


Drying technologies for sewage sludge



Sewage sludge treatment

System solutions from a single source

			
1.000 kg	160 kg	44 kg	20 kg
Wet sludge 4% DS 40–80% organic in DS	Dewatered sludge 25% DS 40–80% organic in DS	Dried sludge > 90% DS 40–80% organic in DS	Ash 0–3% organic > 99% DS
Mechanical waste water treatment Sieves, Screens, Sand filters	Dewatering Belt presses, Decanter centrifuges, Filter presses	Drying Belt-, Drum- and Fluidbed drying systems	Thermal utilization - direct with EcoDry - external (industry, agri- culture)
 	  	  	
		thermal and substantial utilization	
		Co-incineration in coal-fired power plants and waste incineration plants, cement industry	Cement industry, fertilizer, phosphor recycling

Significant reduction in weight and volume by

- Thickening
- Dewatering
- Drying
- Incineration

ence, numerous references, and a worldwide service network make ANDRITZ SEPARATION a leading global supplier of mechanical and thermal sludge treatment systems. Sewage sludge as a final product of wastewater treatment is upgraded to a valuable substance (dried granulate) by drying.

This Class A granulate features the following properties:

- Dry substance content > 90% DS
- Low dust content
- Good handling properties
- Biologically stable (hygienized)

As a result, both the material and the energy contained in the granulate can be used in different ways.

A broad product range, extensive process know-how, many years of experi-

Reuse - Reduce - Recycle

From waste to valuable substance by drying



The road from being a waste product to one that can produce both useful material and energy (dry granulate) with ANDRITZ SEPARATION's thermal process provides the following special features:

- considerable reduction in the sewage sludge volume to be disposed of
- alternative fuel generated with a calorific value comparable to that of lignite
- substitute fuel with carbon neutral properties
- natural nutrient reserves



The right thermal process for each application

Three technologies to offer custom-tailored solutions

Belt dryer (BDS)

- for small to medium evaporation capacity
- to make use of waste heat with temperatures > 90°C and heating steam < 6 bar



Fluidized bed dryer (FDS)

- for medium to large evaporation capacities
- if heating media > 180°C and heating steam > 6 bar are available

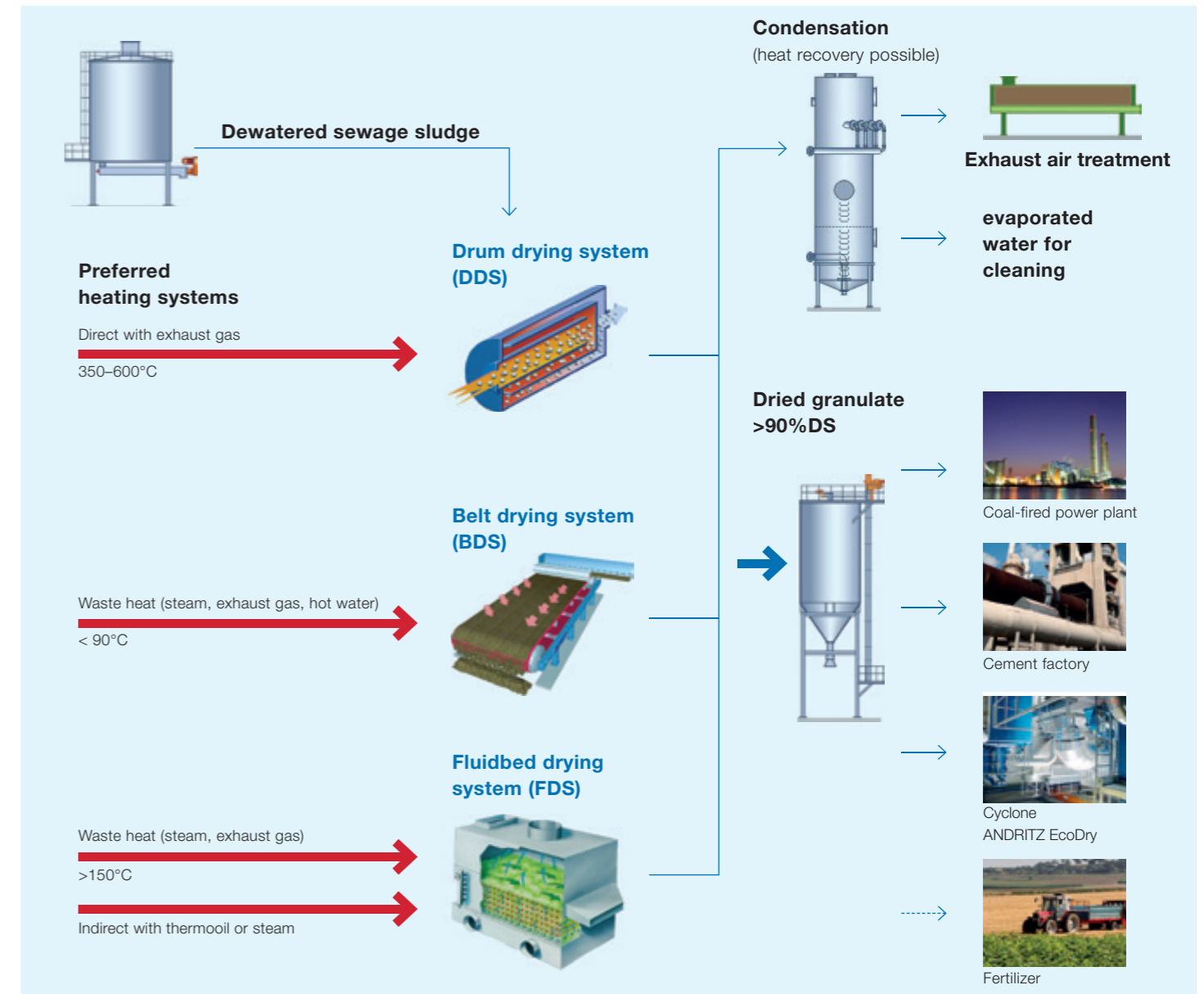


Drum dryer (DDS)

- for medium to large evaporation capacities
- to make use of natural gas, biogas, or heating oil
- if granulate has to meet stringent demands (for fertilizer)



Three possibilities for the optimum path from waste to product



Your advantage

With belt, drum and fluidized bed drying, ANDRITZ SEPARATION has three technologies that offer custom-tailored solutions to the various customer requirements.

Belt drying system

Ideal for making use of waste heat



▲ Belt drying plant, Clos de Hilde, France

The Process

The ANDRITZ SEPARATION belt drying system granulates the dewatered sludge in a mixer with product that has already been dried. The moist granulate produced here is distributed evenly over the belt in the dryer by a specially designed feed module. The even layer of material on the belt creates optimum conditions for even distribution of the drying air.

This, in turn, is necessary for even heating and drying of the sewage sludge.

The layer of material on the belt forms a filter medium for the air flowing onto the granulate layer from above and thus prevents entrainment of dust. The low tem-

perature of the drying gases (< 150°C) and the low dust content in the system facilitate safe operation.

The dried material is not exposed to mechanical stress during drying and is also pre-cooled before the dryer discharge.

The technology - simple, convincing, and successful

- The belt dryer is particularly attractive economically because it uses waste heat with a low temperature.
- Highly product quality of different sludges qualities due to variable back-feeding.
- Modular structure and simple design
- High availability.

- Combination of tried-and-tested components from ANDRITZ SEPARATION sludge drying technologies.
- More than 30 reference plants drying around 800,000 t of dewatered sludge per annum.

Recovery of material and energy content taking waste gas heat from cement production as an example

By creating a thermal and material link between a sewage sludge drying plant and a cement kiln, an innovative concept is obtained for conserving resources (energy and minerals).

Here, the thermal energy for drying the sewage sludges comes entirely from the waste gases from the clinker cooler in the cement works. The dry granulate is produced from the dewatered sewage sludge, which serves as carbon neutral auxiliary fuel in the cement kiln to generate heat for cement production. The sewage sludge

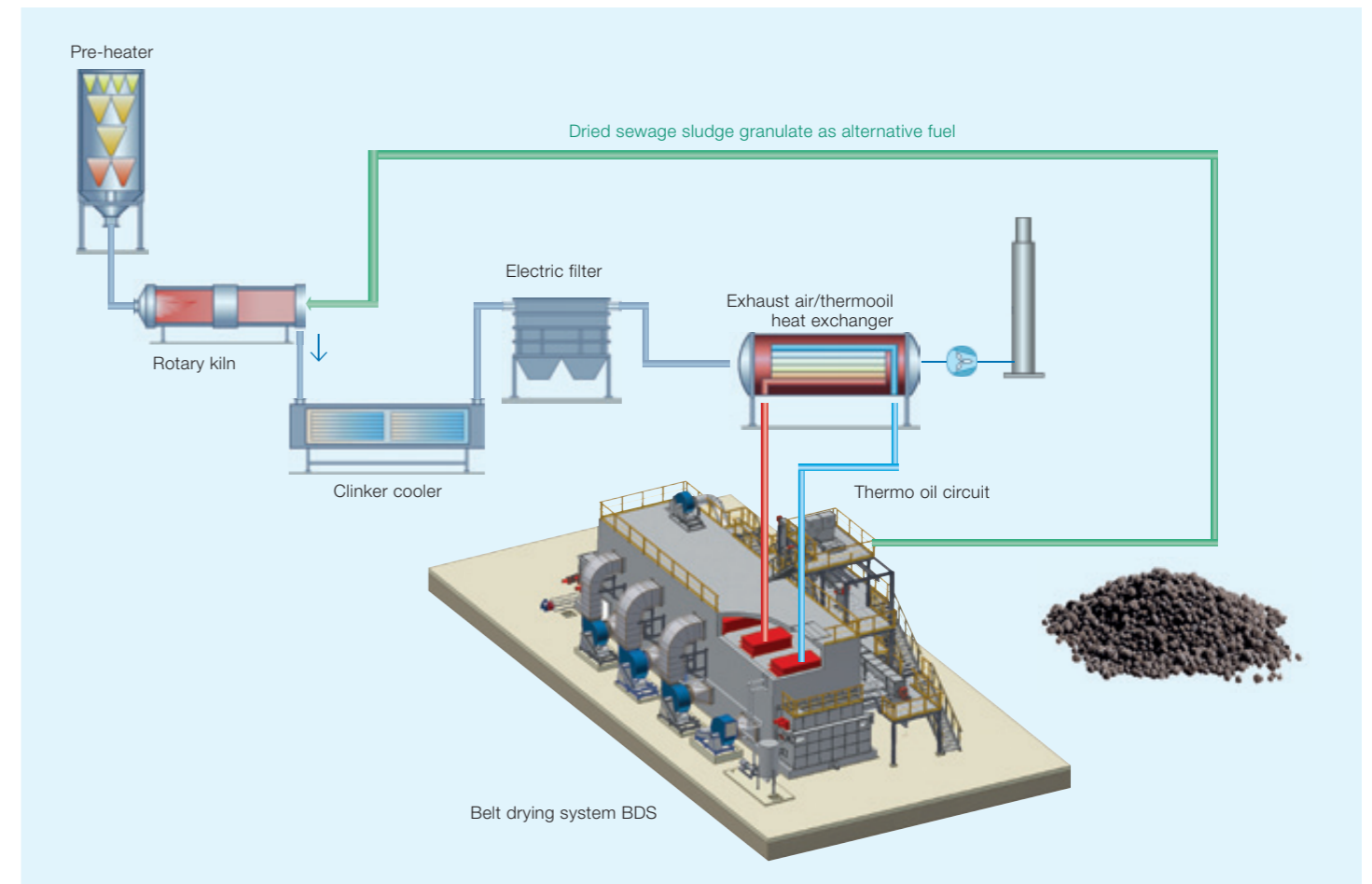
ash is used as an additive in cement production and thus reduces the amount of minerals used.

The advantages

- 100% of the sewage sludge heating value and ash are used in cement production
- Considerable reduction in operating costs by substituting primary energy and minerals
- Substitute fuel that is carbon neutral



▲ Belt drying plant, Hereke, Turkey



▲ Flowsheet of a belt drying plant using waste heat

Fluidized bed drying system

Drying in a closed inert gas loop



▲ Fluidized bed drying plant, Madrid, Spain

The process

Fluidized bed dryers for drying dewatered sewage sludge operate in a closed inert gas loop. The entire heat required to evaporate the water is fed to the dryer via heat exchangers, i.e. without any direct contact between the heat transfer medium and the product.

The dewatered sewage sludge is pumped directly to the fluidized bed dryer without any pre-mixing, broken up using a mechanical breaker, and then mixed into the dried granulate which is held in motion by the fluidizing gas. Due to the excellent heat and material transfer conditions prevailing in the fluidized bed, the sewage sludge fed to it is dried at 85°C to >90% dry substance in a very short time. The fluidized bed dryer uses waste heat from industrial processes, but also primary energy.

At the same time, waste heat at a temperature level of 60°C is available for further use.

The technology - simple, convincing, and successful

- Sludge feed without dry granulate – backfeeding offers substantial flexibility in adapting to different sludge qualities.
- High safety level due to drying operation under inert gas conditions
- Automatic operation (no personnel present during the night and at weekends) is possible and is also practiced in many plants
- High thermal efficiency due to closed gas loops
- Low waste gas volume (<200 m³/h) due to closed design reduces expenditure for waste gas cleaning.
- More than 30 reference plants in operation all over the world.
- High plant availability and proven operating times of >8000 h per annum

Sewage sludge drying at the highest level of safety engineering

Sewage sludge with >90% dry substance is an organic material that is combustible and – under certain conditions – potentially explosive.

Operations under inert gas conditions as used in fluidized bed drying guarantee safe plant operation in all operating modes (start-up, shutdown, stationary, upset).

These inert gas conditions are maintained from the dryer, to product cooling, to storage.

Energy-optimized integration of sewage sludge drying in sewage treatment plant operations

The heat for drying the dewatered sewage sludge is taken entirely from the sludge gas. The sludge gas is used to heat the fluidized bed dryer with an efficiency of >90% in modern incineration plants.

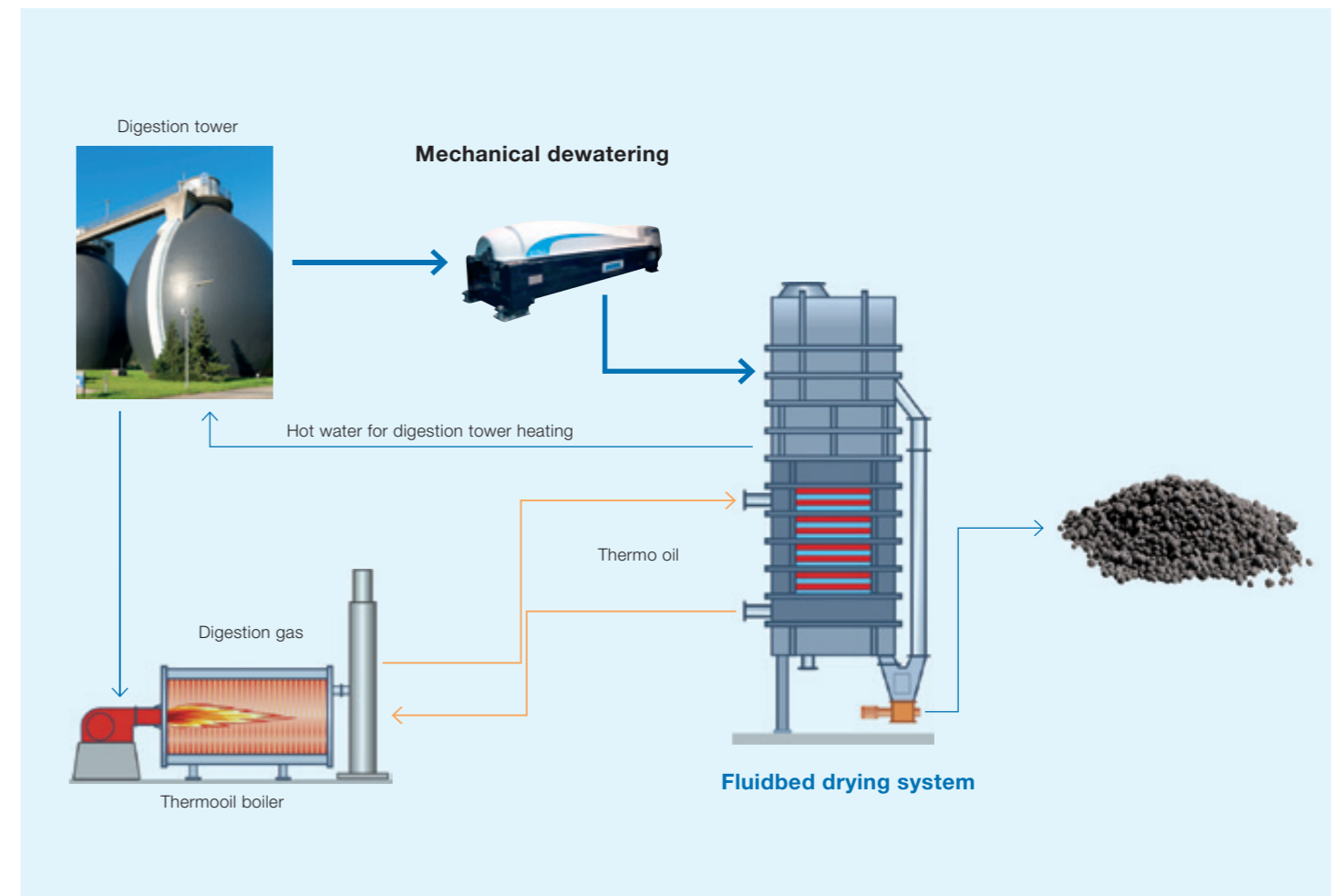
At the same time, the fluidized bed dryer provides the thermal energy to heat the digester. In the drying process stage the sewage plant produces a valuable substance (dried granulate), which is in demand as substitute fuel in cement production or in coal-fired power stations due to its calorific value comparable to that of lignite and its carbon neutral combustion properties.

Advantages for the sewage treatment plant operator

- Significant reduction in the residual substances leaving the sewage treatment plant
- No additional costs for thermal energy needed in drying
- Environmentally friendly concept to conserve resources by – reducing the transport capacities for the sewage sludge and – producing a carbon neutral substitute fuel.



▲ Fluidized bed drying plant, Bailonggang, China



▲ Flowsheet of a fluidized bed drying plant

Drum drying system

Drying and granulating in a single step



▲ Drum drying plant, Ashford, UK

The process

The ANDRITZ SEPARATION drum drying process is one of the oldest processes for drying sewage sludges. Dewatered sewage sludge is mixed in a mixer to a dry content of approximately 60% DS with material that has already been dried.

The pre-granulated moist granulate is fed to the triple pass drum. The hot gas flowing through the drum transports the pre-granulated sewage sludge, and water contained in the sludge is evaporated at the same time. In the slowly rotating triple pass drum, which is made up of concentric cylinders, the product is shaped into round granulate due to the constant rolling movement.

The final product is a largely dust-free, dry granulate with 92–95% DS.

The technology - simple, convincing, and successful

- Low energy consumption due to special drum design
- Low-odor operations due to partial vacuum in the drying system
- Small volume of exhaust air due to closed circulating air loop
- Long plant service life by using sturdy plant components, short conveying routes, and compact design
- ABIS – Advanced Burner Inertization System – to obtain a low-oxygen gaseous atmosphere in the dryer’s circulating air system when the plant is shut down.

The final product

- Dry content 92–95% DS
- Largely dust-free and stable under

pressure

- Evenly dried right through and hygienized
- Easy to store and dose, excellent handling properties
- Dry granulate particularly suitable for material use (as fertilizer)

Drum drying - successful for 40 years

- Up to 12 t/hr water evaporation per line
- Around 70 drum drying plants installed worldwide for drying over 5.6 million tons of dewatered sludge per annum, resulting in 4 million tons of water evaporation per annum and 1.2 million tons of granulate for further use

Energy efficiency from combined heat and power generating (with a gas motor for example)

The electric current for operating the sewage sludge drying plant is supplied by a gas motor operated as a co-generation unit.

The thermal energy required for drum drying is provided from the gas motor exhaust air and also from their cooling water shell. Efficient heat recovery is a very important factor.

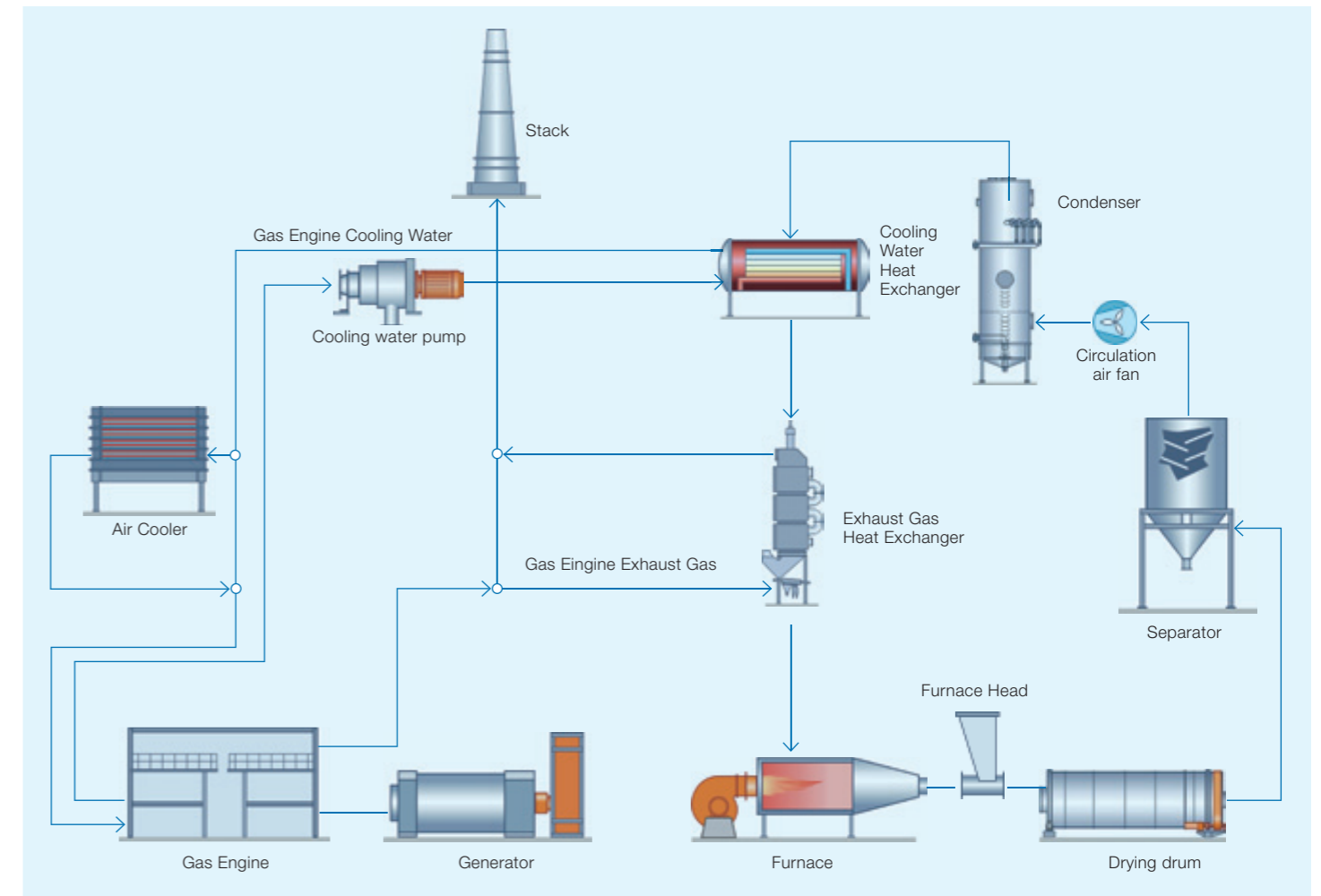
Integration of CHP (Combined Heat and Power) reduces carbon and exhaust air emissions by up to 20% due to direct use of waste gas and greater efficiency of CHP compared to power plants.

The advantages

- Having no direct contact between CHP waste gas and the dryer system results in simple safety management
- Fast and easy switch online from CHP mode to burner mode without impairing product quality
- Efficient heat recovery



▲ Drum drying plant, Paris, France



▲ Flowsheet of a drum drying plant (example with gas engine)

Safety engineering in ANDRITZ SEPARATION drying plants



▲ Explosion suppression



▲ Control panel of a Safe-T-Box for belt drying plants

Safety has top priority in ANDRITZ SEPARATION drying plants for sewage sludge. Dried sewage sludge is an organic substance that

- is combustible,
- has a calorific value comparable to that of lignite,
- is susceptible to self-ignition, and
- can form explosive mixtures of dust and air.

In this sector, dust explosions bear the highest risk potential. Measures must be implemented to prevent damage to individuals and to equipment as far as possible. Three requirements must coincide to create a dust explosion:

Effective ignition source
>500 – 1000 mJ



Oxygen content higher than LOC
>8 – 12 Vol-%

Dust cloud with critical concentration
>50 – 500 g/m³

If at least one of these requirements can be reliably excluded, there will be no explosion.

The primary safety measures derived from this and which are implemented in ANDRITZ SEPARATION belt dryers are strong dilution of any dust concentrations occurring, as well as monitoring of these concentrations and shutdown if approximately 10% of the lower explosive limit is reached. Consistent operations under depleted oxygen atmosphere in all conceivable operating modes, as practiced successfully in fluidized bed and drum drying plants for more than two decades, mean that it is impossible for explosive mixtures to form. This primary explosion protection guarantees the highest level of safety engineering.

In addition to these primary protection measures, the following secondary measures are used, depending on the drying system concerned, in order to minimize the effect of possible explosions on man and machine as far as possible.

- Use of constructive explosion protection measures, such as explosion suppression or explosion pressure venting, e.g. for dust separators (filters, cyclones) and silos.
- Use of CO measurements for early detection of self-ignition processes or overheating.
- Fire-fighting equipment (CO₂, N₂ or sprinklers)
- Eliminating the risk potential by minimizing dust accumulation and swirling and by cooling the product

A careful analysis (ATEX) of the sewage sludge drying plants in consideration of the ATEX directives (particularly 94/9/EC) and the related harmonized standards (particularly EN 1127-1) is essential, particularly during start-up and shutdown procedures and in the event of malfunctions.



▲ Spark detection



▲ Explosion extinguisher



▲ Sprinkler system in a belt dryer

Service offered for drying plants

It is part of the ANDRITZ SEPARATION strategy to provide high-quality equipment. ANDRITZ SEPARATION helps its customers to maintain the profitability and the value of their drying plants for many years. ANDRITZ SEPARATION offers performance assessments and upgrades in addition to service and maintenance, with the aim of optimizing the operating conditions and thus also the profitability of customers' plants.



Service by specialists

ANDRITZ SEPARATION service specialists help customers to keep machine and plant availability as high as possible.

ANDRITZ SEPARATION as system provider and process know-how owner is aware of the many ways of optimizing a plant, reducing the operating costs, and increasing performance.

In addition, ANDRITZ SEPARATION assists the operators of drying plants to keep their plant in line with the latest technical and safety demands required by law.

ANDRITZ SEPARATION leads the market in dryer plant safety, setting benchmarks for safe plant control and equipment, and is thus the ideal partner in matters relating to plant safety.

ANDRITZ SEPARATION offering for service contracts

- Fixed and thus calculable maintenance costs
- Regular inspections and process optimizations
- Preventive maintenance
- Targeted stocking of spare parts
- Diagnosis services via modem or special measuring equipment (e.g. endoscopy)
- Maintenance and operating training for personnel
- Modernization
- Available 24/7
- Identifying potentials to reduce operating costs
- Payments tied to achievement of targets
- Lists of spare and wear parts so that orders can be dealt with promptly
- Involvement of sub-suppliers for full plant service
- Audits for performance and safety engineering assessments of drying operations
- Consulting on optimization/rebuild of drying systems



System solutions for sewage sludge

Worldwide successful



Fluidized bed drying

Energy efficient and environmentally friendly

With the sewage sludge drying plant in Shanghai Bailonggang, the largest sewage treatment plant in Asia, the three lines forming this fluidized bed drying plant are making a further contribution towards environmentally friendly disposal of the sewage sludges produced in wastewater treatment. The energy combination between digestion and drying permits high energy efficiency with the digester gases generated in the digester towers.



Belt drying

Use in the cement industry - sludge disposal with no residue

The order carried out for a European cement factory contains the world's largest belt drying plant, with a water evaporation rate of 8 t/h. 100% of the thermal energy used to heat the dryer in the plant is recovered from the waste gas from the cement factory. The plant supplied incorporates one of the most modern and innovative concepts for protection and conservation of resources.



Drum drying

The world's largest drying plant for sewage sludge

The water treatment plant in Changi, Singapore, was the first phase of the Deep Tunnel Sewerage System (DSTS). The drum drying plant, comprising five DDS 110 lines, is part of the solids process and is still the world's largest plant of its kind today, with a water evaporation rate of 11,200 kg H₂O/hr per line.

We offer ...

- Complete solutions for new plants
- Modernization and upgrades of existing plants
- Service and maintenance

from specialists with over 40 years experience in the field of thermal sewage sludge treatment.

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