

Waste as a resource

Every year the people of Stockholm discard around 450,000 tonnes of household waste that today is used as fuel for generating district heating and electricity at the Högdalen Works.

Each Stockholmer sends around 300 kg of household waste for incineration, although each person produces around 550 kg. The difference is the packaging material etc. sorted at source.





Each year the people of Stockholm produce 225,000 tonnes of sorted household waste, which corresponds to an amount that would fill one and a half arenas like the Globe in Stockholm. This is then dealt with and used for the production of environmentally adapted district heating and electricity.

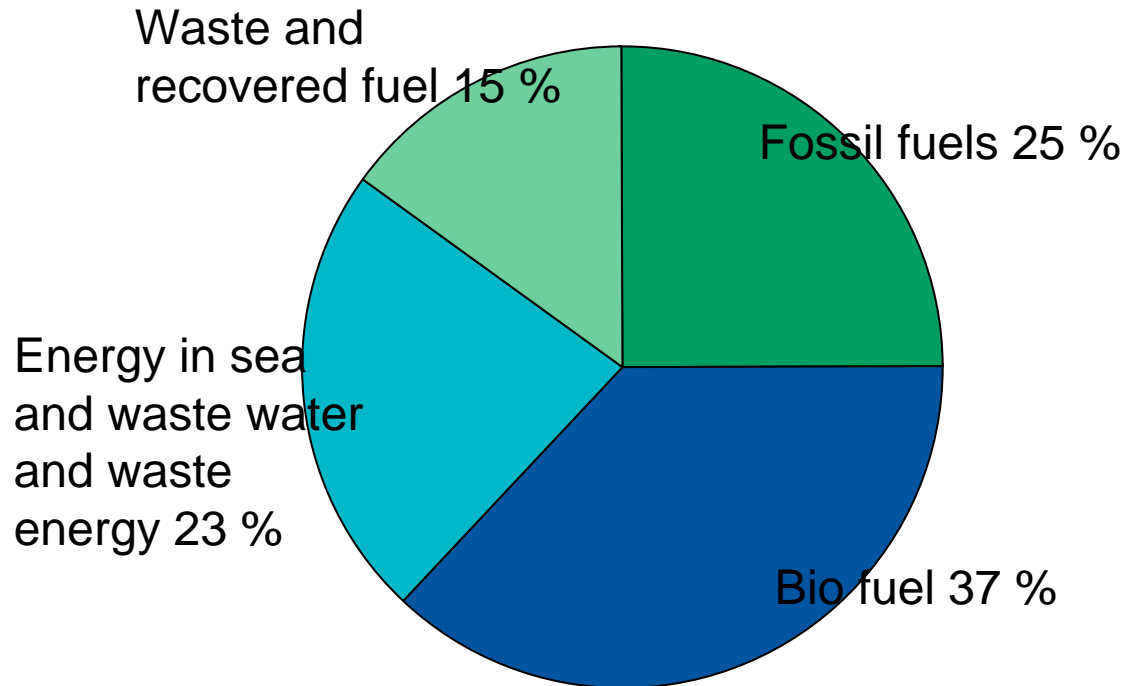


Ten bags of sorted waste are enough for a long, relaxing candlelit bath while enjoying Bach's orchestral suite on the stereo. And there is still enough energy left to dry your towel on the towel drier and brew a cup of strong coffee.

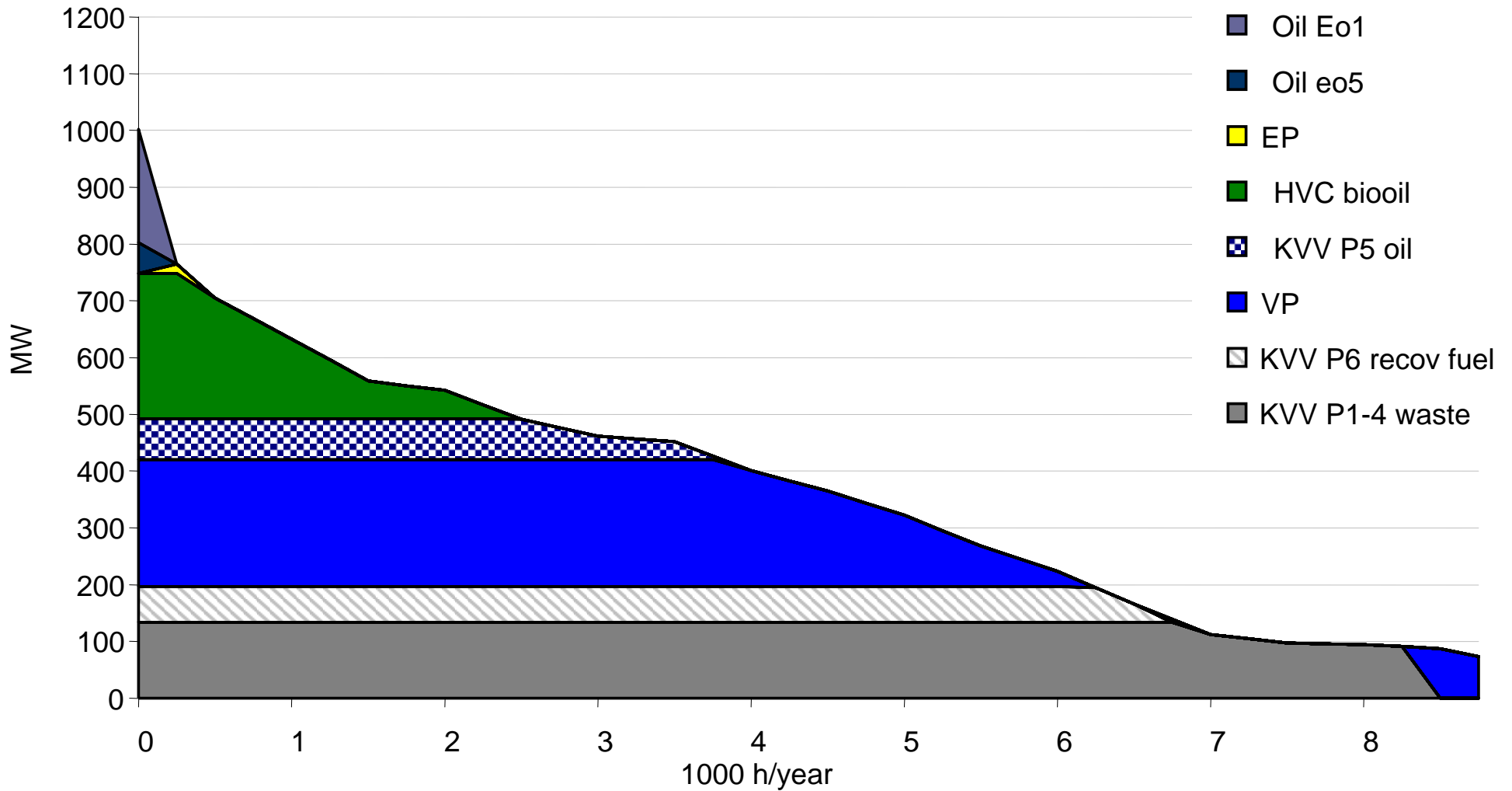
A fuel mix that takes the environment into consideration

Predominantly bio fuel
Waste combustion
Waste heat from sewage treatment plant
Sea water heat
Surplus energy from industry

**Fuel mix 2004.
70 % renewable fuel,
electricity not included.**



District heating production Södra Systemet



Södra district heating network

Production and distribution

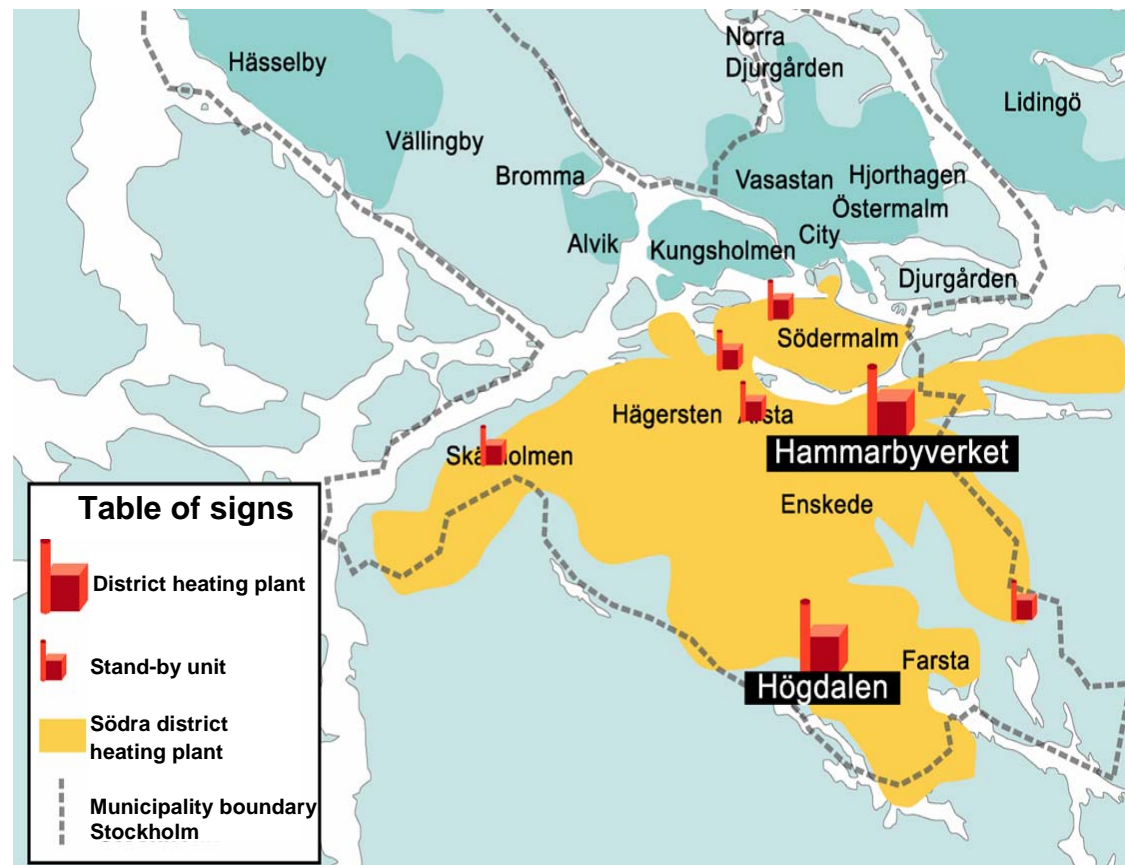
Heat sales	3100 GWh/year
Electricity sales	220 GWh/year
Cooling sales	40 GWh/year
Installed output	1154 MW _{heat}
	67 MW _{elec}

Units

12 production plants

Production units:

- 49 boilers
- 7 VP
- 2 steam turbines
- 1 gas turbine



The Högdalen Heat and Power Plant contributes to a better environment

In 2005 around 500,000 tonnes of waste was incinerated which generated 1,380 GWh, which corresponds to about 135,000,000 litres of oil.

135,000,000 litres of oil corresponds to around 55 full swimming pools of the type at Erikdalsbad and would be sufficient to run 80,000 diesel cars.

Compared to individual heating, emissions drop considerably

NOx	down by 60 %
S	down by 95 %
Dust	down by 92 %
CO2	down by 66 %



Emissions to air

Högdalen Heat and Power Plant

Emission	Limit	outcome 2005 / P1-3/P6
NOx Nitrog Oxides	45 [mg/MJ]	38 [mg/MJ]
NH3 ammonia	5 [mg/MJ]	0.5 [mg/MJ]
S sulphur	15 [mg/MJ]	0.7 [mg/MJ]
Dust powder	10 [mg/nm3]	<1 [mg/nm3]
HCl hydrochloric acid	15 [mg/MJ]	1.4 [mg/MJ]

Emission	Limit	outcome 2005
Hg mercury	15 [Og/nm3tg]	0.3 [Og/nm3tg]
Cd cadmium	0.2 [O g/nm3tg]	0.0005 [Og/nm3tg]
Dioxin	0.1 [ng/nm3tg]TCDD eq.	0.01 [ng/nm3tg]TCDD eq.

Residual products

- Residual products after incineration account for about 15 % of the weight or about 7 % of the volume of the incoming waste.
- 55,000 tonnes of slag per year
- 28,000 tonnes of fly ash per year

- Following metal separation, the slag is used as covering material at waste treatment plants
- The fly ash is stabilised using slag water and monofill (cement) and is then sent to the waste treatment plants, e.g. Sofielund in södertörn

Environmental terms Högdalen Heat and Power Plant - air

The activities at the Högdalen Works are regulated by the environmental permit of the plant and a number of laws, ordinances and directives. One of the most important directives is the Naturvårdsverket (Swedish Environmental Protection Agency) directive on waste incineration that has its origins in the EU's waste incineration directive.

The tables below give an overview of the most important environmental terms at the plant.

Emissions to air

The requirements in Naturvårdsverket's directives on waste incineration - the terms apply every half hour and 24 hour period

<i>Parameter</i>	<i>Normal value</i>	<i>Terms</i>
CO	approx 30 mg/nm ³	50 mg/nm ³
NO _x	approx 80 mg/ nm ³	200 mg/nm ³
Sulphur	<5 mg/nm ³	50 mg/nm ³
HCl	<5 mg/nm ³	10 mg/nm ³
Powder	<5 mg/nm ³	10 mg/nm ³
TOC (measured as methane)	< 5 mg/nm ³	10 mg/nm ³

Terms of environmental permit

<i>Parameter</i>	<i>Normal value</i>	<i>Terms</i>
NO _x	< 45 mg/MJ	45 mg/MJ (supplied fuel)
HCl	< 3 mg/nm ³	15 mg/MJ ("-")
NH ₃	< 3 mg/MJ	5 mg/MJ ("-")

In addition, requirements are set for the flue gas content of metals and dioxins (0.1 ng/m³), measurements and analysis are carried out twice annually.

Environmental terms Högdalen Heat and Power Plant - water

Emissions to water

Emission requirements are set both in the environmental terms of the plant and in Naturvårdsverket's directives on waste incineration.

<i>Parameter</i>	<i>Terms permit/</i>	<i>directive</i>
Ammonium	15 m/l /	
Metals		
- Mercury (Hg)	0.5 ug/l /	30 ug/l
- Cadmium (Cd)	0.1 ug/l /	50 ug/l
- Copper (Cu)	100 ug/l /	500 ug/l
- and others		
Dioxins	/	0.3 ng/l
Suspended solids	10 mg/l /	130/45 mg/l
pH	6.5-11 /	

The metal content is analysed each month; the dioxin content is analysed twice per year.

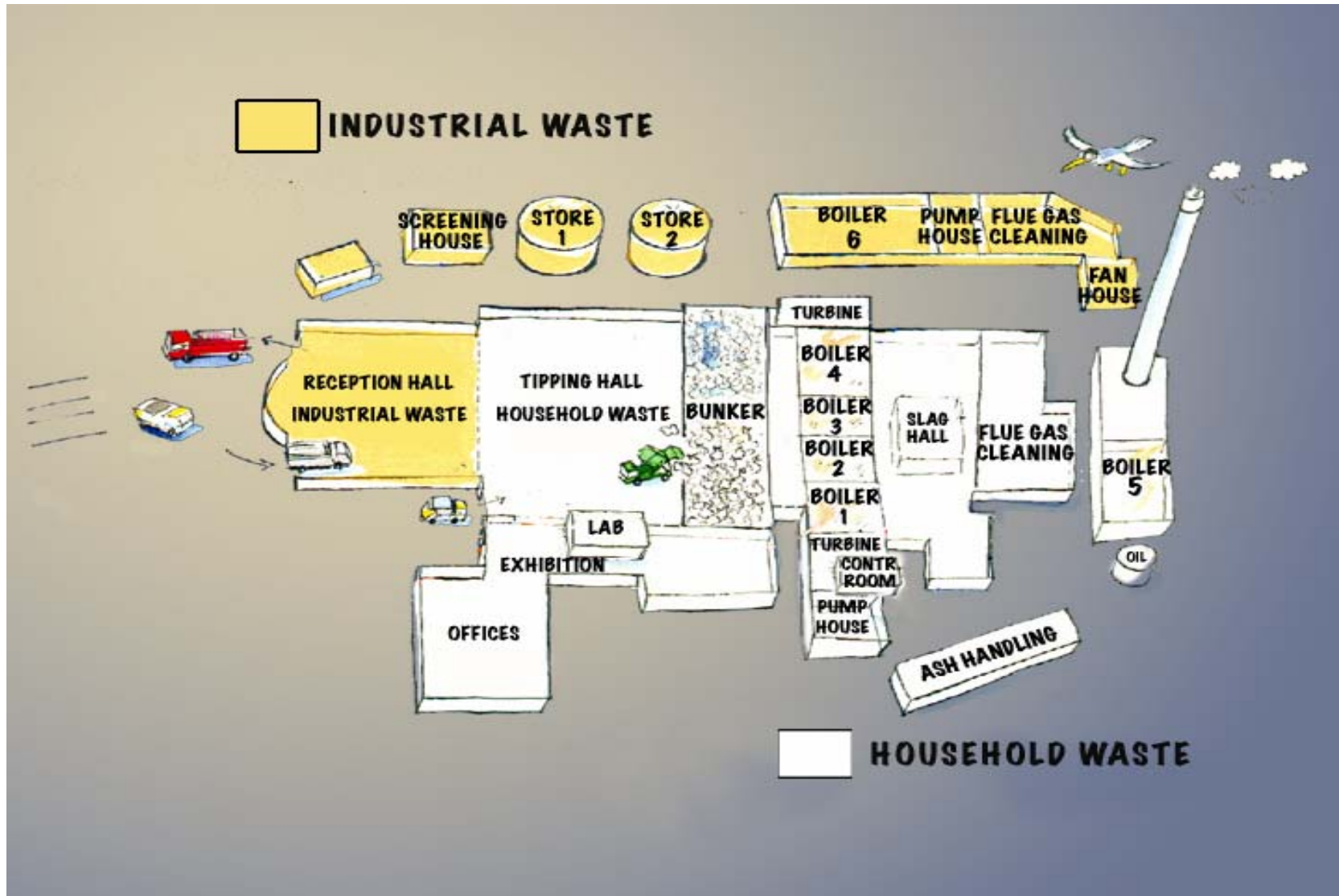
Slag

The uncombusted content of the slag may be up to 5 %. Selection of samples and analysis of the slag takes place twice annually.

Other environmental impacts

The environmental permit of the plant includes terms for noise, dusting, pollution, odours etc.

Overview Högdalen Heat and Power Plant



Steam turbine G1

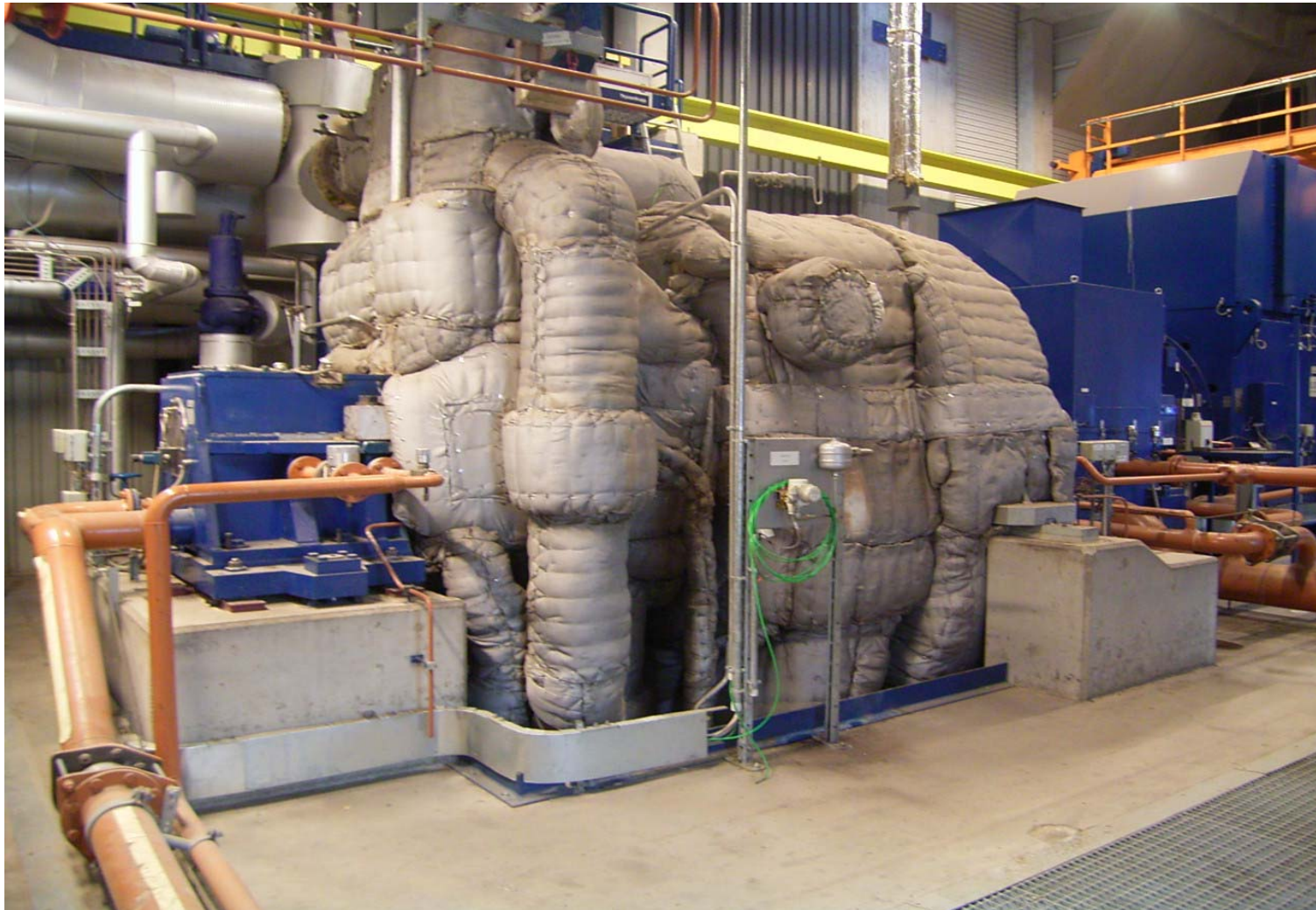
Stal Laval Year: 1970 Radial turbine Elec output: 27.5 MW

Inlet pressure/temp 36bar/400C, Speed 3,000 rpm



Steam turbine G6

LDW / B+V Indusieteknik, Year: 2001 Axial turbine , Elec output: 44.3 MW,
Inlet pressure/temp 60/36bar/400C, Speed T/G: 6,000/1,500 rpm



Other heat capacity, Högdalen Heat and Power Plant

Boiler 5 Generator

Year: 1979

Fuel: Oil

Heat output: 80 MW

Boiler 21

**Zander &
Ingerström**

Year: 1983

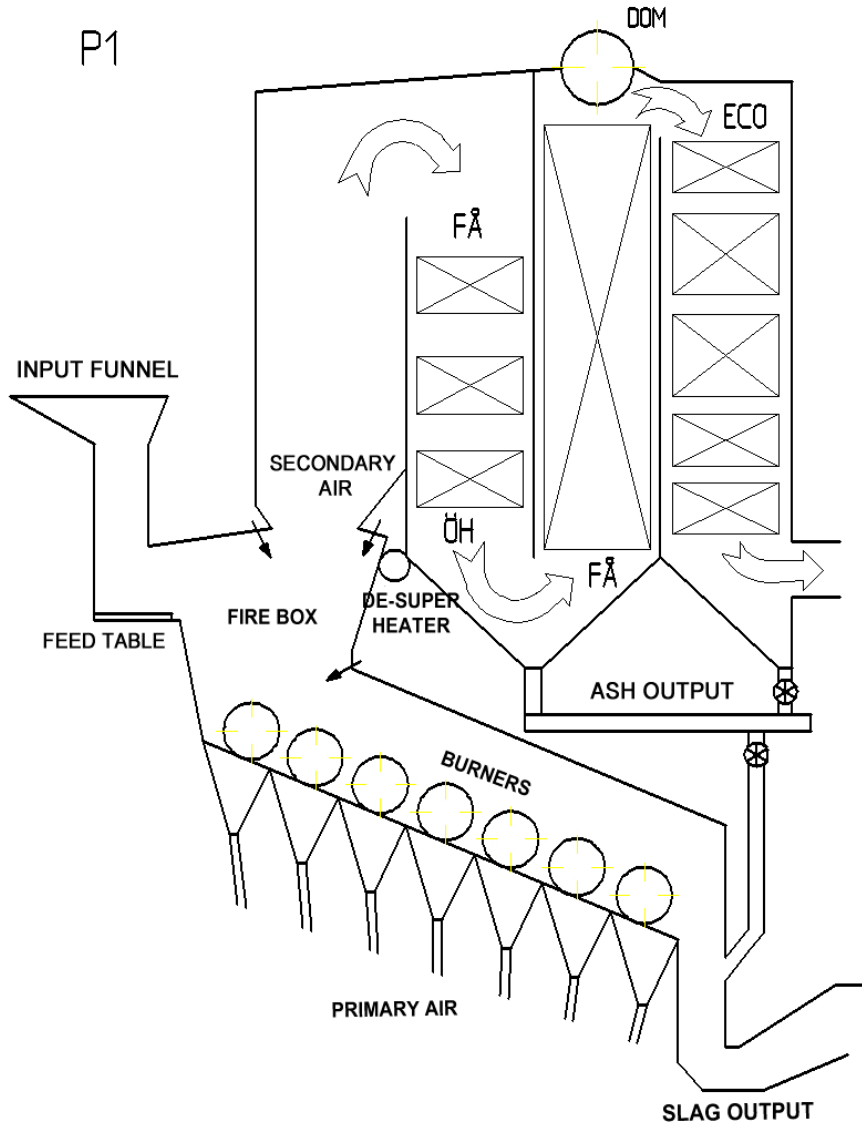
Electric boiler

Heat output: 25 MW



Boiler P1-P2

P1



Boiler 1 & 2

Manufacturer: VKW

Year: 1969

Fuel: Household waste

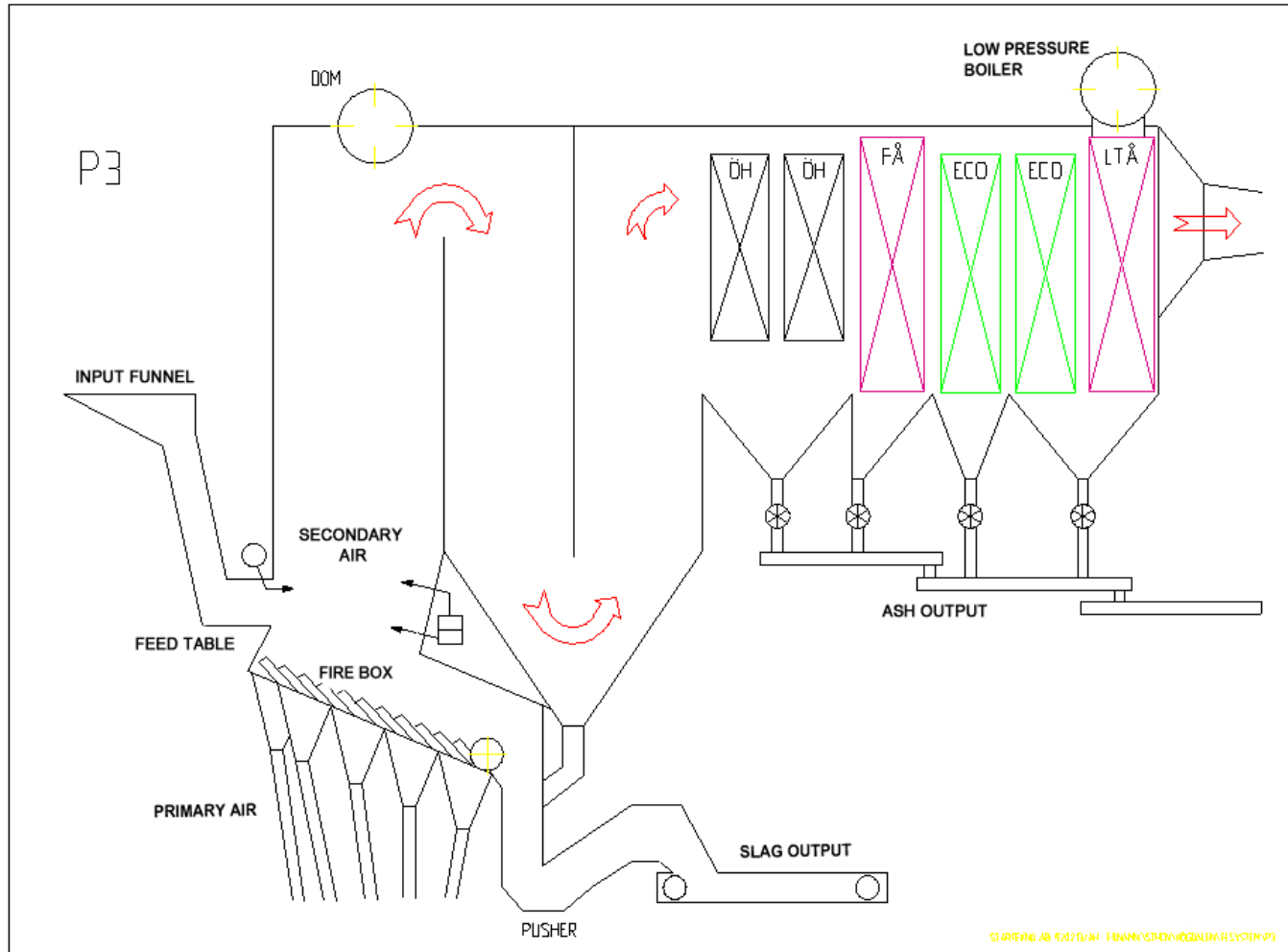
Heat output: 2 x 20 MW

Combustion capacity:

2 x 10 tonnes/h

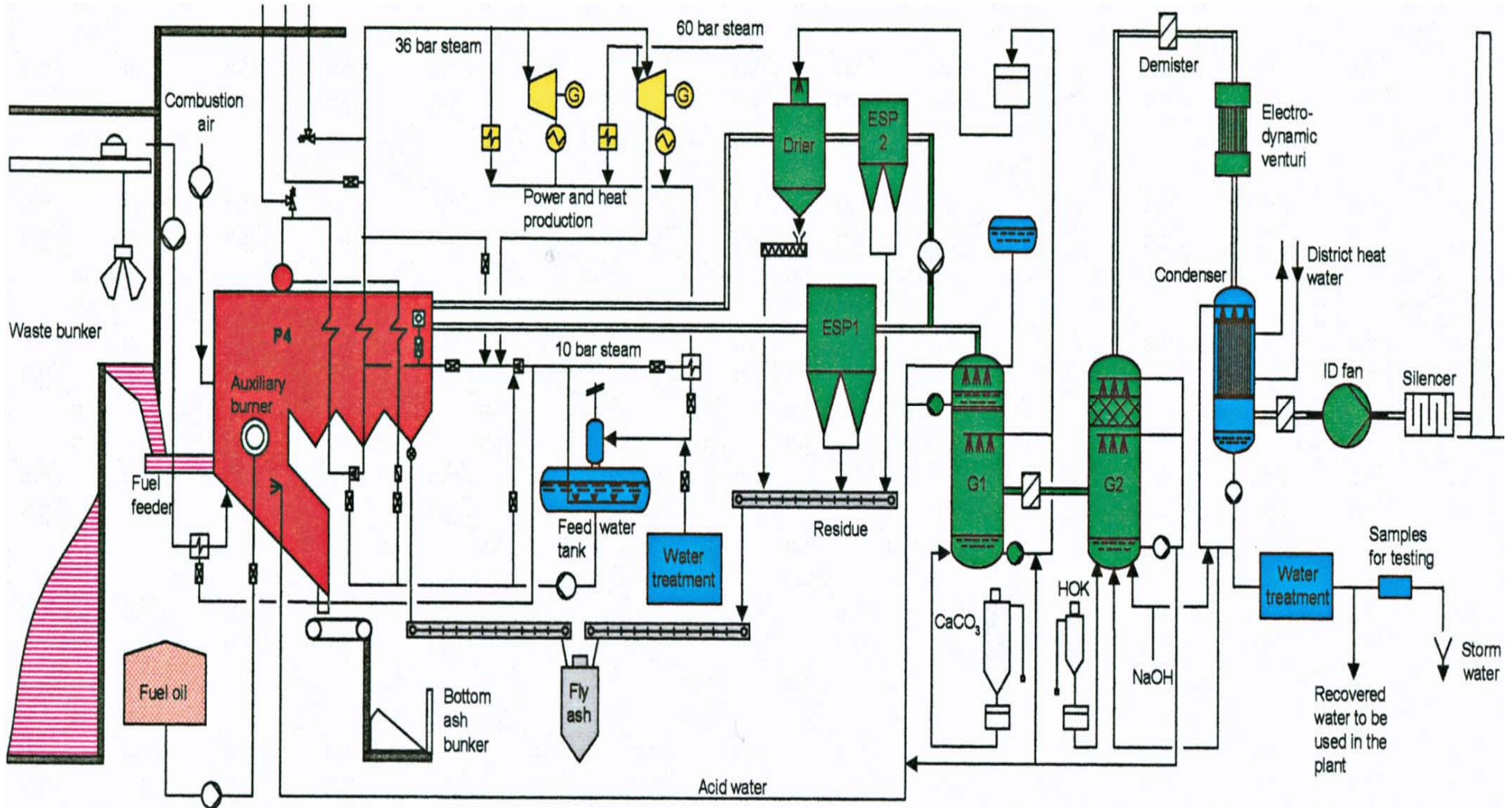
Steam data: 36 bar/400C

Boiler P3

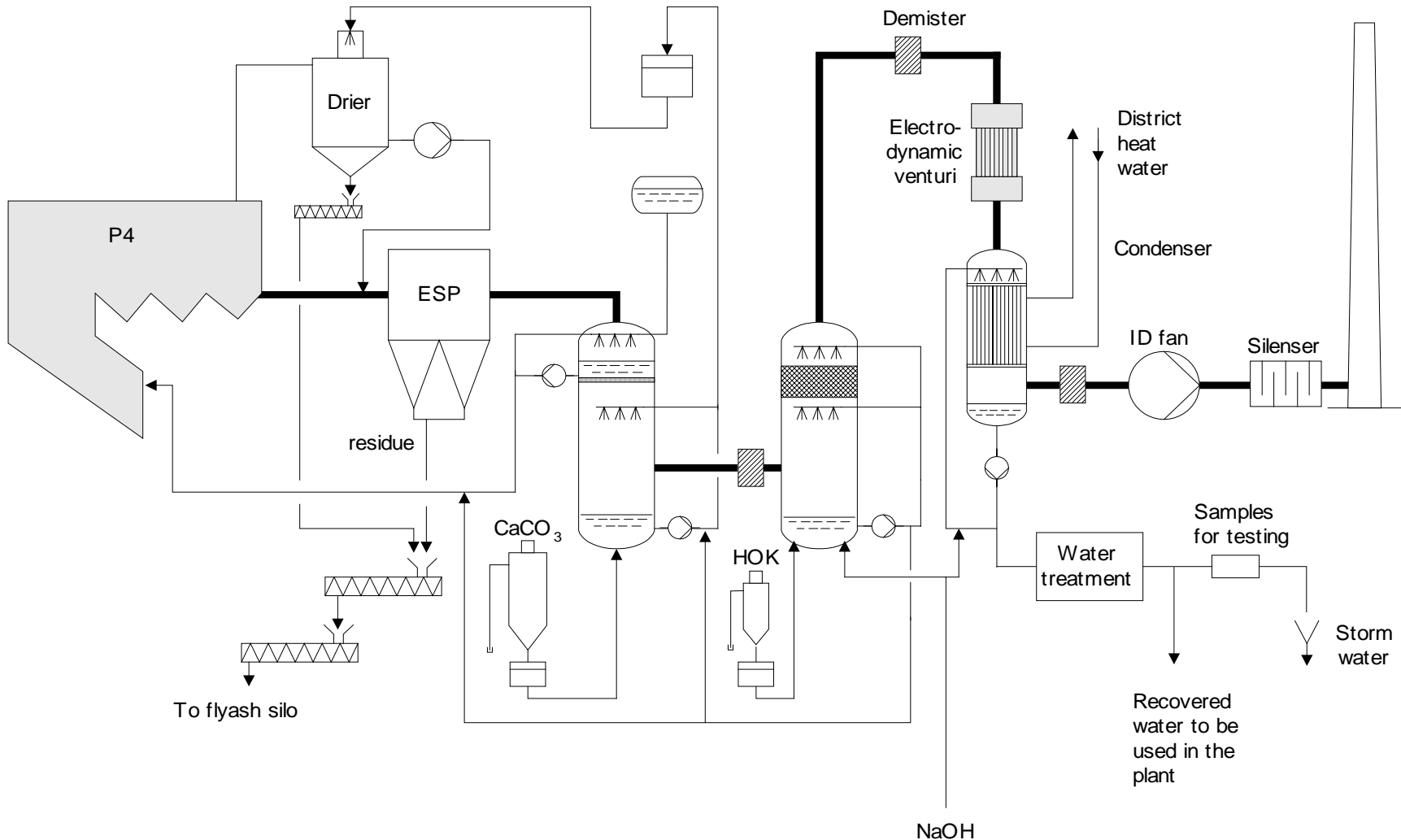


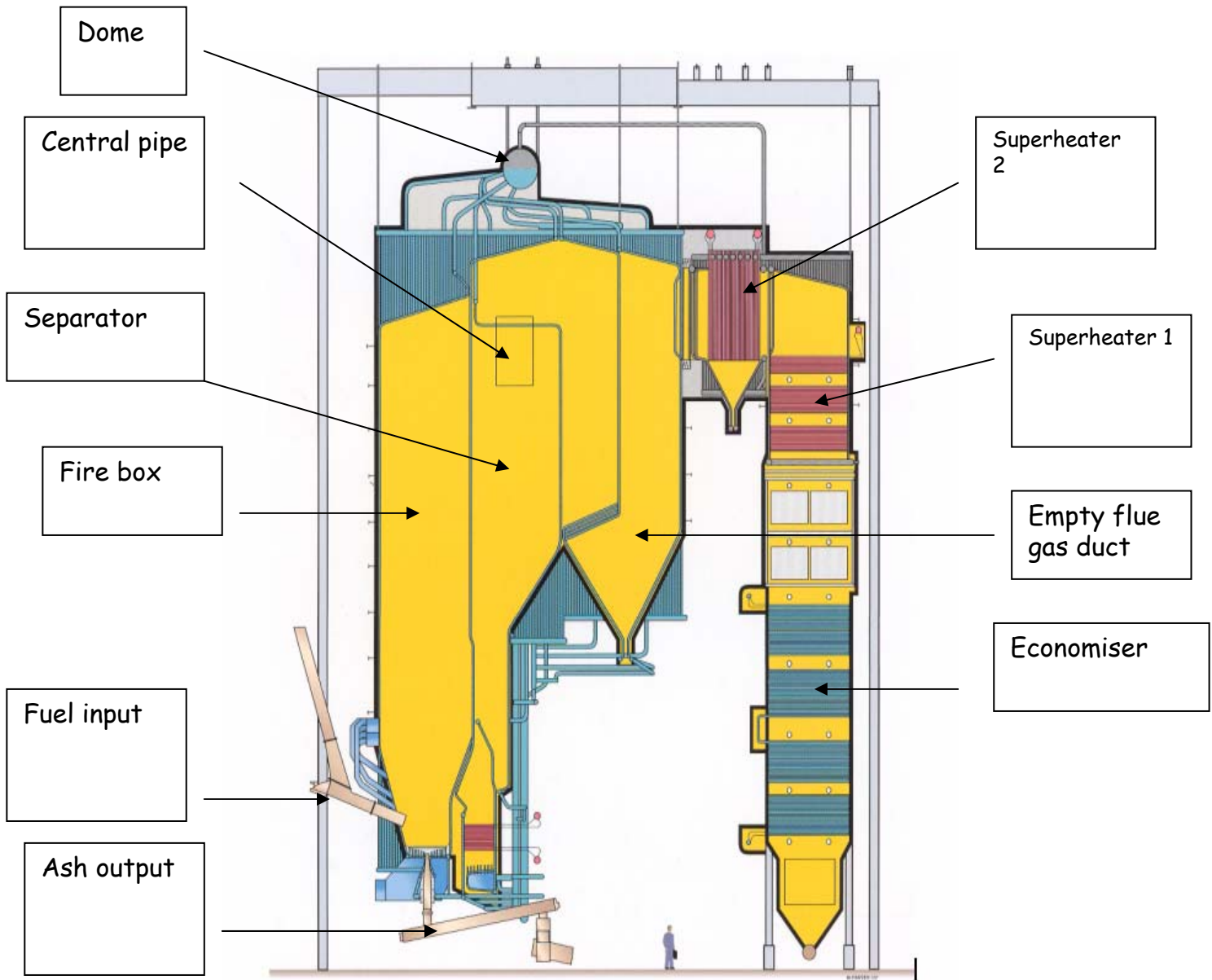
Boiler 3
Manufacturer: Martin
Year: 1986
Fuel: Household waste
Heat output: 44 MW
Combustion capacity:
15 tonnes/h
Steam data: 36 bar/400C

**Boiler P4 94 MW, Year 2004, Babcock&Wilox Volund/LAB, Fuel 34 tonnes/h
 Steam pressure/temp.36 bar/400C, Steam flow 115 tonnes/h**



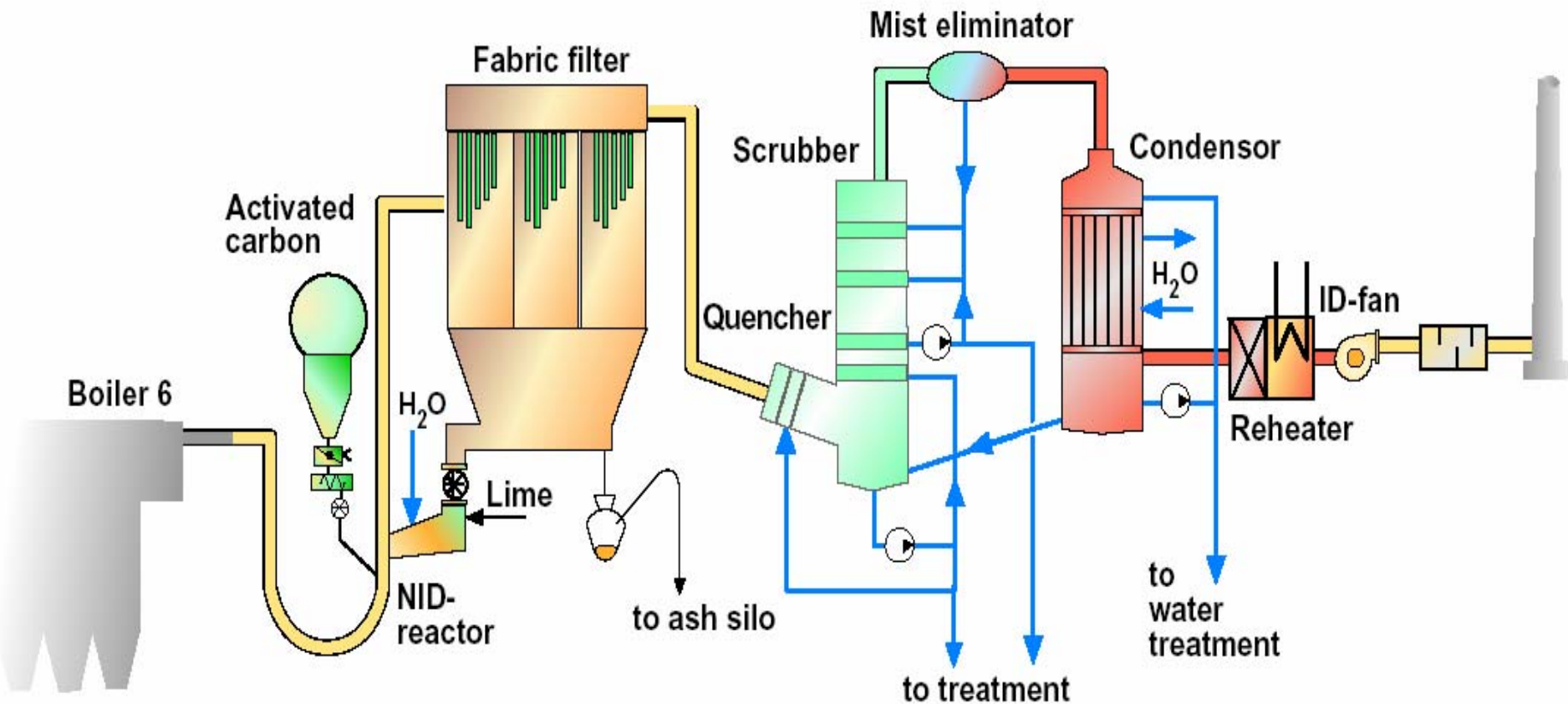
Flue gas cleaning P4, Max, NO_x 80, Slip 8, CO 50 mg/Nm³





Boiler 6
 Manufacturer: Foster Wheeler
 Year: 1998
 Fuel: Industrial waste RB2
 Combustion
 capacity: 28 tonnes/h
 Heat output: 91 MW
 Steam data: 59 bar/400C

Flue gas cleaning P6, flue gas flow 48 nm³/s



Fuel: P6

Main fuel: RB2

The material is made up primarily of splinters/bits around 3x3x10 cm or less.

The fuel must be made up of at least 30 % wood and have a homogeneous and well-defined composition.

Paper: 30 - 40 %

Plastic: 3 - 10 %

Wood: 30 - 50 %

Other: 1 - 10 %



Fuel handling P6

Reference: Stockholm Energi AB

BMH Wood Technology

