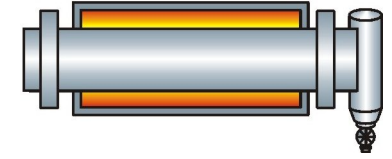




DGEngineering

DGEngineering – The Rotary Kiln Engineers

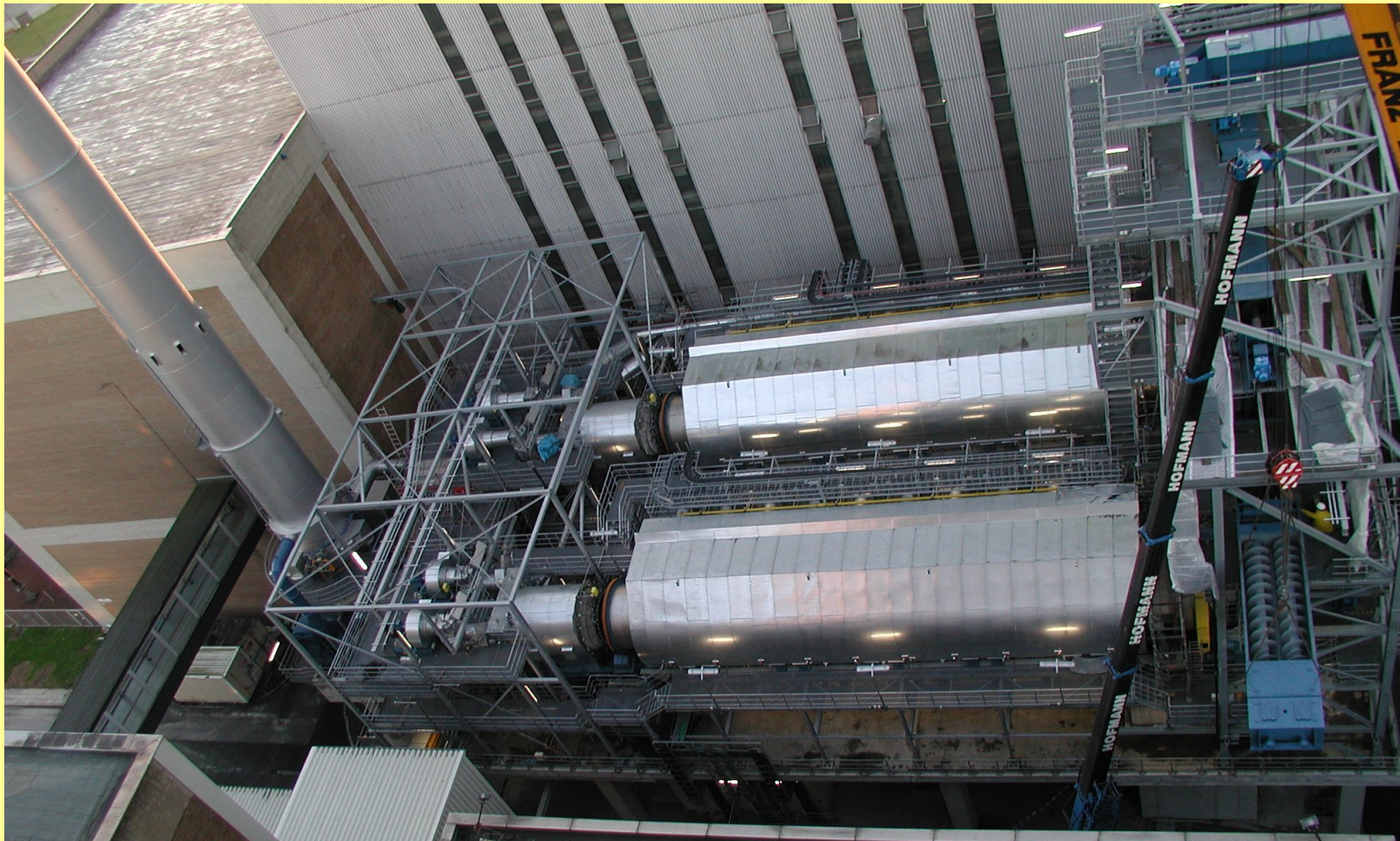
Hamm MW Pyrolysis Plant

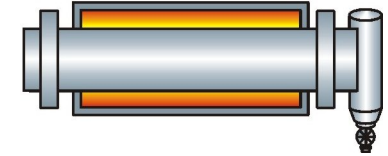


Integrated Pyrolysis into Power Plant

Plant capacity 100,000 t/a

Pre-processed Waste Materials

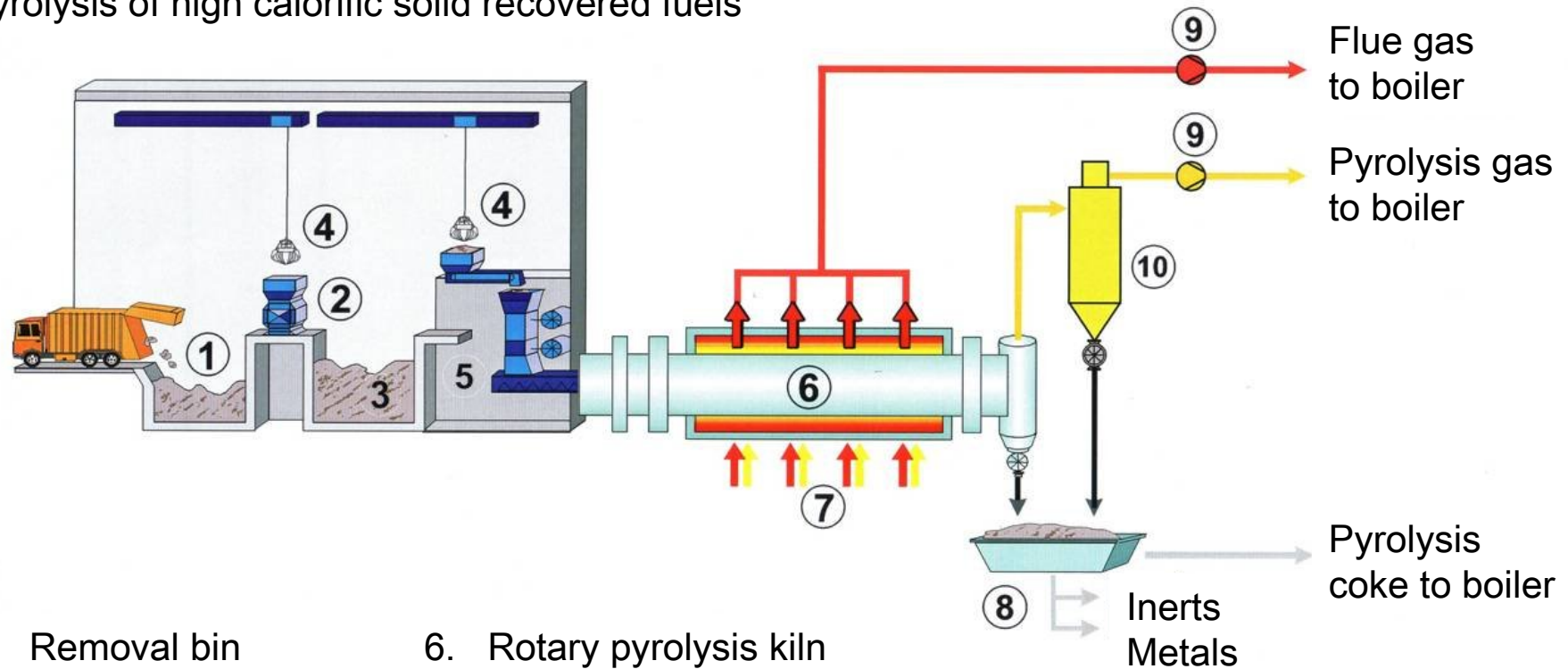




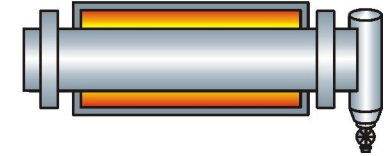
Schematic Flow sheet

Integrated Pyrolysis for Power Plants

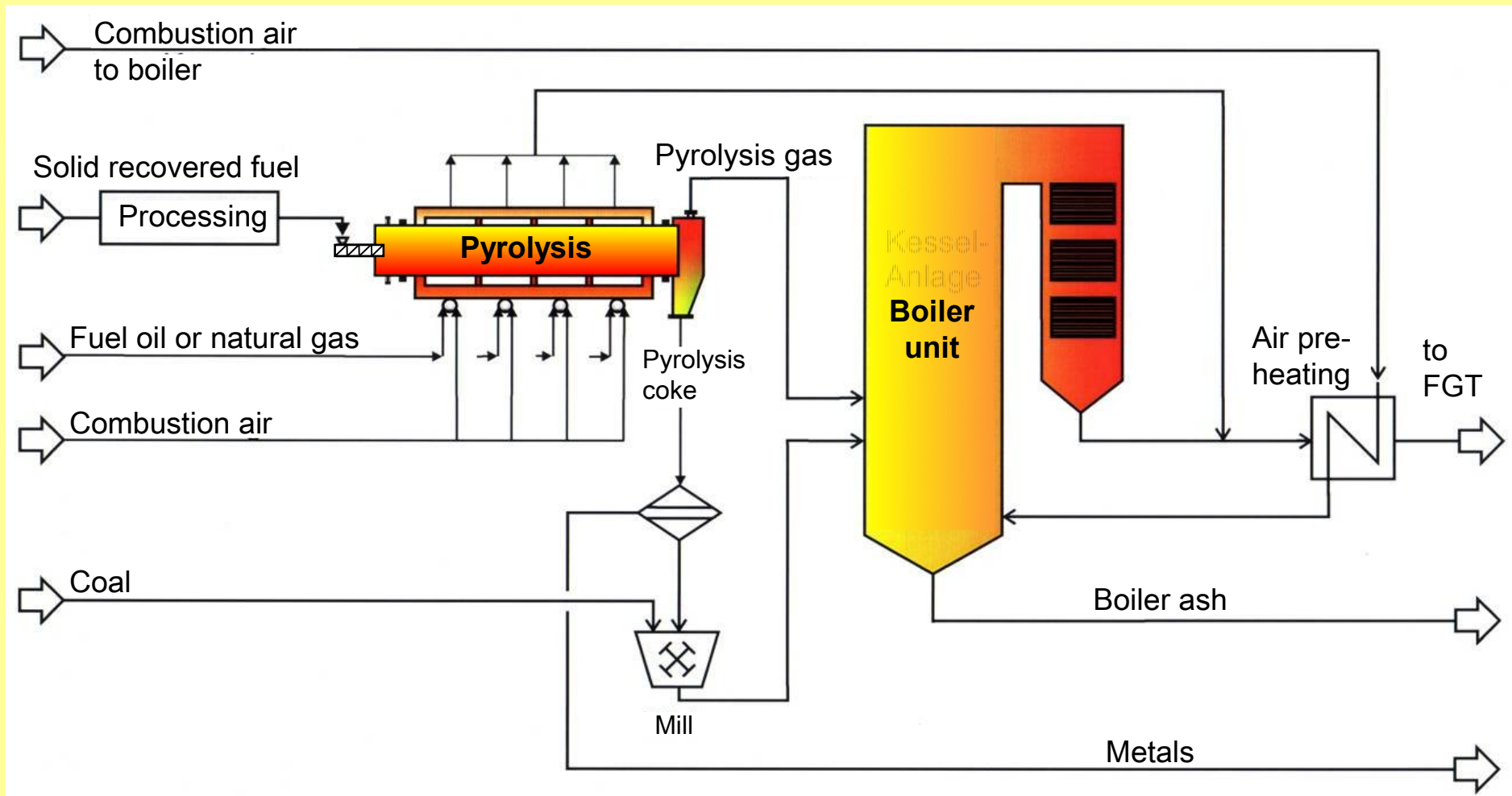
Pyrolysis of high calorific solid recovered fuels



- | | |
|----------------------|----------------------------|
| 1. Removal bin | 6. Rotary pyrolysis kiln |
| 2. Shredder | 1. Burner system |
| 3. Fine material bin | 2. Solid residue discharge |
| 4. Crane system | 3. Fan |
| 5. Material sluice | 4. Cyclone (dedusting) |



Combination Pyrolysis – Power Plant

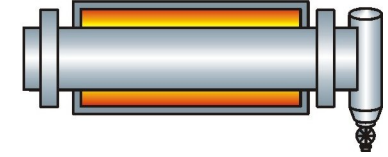




DGEngineering

DGEngineering – The Rotary Kiln Engineers

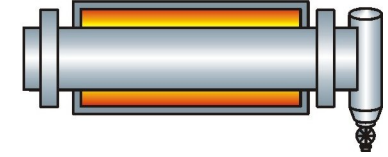
Hamm MW Pyrolysis Plant



Plant description

Objectives:

- Production of fuel by the generation of pyrolysis gas (pygas) and pyrolysis char
- Replacement of fossil fuel
- High efficiency in power generation
- Recycling of ferrous and non-ferrous metals
- Utilisation of the existent infrastructure
- Low investment costs compared with stand alone plants



Process description

The pyrolysis plant serves as processing unit for high calorific waste. The generated fuels, pyrolysis gas (pygas) and pyrolysis char, are incinerated in an existing boiler unit. These fuels replace approx. 10-25 % of the combustion heat performance.

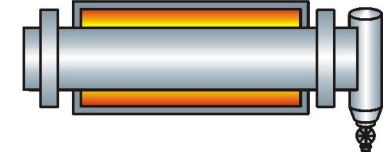
Pre-treatment

The waste fractions are delivered as bulk material or in bales. The waste gets shredded and fed to the charging unit of the pyrolysis by belt conveyors.

Waste pyrolysis in two rotary kilns

The waste material passes through the feeding system into the rotary kiln. In the absence of air/oxygen the waste is heated and decomposed at a temperature of approx. 500 °C. The products of the process are pygas, pyrolysis char, metals and other inerts (stone, glass). The pygas is extracted and charged directly to the firing of the boiler. The pyrolysis char is mixed with the brown coal and after passing the coal mills charged to the firing of the boiler.

The rotary pyrolysis unit is heated by natural gas burners arranged along the heating muffle. Downstream the heating muffle the flue gas is used for the preheating of air in heat exchangers and finally led into the boiler of the power plant. The result is a high efficiency of energy conversion.

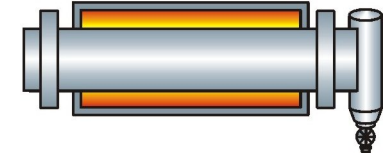


Residue treatment

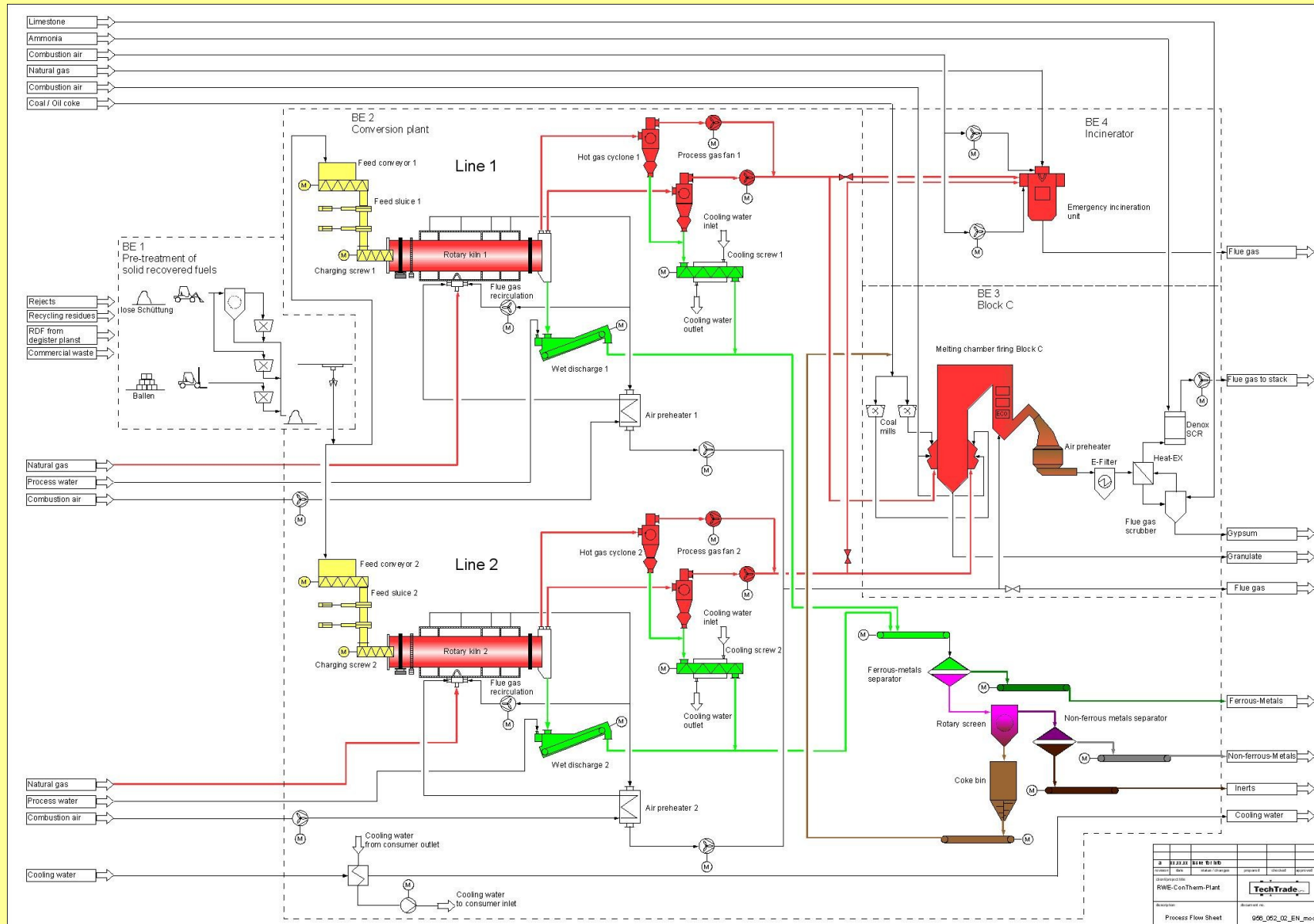
The ferrous and non-ferrous residues are separated and feed to containers by belt feeders for recycling.

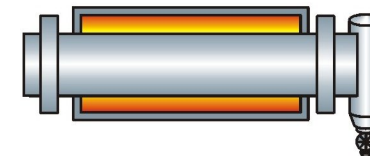
Emergency incineration unit

In the event of an emergency boiler shut down the pygas is incinerated in a burning chamber with stack.



Process flow sheet of „Kraftwerk Westfalen“ plant

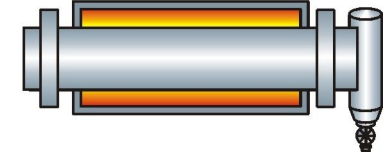




Characteristics of the Pyrolysis Plant

General plant data

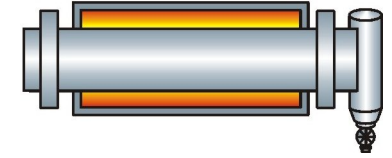
Plant capacity	100,000 t/a 13 t/h
No of rotary kilns	2
Capacity per rotary kiln	6.65 t/h
Plant availability (Availability related to 8,760 yearly hours)	85 %
Scheduled down time	2 x 8 days
Required plant area	
- Pre-treatment	90 x 70 m
- Pyrolysis, solid residue treatment, emergency incineration unit	60 x 30 m



Characteristics of the Pyrolysis Plant

Waste materials

	Recycling residue DSD	RDF from Digester plants	Commercial waste	Rejects
Heating value LHV Hu [MJ/kg]	17 – 28	12 – 22	11 – 24	11 – 15
Moisture [wt.-%]	5 – 25	10 – 40	10 – 50	30 – 50
Ash content [wt.-%]	8 – 10	10 – 23	10 – 20	3 – 10
Bulk density [kg/m ³]	60 – 200	80 – 250	60 – 250	100 – 200
Particle size [mm]	max. 200	max. 200	max. 200	max. 200
C [wt.-%]	58 – 73	45 – 60	52 – 60	35 – 40
H [wt.-%]	8 – 9	6 – 9	6 – 9	5 – 7
S [wt.-%]	0.01 – 0.06	0.1 – 1.0	0.1 – 2.0	0.05 – 0.3
Cl [wt.-%]	0.1 – 3.0	0.1 – 1.5	0.3 – 3.0	0.5 – 3.0



Characteristics of the Pyrolysis Plant

Technical data for rotary pyrolysis kiln

Rotary kiln diameter (effective)	2.8 m
Rotary kiln length (heated)	20 m
Filling degree	approx. 15 %
Average residence time in heated area	approx. 90 min
Process temperature	approx. 500 °C
Kiln shell temperature	approx. 750 °C



DGEngineering

DGEngineering – The Rotary Kiln Engineers

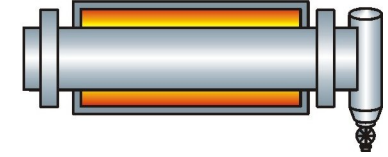
Hamm MW Pyrolysis Plant



Characteristics of the Pyrolysis Plant

Products to material recycling

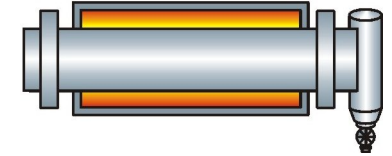
Ferrous metals	approx.	350	kg/h
Non-ferrous metals	approx.	250	kg/h
Inerts (stones, glass, ceramics)	approx.	170	kg/h



Characteristics of the Pyrolysis Plant

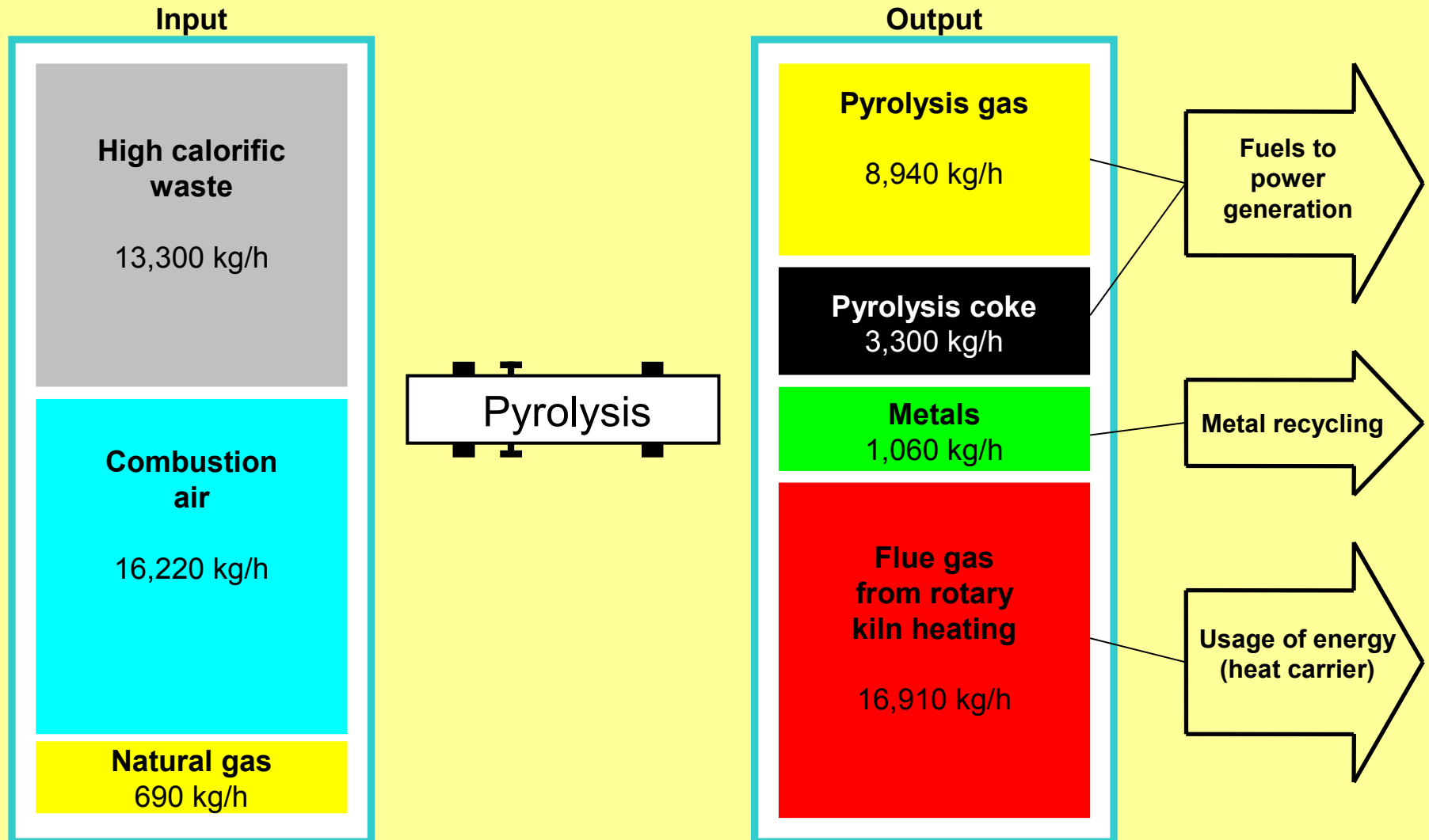
Consumption of operating materials (100% - Load)

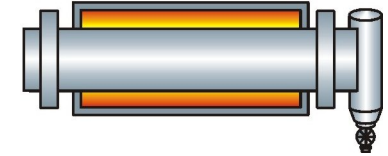
Natural gas ($H_u = 36,000 \text{ kJ/Nm}^3$)	800	Nm^3/h
Electricity	700	kW
Cooling water	1	m^3/h
Nitrogen	20	m^3/h
Compressed air	10	m^3/h



Characteristics of the Pyrolysis Plant

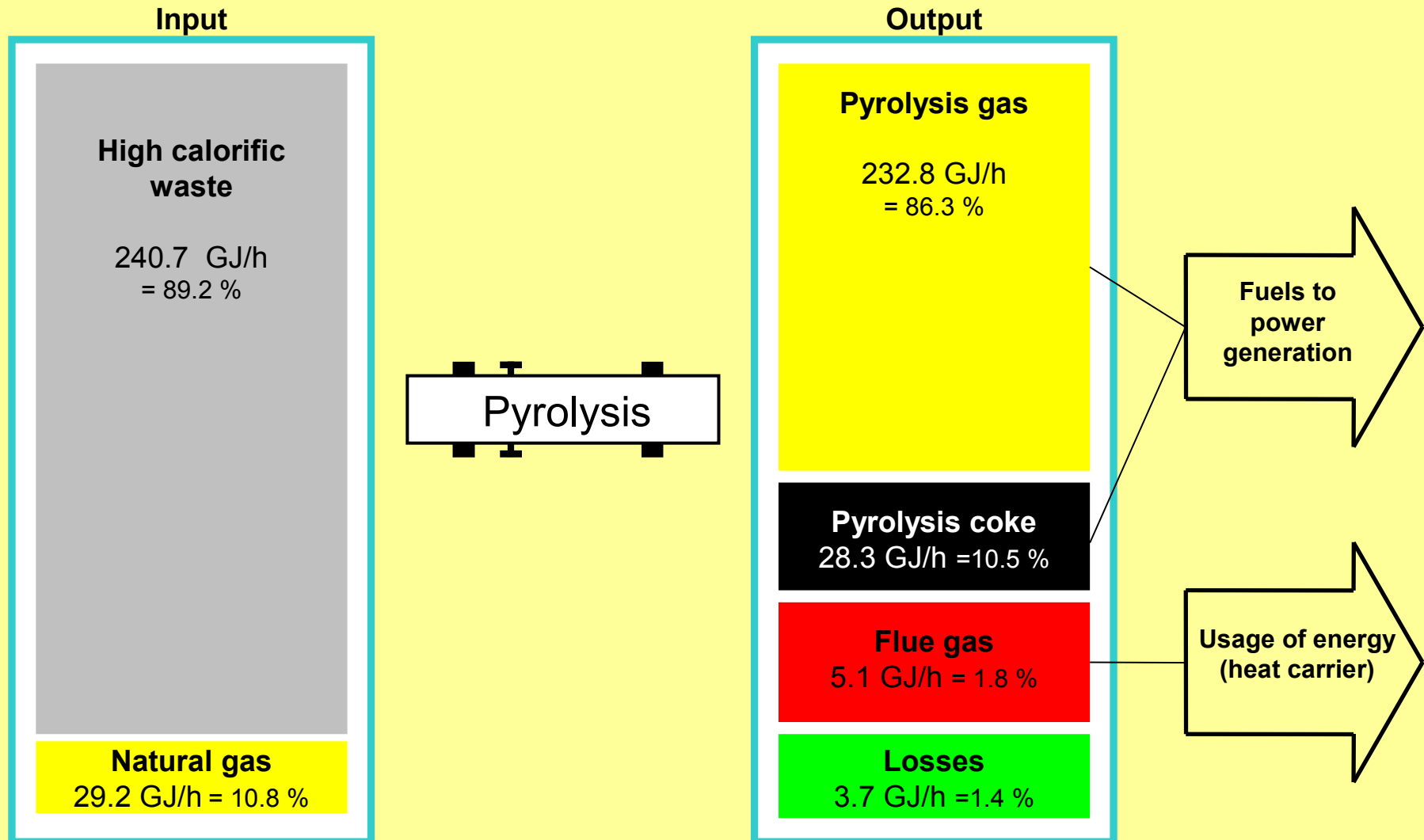
Mass balance

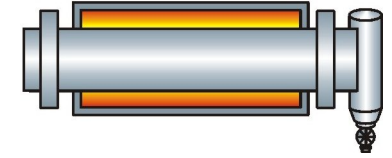




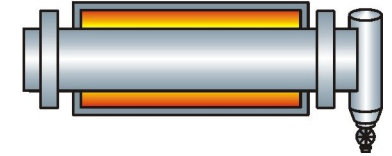
Characteristics of the Pyrolysis Plant

Energy balance





RWE-ConTherm-Plant – View to burner system



Characteristics of the Pyrolysis Plant

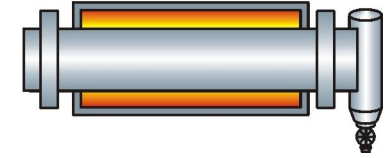
Design data for „Block C“

Before the modification:

	Full load operation (100 %)		Part load operation (40 %)	
	Thermal load	Rate	Thermal load	Rate
Coal	769 MW	100 %	308 MW	100 %

After the modification:

	Full load operation (100 %)		Part load operation (40 %)	
	Thermal load	Rate	Thermal load	Rate
Solid recovered fuels	75 MW	9.8 %	75 MW	24.4 %
Coal	694 MW	90.2 %	233 MW	75.6 %
Total	769 MW	100 %	308 MW	100 %



Emergency incineration unit
← Feeding system