Hitachi Zosen
INOVA

Oslo / Norway

Waste to Energy Plant

5 x 47 t/h, 193 MW

KA_3 in Oslo – Latest Process Technology Provides Maximum Energy Recuperation

With the expansion of the Waste to Energy (WtE) plant at Klemetsrud by a third train, the overall capacity of the plants in the Oslo suburb rises to an annual capacity of 320,000 tonnes. The new plant train, called KA_3, with a combustion performance of 20 t/h and a heating value of 12 MJ/kg, is designed for maximum recovery of heat and electricity production.

Energy-efficient, economical and environmentallyfriendly – these were the requirements stipulated by the City of Oslo, the "Energigjenvinningsetaten" (EGE), for the additional train in the Oslo suburb of Klemetsrud. In mid-2008, Hitachi Zosen Inova (HZI) was selected supplier by offering the most persuasive solution in terms of the concept and experience in the construction of WtE Plants .

The WtE Plant is based on HZI's firing technology using the proven HZI reciprocating grate. Flue gases are efficiently cleaned using a process based on a wet scrubber. The energy is used to directly supply local district heating and electricity companies.

Optimum Combustion with Energy Extraction

The waste material stored in the bunker is conveyed into the charging hopper of the combustion system via loading grabbers. In the combustion chamber, the reciprocating grate that comprises five individually-controllable zones ensures optimum combustion thoughout the various combustion stages. The first two water-cooled grate zones provide the greatest degree of flexibility with regard to the heating values of the waste material.

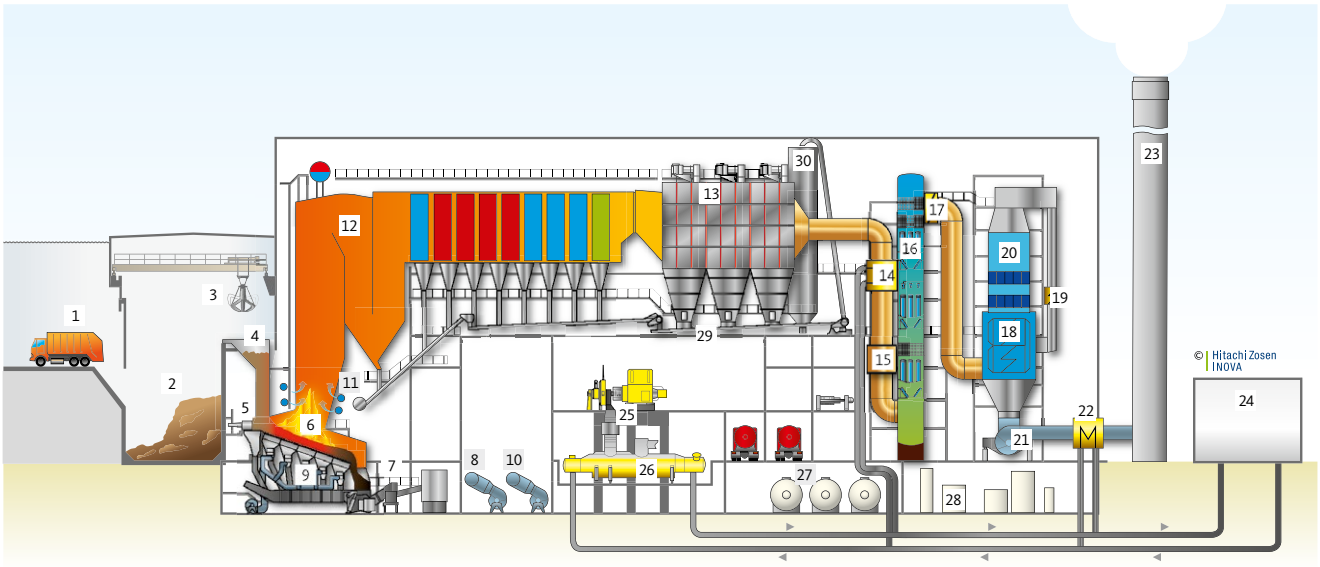
The recovered heat from the water-cooled grate is used to pre-heat the primary air. In the postcombustion chamber, above the grate, secondary air and recirculated flue gas is injected tangentially at high speed. This guarantees the intensive mixture and excellent combustion of the gases. The energy released is transferred to the watersteam cycle in a subsequent four-pass boiler.

Efficient Cleaning of Flue Gas

Multi-stage flue gas cleaning ensures the safe separation of all pollutants to maintain the lowest emissions values. The plant has been designed for low operating material costs and maximum energy recuperation.

In a first step, 99% of dust and heavy metals that are contained in the flue gas are removed in the electrostatic precipitator.

Both before and when inside the wet scrubber, dioxin compounds and mercury are adsorbed via lignite coke and are discharged with the scrubber water. The acidic pollutant gases and heavy metals are separated in the first two stages of the 4-stage scrubber. Sulphur dioxide is dissolved in the neutral stage, and the remaining fine dust particles and aerosols are separated via a ring jet stage (venturi process). The fourth scrubber stage provides a safeguard in the event of high levels of pollutants and also allows heat recovery via flue gas condensation.



Waste Receiving and Storage

1 Delivery hall
2 Waste pit
3 Waste crane

Combustion and Boiler

4 Feed hopper
5 Ram feeder
6 HZI Grate
7 Bottom ash discharger
8 Primary air fan
9 Primary air distribution
10 Secondary air fan
11 Secondary air injection
12 Four-pass boiler

Flue Gas Treatment

13 Electrostatic precipitator
14 Economiser 1
15 Quench
16 Wet scrubber (4 stages)
17 Flue gas reheater 1
18 Gas/gas heat exchanger
19 Flue gas reheater 2
20 SCR-Catalyst
21 ID-Fan
22 Economiser 2
23 Stack

Energy Recovery

24 District heating system
25 Extraction condensation turbine
26 Hot water condenser

Residue Handling and Treatment

27 Waste water tanks
28 Waste water treatment
29 Ash conveying
30 Ash silo

Nitrous oxides are decomposed into their approximate components of air and water by the addition of ammonia solution. In the catalytic converter, dioxin compounds are broken down and reduced to the lowest threshold values.

As a special feature in KA_3, two economisers – one upstream of the wet scrubber and one after the suction draught – provide optimised recovery of the energy contained in the exhaust gas. Before the cleaned flue gas leaves the plant, a measuring system checks compliance with the admissible emissions values.

The waste water cleaning system comprises several stages and cleans the scrubber water, which then is channelled into the drainage system.

Energy for the Region

Klemetsrud KA_3 is designed for optimised energy recovery. The plant produces electricity and district heat from steam recovery in combustion. Conversion takes place in a turbine generator comprising an extraction-condensing turbine with regulated low-pressure extraction and taps for district heat extraction.

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General Project Data

Owner and operator	EGE Oslo Kommune
Start of operation	2011
Total investment	EUR 350 million
Scope of HZI	Entire combustion system, boiler, flue gas cleaning system, waste water treatment, connection to district heating network, electrical systems and the entire control system
Plant design	Hitachi Zosen Inova AG

Technical Data

Annual capacity	150,000 t/a
Number of lines	1
Throughput	20 t/h (nom.)
Calorific value of waste	8 MJ/kg (min.), 16 MJ/kg (max.), 12 MJ/kg (nom.)
Thermal capacity	66.7 MW
Waste type	Municipal and commercial waste

Combustion System

Grate type	HZI Grate AR-12-10078
Grate design	3 rows with 5 zones per row
Grate size	Length: 10.25 m, width: 7.8 m
Grate cooling	First two zones water-cooled (Aquaroll®)

Boiler

Type	Four-pass boiler, horizontal
Steam quantity per line	77.2 t/h
Steam pressure	41.5 bar
Steam temperature	402 °C
Flue gas outlet temperature	170 °C

Flue Gas Treatment

Concept	Electrostatic precipitator, economiser 1+2, 4-stage wet scrubber, exhaust gas reheating 1+2, SCR, dioxin separation, waste water treatment
Flue gas volume per line	120,000 Nm^3/h
Flue gas temperature	85 °C at stack
Design	Hitachi Zosen Inova AG

Energy Recovery

Type	Extraction-condensation turbine, connection to district heating system
Electric power output	max. 13 MW
District heating	max. 55 MW

Residues

Bottom ash	approx. 30,700 t/a
Flue gas treatment	approx. 4,900 t/a

Special features

	Two economisers and condensation cooling for district heating, max. 9 MW

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