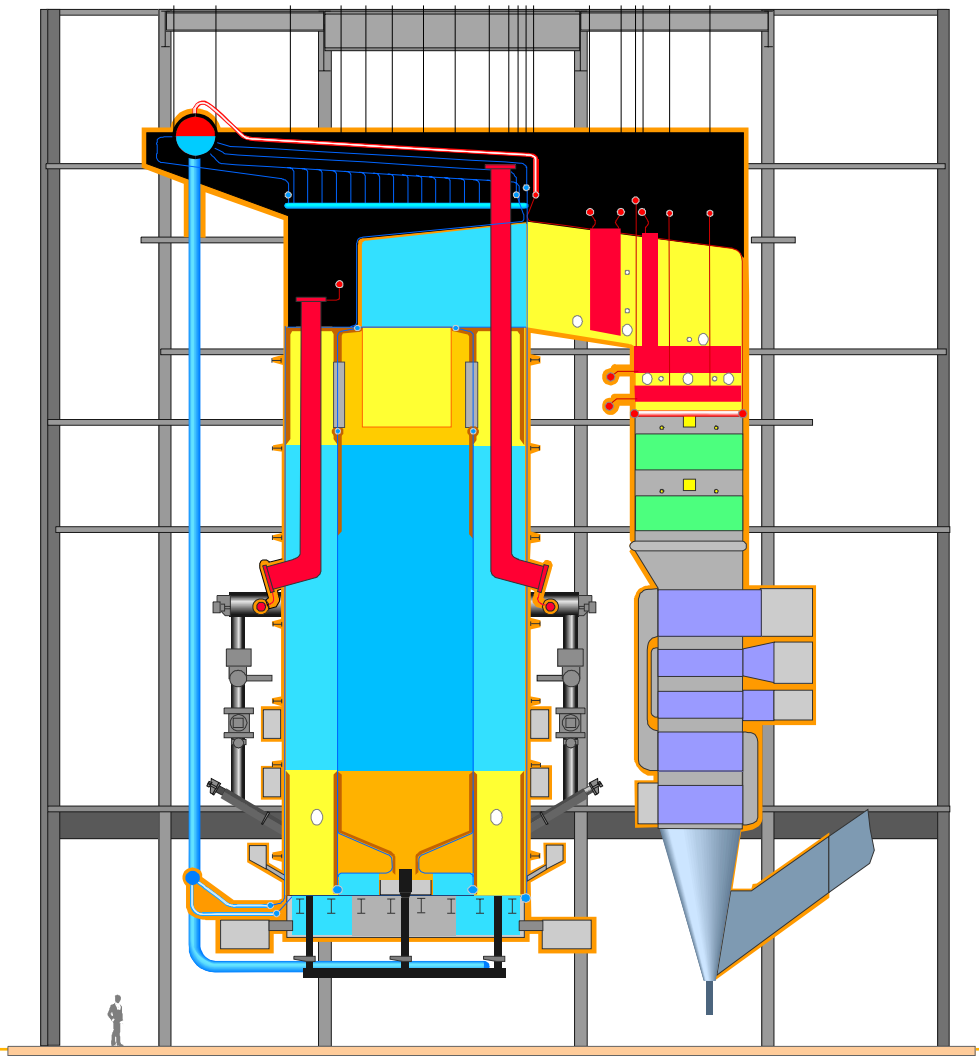
Circulating fluidized bed boiler

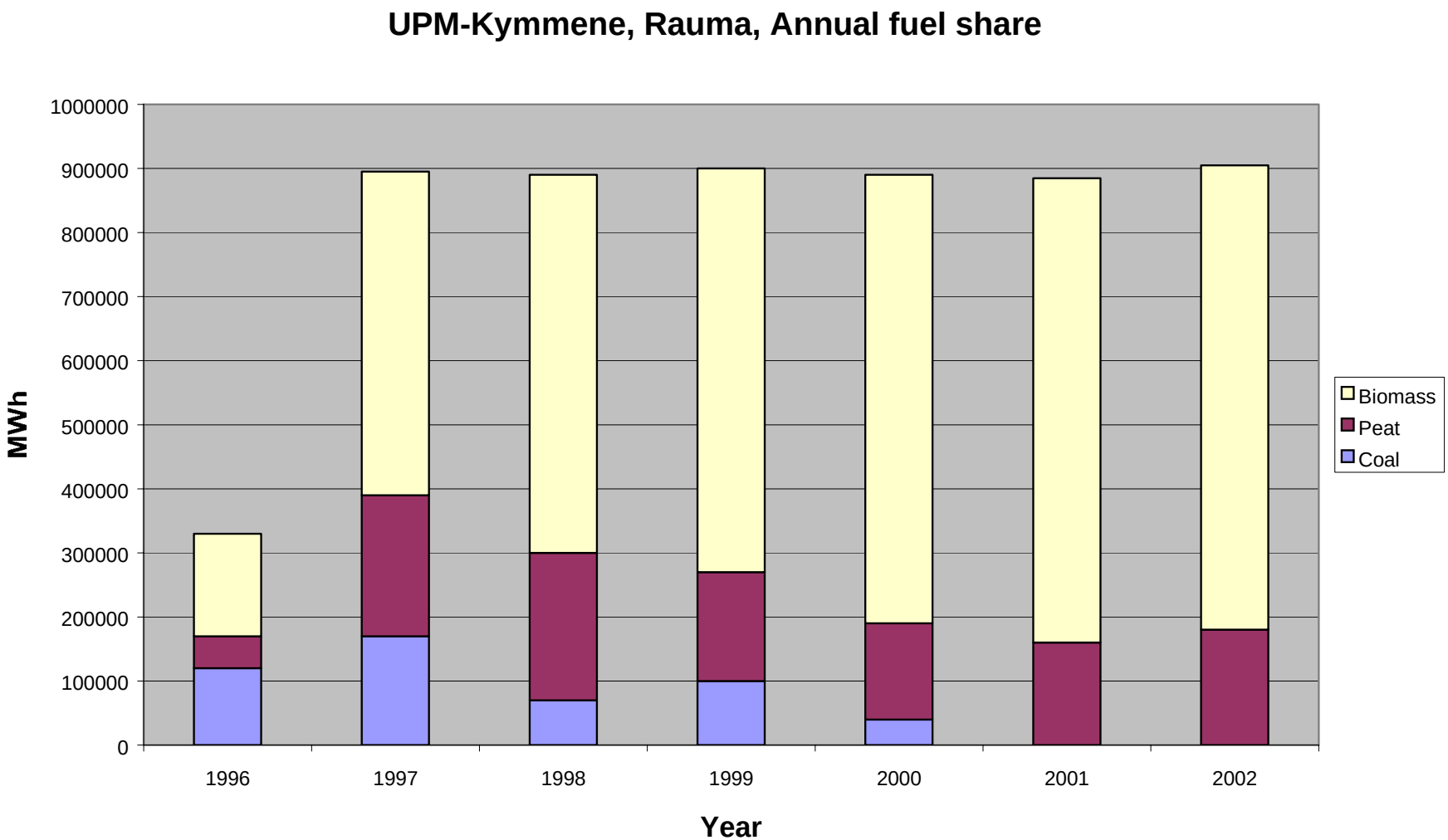


UPM-Kymmene,
Rauma Paper, Finland

CYMIC® boiler

Steam	160 MW_{th}
	60 kg/s
	69 kg/s with coal
	115 bar
	530 °C
Fuels	Bark, peat, sludge, coal
Start-up	1996

UPM-Kymmene, Rauma fuels 1996-2002



UPM-Kymmene, Rauma fuels 1996-2002

- Biomass has been
  - Bark from Pulp Mill
  - Sludge from Pulp&Paper Mill
  - Demolition wood from mill area
  - Wood waste
  - Harvesting residue (green chips)
  - Railway sleepers

Large Multifuel CFB Boiler Plant

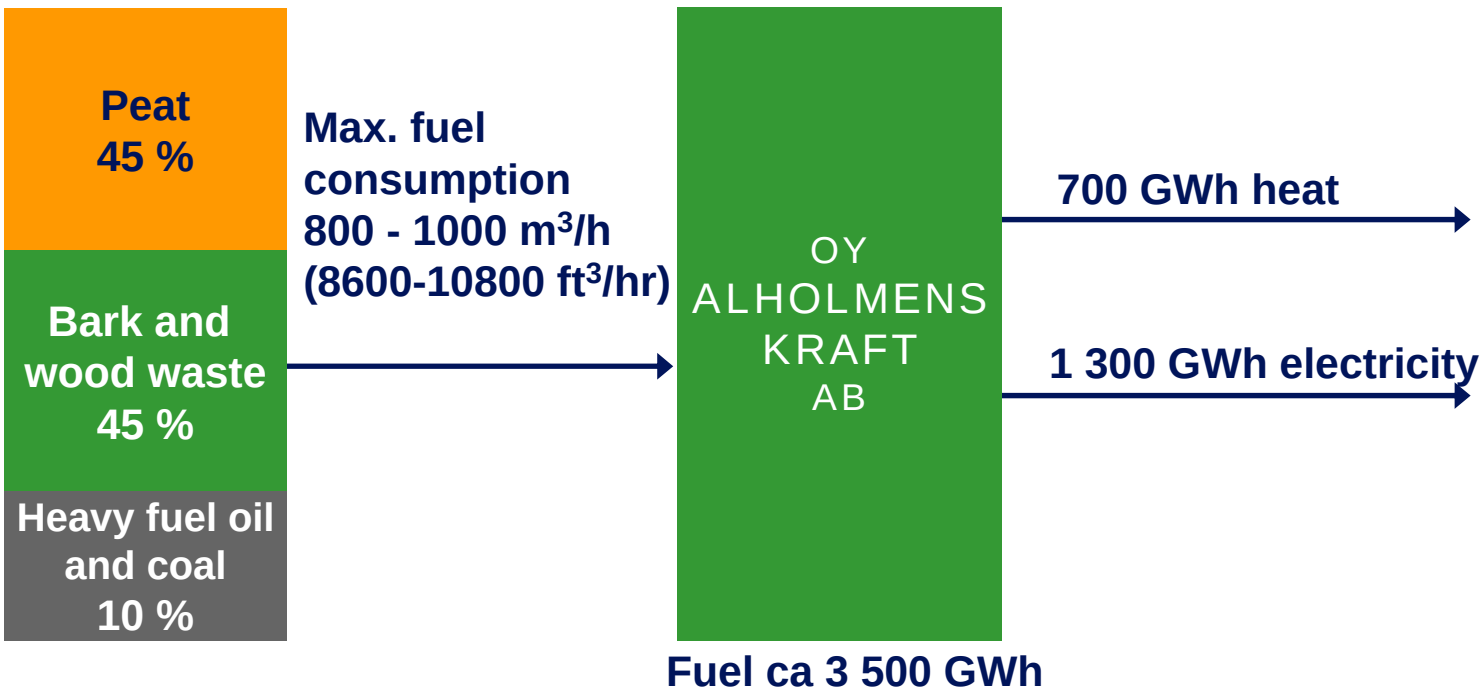
Alholmens Kraft,
Pietarsaari,
Finland

Steam	550 MW_{th}
	194/179 kg/s
	165/40 bar
	545/545 °C
Fuels	Wood, peat, coal
Start-up	2001

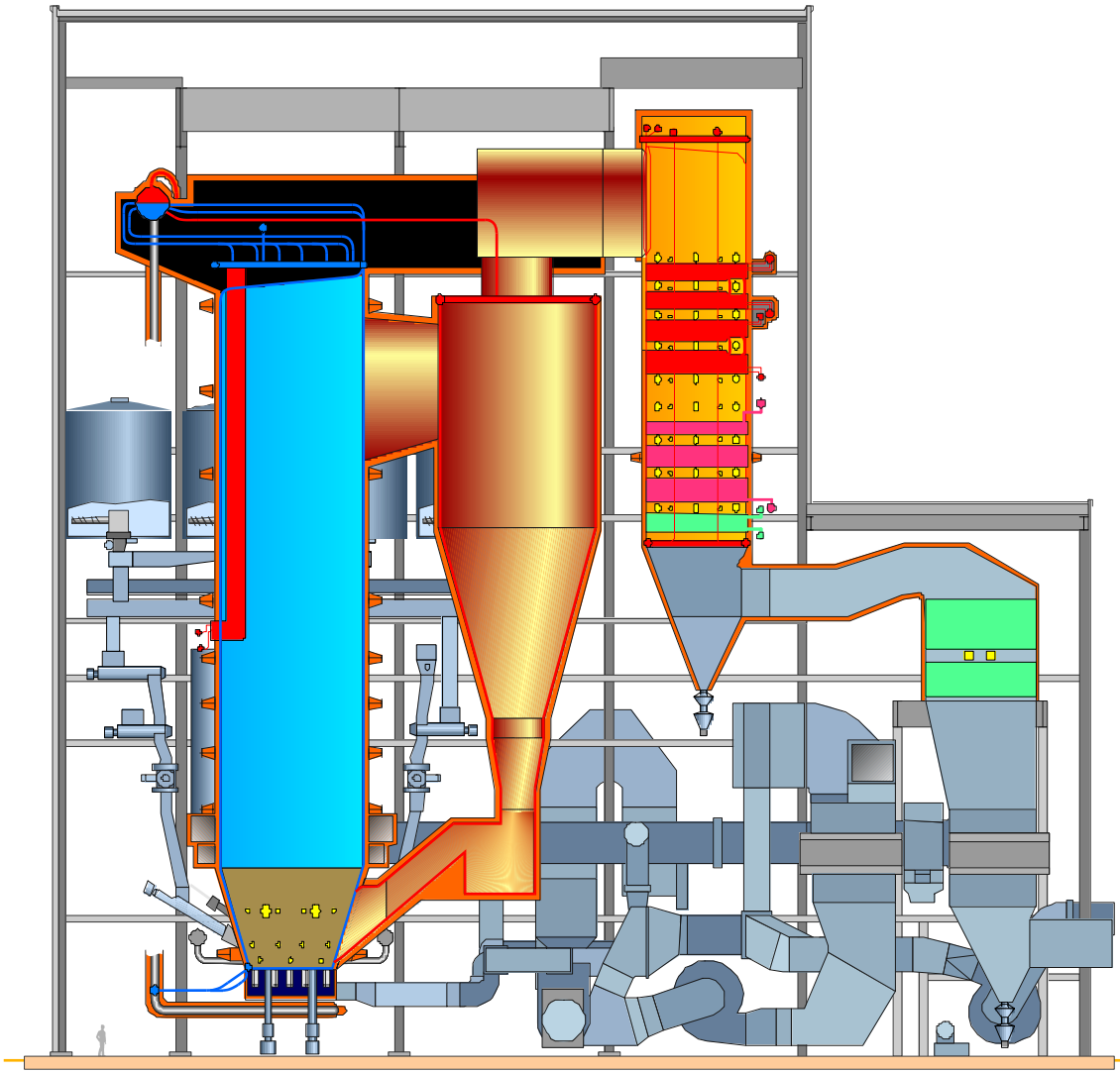
Annual Production and Consumptions

Oy Alholmens Kraft Ab

Electricity	New power plant	240 MW
	Existing power plant	25 MW
Heat	Process steam	100 MW
	District heat	60 MW



Circulating fluidized bed boiler



Alholmens Kraft,
Pietarsaari, Finland

Steam	550 MW_{th}
	194/179 kg/s
	165/40 bar
	545/545 °C
Fuels	Wood, peat, coal
Start-up	2001

Pressure parts

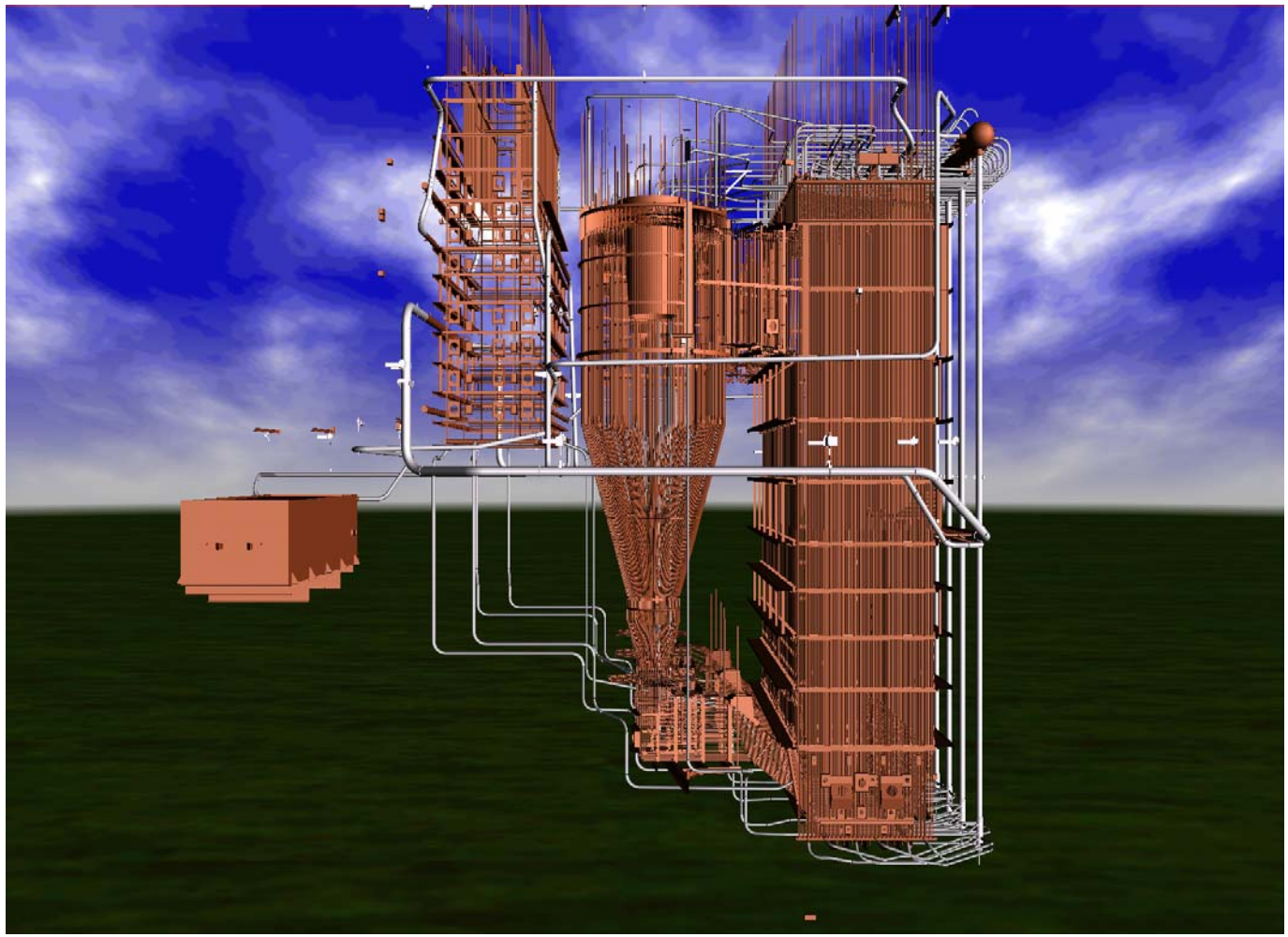
Furnace:

8.5x24x40.5 m

28x79x133 ft

Pressure parts:

abt. 4000 t



Alholmens Kraft Biomass

Utilization of wood residuals from saw and pulp mills

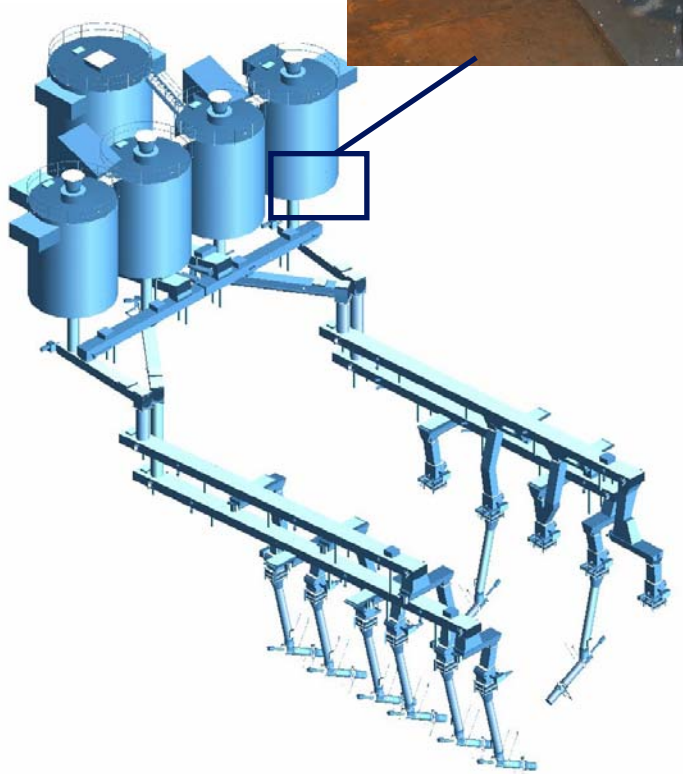
Harvesting

Bales

Chips

		Bark and wood
LHV HHV	MJ/kg Btu/lb	7.7 4530
Volatiles	w-%	70
Moisture	w-%	57
Ultimate analysis	dry basis	
C	w-%	55.3
H	w-%	6.3
N	w-%	0.5
S	w-%	0.0
O	w-%	36.3
Ash	w-%	1.6
Cl	w-%	<0.1
Annual proportion	%	25

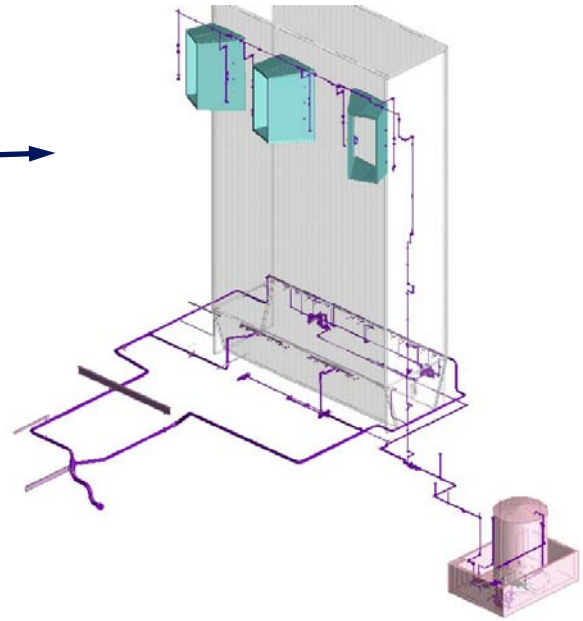
Fuel Feeding

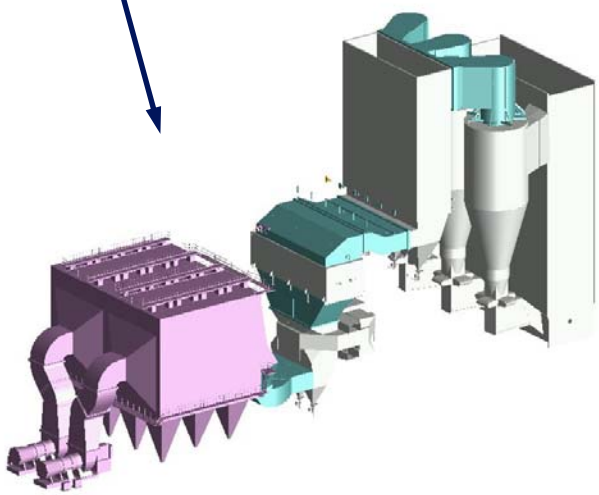


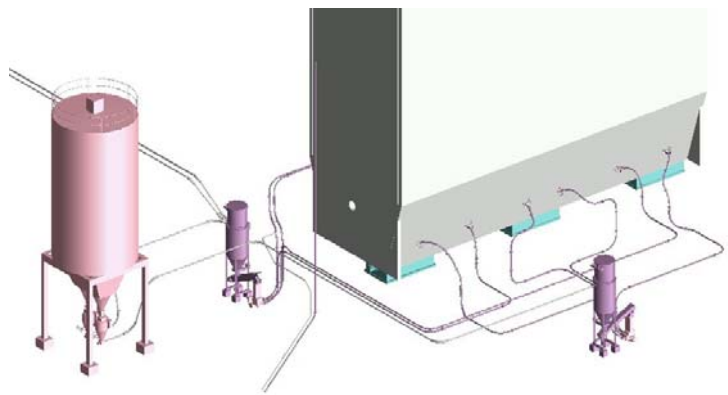
- Four independent feeding lines
- Common feeding lines for both fuels
- Fuel consumption:
  - Biomass 1 000 m^3/h
  - Coal 110 m^3/h

Emission Control

- Aqueous ammonia (24 %) injection
- Pneumatic limestone feeding
- Four field ESP

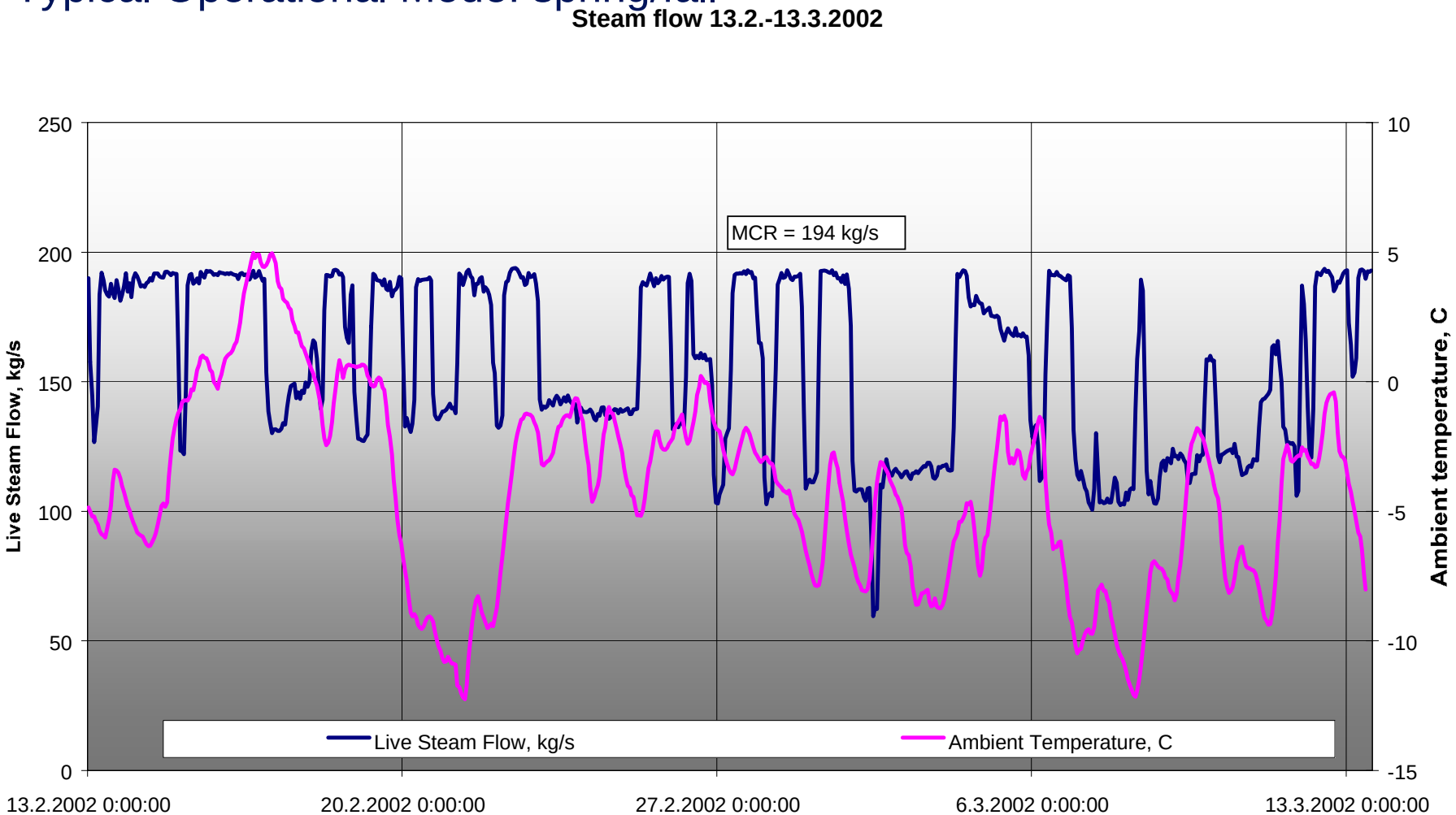






Alholmens Kraft, Pietarsaari, Finland

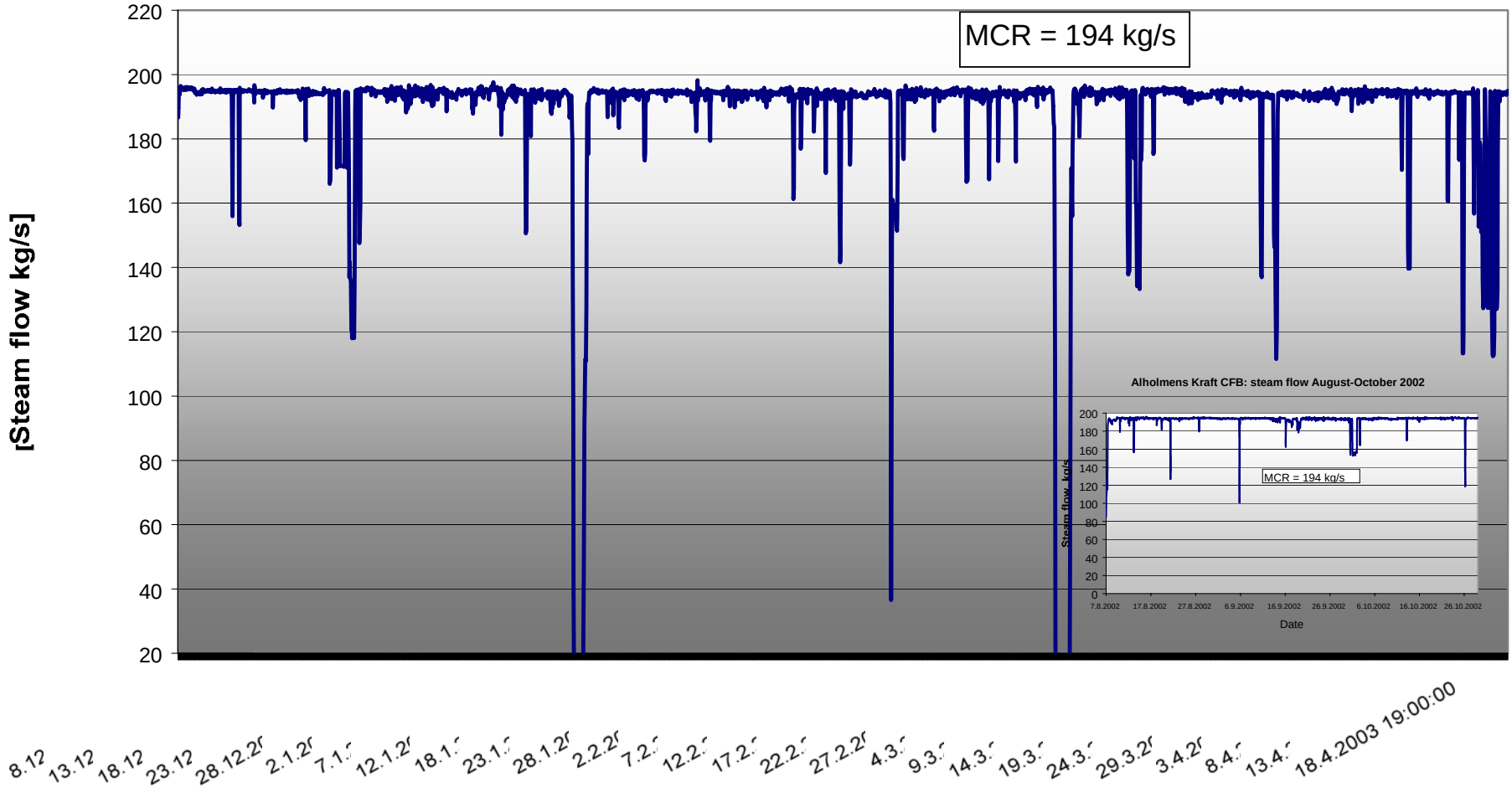
Typical Operational Mode: spring/fall



Alholmens Kraft, Pietarsaari, Finland

Reliable operation

Steam flow, kg/s December 2002 - April 2003



Alholmens Kraft, Pietarsaari, Finland

Fuel flexibility: from biomass to coal

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Conclusion

- Biomass co-combustion with coal reduces net CO_2 emission
- CFB technology enables various design fuels
- Low emission limits are achieved without any secondary equipment
- CFB scaled-up to 250 MW_e size also with low calorific fuels