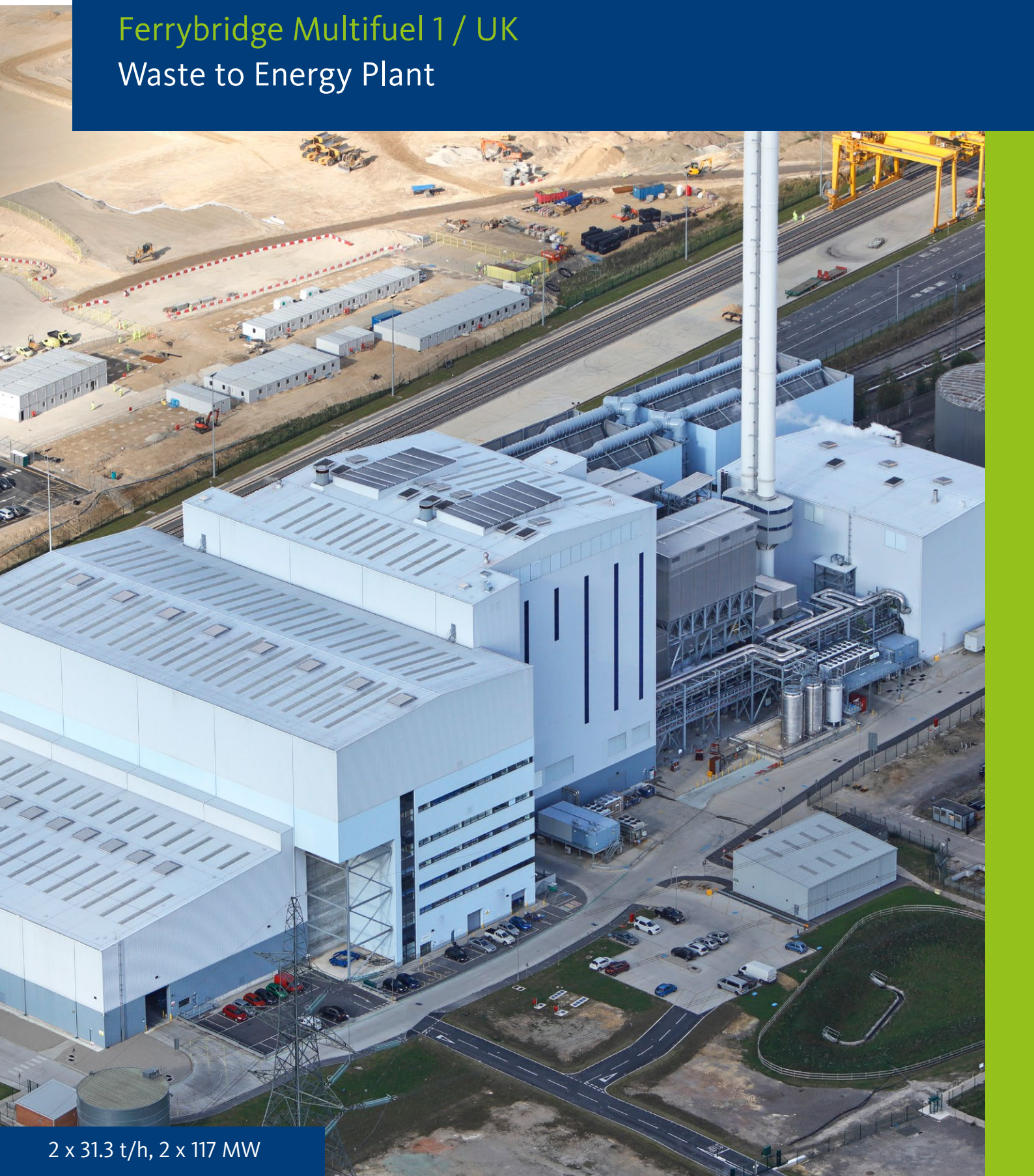
Hitachi Zosen
INOVA

Ferrybridge Multifuel 1 / UK

Waste to Energy Plant



2 x 31.3 t/h, 2 x 117 MW

Ferrybridge Multifuel 1 – where Four Specialists Join up to Tackle Climate Change

The Ferrybridge Waste to Energy (WtE) plant is the latest example of Hitachi Zosen Inova (HZI) providing best available technology as a turnkey contractor to key players in the waste and energy sector. The plant, with a thermal capacity of 2 x 117 MW, is designed to use a variety of different fuels, like household and commercial waste, solid recovered fuel, and waste wood.

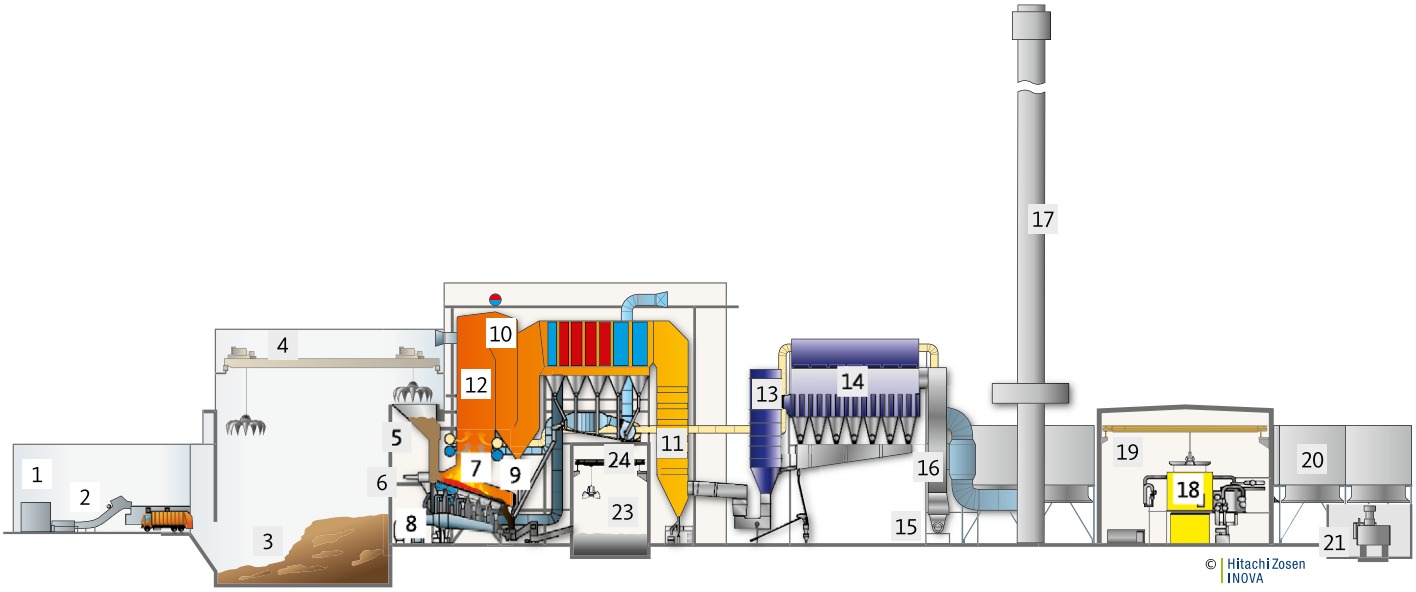
The WtE plant is funded, owned and will be operated by Multifuel Energy Ltd., a 50 : 50 joint venture of SSE plc and Wheelabrator Technologies Inc. The facility will use a range of waste-derived fuels, including waste wood, to generate electricity and heat. Consent to develop the facility was received from the Department of Energy and Climate Change in October 2011. The majority of the fuel will be solid recovered fuel, derived from a mechanical biological treatment plant that is being built by 3SE, a joint venture of the waste management company Shanks and SSE, as part of the Barnsely, Rotherham and Doncaster PFI procurement. The plant, with a thermal capacity of 2 x 117 MW, is being built at SSE's Ferrybridge power station in West Yorkshire. Completion is scheduled for early 2015. Hundreds of jobs will be created for the three-year construction period, with over 50 new full-time jobs once the plant is fully operational. Once operational, the electricity generated by the plant will be sold to SSE.

Contribution Toward Tackling Climate Change

The UK is the only country around the world that has introduced a long-term, legally binding framework to tackle the dangers of climate change. The Climate Change Act received royal assent on November 26, 2008. The act requires that emissions be reduced by at least 34% by 2020 and by at least 80% by 2050, relative to 1990 levels. In addition, the 2009 Renewable Energy Directive sets a target for the UK to obtain 15% of its energy from renewable resources by 2020, compared to only 3% in 2009. With this continued strong political support for increased renewable energy in the portfolio mix, SSE, UK's second largest energy producer, is committed to decarbonising its power generation by 50% by 2020. Renewable energy like the one produced by the Ferrybridge multi-fuel plant contributes significantly to achieving these goals. With its net power production of about 68 MW and an UK average consumption per home of 3,300 kWh1, the facility, supplied by HZI on a turnkey basis, will be able to power approx. 165,000 homes.

Latest Technology for Multi-fuel Use

A solid recovered fuel, derived from municipal solid waste, commercial waste, and/or waste wood, is delivered to the site by train or road. In the case of train delivery, a container unloading station is integrated next to the facility. The fuel is tipped into the fuel reception bunker within an enclosed solid fuel reception hall. With its capacity of 57,600 m³, the bunker offers intermediate storage for up to 7 days of autonomous operation. After the fuel has been thoroughly mixed, the solid fuel crane feeds the two independent lines, either in manual, semi-automatic or automatic operation mode. Once in the feed hopper, the fuel is pushed onto the proven HZI grate by a double ram feeder. The double ram feeder concept is used to accommodate the different fuel properties the plant is designed for by being able to vary the opening width from the feed hopper to the grate. Special features of the fully integrated control system for stable and efficient operation with the multi-fuel include for instance additional temperature measurements in the grate area. By coupling with a water spray system, the fire position on the grate can be optimised. The grate itself has a water-cooled zone to protect the grate against excessive heat when using high caloric fuels. When the fuel is completely burnt, the remaining ash falls into the chain slag extractor, which transports the bottom ash to its dedicated bunker. The pyrolytic gases released from the waste are mixed with secondary air and recirculated flue gas, which are injected tangentially at high velocity for intensive mixing into the post combustion chamber above the grate to allow complete burnout of the flue gas for very low CO emissions. The recirculation of flue gas also enhances the efficiency of the plant.



Waste Receiving and Storage

1 Delivery hall
2 Shredder
3 Solid fuel bunker
4 Solid fuel crane

Combustion and Boiler

5 Feed hopper
6 Ram feeder
7 HZI Grate
8 Primary air
9 Secondary air
10 Five-pass boiler
11 Economiser

Flue Gas Treatment

17 Ammonia injection
13 SemyDry reactor
14 Fabric filter
15 Inducted draft fan
16 Silencer
17 Stack

Energy Recovery

18 Turbine
19 Turbine building
20 Air cooled condenser
21 Transformer

Residue Handling and Treatment

22 Bottom ash conveyer
23 Bottom ash bunker
24 Bottom ash crane

Small is Beautiful

When built next to the existing power station, which is made up of four 500 MW generating sets (using 800 tonnes of coal and 218 million litres of coolant water per hour) with two additional gas turbines (which produce an extra 34 MW), the Ferrybridge WtE plant will be a small-size energy producer. However, with its optimised design and its highly efficient processing equipment, the facility can be proud of its net efficiency of › 29%. This is achieved by recovering the energy released by the combustion process in a five-pass boiler, which produces superheated steam. The chosen parameters of 71.5 bar/430 °C for the superheated steam ensure high energy efficiency while still maintaining reliable boiler operation. The superheated steam is expanded in a condensation turbine. About 90% of the gross electricity production is fed to the national grid. High plant availability is supported by an effective boiler cleaning system, consisting of a water-spray system for the 1st, 2nd and 3rd passes, a pneumatic rapping system for the 4th pass, and an explosion generation system in the 5th pass.

Clean Diversion from Landfill

In the first pass of the boiler nitrous oxides are reduced at a flue gas temperature of 850–950 °C by means of HZIs' Selective Non-Catalytic Reduction (SNCR) system with aqueous ammonia as the reducing agent. The flue gas temperature is decreased to about 170 °C at the outlet of the boiler, which is necessary to allow for the effective and safe removal of hazardous substances, such as dioxins or heavy metals, from the flue gas, using the proven proprietary SemiDry system. The flue gas cleaning process keeps the plant in full compliance with the EU emission limits under any operating conditions. Agents used are hydrated lime and activated carbon. The flue gas treatment residues are separated in a fabric filter and sent for safe disposal to an appropriate landfill. The disposed-of residues amount to 3–5 % of the waste treated by the facility. The clean flue gas is finally released into the atmosphere through the 80 m stack.

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General Project Data

Owner	Multifuel Energy Ltd.
Operator	Multifuel Energy Ltd.
Start of operation	2015
Total investment	CHF 330 million
Scope of HZI	General Contractor for entire plant, including civil works

Technical Data

Annual capacity	513,000 t/a (nom.)
Number of lines	2
Throughput per line	31.3 t/h (nom.), 42.2 t/h (max.)
Calorific value of waste	8.5 MJ/kg (min.), 16.5 MJ/kg (max.)
Thermal capacity per line	117.38 MW
Waste type	Multifuel: Solid Recovered Fuel (SRF), municipal solid waste, commercial/industrial waste, waste wood

Waste Receiving

Bunker volume	57,600 m^3
Pretreatment of waste	MBT plant with max. size of 300/300 mm

Combustion System

Grate type	HZI Grate AR123-120120
Grate design	4 rows with 6 zones per row
Grate size	Length: 12.25 m, width: 12 m
Grate cooling	Air- and water cooled

Boiler

Type	Five-pass boiler, vertical
Steam quantity per line	145.13 t/h
Steam pressure	71.5 bar
Steam temperature	430 °C
Flue gas outlet temperature	170 °C

Flue Gas Treatment

Concept	SNCR DeNO$_x$, SemiDry system
Flue gas volume per line	240,000 m^3/h (i.N.)

Energy Recovery

Concept	Extraction-condensation turbine
Electric power output	67.8 MWe

Residue Handling

Concept	Bottom ash treatment off site

Residues

Bottom ash	57,830 t/a (nom.)
Flue gas treatment	28,618 t/a (nom.)

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