AFTER SALES SERVICE



WE MAKE THE WORLD A CLEANER PLACE



Steinmüller Babcock Environment – innovative and global



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



After Sales Service

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 optimising 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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Energy from Waste

Flue Gas Cleaning

Our After Sales Service – always at your side



Even after completion and commissioning of a plant, we are there for our customers. With us, you have access to all services, from engineering to plant construction 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. On the one hand, our services include revisions, repairs, and spare parts management, on the other we offer a full range of services for plant operation and optimisation in form of engineering services, employee training, modernisation and modification of plants. Furthermore, we offer service contracts for revisions and the continual maintenance of waste incineration plants and flue gas cleaning units, which are tailored to your specific requirements.



Our range of services

Inspection, maintenance, and repairs evision and maintenance

Inspection and repair

Spare- and wear parts management

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

Service contracts for wear parts

Our technology: goal-oriented and setting standards

As a plant manufacturer, our After Sales Service can rely on the entire knowledge of our development, engineering and construction departments. Our comprehensive knowhow 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.

Our employees: supportive and reliable

Our team is available to you at all times to provide planned and unplanned service work - not only for plants constructed by us. With our After Sales Service, we provide you with certainty you can rely on. Anytime, anywhere in the world!

Our standard: outstanding quality and safety

Safety and quality are especially important to us. This is why we are certified in terms of our management systems for quality, health, safety and environmental protection. Together with our 100% subsidiary Steinmüller Babcock Montaz (SBM) we maintain a multi-site certification for the standards DIN EN ISO 9001-2015, DIN EN ISO 18001 and 14001. In addition, with SBM we hold a factory production control (WPK), according to DIN EN ISO 1090-1, a welding certification EXC 3 according to DIN EN ISO 1090-2 (Eurocode 3) and DIN EN ISO 3834-2 as well as the approval as a specialist company according to the Water Resources Act. We are not only supplier of boiler systems, but also certified as a manufacturer according to the current EU guidelines.

With the corresponding ASME S stamp (constructions) 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.

Operation of plant and optimisation Studies and Engineering Service

Modernisation, expansion and deconstruction

Optimisation and management of technical mode

Employee instruction



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 allround inspection services. Our Polish subsidiary, Steinmüller Babcock Montaz Sp. z o.o., based in Gliwice, Poland, provides qualified support for the execution of assembly, repair and maintenance. This young company, which was integrated into our company in 2015, works with highly qualified experts and ensures our extremely competitive international conditions. Steinmüller Babcock Montaz shows its performance throughout, from assembly planning and installation execution for both retrofittings and new plants to service and maintenance for existing plants.

Tailored to your requirements

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 knows how to reconcile scheduling requirements with the necessary scope of measures. We offer you a full service for the revision of complete plants: according to your requirements, we prepare a tailored package whereby you decide whether to include, for example, the opening of manholes, disassembly and assembly of the insulation, emptying the boiler system, conservation and refilling of the boiler, scaffolding, or boiler cleaning.

This approach follows the "just in time" principle and therefore ensures that downtime is kept to a minimum. Here, you benefit from our know-how in the implementation of new plants. For us, adherence to schedules is a matter of course. In this way, we maintain and improve the system's level of availability and service life, and you can operate your system in a more profitable manner.

Support at short notice

We support our customers in all necessary repairs. Even if these are required at short notice, we can provide near-term support and solutions. For emergencies SBENG keeps components of the feeding system and grate spare parts in stock, or can organize spare parts for all components promptly. If you wish, we can also prepare in advance a comprehensive concept for necessary repairs that arise, including the supply of all necessary spare parts.



Our plant inspections, revisions and areas of consultation cover, among others, the following areas:

Boiler / grate

Grate	Inspection, revision, supply of spare parts, redesign, renewal of the waste feeding and discharge chutes incl. installation of appropriate protection measures
Cladding	Examination, layer-thickness measurement, repair, re-cladding
Wall thickness measurement	Evaporator, economizer, superheater documentation, grid measurement
Boiler	Planning and carrying out of boiler repairs, reconstructions (incl. crane planning), mechani- cal boiler load examination, boiler suspension, adjusting boiler suspension (e.g., after modifications; with SBENG equipment and expert personnel)
Boiler components	Engineering, manufacture and assembly of pressure-part components
Refractories	Determination of the current status, assessment, repair, optimisation
Revision logistics	Schedule planning, coordination of all crafts on-site, documentation of all revision activities
Provision of qualified personnel	Revision management, specialist for site management, quality assurance, grate and pressure-part fitters, welders
Fault clearance in case of damage	Boiler grate and conveyor system

Flue Gas Cleaning

Electrostatic precipitators, wet electrostatic filter	Inspections, revisions, gas distribution measurements using in-house experts and equipment, supply of spare parts, optimisation, repair
Fabric filters	Inspections, revisions, supply of spare parts
DeNOx systems	Inspections, revisions, supply of spare parts
Ducts	Inspections, repairs, coatings, supply of spare parts
Provision of qualified personnel	Revision management, specialist for site management, fitters, welders
Visual inspection and assessment of	Signs of corrosion, surface coatings, GRP and steel tanks, internals of absorbers and tanks, filter systems, channels, fans
Engineering, manufacture, supply, and assembly of	Demisters, absorber and tank installations, heat exchangers, fans, conveyor systems
Water treatment systems	Carrying out of revisions, reconstructions, modifications following studies, equipment maintenance

Equipment, repairs, maintenance / replacement / supply of spare parts

Fans	Qualified SBENG personnel and measuring equipment according to ISO standards (on-site with catalog of measures), on-site troubleshooting, machinery diagnosis, fan-condition assessment, vibration analysis, bearing analysis, balancing, revision service, early detection of roller-bearing damage incl. preparation of action plans
Slag and ash conveyor systems	Provision of qualified personnel for revisions, repairs and maintenance, supply of spare parts
Pumps	Carrying out servicing in accordance with manufacturer's specifications
Dampers and compensators	Repairs, servicing, replacement, supply of spare parts
Support through archive of documents and spare parts	All SBENG plants

Plant operation and optimisation – maintaining efficiency



The service life of plants for thermal waste treatment and flue gas cleaning is generally more than 25 years. In the course of the plant's operating life often emerge new requirements, such as increased legal requirements on environmental compatibility, changes in the fuel supply or composition, or the need to expand the system's capacity. All of this affects the operation and sometimes also the system's essential technical design.

Recognising optimisation potential

SBENG is your ideal partner when it comes to environmental questions or improving system efficiency: based on an exact inventory and analysis of the respective system, we can clearly identify optimisation potential and determine what measures are required.

Steinmüller Babcock Environment possesses special tools for carrying out system-specific assessments quickly and reliably. For different operating conditions this requires a detailed heat and mass balance, as well as information on system behavior (e.g., corrosion) and resource usage. A thorough analysis also includes consideration of dynamic processes (e.g., the start-up process), as well as of the control accuracy of individual control circuits and an analysis of process-relevant measured data. On the basis of this determination of the current status, we can then clearly define possibilities for adjusting and optimising the plant. As well as the analysis, a macroeconomic assessment requires an overall consideration of the mode of operation, taking into account revision and maintenance times, full-load operation, availability, and the associated costs and proceeds. Here again, SBENG is an ideal partner, offering you competent advice so that you can use your plant in the best possible manner.

Studies and engineering services: we have the know-how

Due to our long experience in the field of plant engineering and construction, we have the necessary know-how to inspect your plant covering the entire process. With our engineering based services, you receive the support you need to overcome all the challenges arising in continuous operation. We are specialised in feasibility studies, the analysis in case of damage and the development of process engineering concepts for solving plant-specific tasks. Beside plant analysis, our services also include investigation of necessary measures for the steam generator, supported by heat balance calculations, circulation water systems and pressure loss. The inspection of corrosion protection concepts and measures for emission reduction and control are also additional areas of expertise.

Computational Fluid Dynamics (CFD)

We also provide CFD-based analysis and optimisation of your plant. The computational fluid dynamic simulations cover momentum, heat and mass transfer in multiphase reactive fluid systems in all domains of interest. Detailed and reliable results are achieved due to our engineering know-how in mechanical and physico-chemical plant behavior. The purpose of optimisation in multiphase fluid flows are, e.g., homogeneous incident flow of relevant plant components, minimising pressure loss and to accomplish perfect particle or droplet distribution. With our high performance computing system, analysis and optimisation results can be obtained very fast, even for models with up to 100 million cells.

CFD – far more than coloured pictures

The actual use of investigations in fluid flow using CFD is best illustrated on the basis of an example:

Figure A shows the combustion chamber and boiler of a waste-fuelled heat and power station, whereby the flow lines of the combustion gases are colour-scaled according to temperature. The decreasing temperature of the gas is apparent along the flow path due to the heat transfer to the heating surfaces of the water-steam circuit. The secondary air injection area is enlarged in figure B. The local nozzle throughput is set such that two opposing vortices are generated. These result in an optimum mixing of the combustion gases with the secondary air and also lead to a stabilisation of the flow. At the end of the horizontal pass in the economizer a bypass flow can be discerned (see figure A). This flow, detected with CFD, can now be optimised through a simple change to the plant design - in this case the addition of baffle plates in the funnel.



Temperature distribution within a boiler of a waste incineration plant (A), zoom to secondary air injection (B)

Modernisation, extension and dismantling of plants – our area of expertise

We subject procedural aspects of your system to scrutiny and advise you on modernising and extending the system. Renovation concepts for extending the remaining service life, and their implementation, are our specialty.

Our modernisation services include among others:

- Repairs / replacement of system components
- Analysis of heating surface efficiency and optimisation of heat transfer
- Flow simulations for boiler and flue gas cleaning plants
- Modernisation and implementation of further developments
- Adaptation of the system technology to new legal requirements
- Optimisation and implementation of corrosion protection concepts for the incineration area
- Retrofitting of system technology (air pre-heaters, vibration sensors on fans and pumps, automatic gas explosion cleaning, pump systems incl. pipelines, reduction stations)
- Reduction of resource and energy requirements
- Improvement in efficiency
- Reduction of emissions
- Optimisation of heat utilisation and recovery
- Demolition work / dismantling of plants
- Project documentation and archiving

Optimisation and management in technical operation

To support you in plant management, we also optimise operating procedures or realise the entire technical and operational management of your plant. In this context, we analyse the mode of operation, carry out our own measurements and acceptance measurements with experts (e.g., resistance time measurements). With an optimised operation, you can reduce operational as well as maintenance costs and reliably meet legal requirements.

Special tools and detailed solutions



A particular strength of our After Sales Service lies in the requirement-orientated engineering it offers, in addition to pure assembly activities and maintenance work. The service department has access to around 200 engineers for this purpose. In particular when modernising, optimising, troubleshooting or modifying plants, the After Sales Service profits from the expertise of the design and development departments, meaning that decades of experience are utilised in the service work.

The detailed knowledge and corresponding processing tools are of equal importance here to the possibility of handling the complete scope of service and performance in our own house.



Industrial machinery diagnostics

The added value for our customers is obvious: experience and further developments from new plant construction, as well as the findings from plant operation, are incorporated into considerations and therefore guarantee the best possible optimisation measures.

Plant-specific optimised solutions

In many cases, the foundations for the successful execution of such projects are studies and concept investigations, which provide a more precise picture of the modifications required on the basis of process and design data. Using these results, technical process solutions and design concepts are subsequently formulated on a plant-specific basis and orientated towards the customer's requirements - naturally always with consideration to the respective cost framework. Because we know that standing still equates to taking a step backwards, we are constantly expanding our performance spectrum to offer our customers the best support at all times.

Patent for rapper plates

Patent number EP 3 128 280 - DEVICE FOR INTRODUCING IM-PACT FORCES INTO A HEATING SURFACE AND METHOD FOR MOUNTING AN ANVIL

Boiler heating surfaces are freed from ash and slagging by means of pneumatic force application via impact cylinders. Since the beating plate must also be resistant to high flue gas temperatures in the superheater area, in the past several heat treatments of the welding connections were necessary due to the choice of material. In the long term, there was often component failure and loss of the beating plates on the heating surface collector due to inadequate collector rapping device alignment and the resulting non-centric application of force through the rapping device. Steinmüller Babcock has now developed a new rapper plate design which as a hybrid solution without an intermediate plate does not require any subsequent heat treatment, both for the production of new heating surfaces and for repair or replacement measures.



Example: Rapper plate, flange connection

Our new solution has already proven itself in several existing and new plants.

Main advantages on existing plants:

- -Existing header ends are retained, the new system can be installed without heat treatment. This prevents dirt from entering the steam or water system.
- The system can also be used in existing boilers in confined spaces.
- The header diameter and rapper plate are manufactured with the same outer diameter, making the system more tolerant with regard to its alignment with the impact device.
- Standard diameters are Ø 88.9, Ø 101, Ø 114 and Ø 168 mm, rapper plates for other header diameters on request. Site welds are of the same type up to 16Mo3 (Manual arc welding or TIG)



Newly manufactured heating surfaces with patented rapper plate system



Replacement of worn rapper plate by new patented system

Industrial machinery diagnostics

Machinery diagnostics serve to facilitate the early detection of state deterioration in machinery and roller bearings. Impending bearing, rotor, coupling or stator failures can be detected with vibration measurements and the requisite repair measures can therefore be planned in good time. Vibrations on rotating parts due to field balancing can also be eliminated on location whilst still installed, meaning that complex disassembly and reassembly are superfluous. Lengthy downtimes are therefore avoided, whilst costs and risks are reduced.

We utilise the latest measuring techniques here, in order to generate vibration spectra. When evaluating and analysing the measurement results, our experienced employees help to make the right decisions regarding immediate repair, preventative maintenance or the stocking of spare parts. Our core competence here lies in the acquisition of frequency spectra, signal analyses and roller bearing diagnostics. It is advisable to conduct periodic analyses within the framework of the annual inspection, in order to obtain a trend evaluation for each machine. We also offer you targeted, detailed analysis where concrete suspicions exist, or if an independent second opinion is simply required to determine whether a costly bearing replacement is actually necessary.

Special tools and detailed solutions

Thermography

Thermography is a tool for maintenance and plant optimisation, which offers diverse application possibilities. It is not only used in the testing of insulation on heat engineering plants, in which areas with high temperatures imply damage to the insulation or improper installation; it is also employed in the functionality testing of units and complex heat engineering plants. Impending failures, which can be detected through unit temperature increases, are determined by the digital thermal imaging camera and can therefore be detected and eliminated in a timely manner.

A particular advantage of the camera is that large-scale areas can also be checked for their compliance with the specified temperature. Furthermore, this tool also facilitates the thermographic examination of areas that are not directly accessible.



Detecting thermal losses using thermography

Anchor load adjustment

With existing plants, load changes in the boiler suspension can arise due to retrospective plating of the heating surfaces or major renovation works on the steam generator. This leads to one-sided loads on the anchors, the structural steel system and the load transmission points on the boiler. These load changes can result in boiler deformations and overloading at the load transmission points. If this is not detected then damage can arise in the long-term. In order to avoid this, a check and adjustment of the anchor loads is required.

Steinmüller Babcock has developed a system especially for this case, with which it is possible to check and adjust up to 16 anchor loads simultaneously on site. The basis for the requisite adjustment processes is a static calculation of the complete system. During this process the anchor loads are first determined with consideration

of all framework conditions during pre-planning, before the actual loads measured on site are checked, compared with the calculated loads and adjusted accordingly. Due to the dependencies of the steel structure on the boiler parts, the neighbouring anchor loads change with every adjustment process. However, using load cells it is possible to visualise all anchor loads simultaneously. In this way all anchor load changes can be precisely observed.

In the future, it is conceivable that testing the actual anchor loads under operating conditions will also become mandatory for the operators of boiler plants in Germany, within the framework of recurring testing. SBENG is able to provide competent support to the operators of waste incineration plants right now, using this service that we have developed, and tried and tested many times over.



Checking and adjusting up to 16 anchor loads simultaneously

Industrial video endoscopy

Industrial video endoscopy serves to facilitate indirect visual inspections and enables the rapid and timely detection of damage without great expense. If, for example, modifications have been carried out on pressurised parts of a plant and it is necessary to check that these measures have been implemented correctly, or if a suspicion of damage exists, video endoscopy is an ideal method for providing assurance.

Particularly advantageous is that the application is "minimally invasive" so-to-speak: a small access opening of approx. 25 mm is sufficient for feeding the probe tube into the inspection area. A rapid application with minimal outlay.

Unlike pure testing and inspection companies, SBENG is able to utilise the expertise of a boiler manufacturer and draw comparisons with other boiler plants. This wealth of experience as a manufacturer of steam generators - gained over decades - as well as our engineering evaluations, also assist when internal visual inspections alone are not sufficiently meaningful and where more detailed investigations are required.

Preventative diagnostics

The successful implementation of a wide range of retrofit projects in recent years, as well as the constantly rising numbers of requests, show that this special engineering service from the service division meets with the customer requirements for good After Sales Service that is more than just a "repair workshop", and that is also capable of generating and implementing optimised solutions.

Why wait until major damage, together with the associated downtimes and operating failures, result in high costs? Preventative diagnostics and corresponding optimisation are expedient instruments for the reduction of unforeseen downtimes and high maintenance costs.

Thermographic investigations, vibration analyses, bearing diagnostics, endoscopy and optimisation of the boiler suspension load distribution therefore make an important contribution to increasing efficiency and reducing operating costs.





Our service contracts – always one step ahead



Certainty at all times

Steinmüller Babcock Environment GmbH offers service contracts for revisions and continual maintenance of waste incineration plants and flue gas cleaning units. These are adapted to our customers' needs in terms of four key service areas:

- Contract duration
- Technical scope e.g., individual components, such as the grate and boiler, or the complete system
- Service scope e.g., revision every 8,000 hours of operation (annual revision) and / or during continuous operation; optional on-call service for interruptions to continuous operation
- Service depth e.g., a complete handling team or individual experts for monitoring

The benefits for you

A bespoke service contract has many benefits for you: it offers you certainty in terms of costs for the duration of the contractual relationship and therefore allows you to plan your maintenance costs in the long term. Furthermore, you can count on receiving fast, unbureaucratic support from our service team at any time. Contracts for supplying spare and wear parts ensure fast supply of the required materials.

We also offer services such as operational monitoring or an on-call service for interruptions of continuous operation, including ad hoc repairs. You can therefore rest assured at all times that your system will be looked after competently and without delay.



Management of spare and wear parts: the basis for a trouble-free operation

When operating plants for waste incineration and flue gas cleaning, the level of plant availability and therefore the management of spare parts is a crucial factor. Custom-fit management of the necessary spare parts ensures smooth and economical operation of the system, as it is important to ensure that faults are cleared quickly. We therefore guarantee our customers fast response times and fast assistance in the case of faults.

As well as supplying spare parts, we can also provide you with comprehensive advice on keeping your spare parts in stock and in storage. This means that in the case of a fault you have the suitable spare parts on-site, so that you can minimise downtime. If required, we support you on-site in assembling spare parts and also produce and supply documentation.

Our range of services includes, among others

- Recommendation for stocking pressure-part materials, incl. documentation
- Management and maintenance of the spare parts lists, documentation of stock withdrawals
- Recommendations for spare parts for forthcoming revisions / reconstructions
- Support in procurement of spare parts needed on short notice
- Assembly of spare parts



Services covered in the

- 8,000h Revision
- Pre-inspection by SBENG (optional)
- Logistical preparation of the forthcoming activities:
- -> Detailed schedule planning
- -> Crane and hoist planning
- -> Production of technical inquiry specification
- -> Definition and coordination of the workflow of subcontractors ordered by the customer and SBENG
- Management of external contractors during the revision
- Site-installation and logistics planning (plus implementation, if required)
- Examination of results of work and service approvals
- Revision reports / reconstruction documentation
- Coordination and accomplishment of all forthcoming tasks by the SBENG team on-site
- SBENG site manager, specialist for site management (grate, boiler), personnel quality assurance, expert staff for commissioning, fitters, welders
- Customer support during inspections by the approved inspection body
- 2,000h Revision / Maintenance
- Maintenance according to manufacturer specifications or redundant systems:
 - -> Fans
 - -> Pumps
 - -> Conveyor systems
- Lubrication service and oil change (according to maintenance manual)
- Documentation of works carried out, with professional certificates, reports, checklists etc.
- Recommendation on stocking spare parts

Further on-site support

- Daily inspections (according to operating manual)
- Fault clearance during continuous operation
- Lubrication service (according to maintenance manual)
- Cleaning of system components / areas
- Personnel to support operation

Case studies – uprating through retrofitting



Combustion diagram with operating points as 6h average of summer / winter influence



1st case study: altered fuel composition

Developments in waste quality present a challenge for many plant operators. During operation, it is not rare for the type and composition of the waste to develop calorific



Installing an air pre-heater bypass

values that no longer allow operation within the original combustion area, as the above displayed combustion diagrams show.

In this case, the calorific design value was 15 MJ/kg and the range was specified at 13-18 MJ/kg. Analyses showed, however, that a seasonal calorific value of between 10 and 13 MJ/kg was present, and that the water content, at 25-35 %, was significantly higher than the design's maximum value of 25 %. Since bulky refuse and scrap iron are only partially separated out, these increase the proportion of ash and lower the calorific value. Variations in waste quality affect not only the refuse throughput, but also the ignition and burnout behavior.

Preheating the combustion air represents an effective improvement measure. A fuel-specific adaptation of the combustion temperature can be achieved by retrofitting or extending of an air preheater.

To minimise the system's downtime, a three-step conversion process is suitable for a retrofit of this kind: first, during a revision, a bypass should be retrofitted, to run the system operation. In the next step, a preheater and the preparations of the piping can be installed. Finally, the changeover can be carried out during the next revision or during a brief period of downtime.

2nd case study: uprating through extension of heating surfaces

The following example outlines the implementation of a performance enhancement on a plant, which took place within the time frame of a planned annual revision. By extending the heating surfaces, a permanent performance enhancement was achieved in this system. In addition to the extension of the heating surfaces, the following services were carried out:

- Examination of the consequences of a performance enhancement in relation to the furnace, steam generator, and flue gas cleaning
- Test of all components with regard to the extended load range

- Definition of the required adaptation measures
- Installation of additional cleaning systems for the extended heating areas, so that the required flue gas temperatures can be maintained before the superheater and at the boiler outlet

The combustion diagram clearly shows that a permanent 10% increase in thermal and mechanical output is possible after uprating. After the extension, therefore, a more economical operation of the system has been obtained.





Old combustion diagram (before uprating)

New combustion diagram (after uprating)



Installation of an additional evaporator bundle / extension of the heating surface cleaning system

Worldwide active – a selection of our After Sales Service references

Energy from Waste

Halmstads Energi och Miljö AB / Sweden	Supervision of grate inspection and grate revision, boiler P3, cladding work 2nd pass, revision support, supervision of the repair of the summer cooler, optimisation of the firing rate control	2012-2017
Jönköping Energi AB / Sweden	Cladding and revision support, modification grate system, delivery of boiler pressure parts, engineering support, modification grate system, delivery of boiler pressure parts, optimisation support / upgrating firing rate control	2012-2017
E.ON Energy from Waste Delfzijl B. V. / Netherlands	Supervision of grate inspection and grate revision, study on improvement of the flue gas temperature profile in the steam generator, study to extend the load range, reconstruction of the water cooled fuel shaft (engineering, delivery and supervision of erection), analysis of a black out of the plant, study about load increase and optimisation regarding temperature profile 1st pass	2011-2017
Riihimäki Ekokem Oy Ab / Finland	Grate and boiler revision, cladding work, grate and boiler revision, ESP optimisa- tion service, repair of water cooled fuel shaft, vibration measurement, frequency measurement and assessment of pumps and fans, engineering and replacement of slag hopper	2009-2017
Lillesjöverket Uddevalla Uddevalla Energi AB / Sweden	Scheduling, organisation and execution of the complete revision of grate, boiler and FGC plant incl. change DeNOx catalysts, optimisation slag handling, dismant- ling and cleaning of 2 levels of the DeNOx catalysts	2009-2017
Müllheizkraftwerk Kiel Müllverbrennung Kiel GmbH & Co. KG / Germany	Advisory activity for refractory works (technical assistance of client by boiler inspection, evaluation of status and determination of preservation- / mainten- ance actions), inventory of steam generators and identification of optimisation potential, analysis of reports on the measurement of the combustion chamber temperature	2002-2017
Kristiansand Returkraft AS, Kristiansand / Norway	Scheduling, organisation and execution of grate, boiler and components revision, execution of cladding work incl. cladding maintenance	2011-2017
Berliner Stadtreinigung Müllheizkraftwerk Ruhleben A	Scheduling, organisation and execution of the complete revision of grate, boiler and FGC	2014-2021
Ecomaine Portland / USA	Basic analyses of process data and boiler recalculation of 2 WtE boilers	2017
Covanta Energy Long Beach / USA	Manufacturing and delivery of slag extractors and grate hydraulic cylinders	2017
Veolia Environment China Yung Kang / Taiwan	Optimization of cumbustion control system	2017
IKWR Industriekraftwerk Rüdersdorf GmbH Rüdersdorf / Germany	Several engineering services	2017
Fortum Oslo Varme Klemetsrudanlegget AS Oslo / Norway	Organisation and execution of grate and boiler revision	2017
Söderenergi ÁB Södertälje / Sweden	Study of refurbishment of grate and combustion chamber	2017
AWG Wuppertal Wuppertal / Germany	Organisation and execution of revision K13	2017
I / S Verstforbraending, Glostrup / Denmark	Scheduling, organisation and execution of grate revision	2017
Currenta GmbH & Co. OHG Leverkusen / Germany	Continuous process and plant optimization and operating tests, wall thickness measurements, basic engineering and project support for the new VA1 and VA2 dust chambers	2016
Müllverbrennung Kiel GmbH & Co. KG Kiel / Germany	Retrofit of HD-DaGaVos for fuel gas heating before DeNOx as a compensation for the gas burners	2016
E.ON Värme Sverige AB Norrköping / Sweden	Complete design and built supply of direct condenser (DC) for district heating including required auxiliary equipment	2016
EVN Dürnrohr Dürnrohr / Austria	Partly reconstruction of feeding chutes for 3 plants	2016
Fortum Oslo Varme Klemetsrudanlegget AS Oslo / Norway	Renewal of existing Flue Gas Treatment Units	2015
A2A SpA. Acerra WtE Plant Naples / Italy	Optimisation of firing rate control and analysis of residence time measurements	2014
AVEA GmbH & Co. KG Leverkusen / Germany	Implementation of new firing rate control (boiler 3) and supporting measurements	2014
Dynamit Nobel GmbH Leverkusen / Germany	Study about boiler load	2014
ETN Heringen E.ON Energy from Waste GmbH / Germany	Execution of revision work of boiler (replacement of membrane wall elements, repair of feedwater preheating, header inspection, welding of valves, etc.)	2013-2014
UAB Fortum Klaipeda Klaipeda CHP Plant / Lithuania	Grate and boiler revision, repair of explosion damages	2014
MVA Bonn - Stadtwerke Bonn Bonn / Germany	Execution of studding and refractory work at line 1, 2 and 3 during revision 2014	2011-2014
- Halmstads Energi och Miljö AB / Sweden	Boiler refurbishment including subsystems P1 / P2	2013

SITA WASTE (ISLE OF MAN)	Erection activities for installation of feed guide and beam	2013
Shanghai Huancheng WtE Co. / Veolia Env. Services, MVA Jiangqiao / China	Inspection of the firing system	2013
Covanta Energy Plymouth, MVA Montgomery / USA	Optimisation of the water circulation system	2013
I / S Verstforbraending, Glostrup / Denmark	Optimisation of secondary air nozzles and conversion of water-cooled to air-cooled grate surface	2012
A2A SpA. Acerra WtE Plant Naples / Italy	Engineering and delivery of an air preheater per line (3 lines) including steam supply and condensate system	2012
I / S Verstforbraending, Glostrup / Denmark	Grate revision, engineering, delivery and replacement of secondary air nozzles after changing of the fuel quality	2012
ETN Heringen E.ON Energy from Waste GmbH / Germany	Scheduling, organisation and execution of grate and boiler revision (change of feeder on one line, replacement of membrane walls in the crossing section between combustion chamber roof and front wall, etc.)	2010-2012
MVV O & M GmbH TREA Leuna Leuna / Germany	Reconstruction of fuel shaft (engineering, delivery and supervision of erection)	2011
SIRUSA Tarragona / Spain	Technical study about the existing combustion system	2011
A2A SpA. Acerra WtE Plant Naples / Italy	Repair of the platen superheater 2 and 3 Line 2	2011
Lillesjöverket Uddevalla Uddevalla Energi AB / Sweden	Installation of additional heating surfaces (economiser and evaporator heating surfaces) to increase boiler load	2011
A2A SpA. Acera WtE Plant	Installation of an air preheater bypass in preparation of an air preheater installation (line 2)	2011
EBS - IKW Rüdersdorf Vattenfall Europe New Energy Ecopower GmbH / Germany	Scheduling, organisation and execution of the complete revision of grate, boiler and FGC plant	2009-2010
AWG Wuppertal / Germany	Optimisation of the firing rate control at boiler K12 depending on decreased caloric value of the waste	2009
Flue Gas Cleaning		
EnBW Energie Baden-Württemberg AG Karlsruhe / Germany	Revision works on the electrical precipitator	2017

Karlsruhe / Germany		
Raffinerie Heide GmbH Heide / Germany	Supervision and support during the execution of maintenance and repair work on the electrostatic precipitator	2009 -2014
Müllheizkraftwerk Kiel Müllverbrennung Kiel GmbH & Co. KG / Germany	Optimisation of eletrical filter, inventory for flue gas cleaning generators and identification of optimisation potential, process engineering: concept development acid system	2008 - 2014
Oslo kommune, Energigjenvinningsetaten / Norway	Refurbishment of 2 FGC plants with enhanced district heat production	2014
Riihimäki Ekokem Oy Ab / Finland	Study mist eleminators before heat exchanger	2012
ENDESA Generacion S. A. C. T. Alcudia L 1 / L 2 Mallorca / Spain	Supervision and support during the execution of the revision	2011
NUON, Hemweg / Netherlands	Engineering, delivery, installation, commissioning of a heat exchanger for primary air for unit 8	2009
MVA Flingern Stadwerke Düsseldorf / Germany	Investigation of the DeNOx catalyst for and after regeneration	2006
MHKW Iserlohn Abfallentsorgungsgesellschaft des Märkischen Kreises (AMK) / Germany	Study about the decrease of the catalysts operating temperature	2005
Halmstads Energi och Miljö AB / Sweden	Feasibility Study for the retrofit of a flue gas condenser with and without heat pump	2005
AEZ Asdonkshof Kreis Weseler Abfallgesellschaft mbH & Co. KG / Germany	Investigation to modify the DeNOx plant from ammonia to ammoniumhydroxide solution	2005
MVR / Müllverwertungsanlage Rugenberger Damm Hamburg / Germany	Study for the installation of a heat transfer system into the flue gas cleaning plant in order to replace the existing steam heated flue gas reheating system	2004
MVA Flingern Stadwerke Düsseldorf / Germany	Investigation of the catalysts for line 1 and 2	2002

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