Hitachi Zosen
INOVA

Cleveland / UK

Waste to Energy Plant

Turnkey Plant 1 x 19 t/h, 45.8 MW

SITA Northumberland Waste to Energy plant at Teesside – a successful cooperation between local authority and industry

The extension of the Teesside Waste to Energy (WtE) Plant is a continuation of the successful, integrated waste management in the North East of England. In parallel, the technically independent concept of the third line provides the highest security with regard to availability. The additional line thermally treats 136,000 tonnes a year of residual household waste while exporting sufficient electricity to power more than 10,000 homes.

The Teesside WtE Plant extension is run by SITA Northumberland Ltd., a joint venture between Sita UK, RBS and AXA to serve Northumberland County Council under a 25-year PFI contract. Hitachi Zosen Inova (HZI) AG assumes the role of an EPC contractor and provides the complete turnkey facility. Civil construction started in April 2007, heavy erection began in November 2007 and the facility was handed over in 2009.

Integrated Waste Management

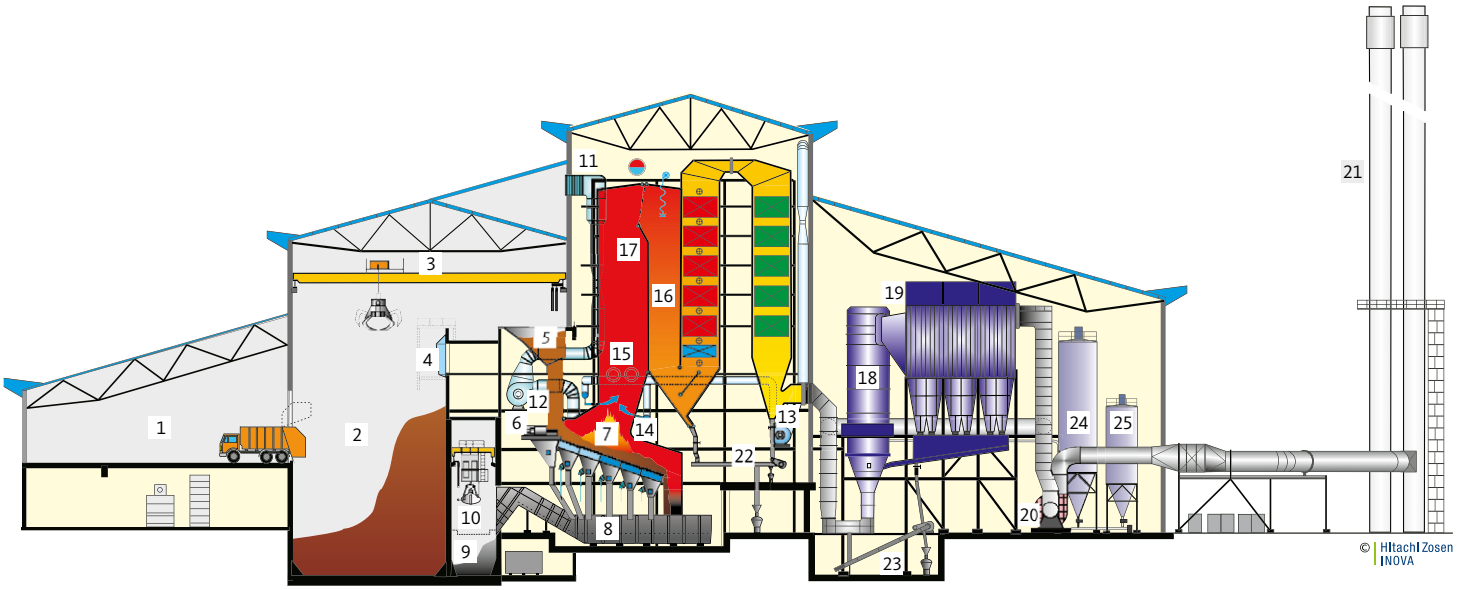
The extension of the Teesside WtE Plant carries out the integrated waste management of the existing facility with its already existing community recycling centre, ash recycling, and composting facility. The metal separation of ferrous and non-ferrous metals as well as the bottom ash recycling at the existing ash recycling facility adjacent to the site will contribute further to the integrated solution.

Reducing the Greenhouse Effect

The Teesside Waste to Energy facility exports about 10 MW of electricity by using waste as a renewable resource. Therefore virgin energy sources can be saved. The electricity supplied to the national grid is equivalent to powering more than 10,000 homes.

The Technical Solution for Ecological Friendly and Economical Energy Recovery

After waste is collected via kerbside recycling schemes or the network of Household Waste Recycling Sites, pre-treated waste is processed at the Energy Recovery facility. The residual waste is tipped into its independent bunker within the waste reception hall and placed by a crane of its own into the feed hopper of the process train, with a four-pass vertical boiler at a maximum thermal capacity of 45.8 MW. The boiler design was developed in order to suit the building envelope of the existing building. The waste then passes down a feed chute onto the two-row HZI grate. The moving grate allows an optimal burnout of the diverse waste fractions. In addition, a fully integrated control system allows the rapid adjustments of combustion conditions for the safest and most efficient operation, possible. In the first pass of the boiler, the NO_x reduction is provided by the Selective Non-Catalytic Reduction (SNCR) system using injected aqueous ammonia as the reducing agent. The process reduces the waste volume received by up to 90%. The burnt out bottom ash passes through the ash discharger onto an ash handling system within enclosed areas. The remaining ash is sent for processing and reuse for disposal.



Waste Receiving and Storage

1 Delivery hall
2 Waste pit
3 Waste crane
4 Crane control cabin

Combustion and Boiler

5 Feed hopper
6 Ram feeder
7 HZI grate
8 Bottom ash discharger
9 Bottom ash pit
10 Bottom ash crane
11 Primary air intake
12 Primary air fan
13 Secondary air fan
14 Secondary air injection
15 Start-up burner
16 Four-pass boiler

Flue Gas Treatment

17 SNCR injection levels
18 Semi-dry reactor
19 Fabric filter
20 Induced draft fan
21 Stack

Residue Handling and Treatment

22 Ash conveying system
23 Residue conveying system
24 Hydrated lime silo
25 Activated carbon silo

Pyrolytic gases produced in the combustion process pass are mixed with secondary air, which is injected tangentially at high velocity into the post combustion chamber above the grate, resulting in intensive mixing and the through-out burnout of the hot gas. The thereby produced raw gas passes through a water tube boiler where it is cooled while the water of the closed steam condensate cycle is vaporised and superheated. The superheated steam is then expanded by means of a turbo-generator. As a result, electricity is produced to supply the facility thereby allowing island operation as well as the export of about 85% of the produced electricity to the national grid.

After leaving the last pass of the boiler and having extracted as much energy as possible by still maintaining sufficient temperature levels for efficient and reliable removal of emissions, the cleaning takes place in the semi-dry system consisting of a reactor in combination with a fabric filter. The well proven semi-dry system technology keeps the plant in safe compliance with the emission limits of the European Union by using lime and activated carbon for removal of the gaseous pollutants including heavy metals and dioxins. Small particulates are separated in the fabric filter.

The residues resulting of the flue gas treatment are then either recycled or sent for safe disposal by an appropriate facility. The cleaned flue gas is finally released into the atmosphere through the third stack.

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General Project Data

Owner and operator	SITA Northumberland Ltd.
Start of operation	2008
Scope of HZI	General contractor for entire plant, including civil works
Plant design	Hitachi Zosen Inova AG

Technical Data

Annual capacity	136,000 t/a
Number of lines	1
Throughput per line	17.9 t/h
Calorific value of waste	7.6 MJ/kg (min.), 12.5 MJ/kg (max.)
Thermal capacity per line	45.8 MW
Waste type	Domestic solid waste

Combustion System

Grate type	HZI Grate R-10060
Grate design	2 rows with 5 zones per row
Grate size	Length: 10 m, width: 6 m
Grate cooling	Air-cooled

Boiler

Type	Four-pass boiler, vertical
Steam quantity per line	54 t/h
Steam pressure	43 bar
Steam temperature	400 °C
Flue gas outlet temperature	150 °C

Flue Gas Treatment

Concept	SNCR, SemiDry system
Flue gas volume per line	95,000 m^3/h

Energy Recovery

Type	Extraction-condensation turbine
Electric power output	10 MW

Residues

Bottom ash	35,000 t/a
Flue gas treatment	5,500 t/a

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