

Doosan Lentjes

Environmental technologies for thermal waste and sewage sludge treatment



About us

Doosan Lentjes specialises in environmental technologies for the efficient use of resources in the spirit of a sustainable circular economy.

With our proprietary technologies for combustion, steam generation and flue gas cleaning, we supply tailor-made plants for thermal waste and sewage sludge treatment.

Our roots date back to 1928, when the company was founded as a boiler manufacturer. Since then, we have continuously evolved from a traditional mechanical engineering company to an internationally active plant manufacturer for energy and waste disposal infrastructure.

With more than 80 lines commissioned worldwide for waste-to-energy and over 35 reference lines in the field of sewage sludge treatment, we have decades of experience with projects of this kind. In compliance with strict emission requirements, our plants ensure efficient recovery of environmentally friendly energy and valuable materials from the fuels used.

The Doosan Lentjes Group consists of Doosan Lentjes GmbH in Ratingen (Germany) and its subsidiary Doosan Lentjes Czech s.r.o. in Prague (Czech Republic). As a member of the global Doosan Group, Doosan Lentjes is part of a powerful international network of companies offering complementary technologies and services worldwide.

On the market since 1928

1928

Many years of experience as a specialist in energy and environmental technologies.

Proprietary technologies

for combustion, steam generation and flue gas cleaning.

Proven Track Record

Over 80 reference lines for waste-to-energy and over 35 for thermal sewage sludge treatment.

Strong network in Europe and worldwide

With a subsidiary in Prague and access to global networks.



Thermal waste treatment

Doosan Lentjes is an experienced partner for thermal waste treatment. More than 80 process lines have been contracted worldwide to treat non-recyclable waste reliably, efficiently and in an environmentally friendly way. We supply plants along the entire process chain from a single source – from waste feeding to the stack.

Thermal waste treatment is a central pillar of the circular economy. It reduces landfill volumes, protects people and the environment from pollutants, lowers CO₂ emissions by substituting fossil fuels, and enables the recovery of energy and recyclable materials from bottom ash. Our plants use the energy content of waste to generate electricity and district heating. Since around 50% of the energy contained in waste is of biogenic origin, its utilisation contributes to the use of renewable energy sources.

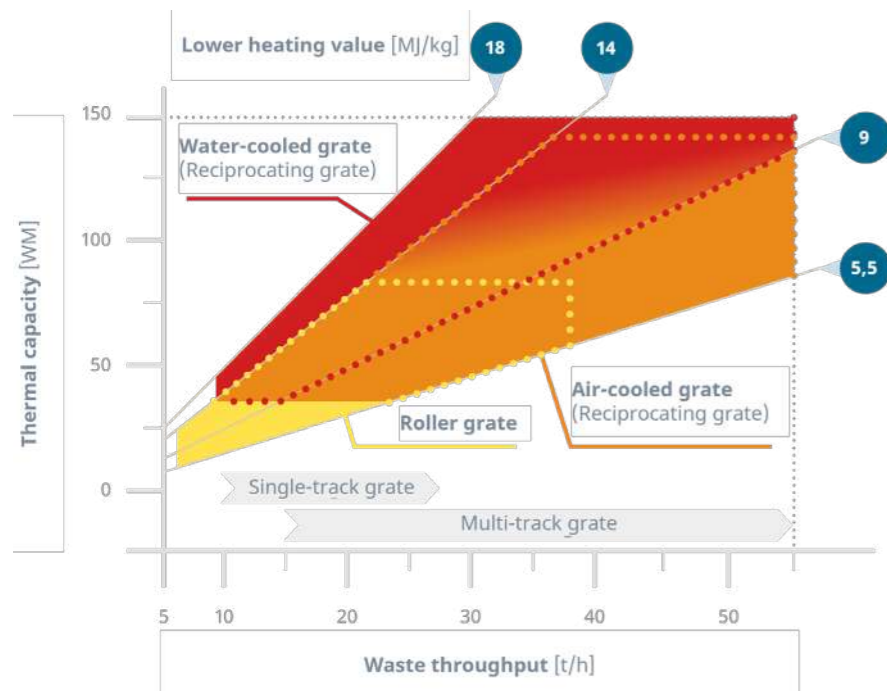
Grate firing – the heart of the plant
Our counter-reciprocating grate technology has been developed for the thermal treatment of a wide range of waste qualities and compositions. The counter-reciprocating movement of the grate bars ensures optimum stoking and air supply, ensuring complete burnout and low emissions. The modular design of the system provides a high degree of flexibility and plant availability.

Depending on the fuel composition, either air- or water-cooled grate bars are used. The design is tailored to each project on the basis of CFD*-supported simulations of the combustion process.

Steam generators – efficient energy use
The main task of the boiler is to efficiently transfer the heat generated during combustion to water for steam production. It is vital to minimise contamination of the heating surfaces, as this can affect heat transfer and alter heat absorption in the boiler. Our steam generators are designed so that key process parameters such as fuel mass flow, exhaust gas temperature and hot steam parameters remain stable even under changing operating conditions.

Thanks to a proven process engineering concept with sufficiently dimensioned radiation chambers, low flue gas velocities and optimised pipe routing, our steam generators are long-lasting, easy to maintain and enable stable operation – without any additional auxiliary firing, even with varying waste quality.

*Computational fluid dynamics



Grate ash extractor – safe and clean ash removal

The Doosan Lentjes grate ash remover ensures low-dust and low-odour discharge of hot grate ash after combustion. The ash is completely quenched in the integrated water surge tank. The robust design with replaceable wear plates ensures maintenance-friendly operation and a long service life. The ash remover is designed to work reliably even with difficult ash compositions – with low residual moisture in the separated ash.

Combustion control – for stable processes and low emission

Doosan Lentjes’ intelligent combustion control system automatically stabilises plant operation – even when fuel quality varies. Sensors and cameras continuously monitor temperature, flue gas values and grate movement. Among other things, the control system regulates fuel and air supply as well as grate speed on a segment-by-segment basis. This ensures constant steam output with low emissions, optimal combustion and high plant availability. The combustion control can be implemented either in a separate process control unit or in the central control system.

Optimal combustion on the grate
Counter-reciprocating grate movement for complete burnout and low emissions.

Efficient heat utilisation in the boiler
Stable process parameters thanks to intelligent design and low degree of wear.

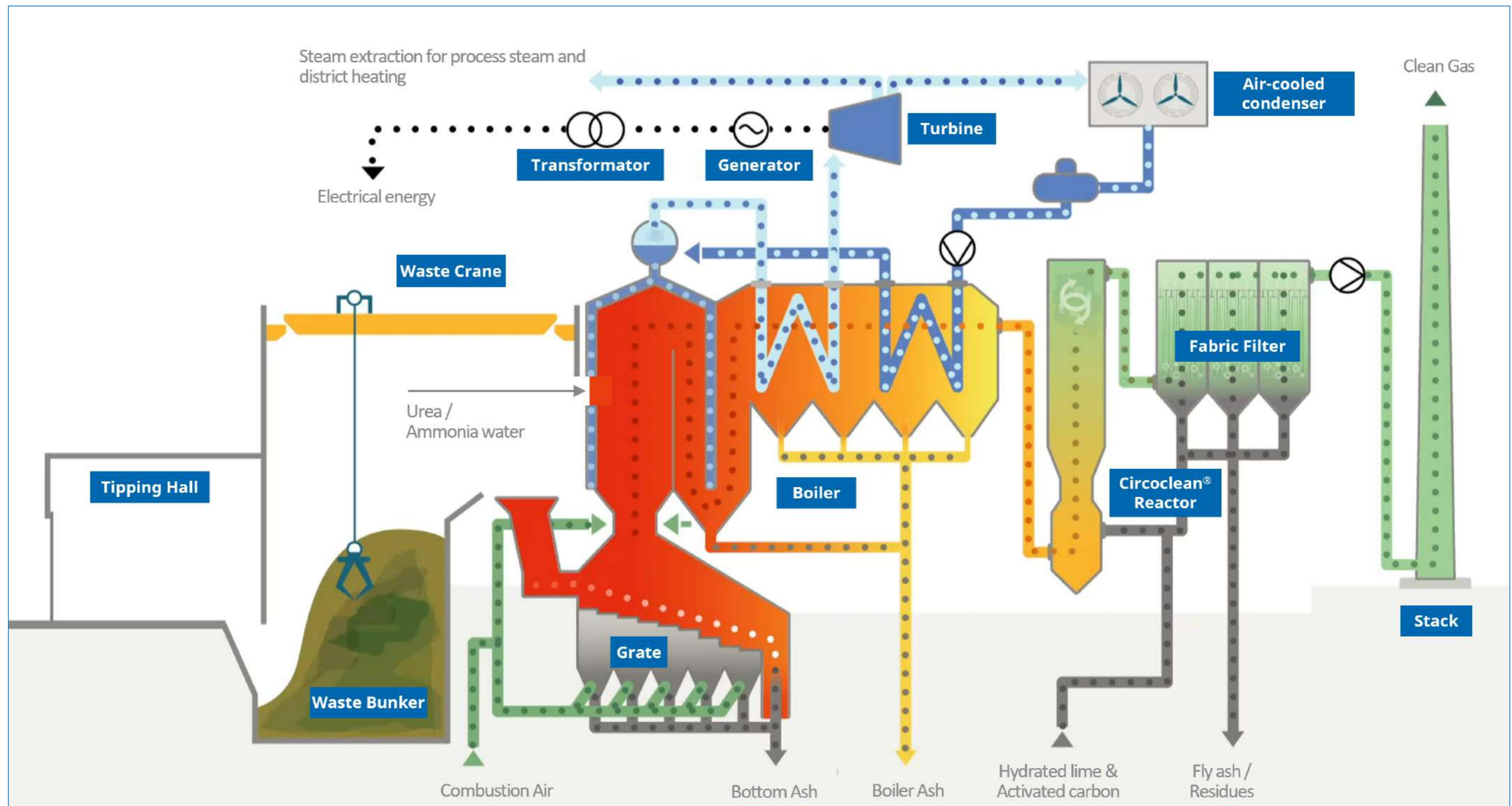
Clean ash extraction
Grate ash extractor ensures low-odour operation and low residual moisture in the ash.



Efficient use of waste

The flow diagram shows the typical structure of a waste-to-energy plant

The waste is received and mixed in the delivery and bunker. Thermal treatment is carried out using the proven Doosan Lentjes grate system. The heat released during the incineration process is used to convert water into steam. The steam produced drives a turbine to generate electricity or is used for industrial processes and district heating. A multi-stage flue gas cleaning system ensures that all emission limits are fully complied with.





Reference plant: Olsztyn, Poland

Fuels: Refuse-derived fuels (RDF)

Number of lines: 1

Total plant capacity: 120,800 t/a

Contract award: 2020

Doosan Lentjes, together with Doosan Enerbility, supplied the new waste-to-energy plant in Olsztyn, Poland. The plant is owned by the local energy supplier MPEC Olsztyn and operated by Dobra Energia dla Olsztyna.

As part of the turnkey project, **Doosan Lentjes** was responsible for the planning, delivery, installation and commissioning of all mechanical and electrical components. The plant includes a water-cooled reciprocating grate, a steam generator, a multi-stage flue gas cleaning system based on proven Circoclean® technology including SCR (*selective catalytic reduction*) and the water-steam cycle. Two gas- and oil-fired peak load boilers complement the system and ensure the district heating supply for the city. The new flue gas cleaning system meets all BREF (*Best Available Techniques*) requirements.

Reference plant: Warsaw, Poland

Fuel: Municipal solid waste (MSW)

Number of lines: 2

Total plant capacity: 314,000 t/a

Contract award: 2021

Doosan Lentjes has been awarded a contract by general contractor POSCO E&C to supply grate and boiler systems for the new waste incineration plant in Warsaw, Poland. The plant is owned by municipal waste management company MPO.

Doosan Lentjes' scope of supply includes an air-cooled reciprocating grate, a highly efficient steam generator and an SNCR (*selective non-catalytic reduction*) system for reducing nitrogen oxides in the flue gas. Doosan Lentjes' proven technologies help to ensure stable, efficient and low-emission plant operation.



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Thermal sewage sludge treatment

With more than 30 plants commissioned in Germany and Europe, Doosan Lentjes has extensive experience in sewage sludge incineration. Based on proven bubbling bed combustion, we supply reliable thermal sewage sludge treatment plants – from sludge reception to the stack.

Enabling phosphorus recovery from sewage sludge incineration ash

Modern regulations across Europe increasingly focus on the sustainable treatment of sewage sludge and the recovery of critical resources such as phosphorus. As phosphorus is classified as a critical raw material by the EU, national frameworks are moving towards its mandatory recovery from sewage sludge incineration ash to reduce import dependence and strengthen the circular economy.

In this context, mono-incineration of sewage sludge is widely regarded as the most effective and future-proof technological pathways. Our plant concepts are specifically designed to create technical conditions for phosphorus recovery by providing well proven mono-incineration and producing suitable sewage sludge ash.

At the same time, our design reliably complies with strict European emission requirements and ensures a minimum combustion temperature of 850 °C with a residence time of at least two seconds. This combination of regulatory compliance and phosphorus-ready plant design enables operators to meet current environmental standards while preparing for future obligations.

Our proprietary technologies Bubbling bed combustion

The bubbling bed combustion system is the heart of every thermal sewage sludge treatment plant. It ensures stable, autothermal combustion even with varying fuel properties.

Thanks to staged air supply with primary and secondary air and optional flue gas recirculation, low primary emissions and high burnout can be achieved. Today's high requirements for ash quality, emissions and availability are met by Doosan Lentjes' adiabatic bubbling bed furnace with staged combustion thanks to the high variability of air preheating and distribution. This enables stabilisation of the bed and freeboard temperatures without short-term readjustment of fuel moisture.

Our technology is characterised by high availability, energy self-sufficiency and a long service life – important prerequisites for economical operation and high-quality ash for subsequent phosphorus recovery.

Advantages:

- Thermal output up to 32 MW per line
- High flexibility in fuel calorific value thanks to flue gas recirculation and air preheating (flue gas)
- Low primary emissions in flue gas (CO, TOC, NO_x, N₂O)
- Very good ash burnout
- No built-in components in the combustion chamber
- Compliance with legal requirements for temperature and residence time ensured

Steam generator with integrated air preheater

The optimal design of the steam generator is crucial for the efficient use of the energy contained in sewage sludge. Our boiler concepts combine high efficiency with compact design and can be flexibly adapted to project-specific requirements.

In the steam generator, the flue gas is cooled from combustion temperature to a gas temperature, which enables downstream ash precipitation suitable for phosphorus recovery and a state-of-the-art flue gas cleaning system. The heat from combustion can be utilised, for example, for sewage sludge drying and/or in a water steam cycle.

The integrated air preheater ensures stable temperatures in the combustion process and contributes to autothermal combustion even with changing fuel properties.

Advantages:

- High flexibility for individual customer requirements
- Adaptation to project- and location-specific conditions
- Compact, reliable and economical design
- High efficiency with low maintenance requirements and reliable long-term operation

Experience & reliability
Over 30 sewage sludge incineration plants successfully realised across Europe.

Legally compliant solutions
Our technologies reliably meet European BREF requirements

Efficient combustion
Autothermal operation with stable temperature and low emissions.

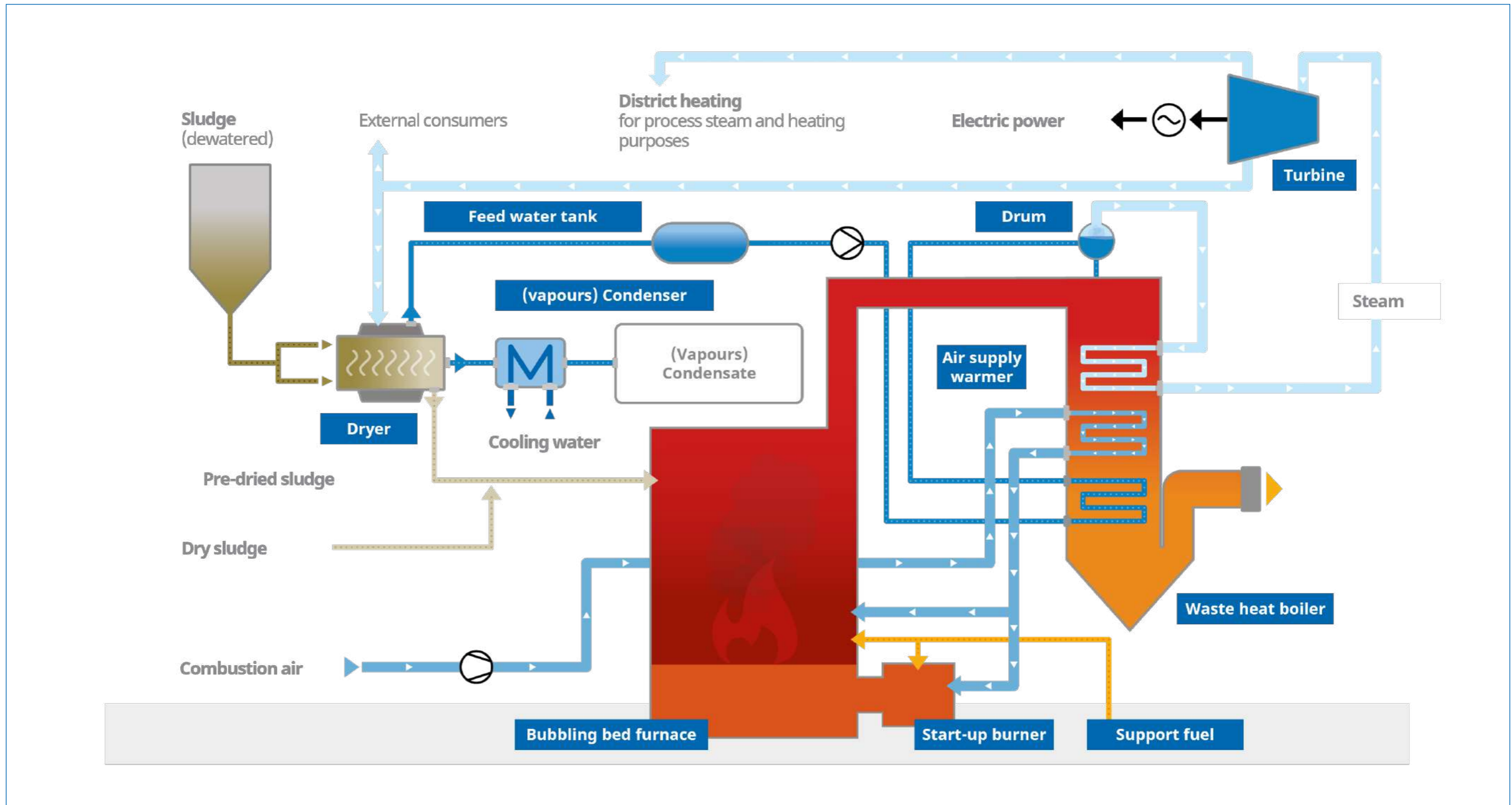
Efficient heat utilisation
To be used for drying, electricity or district heating generation.



Proven energy utilisation concept

Our plants for thermal sewage sludge treatment are designed for maximum efficiency and flexibility.

As standard, we rely on the proven concept of steam generation: the waste heat is utilised to generate steam, which can be used, for example, for sewage sludge drying, preheating combustion air or for additional district heating and electricity generation. Alternatively, depending on individual requirements, we offer more cost-effective solutions with thermal oil boilers. In this case, the heat transferred to the thermal oil is usually used for sewage sludge drying.





Reference plant: Flanders, Belgium

Fuels: Dewatered and dried sewage sludge

Number of lines: 1

Plant capacity (DS): 65,000 t/a

Contract award: 2022

Doosan Lentjes has been awarded the contract to supply a new sewage sludge treatment plant in Flanders, Belgium. The DBFMO contract was awarded by the Flemish wastewater disposal company Aquafin to FOSTER – a consortium consisting of the BESIX Group and Indaver NV.

As part of the turnkey project, **Doosan Lentjes** is responsible for the design, supply, installation and commissioning of all process, mechanical and electrical equipment. A process line consisting of a bubbling bed furnace, a steam generator, a multi-stage flue gas cleaning system and a water-steam cycle will be supplied.

Mono-incineration forms the basis for possible subsequent phosphorus recovery and is in line with current requirements for sustainable and safe sewage sludge disposal.

Reference plant: Belfast, Northern Ireland

Fuels: Sewage sludge, dewatered sewage sludge, screenings from the sewage treatment plant

Number of lines: 1

Plant capacity (DS): 24,000 t/a

Contract award: 1997

Doosan Lentjes was responsible for the design, construction and commissioning of the mono sewage sludge incineration plant in Belfast, Northern Ireland. The client was Water Executive.

The technical concept comprised a mechanical dewatering system, sewage sludge drying, a bubbling bed furnace, a steam generator and multi-stage flue gas cleaning. The latter consisted of an electrostatic precipitator, a quench scrubber, a packed bed scrubber, a flue gas reheater and an adsorber for mercury separation.

The heat recovered is used to generate electricity: the steam produced drives a turbine that supplies around 1 MW of electrical energy, enabling the plant to operate self-sufficiently. With a thermal input of 15.5 MW_{th}, the plant processes around 24,000 tonnes of dry substance per year.



Flue gas cleaning

With over 50 years of experience, Doosan Lentjes offers tailor-made flue gas cleaning systems for thermal waste and sewage sludge treatment plants. These systems reliably meet the strict emission requirements in accordance with the European BREF (*Best Available Techniques*) documents.

Our portfolio includes a wide range of proven proprietary technologies that can be flexibly combined depending on project requirements:

Semi dry Circoclean® flue gas cleaning

The semi-dry process is a proven and well-established solution for the removal of pollutants such as SO₂, SO₃, HCl, HF, dioxins, furans and heavy metals including mercury. It uses hydrated lime or quicklime as the primary reagent and is typically supplemented with activated carbon or HOK® activated lignite.

Dry FER-DI® flue gas cleaning

We offer the dry FER-DI® process (*Flexible Economic Reagent Direct Injection*) as a straightforward and cost-effective solution for applications with moderate pollutant concentrations. This technology reliably removes acidic gases — including SO_x, HCl and HF — as well as dioxins, furans and heavy metals such as mercury. Sodium hydrogen carbonate is used as the main additive and is injected together with activated carbon or HOK® activated lignite.

Particle separation technologies

Depending on the size of the plant and individual requirements, electrostatic precipitators, high-pressure pulse jet fabric filters (HPPJ) or low-pressure pulse jet fabric filters (LPPJ) are used – each with high efficiency for separating dust particles.

Wet scrubbers (acidic and alkaline processes)

Wet scrubbers utilize consecutive acidic and alkaline stages to maximize pollutant removal. In the acidic stage, contaminants such as HCl, HF, NH₃ and mercury are efficiently separated from the flue gas, while the subsequent alkaline stage primarily removes SO₂, SO₃ and remaining residual substances. Commonly used as an additional flue gas cleaning step, wet scrubbers enable the achievement of very low emission limits with moderate consumption of reagents.

In addition, limestone scrubbers are commonly employed to remove acidic pollutants, especially in flue gas cleaning downstream of sewage sludge incineration plants.

Technologies for reducing nitrogen oxide (NO_x)

In addition to primary combustion controls, proven secondary processes such as selective non-catalytic reduction (SNCR) and selective catalytic reduction (SCR) are used to effectively lower NO_x emissions. In SNCR, ammonia water (NH₄OH) or urea (CO(NH₂)₂) is injected into the flue gas stream at high temperatures, where it reacts with nitrogen oxides. SCR, on the other hand, employs a catalyst, enabling higher NO_x reduction efficiencies and allowing the reaction to proceed within a lower temperature range.

Heat extraction and flue gas condensation

Advanced systems for heat recovery from the flue gas stream enable the captured energy to be reused in internal processes or supplied to external applications. This makes a significant contribution to the overall energy efficiency of the plant.

Ensuring compliance with legal regulations

Compliance with stringent European BREF requirements

Broad range of procedures

Technologies for separating particles and harmful gases, denitrification and heat extraction.

Proven technologies, individually combined

Modular cleaning solutions – tailored to emission specifications and project requirements.



Tailor-made flue gas cleaning

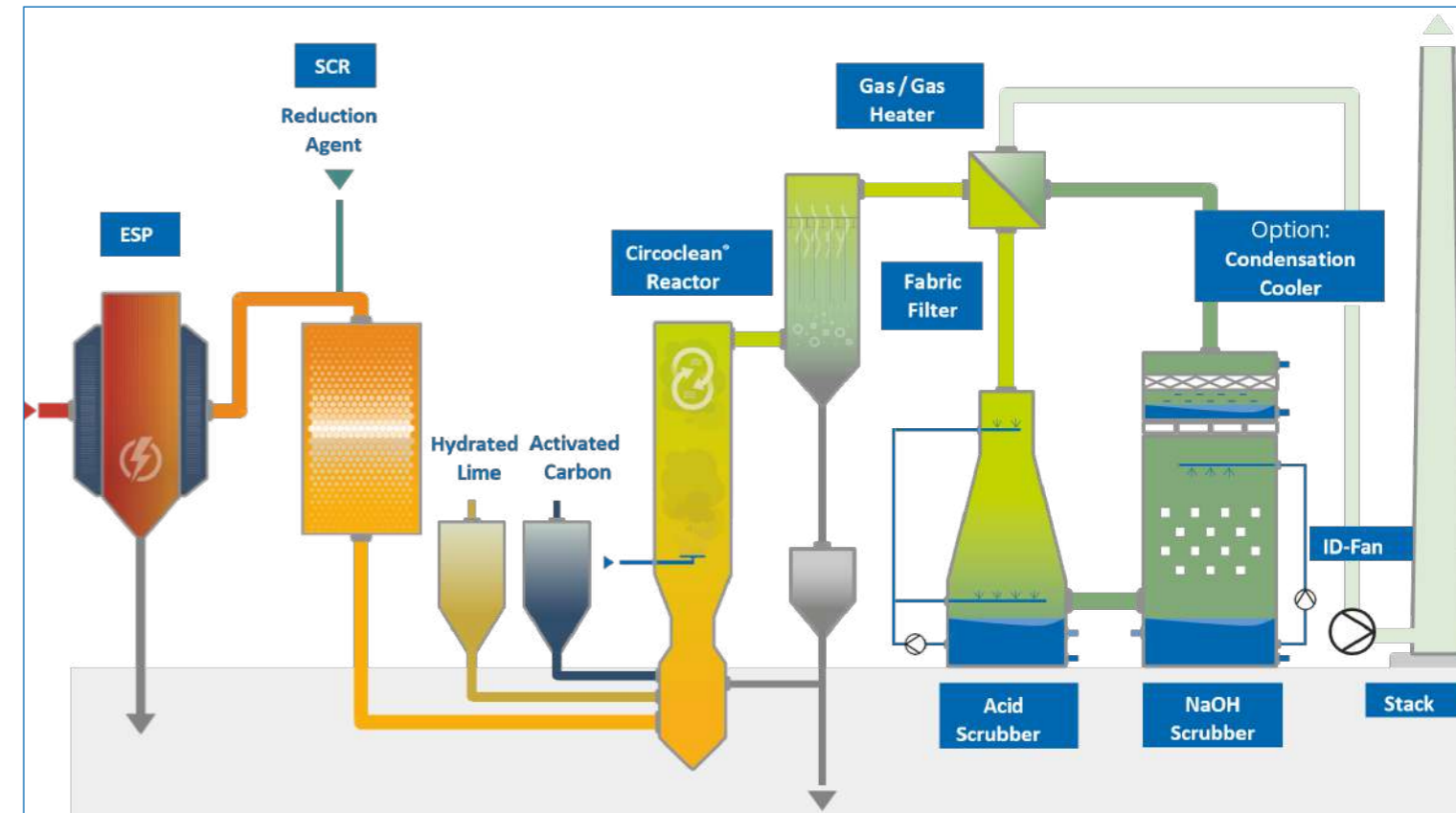
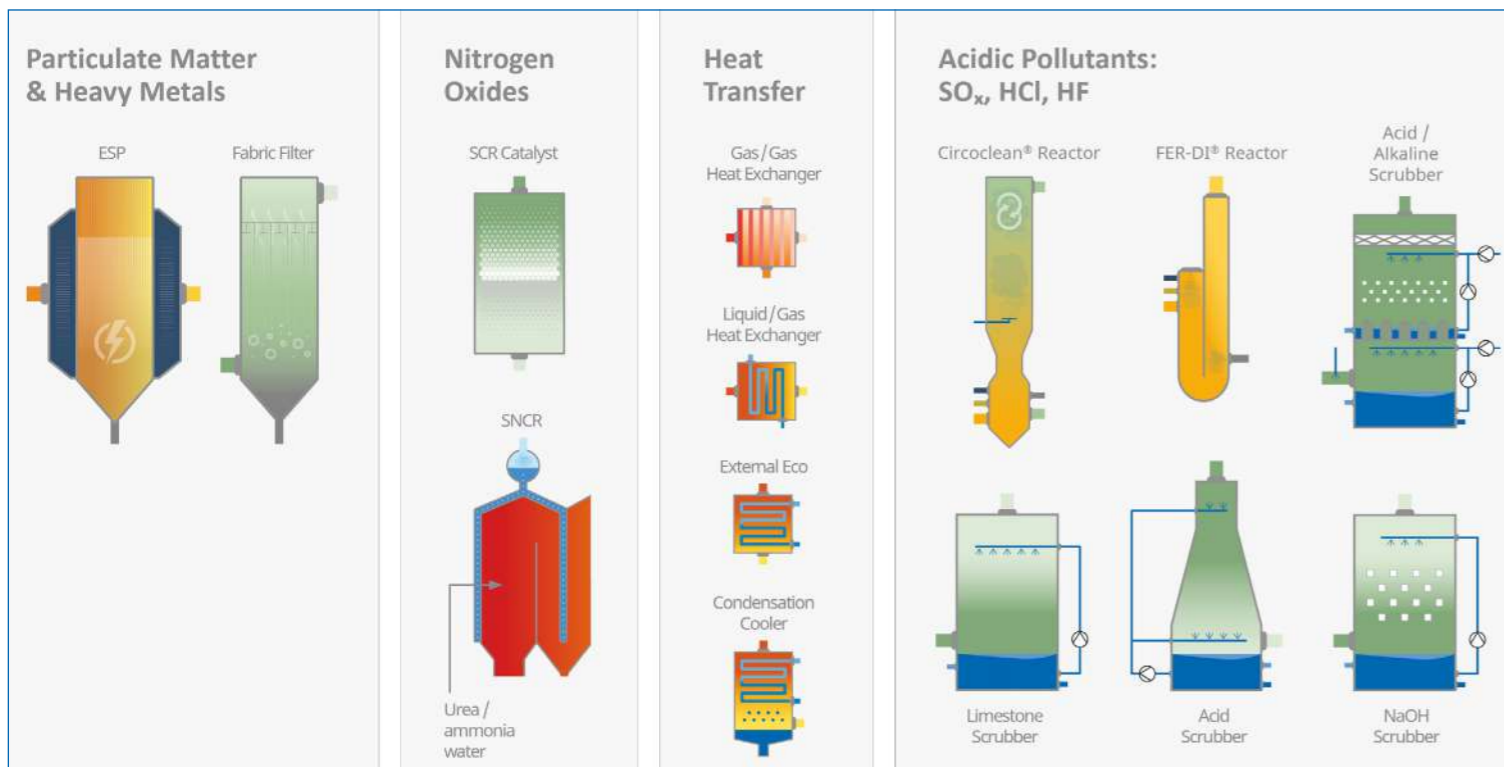
Customised solutions for the most stringent requirements

Toolbox for flue gas cleaning – flexible combination options

Depending on project requirements, site conditions and legally prescribed emission limits, our modular technology platform enables the targeted selection and combination of suitable cleaning stages. The result: safe, reliable and economical plant solutions – tailored to your needs.

Case study: Tailor-made solution for complex requirements

In this case study, various cleaning stages were integrated to create a multi-stage, high-performance system. Technologies such as electrostatic precipitators (ESP), SCR catalysts, Circoclean® reactors, fabric filters and wet scrubbers were employed. The plant not only complies with all emission limits in accordance with EU requirements, but also impresses with its high energy efficiency and operational reliability.





Reference plant: Kelvin, UK

Flue gas cleaning technology:
Circoclean®

Flue gas flow rate::
1 x 232,000 m³/h (STP, wet)

Fuel: Municipal solid waste (MSW)

Contract award: 2022

Doosan Lentjes has been selected by general contractor Acciona Industrial UK to supply the flue gas cleaning system for the new waste-to-energy plant in West Bromwich, UK. The plant is owned and operated by enfinium Kelvin Limited.

The system will use Doosan Lentjes' proven Circoclean® technology, which works with hydrated lime and activated carbon. It ensures reliable compliance with all European BREF emission requirements, including the separation of SO_x, HCl and solid particles.

The scope of supply includes the planning, manufacture and delivery of the complete flue gas cleaning system as well as consulting services for installation and commissioning.

Reference plant: Dinslaken, Germany

Flue gas cleaning technologies:
Circoclean® & SCR DeNO_x

Flue gas flow rate:
2 x 112,000 m³/h (STP, wet)

Fuel: Waste wood (class I-III)

Contract award: 2020

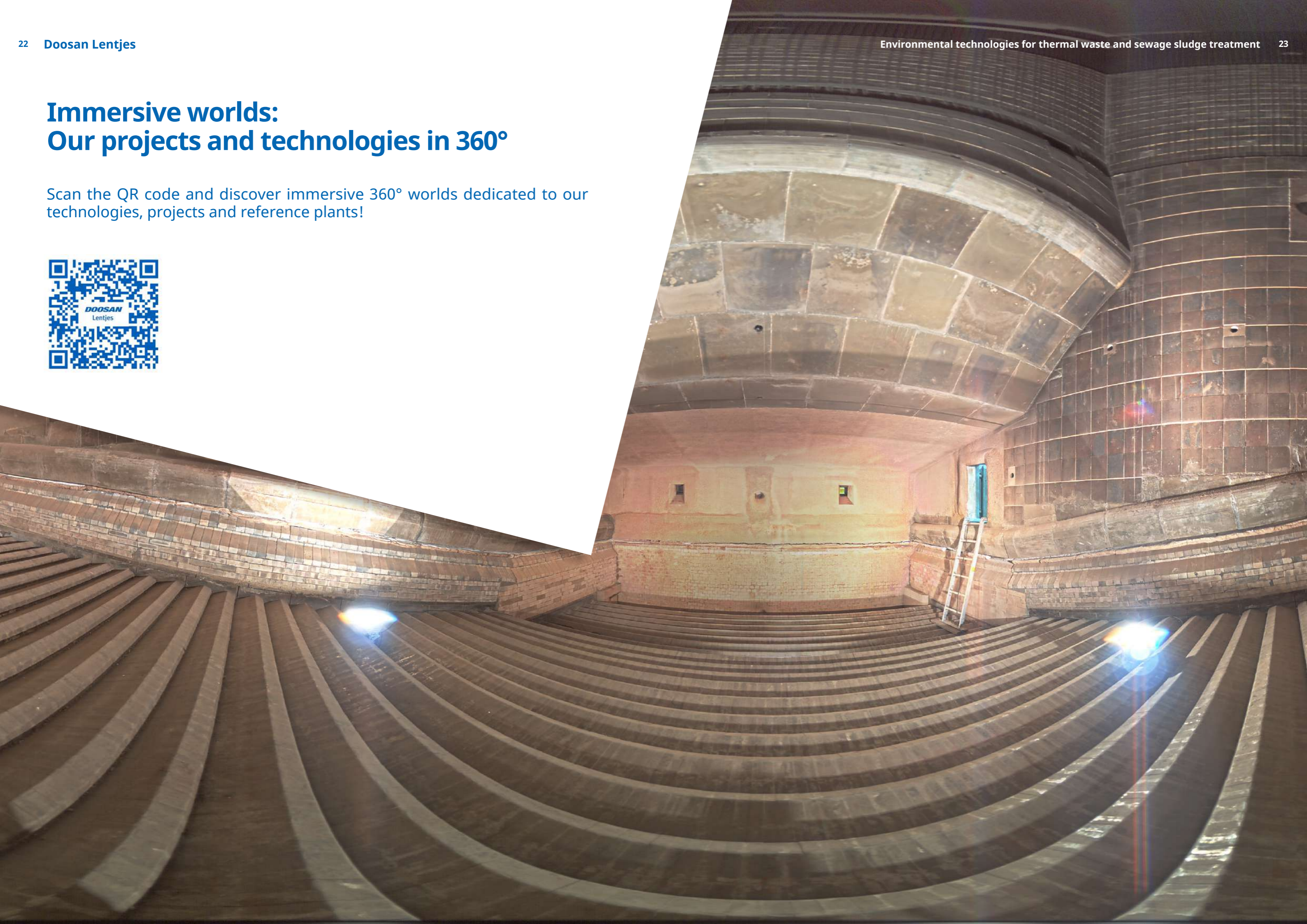
Doosan Lentjes was awarded the contract to supply the complete flue gas cleaning system for the new waste wood incineration plant in Dinslaken. The project was carried out as part of a turnkey contract – also awarded to Doosan Lentjes – which includes the construction of two incineration lines. The new power plant is owned by Dinslakener Holz- und Energiezentrum (DHE).

The customer benefits from a reliable flue gas cleaning solution that ensures compliance with the emission limits in accordance with the revised European BREF documents.



Immersive worlds: Our projects and technologies in 360°

Scan the QR code and discover immersive 360° worlds dedicated to our technologies, projects and reference plants!



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