



# ENERGY FROM WASTE

WE MAKE THE WORLD A CLEANER PLACE



**Steinmüller  
Babcock  
Environment**  
SBENG NIPPON STEEL & SUMIKIN ENGINEERING GROUP

## WE MAKE THE WORLD A CLEANER PLACE

Steinmüller Babcock Environment (SBENG) – a name that stands for cutting-edge technology in thermal waste treatment and flue gas cleaning. Our company develops, plans, builds and manages complete plants as well as individual key components. Our products are all “Made in Germany” and over 1.200 reference plants worldwide stand testament to our expertise. The company is based in Gummersbach, in the heart of North Rhine-Westphalia, the most heavily populated of the German federal states. Around 300 employees work here for SBENG or, if required, on-site at our plants around the globe. We develop plant concepts in close coordination with our customers, therefore the plants are tailored to the requirements of the individual markets. We are supported by our subsidiary Steinmüller Babcock Engineering Consulting Co. Ltd., which is situated in Shanghai.

Worldwide, our plants offer solutions to the increasingly pressing question: “How can the quantities of waste arising be treated in an environmentally friendly and energy-efficient manner?”

### Tradition breeds progress and development

We have been developing solutions for environmental protection for over 50 years – five decades in which we have combined tradition and experience with research and innovation. SBENG products have therefore contributed to modern waste disposal being seen as a clean, environmentally friendly technology. Thermal waste treatment today: a safe process, economically and ecologically sound.

### Our partnership: strength in numbers

Steinmüller Babcock Environment (SBENG) is part of the NSENGI group (Nippon Steel & Sumikin Engineering Co., Ltd), one of the leading environmental technology companies in Asia. Being one of the most important subsidiaries of Nippon Steel & Sumitomo Metal (NSSMC), the second largest steel producer in the world, NSENGI was initially set up as a development division of NSSMC in 1974. In 2006 it was outsourced as an independent unit of NSSMC, but remained fully-owned. NSENGI employs more than 4,000 people and with 42 reference plants (40 in Japan and 2 in South Korea) it is the world's leading supplier of waste gasification and melting technology with its Direct Melting Systems (DMS).

### Our origins: historic growth

Our roots stretch back more than 150 years. SBENG was created by pooling the environmental technology know-how of three companies steeped in tradition: Deutsche Babcock Anlagen



Energy from Waste

GmbH, Noell KRS Energie- und Umwelttechnik GmbH and L & C Steinmüller GmbH. These origins have shaped what we are today and entail a sense of duty: for our customers we are a partner that is both competent and innovative when it comes to building environmental technologies. Now and in the future.

**Our Energy from Waste:  
robust solutions designed to last**

We plan and implement plants for thermal treatment of a wide range of different waste materials. Our services are specifically tailored to the respective requirements of our clients.

Irrespective of whether we are supplying the entire process chain or just individual components, we are constantly optimizing our products and processes to ensure we always offer long-lasting, efficient and cost-effective solutions.

**Our Flue Gas Cleaning:  
plan for the long term, act sustainable**

One of the greatest challenges of our time is to protect the quality of the air we breathe. Our flue gas cleaning plants for power stations and industrial facilities play a significant role towards this by complying with the most stringent of environmental standards. The new plants and retrofit measures of SBENG guarantee great efficiency with maximum availability.



After all, as one of the market leaders, we are fully aware of our responsibility to act sustainable – for the sake of our clients and the environment.

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Flue Gas Cleaning



After Sales Service

## Thermal waste treatment – an environmentally friendly process



Already in ancient times, citizens complained about the mountains of waste contaminating their city – a problem that was to remain unsolved in human settlements for centuries. Modern industrial society made the problem yet more acute, as it lacked an appropriate method for handling the constantly growing quantities of refuse. Waste was disposed of in giant landfill sites. Here were stored, and are still stored today, ticking ecological time bombs. In addition, methane gas is released: a greenhouse

gas over 20 times more harmful to the climate than carbon dioxide. In Germany, the appropriate environmental steps have been taken: Since June 1, 2005, the deposition of untreated organic waste is no longer permitted anywhere in the country. But across the world, and even in many parts of Europe, the overwhelming proportion of waste still goes to landfill. Globally, we are still faced with the challenge of how to treat refuse in a sustainable, environmentally compatible, and economically sound way.



***“Waste incineration not only serves the purpose of environmentally sound waste disposal but also generates significant amounts of energy in the form of electricity and heat. In this way, it contributes to climate protection and helps preserve natural resources.”***

[Study by the German Federal Environment Agency: The Role of Waste Incineration in Germany, Dessau 2008, p. 9]

## The five-step route

Today, when it comes to waste, we should proceed according to the five-step waste hierarchy. Waste prevention enjoys the highest priority, followed by reuse. Where waste cannot be prevented or reused, it should be recycled wherever possible.

Also the non-recyclable quantities of waste, however, still contain energy that can be harnessed through thermal treatment. To the landfill site go only those substances that remain after thermal treatment and that cannot be used any further.

## Reduction of waste volume

Thermal treatment considerably reduces the volume of waste. In conurbations worldwide, every citizen produces on average 500 kilograms of refuse every year. Incineration reduces the waste volume by around 90%. This brings a lasting reduction in the quantity of waste sent to harmful landfill sites. Furthermore, the residual substances remaining after thermal treatment are completely sanitised, i.e., free of hazardous and pathogenic substances.

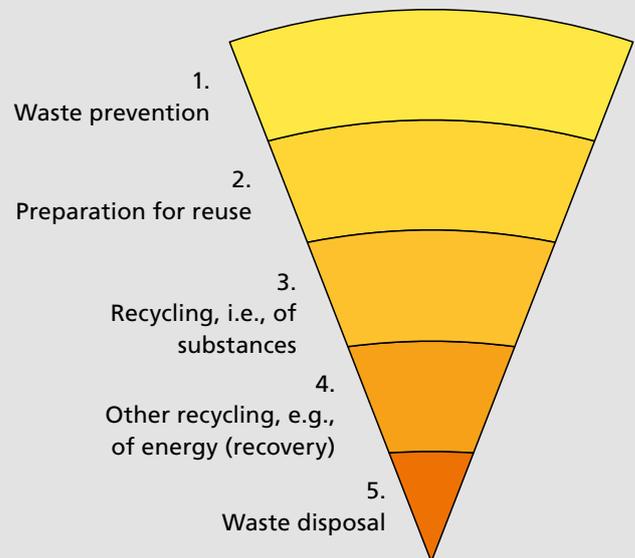
Thanks to today's cutting-edge technology in the field of flue gas cleaning, the flue gases that leave a modern waste incineration plant are clean and pose no danger to man or the environment. Thermal waste treatment therefore offers a proven and safe way to reduce quantities of waste while adhering to all environmental considerations.

## Energy from Waste

In addition, thermal treatment also uses the energy contained in the waste to produce power and heat – another step toward reducing the burden on the environment. In this way harmful fossil fuels such as natural gas, oil, and coal can be replaced with a clean alternative.

Today's modern thermal treatment systems guarantee environmentally friendly, energy-efficient, and thus future-oriented treatment of our residual waste.

## The five-step waste hierarchy (Directive 2008/98/EC):



- Produce long-lasting goods in order to save raw materials
- Avoid using harmful materials
- Reduce the volume and weight of goods, e.g., in terms of packaging

- Avoid single-use products, e.g., use returnable bottles instead

- Reprocess used goods to make other products, e.g., by melting down metals

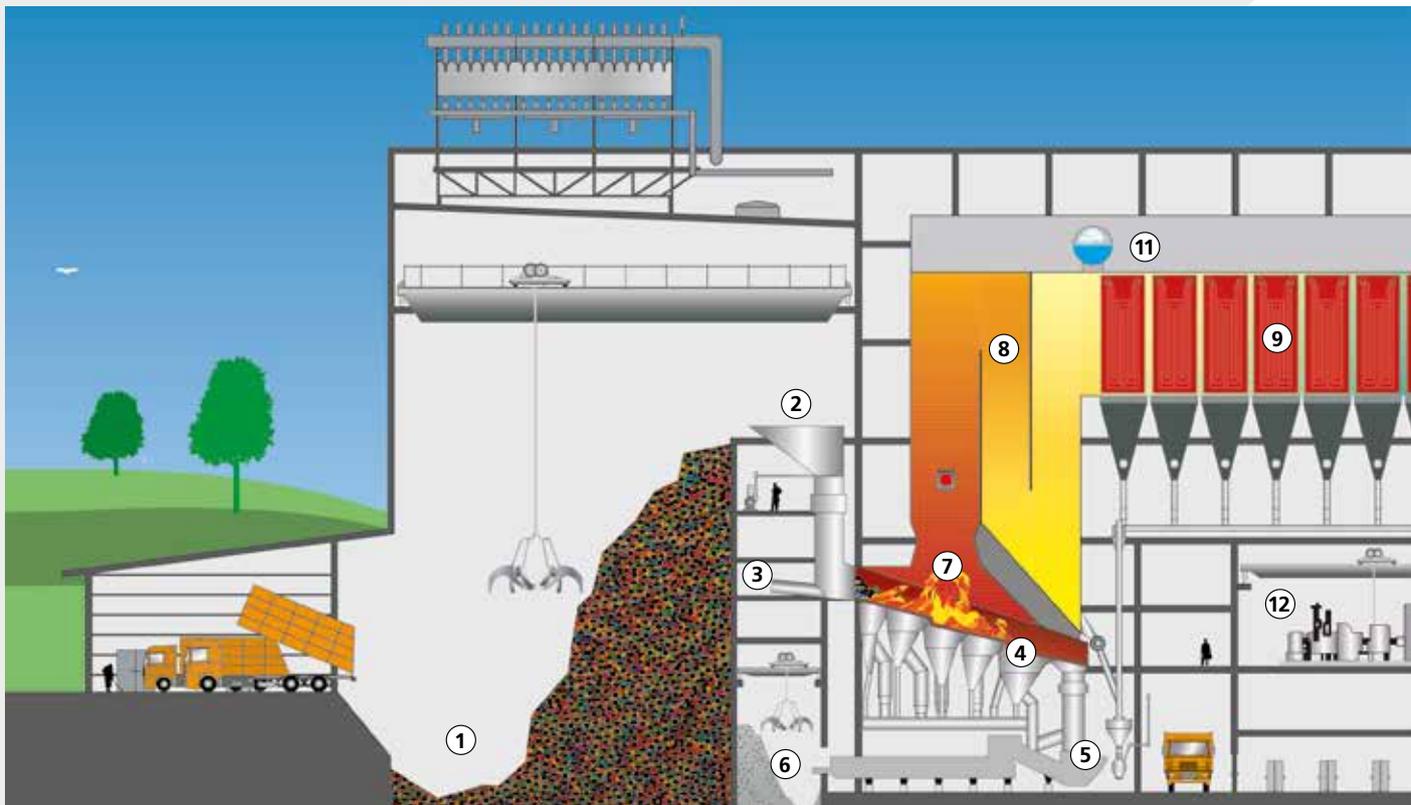
- Producing energy with thermal treatment of residual waste while completing the efficiency criteria

- Thermal treatment of residual waste without completion of the efficiency criteria

***“Before 1990, pollutants with a toxicity equivalent to that of 188 tonnes of arsenic were distributed in the air; today, at least 3 tonnes are withdrawn from the air. Admittedly, this concept takes some getting used to. But this reduction results from the power and heat produced by incinerating household refuse. If this energy was produced in traditional power stations, there would be 3 tonnes more toxins in the air.”***

[Study by the German Federal Ministry for the Environment, Nature Conservation and Reactor Safety:  
Refuse incineration – a potential danger? Saying goodbye to the dioxin spewer, Berlin 2005, p. 3f]

# The process of waste incineration – clean and safe



**Waste bunker:** The waste delivered is stored in the waste bunker (1) and homogenised by the crane. The crane then transports the mixed waste to the feeding hopper (2). Via the chute the waste arrives at the feeder (3) which pushes the waste onto the combustion grate in accordance with the firing control requirements.

**Forward moving grate:** The waste incineration process takes place on the grate (4) which comprises of grate bar rows with grate bars side by side. The grate bar rows are arranged overlapping one behind the other. Every second row moves alternately forth and back. The waste and later the slag material is transported by these rows to the end of the grate where the slag is discharged into the slag extractor (5).

**Slag extractor:** The slag extractor (5) is partially filled with water resulting in an air exclusion between the environment and the furnace itself. The slag falling from the grate is cooled in the water bath and conveyed by the ram of the slag extractor to a vibrating conveyor which transports the slag to the slag bunker (6).

**Fire on grate:** The plant operators monitor the incineration process on the grate (7) with CCTV. The air required for incineration (primary air) is controlled supplied from below through the grate. To obtain an optimal burnout of the flue gases, additional air (secondary air) is injected above the grate. In the boiler the hot flue gases are then

cooled down to the respective desired flue gas outlet temperature.

**Boiler:** The heat of the flue gases is used to heat demineralised water in the economiser heating surfaces (10). This so-called boiler feed water is then fed into the drum (11) which feeds the evaporator operated in natural circulation.

The water-steam mixture arising in the walls of the boiler radiation passes (evaporator) (8) is separated in the drum into water and steam (11). The steam is directed to the superheater heating surfaces (9). After heating up to the specified temperature, the live steam is led to the turbine (12).



Waste bunker



Forward moving grate



Slag extractor

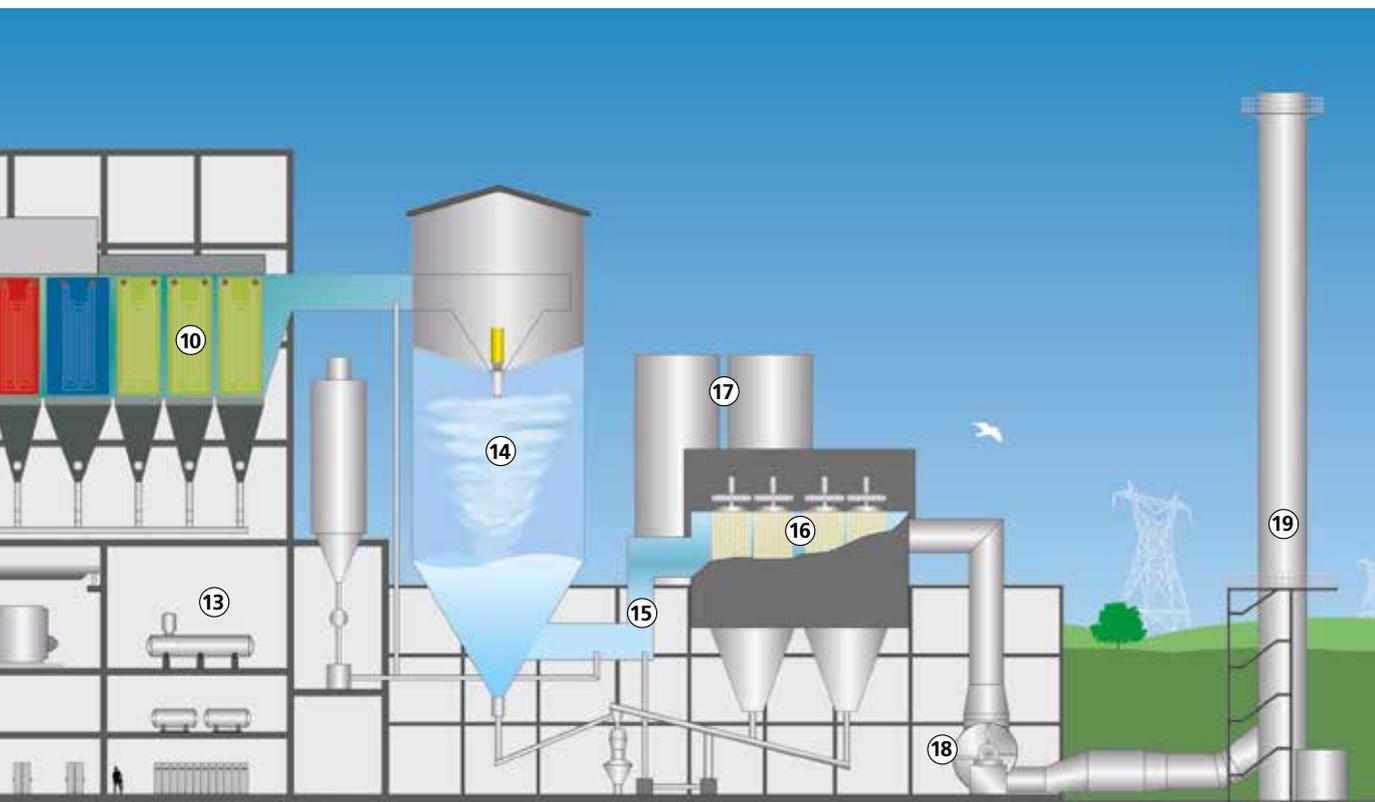


Fire on grate



Boiler drum

- |                        |                 |                   |                 |
|------------------------|-----------------|-------------------|-----------------|
| ① Waste bunker         | ⑥ Slag bunker   | ⑪ Boiler drum     | ⑯ Fabric filter |
| ② Waste feed hopper    | ⑦ Fire on grate | ⑫ Turbine         | ⑰ Silos         |
| ③ Feeder               | ⑧ Evaporator    | ⑬ Feed water tank | ⑱ ID-fan        |
| ④ Forward moving grate | ⑨ Superheater   | ⑭ Spray absorber  | ⑲ Stack         |
| ⑤ Slag extractor       | ⑩ Economiser    | ⑮ Flow reactor    |                 |



**Turbine:** Inside the turbine (12), the over-heated steam is relieved to turn the rotor of the turbine and is then condensed. The energy released during this process is utilised in the attached generator to produce electricity. The electricity is fed into the public grid. The condensate is collected in the feed water tank (13) and finally returned to the boiler. Alternatively part of the energy can be fed to local or district heat networks or used as process steam (combined heat and power production).

**Spray absorber:** In the spray absorber top (14), water and lime milk are injected into the flue gas from the boiler. Flowing down the absorber cooling achieves optimum reaction conditions for capturing the acidic pollutants in particular.

After cooling the flue gas, recirculate (reaction products separated in the fabric filter), fresh dry absorbent and activated carbon are injected into the entrained-flow reactor (15).

**Fabric filter:** The pollutants still contained in the flue gas react chemically or are adsorbed by the solids and thereby precipitated with the fly ash in the subsequent fabric filter (16). As a filter medium several thousand filter hoses ensure that the filtered flue gas safely complies with all legal and environmental requirements. A high percentage of the reaction products is recirculated ahead of the fabric filter. The recirculate can be moistened to optimise utilisation of the feed materials. A partial flow of the reaction products is con-

tinuously discharged and conveyed into silos (17) for disposal.

**ID-fan:** The ID-fan (18) keeps underpressure in the incineration process and leads the flue gas through the boiler and the flue gas cleaning system. Underpressure also ensures system tightness regarding flue gas.

**Stack:** The cleaned flue gas is leaving the process to atmosphere via the stack (19). In order to further improve efficiency, more and more condensation heat exchangers are installed in waste incineration plants. This means that clean, pure water vapour is emitted from the stack in the form of white clouds which dissolve – a sign of optimum energy utilisation.



Spray absorber



Fabric filter penthouse



Filter hoses



ID-fan



Stack

## The Steinmüller Babcock forward moving grate – always under fire



The Steinmüller Babcock forward moving grate is the central component of a waste incineration plant. Whether air- or water-cooled, this forward moving grate performs miracle transformations as it turns waste into energy. In constant motion, it leads the inserted refuse through several phases of incineration – from drying at the beginning of the grate to the main combustion zone in the centre of the grate and to the slag burnout at the end of the grate.

The grate has a modular construction. The optimum grate size can therefore be achieved for every application. The spectrum of combustibles ranges from household refuse with a high level of moisture to high-calorific plastics. The maximum throughput capacity per line is approximately 400,000 tonnes per year, respectively about 1,200 tonnes per day. Thanks to decades of experience, sturdy construction,

and constant development, the air- and watercooled forward moving grates always represent the latest in incineration technology.

### Optimal burnout

The overall concept of the forward moving grate speaks for itself. It provides during the combustion process, for example, in each combustion zone individual combustion air control as well as individual grate velocity for transporting the waste. Both features are ensured by our advanced combustion control system. In order to achieve even better burnout quality, our grate system works with two grate steps which ensure that the waste is repeatedly broken up and mixed during the combustion process. This delivers a perfect burnout and the strict German and European regulations are reliably adhered to.

***Cautious estimations assume that using waste to produce energy now saves, on average, a quantity of fossil fuels corresponding to the needs of around 700,000 citizens.***

***Incineration of around 2 kg of household refuse with a calorific value of around 8,000 kJ/kg can produce 1 kWh of power. This can light a 40-watt light bulb for some 25 hours. The amount of energy in a well-filled 60-litre household bin can run the light bulb for almost an entire week.***

### High versatility

The moving grate is characterised by its high degree of versatility. It is divided into five combustion zones. Both grate systems, i.e., air- and water-cooled, allow the treatment of waste with a wide spectrum of calorific values. While the air-cooled forward moving grate is used preferentially for municipal waste with low calorific values, the water-cooled version is recommended for high-calorific combustibles. The modular construction of our grate allows the air-cooled rows of fire bars to be replaced with the water-cooled option at any time – or vice versa. Even in existing grate systems, therefore, it is possible to adapt to altered calorific values.

### High availability – assured service life

A must for every plant operator: high availability and long service life – regardless of the combustible. The Steinmüller

Babcock forward moving grate offers precisely this – thanks to sturdy construction, long professional experience, and constant development.

### Economical solution

Thanks to our long experience in developing, constructing, and operating these systems, our combustion grates are extremely dependable. Furthermore, the systems' ease of maintenance ensures that downtime is kept to a minimum. Our After Sales Service also ensures that inspections of the grate system can be carried out quickly and decisively. We also constantly familiarise our customers with the innovations from our development department. We thereby guarantee the system's technical optimisation and longlasting efficiency.



## The boiler – full of energy



The popular term is “waste incineration”. But this expression only goes some way toward describing a modern plant for thermal waste treatment, since today’s plants not only reduce the waste volume by 90%, but are also designed to exploit the maximum possible amount of energy. The key word now is “Energy from Waste”. The incineration process releases the energy bound within the waste. The energy is recovered with the help of a boiler or steam generator positioned after the incineration stage. A boiler is a complex heat-exchange system that must meet the special operating requirements in terms of, among others, corrosion, fouling, slagging, stress, part load behaviour, and system dynamics.

As they flow through the boiler, the hot flue gases are cooled; conversely water, the so-called feed water, is initially heated up, then evaporated and finally superheated. The steam produced is then used to produce power and heat. By increasing

the steam parameters, using new circuit designs, and ensuring optimum energy utilisation (through measures on the cold end), efficiencies of over 30 % can now be achieved.



***“Given the limited supply of fossil primary energy sources, the globally rising energy demand cannot be met in the current form over the long run. In parallel with intensive efforts to boost energy efficiency and realize energy savings, it is imperative to make use of all available energy sources that help conserve limited resources, are environmentally benign and contribute to climate protection. This also applies to high-caloric waste streams. ... the waste sector is already making relevant contributions to energy supply... .”***

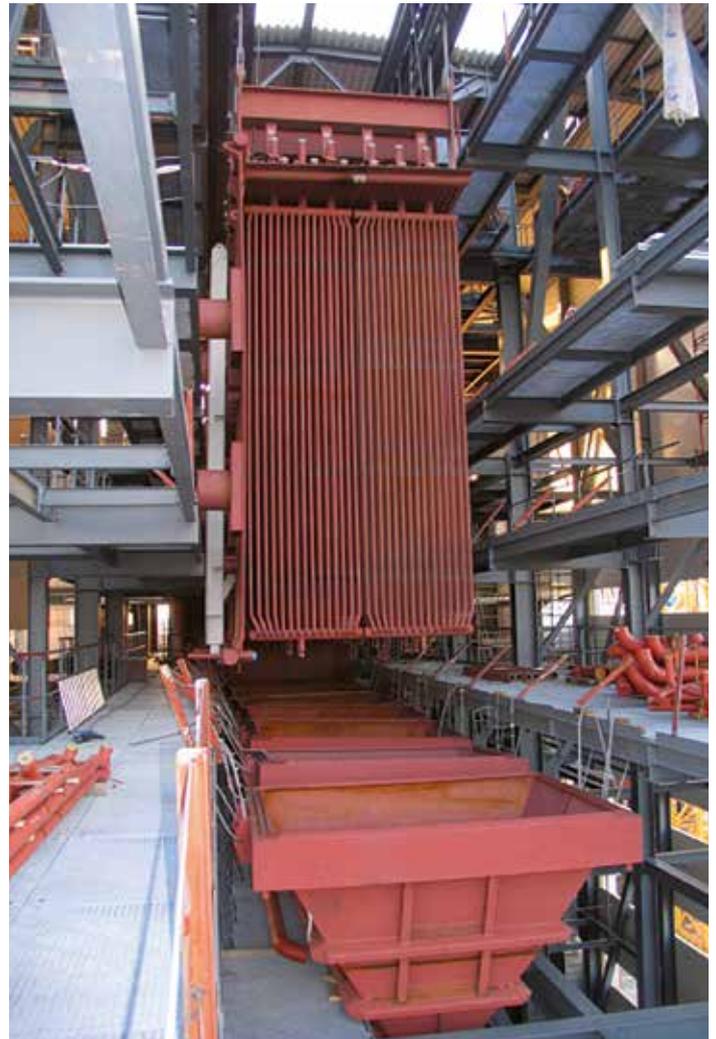
[Study by the German Federal Environment Agency: The Importance of Waste Incineration in Germany, Dessau 2008, p. 15]

### Quality guarantees long service life

Steinmüller Babcock Environment designs and builds tailored systems, adapted to the predicted calorific value of the waste. Our boiler systems are adapted to the respective operating conditions, right down to the finest details. As well as the materials concept, which guarantees a long boiler service life, the boiler's time between services is also a decisive quality aspect.

In our systems the sequence, layout, and construction, as well as the protection of the heating surfaces, all take special account of risk factors including fouling, slagging, corrosion, and erosion.

And during the system's operation, our After Sales Service is on-hand to carry out checks as part of inspections and to develop any measures needed to ensure trouble-free and efficient operation.



## Ash and clinker – a lot left to offer



Waste incineration preserves resources: thermal treatment not only transforms the energetic potential of the waste into power and heat; it also leaves behind residual substances, mostly ash and slag, that are produced in combustion, flue gas cleaning, and wastewater treatment

and that are almost completely sanitised. These solid substances correspond to around 25 percent of the quantity of raw waste. A large part of them can be recycled, so that only 3-4 percent of the original amount of waste has to be landfilled.



***“On the one hand, the burnout quality of the ashes is important for ensuring the residual substance quality and for adhering to the deposition conditions. On the other hand, the amount of energy released per mg of combustible, and ultimately the amount of steam produced, is greater when the ashes exhibit a low ignition loss.”***

[Prof. Bernd Bilitewski (ed.), 14th Thermal Waste Treatment Symposium, A Series in the Field of Waste Disposal Technology, University of Kassel, p. 61]

### Specialised in ash and slag treatment

Steinmüller Babcock Environment disposes of modern and environmentally friendly processes for handling residual materials. We are specialised in ash and slag handling systems. The combustion residues arising on the grate and at the end of the grate are dropped directly into the subsequent slag extraction system through a closed chute. As slag extraction units, we mainly use hydraulically driven ram type slag extractors. SBENG developed these specifically for waste incineration plants, and the systems have proven themselves extensively in this area.

### Especially robust

The SBENG ram type slag extractor excels in safely extracting even larger, incombustible waste components that occasionally arise. The especially robust construction allows low-wear operation with long service life.

The subsequent transport devices are designed to also allow uninterrupted operation. Ram type slag extractors serve to extinguish and extract the slag. This slag is either fed directly into the slag bunker or transported via further transport devices such as apron conveyors, vibrating conveyors, or belt conveyors. The slag collected in the slag bunker can later be used in further processing. For example, the reusable materials it contains, such as iron and light metals, can be separated for reuse. The remaining residues are largely used as filling material for road construction.



## Combustion control system – for optimal running



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Waste incineration is a complex process, an interaction between very different components. Correct control of the combustion process is decisive for the solid, economical and environmentally sound operation of a waste incineration plant. If the optimum power for the steam generator is achieved via the control, this also derives maximum efficiency from the system.

Combustion control is the signal box as it provides the correct adjustment for the actual incineration process – a complex task, since the composition of the waste varies constantly. The combustible material is extremely heterogeneous and can lead to large variations in terms of the amount of heat and pollutants released.

An optimal combustion control system compensates for the varying waste composition during incineration. It ensures that the waste burns out in an optimum fashion and thus that the

ideal power is achieved for the steam generator, i.e., that a maximum steam output capacity is achieved with consistent steam quality while observing all regulatory limits.

### Tailored solutions

Depending on the throughput and waste composition, every system requires an individual combustion control. Precisely this aspect is one of the strengths of SBENG. Whether for new systems, for inspection, or for retrofitting: when it comes to optimum combustion control, we develop an individually tailored solution for every system. The quantity, temperature, and distribution of the air supplied to the incineration process, as well as the speed of the feeder and grate, are the parameters that can influence the quantity of steam, the oxygen content in the flue gas and the position of the fire on the grate. Through targeted alteration of these parameters, we ensure uniform release of heat even if the system has to incinerate

***“The reductions in fossil fuel usage through waste recycling are eight times higher today than in 1990. Standards are being set by developments in climate protection by using the energy and by avoiding greenhouse gas emissions from landfill sites.”***

[Waste Management in Germany 2011, Facts, Data, Graphics, published by the German Federal Ministry for the Environment, Nature Conservation and Reactor Safety, p. 5]

heterogeneous residual waste. SBENG is also your ideal expert partner when it comes to bringing an existing combustion control system up to date. It is worth examining all parameters and modernising the control system, since an incorrectly adjusted incineration leads to impaired performance, faster wear and damage, and significantly reduced service life.

In Germany, the Federal Immission Control Act specifies that flue gases must reach a temperature of 850 degrees for at least two seconds. This ensures that pollutants, in particular dioxins, are destroyed.



## Hazardous waste – the end of the line for dangerous refuse



Hazardous waste is a legal term for which the European Union's list of refuse includes around 400 types of waste. These include, among others:

- Residues from production processes in the chemicals industry
- Laboratory chemicals
- Used pesticides
- Hospital waste, infectious materials
- Highly polluted industrial waste

This hazardous waste may not be incinerated together with normal household and residual waste. It belongs in systems that allow high-temperature incineration. This is because in the thermal treatment of hazardous waste a temperature of 1,100 degrees must be reached for at least two seconds in order to prevent the release of emissions that are harmful to health and to the environment. The high temperatures ensure the destruction of all organic substances. Furthermore, this type of waste treatment makes it possible to obtain energy in

the form of steam and power from polluted, contaminated, and mixed waste. This technology therefore currently represents the only proven procedure for the economically sound treatment of large quantities of hazardous waste.

### The rotary kiln system – a universal concept for hazardous waste incineration

Because of the requirement for high-temperature incineration, hazardous waste incineration systems use so-called rotary kilns as their combustion system. These rotary kilns have a length of up to 12 metres and a diameter of up to five metres, and thanks to their refractory lining are specially designed for high temperatures. The post-combustion chamber positioned downstream of the rotary kiln is responsible for the complete burnout of the flue gases from incineration (residual organics, suspended solid particles, strands CO). Liquid waste and gaseous pollutants are introduced at the start of the post-combustion chamber to ensure that these substances are also fully burnt out. The rotary

***“Thanks to stringent emission control standards, dioxin, dust and heavy metals emissions from waste incineration are no longer an issue, a fact that is all the more impressive as the waste incineration capacity has more than doubled since 1985.”***

[Study by the German Federal Environment Agency: The Importance of Waste Incineration in Germany, Dessau 2008, p. 3]

kiln and post-combustion chamber can therefore be seen as an integral system of two-stage incineration, which also allows the treatment of hazardous waste with a highly variable consistency.

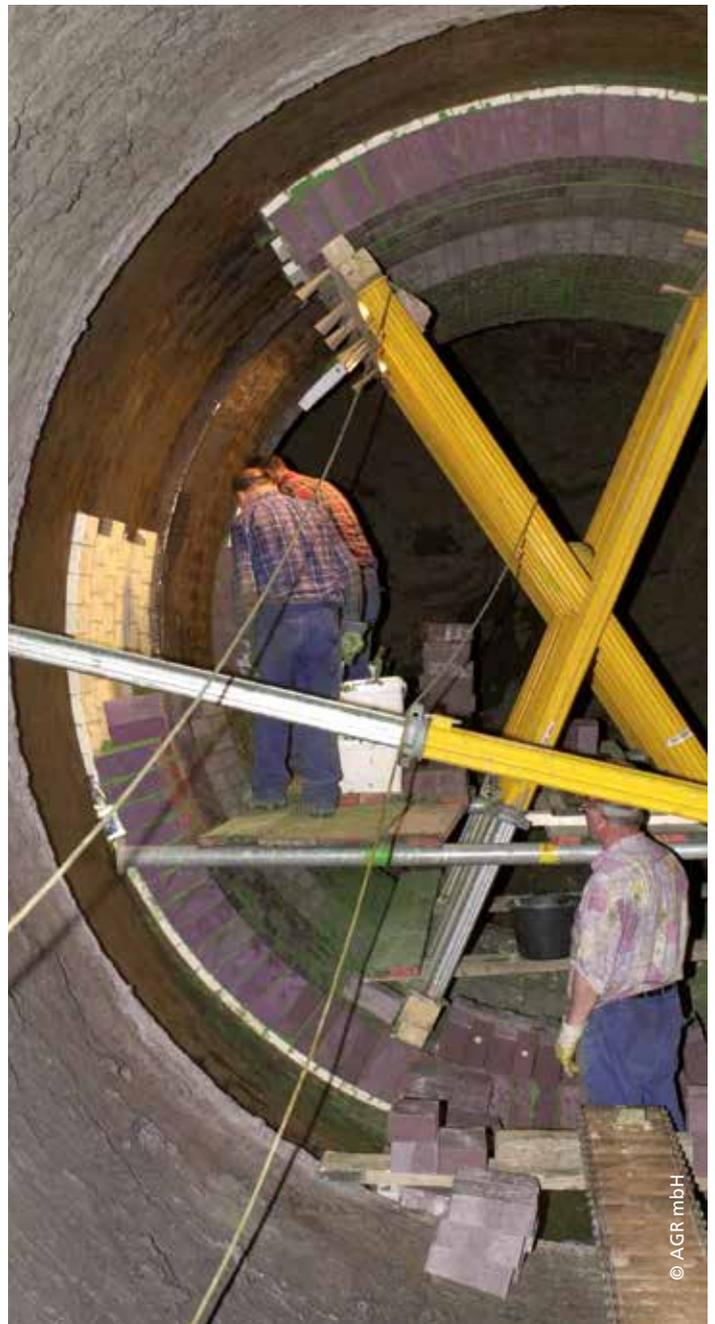
Systems for hazardous waste incineration can be used to incinerate coarse solids, drummed and barreled waste, paste-like, liquid and gaseous waste. Such a system consists of waste storage, a feeding chute for all types of waste and drummed waste, a rotary kiln, a post-combustion chamber, a heat-recovery steam generator, and a flue gas cleaning. Flexibility of operation in terms of the waste feed allows the system to adapt to variations in the amount and composition of waste over time.

### Built according to individual requirements

SBENG plans, builds and manages ready-to-use hazardous waste incineration plants. These plants are configured according to individual requirements. We guarantee highly developed technology that has proven itself in renowned companies in the chemical industry. Our thermal treatment exploits the energetic potential of hazardous waste to obtain steam, power, and heat. At the same time it guarantees the safe and environmentally sound disposal of hazardous substances and, thanks to advanced flue gas cleaning, ensures that emission values lie significantly below the maximum permitted limits.



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## Flue Gas Cleaning – for pure air



Waste is not a simple matter. Waste composition is heterogeneous and leads to the formation of flue gases with varying content of pollutants. If these are left unfiltered, they will cause significant air pollution. However, the modern thermal treatment process poses no risk to the environment.

Harmful substances such as dioxins, particulate matter, or heavy metals have long since been absent from the emissions of waste incineration processes. The air in the area surrounding the plants is proven to be clean. This is thanks to modern flue gas cleaning systems. Thermal waste incineration is subject to the strictest regulations of permitted emissions in comparison to other industrial processes in Germany and Europe. Thereby they produce emissions, which are often cleaner than the combustion air.

### Products of leading-edge technology

Steinmüller Babcock Environment feels a particular sense of duty to the environment. Thus, our flue gas cleaning systems

use cutting-edge technology developed on the basis of decades of research and practical experience. We know the problem well: only if the pollutants in flue gases are safely removed, the strictest emission requirements can be met as a result and waste incineration plants enjoy the necessary acceptance by society.

### Maximum flexibility

Our different technologies of flue gas cleaning and flue gas desulfurization can fulfill the strict emission regulations even with high pollutant contents. SBENG possesses a broad technological portfolio, from which the most suitable technologies can be chosen and combined, in order to meet each combustible's and each customer's underlying conditions and requirements. With decades of experiences with the construction of flue gas cleaning plants, Steinmüller Babcock Environment has convincing reference projects that show the effectivity and reliability of its plants.

***"... without waste incinerators, ambient air pollutant levels would be much higher than with waste incinerators. After all, electricity and heat generated in MSWIs substitute fossil energy sources in conventional (heat and) power plants which typically release higher specific pollutant levels than waste incinerators."***

[Study by the German Federal Environment Agency: The Importance of Waste Incineration in Germany, Dessau 2008, p. 4]

## Energy from flue gas

Our systems are designed for energy efficiency. Depending on the wishes of the respective customer, the flue gas cleaning can be combined with energy recovery systems e.g., by flue gas condensation. This leads to an increase in the overall efficiency. De-

living constant improvement in this respect is one of the big technical challenges facing thermal waste treatment. With our technologies, we have access to optimum solutions for increasing the energy output.

### Core technologies of our Flue Gas Cleaning

#### Dedusting

- Fabric filter
- Electrostatic precipitator
- Wet electrostatic precipitator

#### Separation of acidic gaseous pollutants

- Combined scrubbing systems based on lime products or sodium hydroxide
- Spray absorption with lime milk
- Conditioned dry scrubbing with slaked lime (CIRCUSORB®)
- Dry scrubbing with sodium bicarbonate
- Combined scrubbing processes

### Removal of heavy metals and organic compounds

- Injection of activated carbon
- Activated carbon fixed-bed adsorber
- Catalytic dioxin removal

#### Denitrification

- SCR process for catalytic reduction in NO<sub>x</sub> emissions, as both "High Dust" and "Low Dust" configurations
- SNCR process for non-catalytic reduction in NO<sub>x</sub> emissions using ammonia or urea solutions

#### Energy-recovery systems

- Downstream economiser
- Heat transfer systems for preheating of combustion air
- Flue gas condensation, e.g., for district heating use (optionally with heat pump)
- Heat transfer systems within the flue gas cleaning for optimising energy efficiency

### Technologies for removal of different pollutants

	SNCR	Electrostatic precipitator	Sorption				Bag filter	Combined scrubber systems	Wet electrostatic precipitator	Lignite Coke Fixed Bed Adsorber	SCR Catalyst
			Dry-	Conditioned-dry- (Circusorb®)	Semi-dry-						
Dust		X				X	(X)	X	(X)		
HCl			X	X	X	X <sup>1</sup>	X		X		
HF			X	X	X	X <sup>1</sup>	X		X		
SO <sub>2</sub>			X	X	X	X <sup>1</sup>	X		X		
SO <sub>3</sub>			X	X	X	X <sup>1</sup>	X	X	X		
Droplet and aerosols								X	X		
Quicksilver / Hg			X <sup>2</sup>	X <sup>2</sup>	X <sup>2</sup>	X <sup>2</sup>	(X)		X		
Other heavy metals		(X)	X <sup>2</sup>	X <sup>2</sup>	X <sup>2</sup>	X <sup>2</sup>	(X)	(X)	X		
NO <sub>x</sub>	X									X	
Dioxins, furans and aromatic hydrocarbons			X <sup>2</sup>	X <sup>2</sup>	X <sup>2</sup>	X <sup>2</sup>			X	X	

(X) moderate deposition as side effect | X<sup>1</sup> if alkaline sorbents are added | X<sup>2</sup> if activated carbon or lignite coke sorbents are added

## One company – many roles



Waste disposal technology is cutting-edge, a highly complex interplay between individual components perfectly adapted to one another. Steinmüller Babcock Environment takes on many roles in the process of delivering this technology.

### Our processing expertise: proven

We work as a general contractor for turnkey plants, as well as developing and supplying individual components. Regardless of which area we manage for you: from planning to material logistics, from the breaking ground to commissioning – the individual departments of our company are perfectly coordinated with one another. In order to be able to fulfill our varied roles, we have a team of highly qualified engineers that use the latest tools to ensure top quality in the systems' engineering and subsequent implementation. As well as the en-

gineering department, we also have a professional project management team – also equipped with modern project management tools to provide a high quality of execution. The processing of an order within the project team ensures that every project coworker is always abreast of all the latest developments. This is a fundamental requirement for smooth processing of customer orders. This transparency in our operating processes guarantees adherence to schedules – and at a technical standard that meets the toughest demands.

### Our technology: setting standards

To stay ahead of the game, you have to keep thinking. This is why we engage ourselves in the development of future technologies and work closely with technical universities and research institutes. In this way, we define tomorrow's direction today.



## Our head start: many years of experience

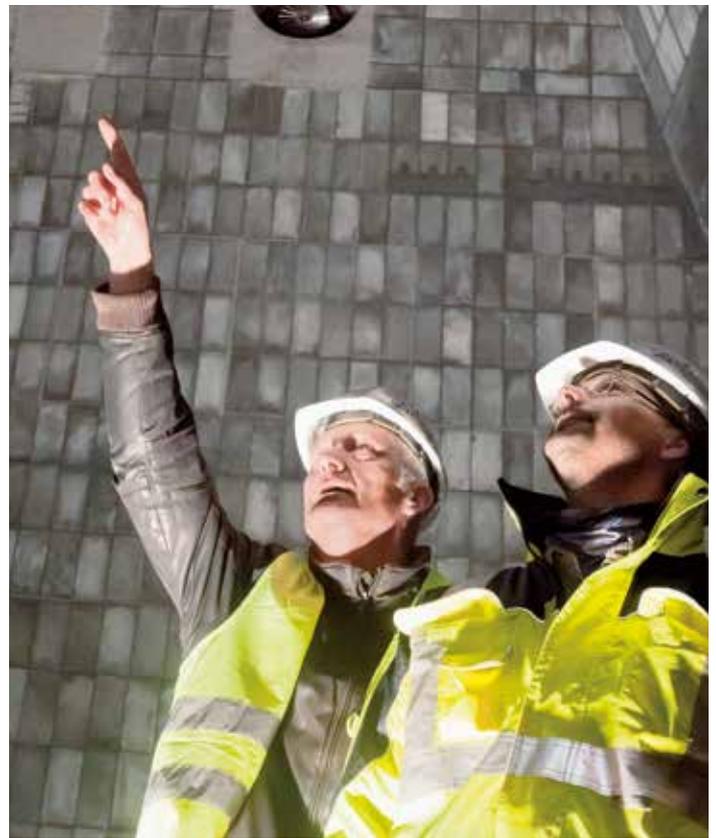
Whether as a supplier of the entire process chain or of individual components – we use our long experience to constantly optimise our products and processes for longterm, efficient, economically sound use.

## Especially important to us: safety and quality

Quality and safety have top priority for us. This is why we are certified in terms of our management systems for health, safety and environmental protection. We are not only supplier of boiler systems, but also certified as a manufacturer according to current EU guidelines. With the corresponding ASME S stamp (construction) and ASME R stamp (repairs, reconstructions) we have also created a basis for selling our products in the U.S.A., Canada, and 90 other countries. With these in place, there are no limits to the use of our products. Also in the long term we ensure the outstanding quality of our products. That's why we maintain our own welding and testing procedure, which is appointed with certified procedure qualifications according to EN ISO 15614 and EN 473.

## Our performance profile:

- General contractor for turnkey plants and single lots
- Supplier of key components
- After Sales Service
- Engineering provider



## Our After Sales Service – always at your side



Even after completion and commissioning of the system, we are there for our customers. With us you have access to all services, from engineering to assembly, and from inspection to repairs of all components: a fully featured, one-stop service team, comprehensive, versatile, and reliable to ensure minimum downtime and maximum efficiency for your plant. Along the complete process chain our After Sales Service is the competent partner at your side – not only for plants constructed by us.

As part of a plant manufacturer, our After Sales Service disposes of the entire knowledge of our development, engineering and construction departments. Our comprehensive know-how is at your disposal for studies, optimisation of plant concepts, the modernisation of plants and also forms the basis for maintenance work at the highest quality level. As an authorised manufacturer of pressure equipment, Steinmüller Babcock Environment is in possession of all certificates required for offering the engineering, manufacturing, delivery, assembly, and documentation of

pressure parts. As a result of our in-house procedure qualification records (PQRs) and welding procedure specifications (WPSs), we meet the legal requirements of the Pressure Equipment Directive (97/23/EC) and are therefore able to market certified systems.

### Inspection, maintenance, and repairs

Prevention is better than downtime. Planned services are the cornerstone of an economically sound maintenance strategy. Our After Sales Service advises you on preventive measures and offers both individual and all-round inspection services. In this way shutdown periods are shortened and the availability of the plant increases. The organisation and execution of maintenance work is based on the time frame you specify and is tailored to the needs of your system. Our experienced personnel know how to reconcile scheduling requirements with the necessary scope of measures.

### Our range of services

Inspection,  
maintenance,  
and repairs

Revision and maintenance

Inspection and repair

Spare- and wear parts  
management

Service contracts  
(incl. on-call service/operational management)

Service contracts for wear parts

## System operation and optimisation

The service life of systems for thermal waste treatment is generally over 20 years. In the course of the system's operating life, new requirements often present themselves, such as changed legal regulations on environmental compatibility or changes in the fuel supply or fuel composition. All of this has an effect on the operation and, sometimes, on the systems' essential technical design. With our engineering-based services, you receive the support you need to overcome all challenges that arise during ongoing operation. In addition to our experience from reference plants we use modern tools, such as thermography, industrial machine diagnosis as well as video endoscopy.



## Service contracts

Steinmüller Babcock Environment offers service contracts for inspections and the continual maintenance of waste incineration plants. These are adapted to our customers' needs in terms of four key service areas:

- Contract length
- Technical scope – e.g., individual components such as the grate and boiler or the complete system
- Service scope – e.g., inspection every 8,000 hours of operation and / or during ongoing operation every 2,000 operating hours; optional on-call service for interruptions to continuous operation
- Service depth – e.g., a complete handling team or individual experts in place as a supervisor

## The benefits for you

A bespoke service contract offers you:

- The ability to plan maintenance costs in the long term
- Fast, unbureaucratic support by our service team
- Additional services such as on-call service
- Faster supply of replacement parts and parts subject to wear
- Price advantage in accordance with the length of the contractual commitment



Operation of  
plant and  
optimisation

Studies and Engineering Service

Modernisation, expansion and deconstruction

Optimisation and management of technical mode

Employee instruction

# Worldwide active – a selection of our 1,600 reference plants

## Energy from Waste

### Austria

Wels

### China

Feixi

Haidian

Hefei

Ningbo

Shanghai

### Czech Republic

Brno

### Denmark

Århus

Fünen

Glostrup

### Finland

Riihimäki

Tampere

### France

Bellegarde

Bordeaux

Bourgen Bresse

Carrieres sur Seine

Chateau Roux

Clermont Ferrand

Dunkirk

Fort-de-France, Martinique

Grenoble

Lagny, Marne-la-Vallée

Le Havre

Lyon

Rambervillers

Reims

Toulouse

### Germany

Berlin-Ruhleben

Böblingen

Bremen

Burgkirchen

Cologne

Düsseldorf-Flingern

Essen-Karnap

Göppingen

Göttingen

Hagen

Hamburg, Borsigstraße

Hamburg, Rugenberger Damm

Hamburg, Stapelfeld

Hameln

Hamm

Heringen

Herten

Kamp-Lintfort

Kassel

Kiel

Krefeld

Leverkusen

Ludwigshafen

Munich

Oberhausen

Pinneberg

Rüdersdorf

Schwandorf

Schweinfurt

Stuttgart-Münster

Weissenhorn

Weisweiler

Wuppertal

Würzburg

### Great Britain

Birmingham-Tyseley

Edmonton

Isle of Man

### Hungary

Budapest

### Italy

Bolzano

Cremona

Dalmine

Fenice Melfi

Macerata

Messina

Naples

Reggio di Calabria

Schio

### Japan

Akashi, Hyogo

Funabashi, Chiba

Iwaki, Fukushima

Kadoma, Osaka

Kawaguchi, Saitama

Kawasaki, Kanagawa

Kishiwada, Osaka

Kobe, Hyogo

Kyoto

Matsue, Shimane

Moriguchi, Osaka

Ohta, Gunma

Ritto

Sennan, Osaka

Shijonawate, Osaka

Shimodate

Tokushima

Tokyo

Utsunomiya, Tochigi

Yashimata

### Korea

Ansan

Anyang Pyongchon

Gyeongju

Icheon

Jung-Ku, Ulsan

Jungwon-Ku, Sung Nam

Kwang Myung

Myung-Ji, Pusan

Nowon-Ku, Sang-Gae

### Lithuania

Klaipeda

Vilnius

### Netherlands

Arnhem

Delfzijl

Eindhoven

Joure

Moerdijk

Nijmegen

Rotterdam, Botlek

Rozenburg

### Norway

Kristiansand

### Russia

Kuybyshev

Moscow

Murmansk

Omsk

Pyatigorsk

Rostov

Saratow

Sochi

### Singapore

Ulu Pandan

### Slovakia

Bratislava

Kosice

### Spain

Palma de Mallorca

San Sebastian

Tarragona

### Sweden

Borlänge

Halmstad

Högbytorp

Jönköping

Linköping

Södertälje

Stockholm

Uddevalla

### Switzerland

Affoltern

Biel

Buchs

Cottendart

Gamsen

Horgen

Muttenz

Oberwallis

Oftringen

Olten

### Taiwan

Kaohsiung

### Ukraine

Dnepropetrowsk

Donezk

Kiev

Yalta

### U.S.A.

Essex County, New Jersey

Hempstead, New York

Long Beach, California

Montgomery, Pennsylvania

Niagara Falls

Portland, Massachusetts

Southeastern County

## Flue Gas Cleaning

### Austria

Lenzing

### Belgium

Antwerp

### Denmark

Aarhus

Avedøre

Glostrup

Odense

### Finnland

Riihimäki

### France

Bellegarde

Grenoble

Reims

### Germany

Aachen

Bamberg

Berlin - Marienfelde

Berlin - Ruhleben

Biebesheim

Bielefeld

Böblingen

Böhlen

Burgau

Cologne

Duisburg

Düsseldorf

Düsseldorf - Flingern

Ebenhausen

Essen - Karnap

Gersthofen

Göppingen

Hagen

Hamburg, Borsigstraße

Hamburg, Rugenberger Damm

Hamburg, Stapelfeld

Hamm

Heide

Herten

Kassel

Kempen

Kiel

Krefeld

Landshut

Lengfurt, Main

Leverkusen

Ludwigshafen

Lünen

Mainz

Mannheim

Marburg

Munich

Münster

Oberhausen

Offenbach

Pinneberg

Rüdersdorf

Salzgitter - Heerte

Sande

Schwedt

Schweinfurt

Solingen

Stuttgart - Münster

Weisweiler

Weißenhorn

Wesel

Wuppertal

Würzburg

Zapfendorf

Zirndorf

### Italy

Fenice Melfi

Naples

### Korea

Busan

Sang Gae

Sung Nam

Ulsan

### Netherlands

Amsterdam

Dordrecht

Nimwegen

Rotterdam

### Norway

Oslo - Brobekk

Oslo - Klemetsrud

### Sweden

Halmstad

Uddevalla

### Switzerland

Basel

Buchs - Aarau

Cottendart

Horgen

### Taiwan

Kaohsiung

### U.S.A.

Babylon, New Jersey

Camden, New Jersey

Charleston, South Carolina

Essex County, New Jersey

Hempstead, New York

Portland, Massachusetts

## After Sales Service

### Austria

Dürnrohr

Pfaffenuau

### China

Shanghai

### Denmark

Aarhus

Glostrup

Odense

### Finnland

Riihimäki

### Germany

Berlin - Ruhleben

Böblingen

Bonn

Düsseldorf - Flingern

Hamburg, Borsigstraße

Hamburg, Rugenberger Damm

Hamburg, Stapelfeld

Heringen

Iserlohn

Karlsruhe

Kiel

Knapsack - Hürth

Leuna

Rüdersdorf

Salzbergen

Stuttgart

Wesel - Asdonkshof

Wuppertal

### Great Britain

Isle of Man

Tyseley

### Italy

Naples

### Lithuania

Klaipeda

### Netherlands

Arnhem

Delfzijl

Hemweg

Moerdijk

### Norway

Klemetsrud

Kristiansand

Oslo

### Spain

Alcudia

Palma de Mallorca

Tarragona

### Sweden

Borlänge

Halmstad

Jönköping

Uddevalla

### Taiwan

Yung Kang

### U.S.A

Long Beach, California

Montgomery, Pennsylvania

Niagara Falls

Portland, Massachusetts



**Waste incineration plant Kristiansand/Norway**

Fuel: Municipal waste  
 Throughput rate: 1x18 t/h  
 Grate system: Forward moving grate (water-cooled)  
 Scope of delivery: Furnace, steam generator  
 Commissioned: 2010  
 Energy production: Electric current / district heating



**Waste incineration plant Rüdersdorf/Germany**

Fuel: Refuse-derived fuel  
 Throughput rate: 1x32.9 t/h  
 Grate system: Forward moving grate (water-cooled)  
 Scope of delivery: Furnace, steam generator, flue gas cleaning  
 Commissioned: 2008  
 Energy production: Electric current



**Waste incineration plant Riihimäki/Finland**

Fuel: Municipal waste  
 Throughput rate: 1x20.75 t/h  
 Grate system: Forward moving grate (water-cooled)  
 Scope of delivery: Furnace, steam generator  
 Commissioned: 2007  
 Energy production: Electric current / district heating



**Waste incineration plant Oberhausen/Germany**

Fuel: Municipal waste  
 Throughput rate: 1x25 t/h  
 Grate system: Roller grate  
 Scope of delivery: Furnace, steam generator, electrostatic precipitator  
 Commissioned: 2006  
 Energy production: Electric current



**Waste incineration plant Isle of Man/Great Britain**

Fuel: Municipal waste  
 Throughput rate: 1x9 t/h  
 Grate system: Forward moving grate (water-cooled)  
 Scope of delivery: Furnace, steam generator  
 Commissioned: 2003  
 Energy production: Electric current



**Waste incineration plant RZR II Herten/Germany**

Fuel: Municipal waste  
 Throughput rate: 2x17.4 t/h  
 Grate system: Forward moving grate  
 Scope of delivery: Turnkey plant  
 Commissioned: 2008  
 Energy production: Electric current



**Waste incineration plant Glostrup/Denmark**

Fuel: Municipal waste  
 Throughput rate: 1x35 t/h  
 Grate system: Forward moving grate (water-cooled)  
 Scope of delivery: Furnace, steam generator, flue gas cleaning  
 Commissioned: 2005  
 Energy production: Electric current / district heating



**Waste incineration plant Uddevalla/Sweden**

Fuel: Municipal waste  
 Throughput rate: 1x11 t/h  
 Grate system: Forward moving grate (water-cooled)  
 Scope of delivery: Furnace, steam generator, flue gas cleaning  
 Commissioned: 2008  
 Energy production: Electric current / district heating



**Waste incineration plant Klaipeda/Lithuania**

Fuel: Municipal waste, biomass  
 Throughput rate: 1x36 t/h  
 Grate system: Forward moving grate  
 Scope of delivery: Furnace, steam generator  
 Commissioned: 2013  
 Energy production: Electric current



**Waste incineration plant Hefei/China**

Fuel: Municipal waste  
 Throughput rate: 2x20,8 t/h  
 Grate system: Forward moving grate  
 Scope of delivery: Furnace, adiabatic combustion chamber, steam generator  
 Commissioned: 2013  
 Energy production: Electric current / district heating



**Waste incineration plant Heringen/Germany**

Fuel: Refuse-derived fuel  
 Throughput rate: 2x20 t/h  
 Grate system: Forward moving grate (water-cooled)  
 Scope of delivery: Furnace, steam generator  
 Commissioned: 2009  
 Energy production: Electric current



**Waste incineration plant Acerra (Naples)/Italy**

Fuel: Refuse-derived fuel  
 Throughput rate: 3x27.1 t/h  
 Grate system: Forward moving grate (water-cooled)  
 Scope of delivery: Furnace, steam generator  
 Commissioned: 2009  
 Energy production: Electric current

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