



WE SET THE BENCHMARK FOR WASTE-TO-ENERGY PLANTS

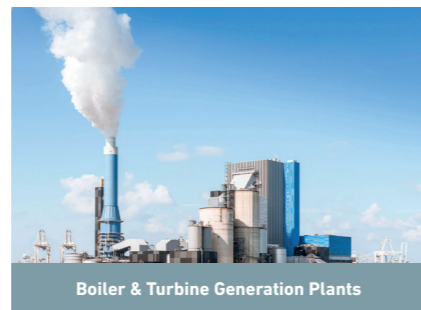
ABOUT MITSUBISHI POWER

Mitsubishi Power is a power solutions brand of Mitsubishi Heavy Industries, Ltd. (MHI)

Across more than 30 countries worldwide, Mitsubishi Power designs, manufactures and maintains equipment and systems that drive decarbonization and ensure delivery of reliable power around the world. Among its solutions are a wide range of gas turbines including hydrogen-fueled gas turbines, solid-oxide fuel cells (SOFCs), and air quality control systems (AQCS). Committed to providing exemplary service and working with customers to imagine the future of energy, Mitsubishi Power is also spearheading the development of the digital power plant through its suite of AI-enabled TOMONI™ solutions.



Integrated Coal Gasification Combined Cycle (IGCC) Power Plants



Boiler & Turbine Generation Plants



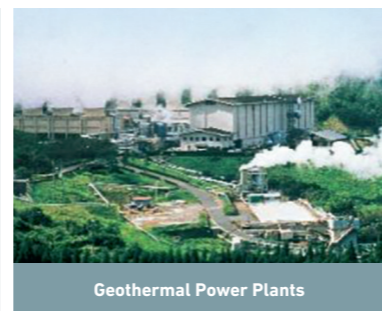
Gas Turbines



Boilers



**MITSUBISHI
POWER**



Geothermal Power Plants



Steam Turbines



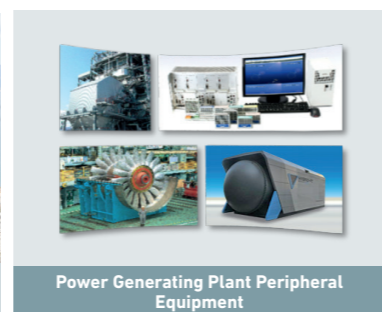
Environmental Plants SCR (De NO_x)
Systems / Flue Gas desulfurization



Generators



Gas Turbine Combined Cycle (GTCC)
Power Plants



Power Generating Plant Peripheral
Equipment

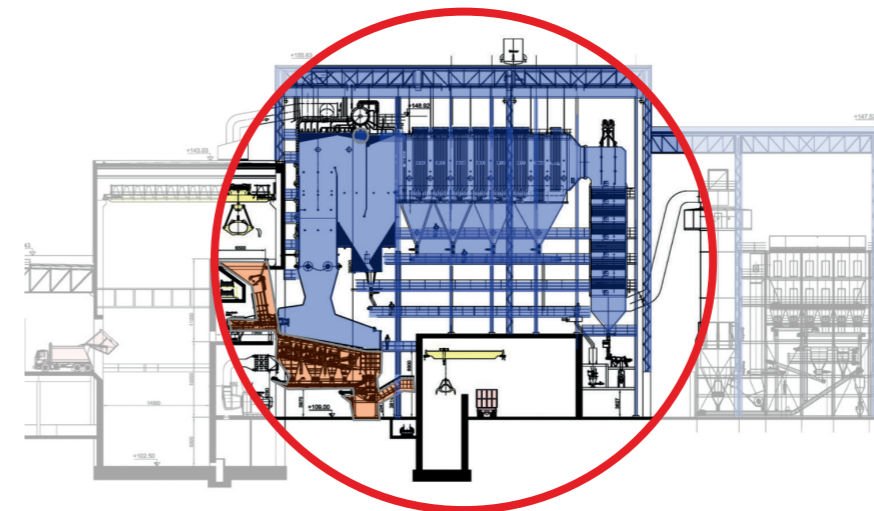
THERMAL WASTE TREATMENT

Environmentally friendly combustion requires special concepts and measures, whether it be for domestic waste, municipal waste, industrial waste, refusederived fuel (RDF) and biomass fuels of all kinds.

According to waste-management concepts, the reutilisation of waste, through energy conversion in the thermal unit, is preferable to its environmentally harmful disposal in landfill.

Mitsubishi Power has been working in thermal waste treatment for more than 50 years and offers integrated solutions worldwide that are always optimally matched to customer-specific requirements for solid waste materials up to 140 MWth and steam parameters up to 500°C – 100 bar.

Our range of services includes engineering, installation, commissioning, maintenance and servicing. As a one-stop shop, Mitsubishi Power supplies complete systems right through from waste feeding device through to the emission of flue gases from the steam generator. And even after handing over the plants, we remain on hand to support our customers. Our service takes care of everything such as maintenance, repair, optimisation and modernisation.



OUR SCOPE OF DELIVERY INCLUDES:

- Waste feeding device
- Combustion grates
- Ash and slag removal facilities
- Combustion air supply
- Steam generator
- Cladding
- Fire-resistant refractories and heat protection insulation
- Ignition and auxiliary firing systems
- Heating surface cleaning system
- Steelwork, stairways and platforms
- Combustion control system
- Electrical and automation technology

STEAM GENERATOR CONCEPTS

Together with the combustion grate, the steam generator forms the core of a waste incineration plant. A large part of the energy released by combustion of the waste fuel is recovered in the steam generator.

The steam generator system must take into consideration the particular operating requirements, e.g. relating to corrosion, fouling, slagging, material loading, partial load behaviour and plant dynamics.

HORIZONTAL PASS STEAM GENERATOR

- 3 conventional empty passes with 2 x 180° direction changes ensure thorough mixing of the flue gases prior to entry into the bundle heating surface
- Reduced fouling tendency for the empty passes, which additionally can also be reliably mastered by use of effective cleaning systems
- Evaporator tube bundles in the horizontal pass can be constructed very compactly and can be effectively cleaned by a rapping system (no steam consumption)
- The bundle heating surfaces can be arranged as required in respect of the pipes' horizontal pitch, so that the bundles are always optimally designed in respect of the fluid flow
- The widely spaced design has improved and easier access, so is easier to inspect, maintain and repair

The hot flue gases are cooled as they flow through the steam generator. At the same time, water is first heated, then evaporated to form steam and lastly overheated. The steam is then used for electricity and / or heat generation.

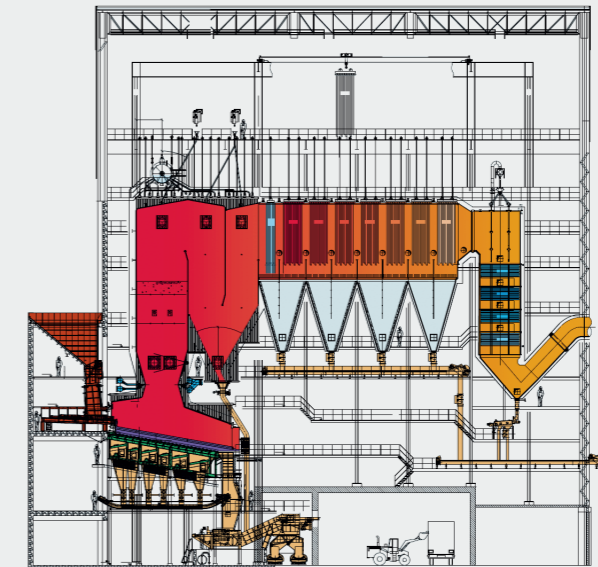
The steam generators are designed as either vertical-pass or horizontal-pass steam generators.

The vertical design solely consists of steam generator passes in which the flue gases only flow in a vertical direction. By contrast, in horizontal steam generators, at least the bundle heating surfaces of the evaporator, and overheater heating surfaces are arranged in a horizontally arranged steam generator pass.

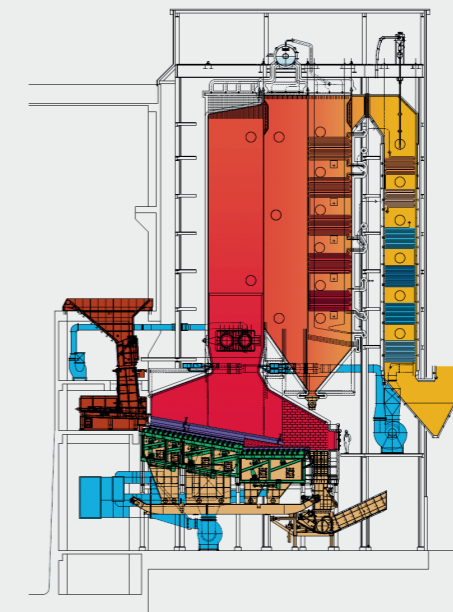
VERTICAL PASS STEAM GENERATOR:

- Reduced base area requirement, therefore this variant is used in particular for revamping measures, where there is only a limited installation surface available for the steam generator
- Simpler steam generator ash removal system, as fewer ash accumulation points
- Surveying and inspection of the bundle heating surfaces in the 3rd pass can take place without auxiliary scaffolding installation

HORIZONTAL PASS STEAM GENERATOR:



VERTICAL PASS STEAM GENERATOR



STOKER FIRING – THE GRATE FOR ANY CALORIFIC VALUE

Whether in power plants purely for power generation, or in industrial power plants for steam or power generation, the firing systems of Mitsubishi Power are used in almost all fields of energy conversion and are always optimally adapted to the specified requirements.

Environmentally friendly combustion requires special concepts and measures for household and municipal waste, industrial waste, refuse-derived fuel (RDF), disposal of residues and biomass of all kinds.

Therefore, various conditions are required in order to achieve optimum combustion, which can be summarised as follows:

- The quality of the combustion products, represented on the one hand, by a high flue gas side burning quality in the form of minimisation of the CO/C content and the NOx content, and on the other hand waste material that is of a quality suitable for energy recovery, characterised in that it results in a low proportion of unburned material and that the leachability of the bottom ash is minimised,
- The economical operation of the plant, documented by high availability and a long period of operation between maintenance outages.

The basic requirement for such an outcome is the careful coordination of the individual process areas with each other and consideration of the fuel-specific factors in the structural design of the stoker firing system, including the steam generator-combustion chamber, resulting in optimum operation.



3-track stoker firing grate during installation



First-time provision of fuel

STOKER FIRING – FIRING GRATE YOUR FUEL, OUR KNOW-HOW

Our grate technologies, with many years of proven successful operation, provide the solution for thermal disposal at all calorific values.

The geometry of the combustion and afterburning chambers of the steam generator are of particular importance in combination with the combustion air supply. The quality of the combustion gases is important on the one hand for an emission potential that must be kept low, while on the other hand defining the conditions for economic plant operation. Uniform combustion means that optimum operating periods between maintenance are achieved.

The consistent implementation of various optimisation studies in respect of the combustion chamber geometry, the formation of the vortex zone for the afterburning (secondary combustion) chamber and the location and direction of the momentum of the secondary air injection are achieved via centre flow firing. This concept is characterised by the way the front wall ceiling directs the combus-

tible gases from the start of the combustion reaction in the area of the hot flue gas flow from the main combustion zone. The area in the vortex zone that is supplied by secondary air intensifies the subsequent afterburning of these material flows.

The mechanical and thermal grate surface load, as well as the layout data of the respective heat input diagram, are the decisive variables for the layout of the grate surface area. Furthermore, the ignition and burn-out behaviour of the fuel, as well as the waste size and burn-out quality, determine the grate lengths and fuel layer height. Our know-how is protected by various German and international patents and registered designs.

APPLICATION RANGE

Air-cooled

LCV 6,000 – 14,000

KJ/Kg

Partially water-cooled

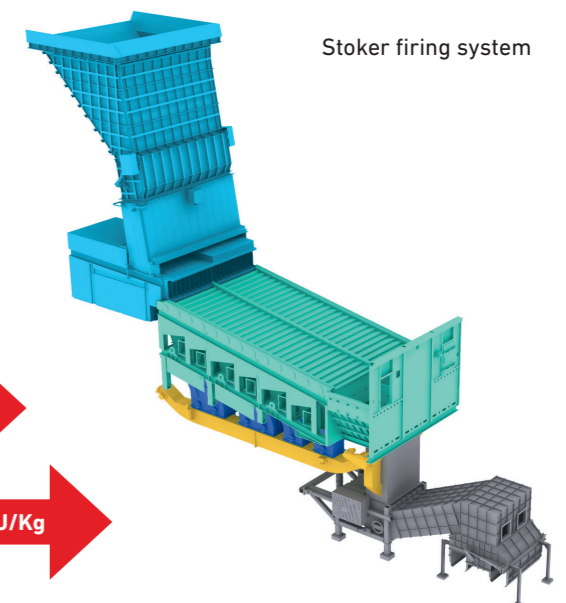
LCV 10,000 – 18,000

KJ/Kg

Water-cooled

LCV 12,000 – 30,000

KJ/Kg



Grate type = f (calorific value)

MOVING GRATE / ROLLER GRATE

Different grate systems are used depending on the calorific value. Waste fuels with medium to high calorific values require grate systems with grate bar cooling systems, such as our patented water-cooled moving grates. By contrast, for low or medium calorific value waste materials, patented air-cooled moving grates are used.

The Mitsubishi Power moving grate is characterised by its robust construction. External hydraulic drives control, via a lever system, the advance and return stroke movements of the moving grate rows of each grate zone in accordance with the control requirements. The fixed and movable grate bar rows alternate in succession in a grate path and are each placed on separate grate frames.

The uniform and long stroke movement in the feed, due to the grate bar design, leads to smooth incineration.

In contrast to short-stroke operation, this movement is notable for its reduced wear. An additional advantage is the additional cooling resulting from the overlap of the grate bars due to the long stroke up to the grate bar head.

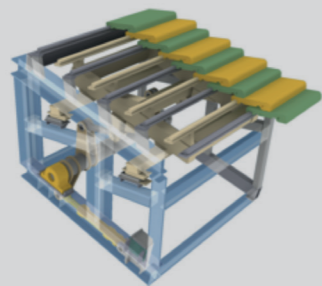
Dependent on the application, an Mitsubishi Power roller grate system can also be used alongside the moving grate system. The robust roller grate system has a modular design comprising six grate rollers. It is intended to be used with low or medium calorific value waste materials. Only a part of the peripheral roller surface is in contact with the combustion chamber, while the bottom side away from the combustion chamber is air cooled. This alternation reduces the thermal loading of the grate surface.

OUR PROPRIETARY GRATE TECHNOLOGY MAKES THE DIFFERENCE

The selection of the grate surface depends on the specific energy potential of the fuel. Accordingly, for low heat waste fuels the air-cooled grate surface is used, while for high heat waste fuels the water-cooled grate surface is used, which is then notable for its longer service life in comparison with a purely air-cooled surface and also because it supports higher thermal loading.

The design of the grate system is such that at any time, it is possible to switch between water-cooled and air-cooled grate bars without any structural change. In the transition range between low caloric and high caloric waste, the two cooling types can be combined. The grate bars of the thermally highly loaded grate zones are water-cooled, while the grate bars of the burn-out zone are purely air-cooled. The grate surface enables process-optimised reduction of the primary air fraction, accompanied by reduction in excess air and consequently a parameter relating to NOx formation.

MOVING GRATE



TECHNICAL DATA (TYPICAL VALUES)

- Grate inclination: 10°
- Number of grate zones: 3
- Grate length: 9.2 – 10.8 m
- Grate width: no limit, because of modular design
- Grate bar material: CrNi steel

TRANSPORT BEHAVIOUR

- Clearly defined transport of the fuel through the step-type arrangement of the grate bars
- No limitation in respect of the consistency of the usual lumpy fuel
- No limitation for solid fuels (municipal waste, industrial waste, processed waste)

ROLLER GRATE



TECHNICAL DATA (TYPICAL VALUES)

- Grate inclination: 20°
- Number of grate rollers: 6
- Grate length: 14.8 m
- Grate width: static, max. 8.0 m
- Through module
- Grate bar material: cast iron

TRANSPORT BEHAVIOUR

- Significant influencing of the transport behaviour by the friction between the carried fuel and / or grate slag cover and the grate rollers
- Limitation for solid fuels (unprocessed municipal waste, industrial waste)



AIR-COOLED GRATE BARS

Our patented air-cooled grate bars are designed for a long service life. This is achieved using a second wear front plate, located behind the frontside so that it is protected against temperature-induced corrosion. The outer frontside ensures the function of the grate bar and therefore also the extension of the lifetime, even subject to thermal wear. The grate bar can be constructed so that it is possible to use it as a "one side" or "two side-reverse" bar.

AREA OF APPLICATION:

- Unrestricted use for mid and low LCV = < 12,000 kJ/kg

ECONOMIC AND OPERATIONAL BENEFITS:

- Increased service life resulting from the use of our variable grate technology with wear front plate technology



WATER-COOLED GRATE BARS

Manufactured from cast iron, the grate bars include cast-in water pipes, the water-tightness of which is ensured even at high temperatures. Moreover, the cast-in steel pipe ensures a defined flow without local turbulences and dead spots of rectangular channels, which result in a risk of overheating.

AREA OF APPLICATION:

- Unrestricted use for the LCV range from 10,000 to 25,000 kJ/kg and with restrictions even up to 30,000 kJ/kg

ECONOMIC AND OPERATIONAL BENEFITS:

- 32,000 h operational guarantee
- Availability > 8,000 h operation / year
- Increased operational safety
- Reduced maintenance costs
- Longer inspection intervals
- Reduced spare parts inventory

COMBUSTION CONTROL SYSTEM (CCS)

The intelligence behind thermal waste utilisation

Waste is an extremely inhomogeneous fuel, the utilisation of which represents a complex process. Large fluctuations in respect of heat output and the release of noxious substances, water content and composition, granularity and / or bulk density over short time intervals must be reliably controlled.

The CCS is the control centre that controls and regulates the interaction of the influencing variables, hopper and grate speeds as well as the combustion air volume and distribution such that combustion chamber temperatures, fire location and residual oxygen content remain within the limits necessary for process control to achieve the following targets:

- Constant steam volume and temperature
- Complete out burn of the fuel slag
- Compliance with flue gas emission values
- Low heating-surface fouling – maximum interval between maintenance actions

We develop the correct solution for every plant type in respect of this demanding challenge. Selecting suitable sensors and actuators and matching them to the necessary control method is decisive for the overall control output. Mitsubishi Power is the competent partner that combines the know-how of the plant design engineer with that of an automation expert. We offer our customers solutions for implementation in existing automation systems, as well as in independent, ready-for-use units.

IGNITION AND AUXILIARY BURNER

The aim of start-up and auxiliary in waste incineration is the achievement and maintaining of the minimum flue gas temperature. Mitsubishi Power has developed special burners that work with oil and / or gas for use as ignition and auxiliary burners in waste incineration plants with a thermal output of up to 40 MW.



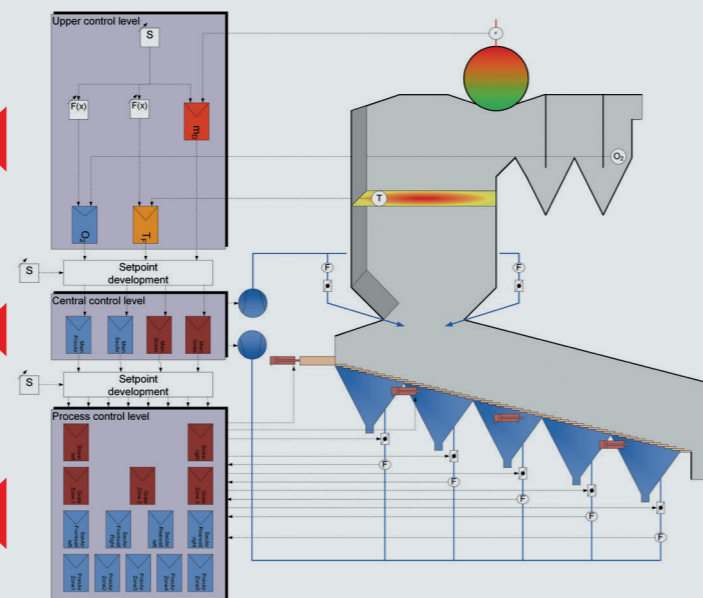
These burners fulfil the legal requirements that apply in respect of safe and low-emission incineration. Shown here is an Mitsubishi Power oil burner with a shut-off slide attached to the side wall at the transition from the vortex zone to the afterburning chamber. The burner internals and the airbox form, as a structural unit, the burner.

SCHEMATIC VIEW OF A COMBUSTION CONTROL SYSTEM

Upper control level

Central control level

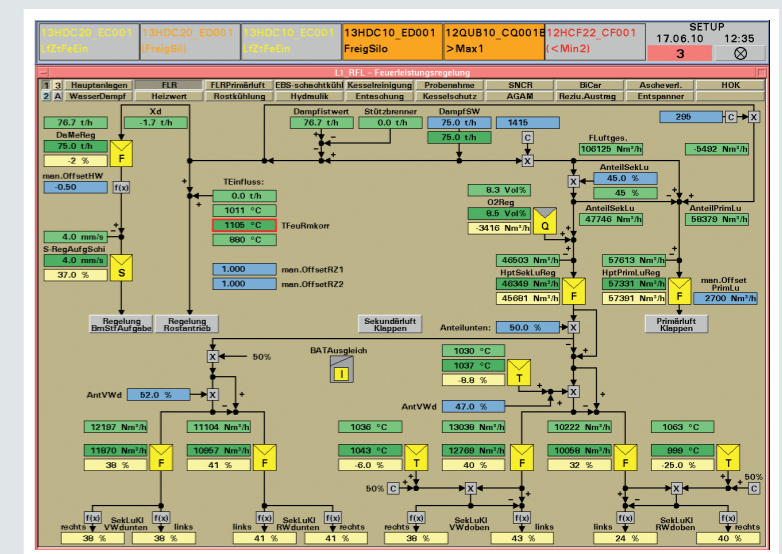
Process control level



OPERATING SCREEN OF A COMBUSTION CONTROL SYSTEM

We successfully apply our extensive knowledge when it comes to updating an operational incineration plant to the latest state of the art. Here, checking the combustion sequence, adapting the existing plant technology and optimising the control structures and algorithms lead to:

- Minimisation of variations in the steam volume
- Increased waste throughput
- Extended time between maintenance / reduced maintenance effort
- Reduction of operating resource consumption, manual interventions, and violation of emissions limit values





Ash removal system for large steam generator



ASH AND SLAG REMOVAL SYSTEMS

For many decades, ash and slag removal systems of different types have formed part of the scope of production and supply of Mitsubishi Power. This relates both to the removal of slag from the stoker firing system and also the transport of ash from all other points where ash is deposited inside the waste incineration plant.

ASH REMOVAL COMPONENTS:

- One track chain conveyor
- Screw conveyors
- Clod crushers
- Rotary value wheel sluices
- Single and double flap valves
- Shut-off valves
- Nozzle conveyors
- Belt conveyors
- Trough chain conveyors

SLAG REMOVAL COMPONENTS:

- Ram slag removal systems
- Submerged apron ash conveyor
- Scraper conveyors
- Vibrating conveyors



Submerged apron ash conveyor

SERVICE – ALL FROM ONE SOURCE

Thanks to comprehensive experience in power plant technology, Mitsubishi Power can fully meet requirements for the maintenance and optimisation of power plant systems, especially in the field of waste-to-energy.

Detailed knowledge of the plant, its method of operation and interactions between the multiple components is essential not only in respect of commissioning or re-commissioning of a thermal waste incineration plant, but also for the optimal performance of essential maintenance and repairs.

To be able to correctly handle all the conditions of use of a plant, we develop appropriate optimisation and maintenance measures suitable for the plant in combination with the customer. With our local sites and skills drawn from the head office, as well as production shops for pressure parts and burner components, we offer our customers all the services they need from a single source. In doing so, we provide short reaction times and personal customer relationships.

Based on comprehensive know-how in all the disciplines of power plant construction, Mitsubishi Power is able to offer efficient solutions to national and international operators of waste-to-energy plants. A wide range of services supports our customers along their whole value creation chain.

The experienced service teams of Mitsubishi Power provide support for all necessary work and planning steps, starting with a feasibility study which extends from engineering through to production, supply, installation and commissioning. To ensure implementation complies with all relevant regulations, the individual steps are monitored by our quality management team.

SERVICE FOR WASTE-TO-ENERGY PLANTS

Decades of experience in waste-to-energy plants means that Mitsubishi Power can develop tailor-made solutions for specific plants and their requirements. Our wide range of previous successfully tackled challenges for WtE plants means we can offer our customers a wide range of options where maintenance and optimisation are concerned. Our experience covers plants from various constructors in different countries.

The increasingly challenging boundary conditions for the operation of a plant require location-specific optimisation and maintenance measures. Mitsubishi Power supports and monitors the maintenance and service work to be performed, taking into consideration both individual and regulatory safety standards.

We ensure that the service offered is tailor-made to meet the requirements of the customer and their plant. This includes long-term maintenance, service life extending actions, and the complete renovation of thermal

waste incineration plants. Here we rely on our own experienced and competent personnel, both for long-term planned overhauls and also for short-notice repair deployments.

Our comprehensive range of skills in all disciplines makes possible a detailed consideration of individual components and their assignment to the overall system. Consequently, we are able to identify possible optimisation potentials and then to assess them based on economic and strategic energy viewpoints.

SERVICE PROVISION

Maintenance

- Replacement / Upgrade
- Spare parts / Components
- Conversions / Overhaul
- Inspections
- Repair
- Inspections / Refurbishment
- Emergency repairs
- Lifetime extension
- Quality assurance
- Service agreements

Operation

- Training
- Analyses
- Studies
- Documentation
- Plant optimisation
- Monitoring of operations
- Operational support



SERVICE – CLOSE TO THE CUSTOMER

With our local sites and skills drawn from head office, Mitsubishi Power offers its customers all the services they need from a single source. Based on the combination of engineering know-how, competent locally available service teams and extensive networking across multiple markets, we offer a complete service portfolio and support our customers along their entire value-creation chain.

By grouping together our comprehensive service portfolio, Mitsubishi Power becomes a competent and leading partner for long-term service agreements (LTSA) for waste-to-energy plants.

Our EMEA-wide network means we can provide a reliable, flexible and prompt round-the-clock emergency service.

Mitsubishi Power in EMEA

Mitsubishi Power Europe provides scheduled and emergency support via our strategically placed offices, workshops and sister companies. We supply tools, field services, technical advisors, component repairs and original spare parts for planned and unplanned outages. Our ultimate goal is minimizing down time of power generation assets to maximize financial value for our customers and grids.

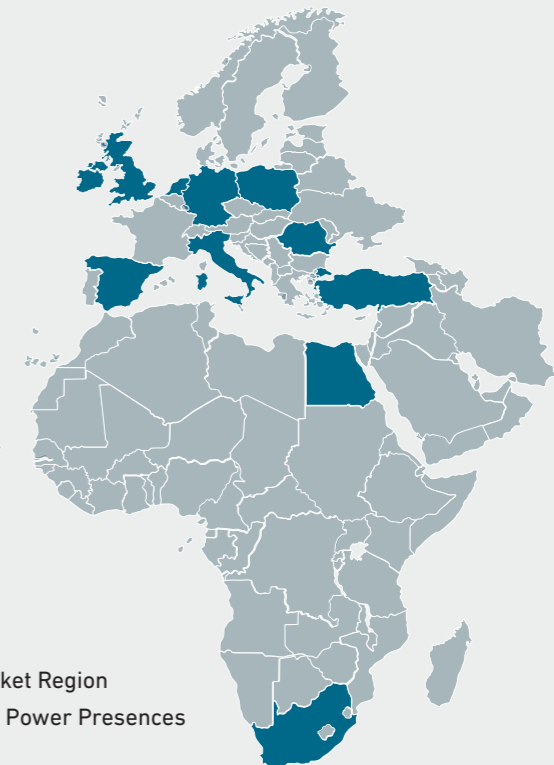
EUROPE

- Austria
- Belgium
- Czech Republic
- France
- Germany
- Ireland
- Italy
- Netherland
- Poland
- Romania
- Spain
- Turkey
- United Kingdom

AFRICA

- Egypt
- South Africa
- Tunisia

■ EMEA Market Region
■ Mitsubishi Power Presences



OUR RANGE OF SERVICES:

- Inspection, failure analysis and consultancy
- Plant and resource optimisation
- Flue gas, dust and ash analysis
- Emissions and flow measurement and investigation
- Overhaul, upgrading, repair, maintenance
- Engineering, delivery, installation and commissioning
- Conversion of electrostatic precipitators (E-filters) to fabric filters
- Modernisation of filter control systems and electrical, instrumentation and control technology

FROM EMISSION TO IMMISSION

In accordance with the motto “From the steam generator to the chimney – all from one source”, we reduce air pollutants during both combustion and also flue gas scrubbing.

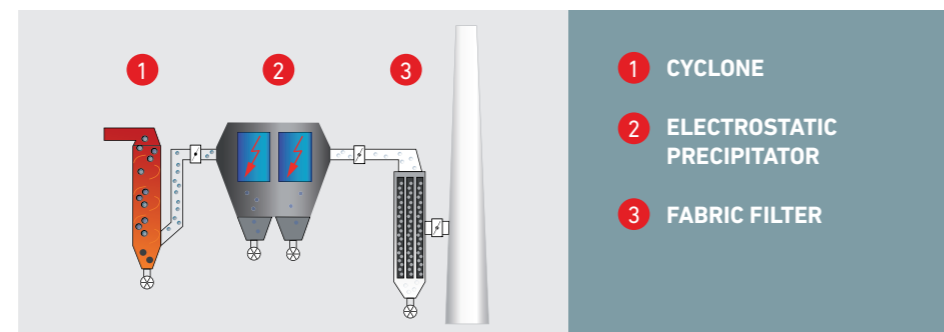
According to European and local regulations, operators of industrial and commercial plants subject to immission control are obliged to set up and operate their plants in such a way that:

- Harmful environmental effects and other dangers, significant detriments and considerable disturbance cannot be caused for the general public and the neighbourhood (protection principle)
- Precautions are taken to prevent environmental effects and other dangers, significant detriments and considerable disturbance (precautionary principle)
- In particular through state-of-the-art measures, waste is avoided, unavoidable waste is reused, and non-reusable waste is disposed of without harming the wellbeing of the general public
- Energy is used sparingly and efficiently

The regulations for large-scale firing and gas turbine plants and the regulations for the incineration of waste place high demands on the flue gas scrubbers. Our application area includes power plants, waste, special waste and sewage sludge incineration plants.

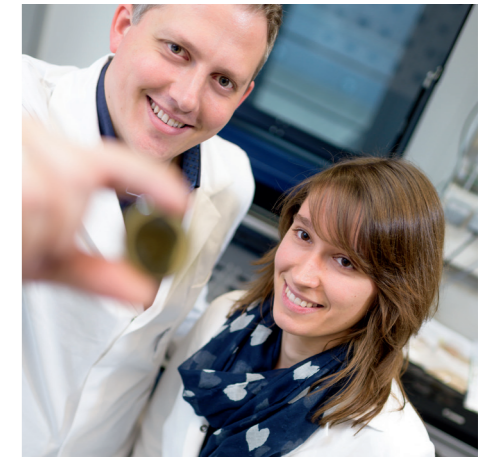
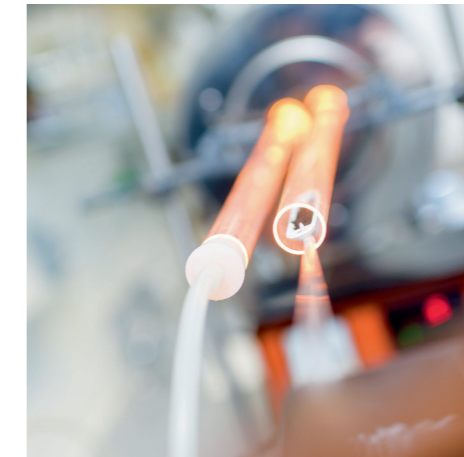
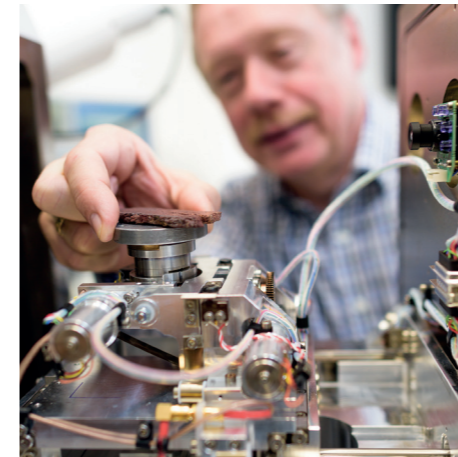
The technical dedusting principles are just as varied as the differing combustion processes. We have been successfully complying with the ever more stringent legal framework over many years with our mature and proven cleaning systems:

- Sedimentation in settlement chambers
- Impact and momentum forces (deflection separators, inertial separators, e.g. cyclones)
- Separation through fabric filters / bag filters
- Washing in scrubbers and spray separators (e.g. spray towers, quenches)
- Electrostatic forces (electrostatic filters, electrical separators)
- Absorption technology (dry, semi-dry and wet, e.g. desulphurisation)



THE MITSUBISHI POWER LABORATORY

Amongst the skills of the Mitsubishi Power Laboratory in Duisburg are materials engineering, failure analysis and chemical analysis. These overlapping topics are covered by various investigation methods and numerous analytical procedures, allowing complex cases to be resolved accurately and reliably.



The skills of the Mitsubishi Power Laboratory include the following services:

I. MATERIALS ENGINEERING AND FAILURE ANALYSIS

- Materials testing
- Failure testing of metallic components
- Support in the qualification of new materials, design solutions or production processes
- Residual life evaluation of steam generator tubes (heating surfaces)
- Consultancy

II. CHEMICAL ANALYSIS

- Chemical and physical properties of solid and liquid fuels including particle size distribution, grindability, ignition point, calorific value, ash melting behaviour, trace element determination and viscosity
- Analyses of power plant products such as ashes, slags, deposits, corrosion products, limestone, gypsum, sludges and leachates
- Investigation and analysis of process waters, aqueous solutions and ultra-pure water
- OES metal analysis (Fe, Ni, Co, Al, Cu or Ti materials)
- Autoclaves for corrosion tests in high-temperature water or other aqueous media



REFERENCE LIST (EXTRACT)

Plant	Thermal power	Throughput	LCV	Grate area	Grate width	Grate length	Commissioned
ANO Bremen, lines 2+3	43 MW	15 t / h	8 – 15 MJ/kg (household waste)	48.6 m ² (W: 1+2, A: 3)	4.5 m (2 tracks)	10.8 m	2003
ANO Bremen, line 1	71.5 MW	24.6 t / h	8 – 15 MJ/kg (household waste)	75.6 m ² (W: 1+2, A: 3)	7.0 m (2 tracks)	10.8 m	2005
ANO Bremen, line 4	70 MW	22 t / h	8 – 15 MJ/kg (household waste)	70.2 m ² (W: 1-3)	6.5 m (2 tracks)	10.8 m	2007
Moscow, lines 1+2	47 MW	22.5 t / h	4.8 – 12 MJ/kg (household waste)	94.8 m ² (A: 1-3)	7.9 m (2 tracks)	12.0 m	2008
Stavenhagen, line 1	52 MW	14.5 t / h	11 – 18 MJ/kg (RDF)	45.7 m ² (W: 1-3)	4.97 m (2 tracks)	9.2 m	2007
EVI Europark, lines 1+2	76 MW	22.8 t / h	8 – 15 MJ/kg (household waste)	83.2 m ² (W: 1+2, A: 3)	8.32 m (3 tracks)	10.0 m	2007
Prokon Weener, line 1	70 MW	21 t / h	11 – 18 MJ/kg (RDF)	74.2 m ² (W: 1-3)	6.87 m (2 tracks)	10.8 m	2007
MKK Bremen, line 1	121 MW	36 t / h	11 – 18 MJ/kg (RDF / household waste)	120.6 m ² (W: 1-3)	11.17 m (3 tracks)	10.8 m	2009
Oostende, line 1	70 MW	21 t / h	11 – 18 MJ/kg (RDF)	74.2 m ² (W: 1-3)	6.87 m (2 tracks)	10.0 m	2009
Bitterfeld, line 1	56 MW	16.8 t / h	11 – 18 MJ/kg (RDF)	59.2 m ² (W: 1-3)	5.92 m (2 tracks)	10.8 m	2009
EAB Bernburg, lines 1-3	67 MW	21 t / h	11 – 18 MJ/kg (RDF)	74.2 m ² (W: 1+2; A: 3)	6.87 m (2 tracks)	10.8 m	2010
Spremberg, line 1	110 MW	31 t / h	8 – 18 MJ/kg (RDF)	120.6 m ² (W: 1-3)	11.17 m (3 tracks)	10.8 m	2012
Samsung, Suwon City, Korea, 1 line	17.25 MW	2.917 t / h	15.4 – 23.4 MJ/kg (RDF + Electronic waste)	20.9 m ² (W: 1-3)	2.375 m (1 track)	8.8 m	2013
Samsung, Cheonan City, Korea, 1 line	29.06 MW	8.33 t / h	7.12 – 13.82 MJ/kg (RDF + Municipal solid waste)	41.0 m ² (W: 1-2; A: 3)	3.8 m (1 track)	10.8 m	2014
Spittelau, lines 1+2	45 MW	16 t / h	7 – 15 MJ/kg (household waste)	62.0 m ² (A: 1-3)	5.74 m (2 tracks)	10.8 m	2014/15
WTE Plant Szczecin, Poland, lines 1+2	29.17 MW	10 t / h	8 – 13 MJ/kg (RDF)	43.8 m ² (A: 1-3)	4.06 m (2 tracks)	10.8 m	2017

LTMA REFERENCE LIST (EXTRACT)

The priority for our customers is also the priority for Mitsubishi Power: plant availability. Thanks to years of experience in continuous on-site care for our customers, Mitsubishi Power is able to ensure efficient and reliable solutions even for short-notice malfunctions and defects.

REFERENCE LIST OF WASTE-TO-ENERGY AND WASTE-DISPOSAL PLANTS LTMA CONTRACTS

Client / Plant / Location	Fuel	Year of Completion	Scope
MVV Umwelt Asset TREA Leuna Unit 1+2 Leuna Germany	Domestic & industrial waste	up to now	Revision/maintenance works grate firing system
MHKW Essen-Karnap RWE Generation SE WtE Plant Essen-Karnap Unit 1 - 4 Essen-Karnap Germany	RDF	up to now - 2019	Engineering support grate incl. maintenance works grate firing system
EEW Saarbrücken WtE Plant EBKW Knapsack Unit 1 - 2 Hürth-Knapsack Germany	Domestic/ Industrial Waste	up to now - 2020	Revision/maintenance works grate firing system
City of Moscow WtE Plant MSZ 3 Unit 1 + 2 Moscow Russia	Domestic waste	up to now - 2016	Supervision of revision/maintenance works for grate firing
AWG Wuppertal WtE Plant Wuppertal Wuppertal-Cronenberg, Germany	Household, bulky, industrial waste	up to now - 2020	Revision/maintenance and erection works for the RGNR 51 (AQCS)
Fortum Oslo Varme WtE Plant Klemetsrud Unit 1 + 2 Oslo Norway	Domestic waste	up to now - 2020	Inspection and overhaul works boiler and grate system
InfraServ Frankfurt RDF Plant EVA Frankfurt Unit 1-3 Frankfurt Germany	RDF	up to now - 2021	Maintenance works and Inspection for mechanical plant
MHKW Kassel WtE Plant Kassel Unit 3 +4 Kassel Germany	Domestic, bulky, industrial waste	up to now - 2020	Maintenance works for pressure parts
swb Entsorgung (former ANO Bremen) WtE Plant Bremen Unit 1 Bremen Germany	Domestic/ Industrial Waste	up to now - 2020	Maintenance and inspection for pressure parts

Client / Plant / Location	Fuel	Year of Completion	Scope
swb Erzeugung MKK medium caloric PP (WtE Plant) Unit 1 Bremen Germany	RDF	up to now - 2020	Maintenance and inspection for pressure parts
EEW Göppingen WtE Plant Göppingen Unit 1 Göppingen Germany	Household, similar household industrial waste	up to now - 2019	Maintenance works at the grate firing system
EEW Helmstedt WtE Plant Buschhaus Unit 1 - 3 Büddenstedt Germany	Domestic waste	up to now - 2017	Maintenance works at the grate firing system
Public Utilities Düsseldorf Biomass Heat & Power Plant Garath Unit 1 Düsseldorf Germany	wood chipscat. A1 & A2	up to now - 2014	Permanent maintenance and various renewal works
MHKW Frankfurt WtE Plant Frankfurt Unit 11 - 14 Frankfurt am Main Germany	Domestic/ Industrial Waste	up to now - 2012	Maintenance works at the grate firing system
ZMS Schwandorf fWtE Plant Schwandorf Unit 4 Germany	Household, bulky, similar household industrial waste	up to now - 1997	Permanent maintenance and various renewal works
EVO Offenbach MHKW (WtE Plant) Offenbach Unit 1 - 3 Offenbach am Main Germany	Domestic and bulky waste	up to now-1996	Maintenance contracts for boiler and grate firing system
Stadtentwässerung Frankfurt Sewadge Sludge disposal Plant HRSG 1 - 4 Sindlingen Germany	Sewadge Sludge	up to now - 1995	Permanent maintenance and various renewal works
Public Utilities Düsseldorf WtE Plant Flingern Unit 1 - 6 Düsseldorf Germany	Domestic/ Industrial Waste	up to now - 1988	Permanent maintenance and various renewal works
MHB Hamm WtE Plant Hamm Unit 1 - 4 Hamm Germany	Domestic waste	up to now - 2003	Permanent maintenance and various renewal works
AMK Iserlohn WtE Plant Iserlohn Unit MK 1 + 2 Iserlohn Germany	Domestic/ Industrial Waste	up to now - 1988	Permanent maintenance and various renewal works
AVEA Leverkusen WtE Plant MHKW Leverkusen Unit 1 - 2 Leverkusen Germany	Household, bulky, similar household industrial waste	2014-2000	Permanent maintenance and various renewal works

Client / Plant / Location	Fuel	Year of Completion	Scope
AVEA Leverkusen WtE Plant MHKW Leverkusen Unit 3 Leverkusen Germany	Household, bulky, similar household industrial waste	2014-2000	Permanent maintenance and various renewal works
Egger Werke Biomass Power Plant Brilon Unit 1a + 1b Brilon Germany	RDF	2013 - 2001	Permanent maintenance and various renewal works
MHKW Würzburg WtE Plant MHKW Würzburg Unit 1 + 2 Würzburg Germany	Household, bulky, industrial waste	2007 - 1998	Permanent maintenance and various renewal works
MHKW Würzburg WtE Plant Würzburg Unit 3 Würzburg Germany	Household, bulky, industrial waste	2007 - 1998	Permanent maintenance and various renewal works
Egger Werke Biomass Power Plant Brilon Unit 1a + 1b Brilon Germany	Biomass	2008	Maintenance Contract
Public Utilities Düsseldorf WtE Plant Flingern Unit 1 - 6 Düsseldorf Germany	Domestic/ Industrial Waste	2003-2001	Maintenance works flue gas cleaning plant

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