Good for the future: **thermal sewage sludge recovery by EEW.**

Pioneering sewage sludge recovery.

eew
Energy from Waste

EEW Energy from Waste – Ihr Partner für eine nachhaltige Klärschlammentsorgung.

Der Bundesrat hat Ende März 2020 die novellierte Düngeverordnung verabschiedet, die dazu beitragen soll, die anhaltend hohe Nitratbelastung im Grundwasser zu reduzieren. Viele der neuen Vorgaben traten bereits im Laufe des Jahres 2020 in Kraft; für Gebiete mit besonders hoher Nitratbelastung gelten darüber hinaus seit dem 1. Januar 2021 noch strengere Beschränkungen.

Für Kläranlagenbetreiber erhöht sich damit der Handlungsdruck: Die erheblichen Einschränkungen bei der landwirtschaftlichen Verwertung und die absehbare Pflicht, die wichtige Ressource Phosphor zu recyceln, führen dazu, die Klärschlammentsorgung in naher Zukunft neu organisieren zu müssen.

Umso relevanter wird die thermische Klärschlammverwertung als besonders nachhaltiger Weg, um diesen Herausforderungen zu begegnen. Allerdings sind die thermischen Verwertungskapazitäten begrenzt. Die Folge: steigende Preise. Besonders Kommunen sind davon betroffen, weil oft nur wenige Partner zur Lösung dieses akuten Problems verfügbar sind.

EEW Energy from Waste blickt auf über mehr als 50 Jahre Erfahrung in der energetischen Abfallverwertung zurück. Mit diesem Know-how und mit ausgewiesenen Experten errichten wir eigene Anlagen zur thermischen Klärschlammverwertung: für die umweltgerechte und gesetzeskonforme Entsorgung bei garantierter Entsorgungssicherheit. Dabei ist uns eine langfristige, vertrauensvolle Zusammenarbeit deutlich wichtiger als ein kurzfristiger Vertragsabschluss.

Zudem: Mit uns können Sie sich auf stabile und faire Preise verlassen und profitieren von einem verlässlichen, auf langfristige Lösungen setzenden Partner.

Auf den folgenden Seiten finden Sie Antworten auf die wichtigsten Fragen, die unsere Kunden umtreiben. Darüber hinaus laden wir Sie herzlich zum Dialog ein, insbesondere wenn Sie weitere Fragen oder ein konkretes Entsorgungsprojekt haben. Dazu finden Sie im beigelegten Faltblatt Ihre persönlichen Ansprechpartner. Wir freuen uns auf den weiteren Kontakt mit Ihnen!

Die EEW Energy from Waste-Geschäftsführung:

Timo Poppe
CEO

Stefan Schmidt
CFO

EEW as a partner:
always on the safe side.

EEW is Germany's leading company for sustainable thermal waste recovery. With more than 1,450 employees, we treat around 5 million tonnes of waste annually. This figure includes more than 400,000 tonnes of sewage sludge original substance with an average dry substance content of 24 per cent, which we co-incinerate. Thanks to our network of plants across Germany, we can avoid unnecessarily long transports and ensure regional value creation. Local authorities, industry and local residents benefit from our highly efficient energy plants which provide inexpensive district heating to households and competitively priced energy to industrial plants. As a service provider with decades of experience in operating waste treatment facilities, we are experts in the management of complex material streams and we are happy to accept your sewage sludge where it arises

17

plants for thermal waste utilisation in Germany and neighbouring countries as well as 2 sewage sludge mono-incineration plants

Around

5.000.000

tonnes of energy recovery capacity, including 400,000 tonnes of sewage sludge original substance

> 1.450

employees

Contents.

This brochure answers the most important questions about pioneering thermal sewage sludge recovery at EEW Energy from Waste.

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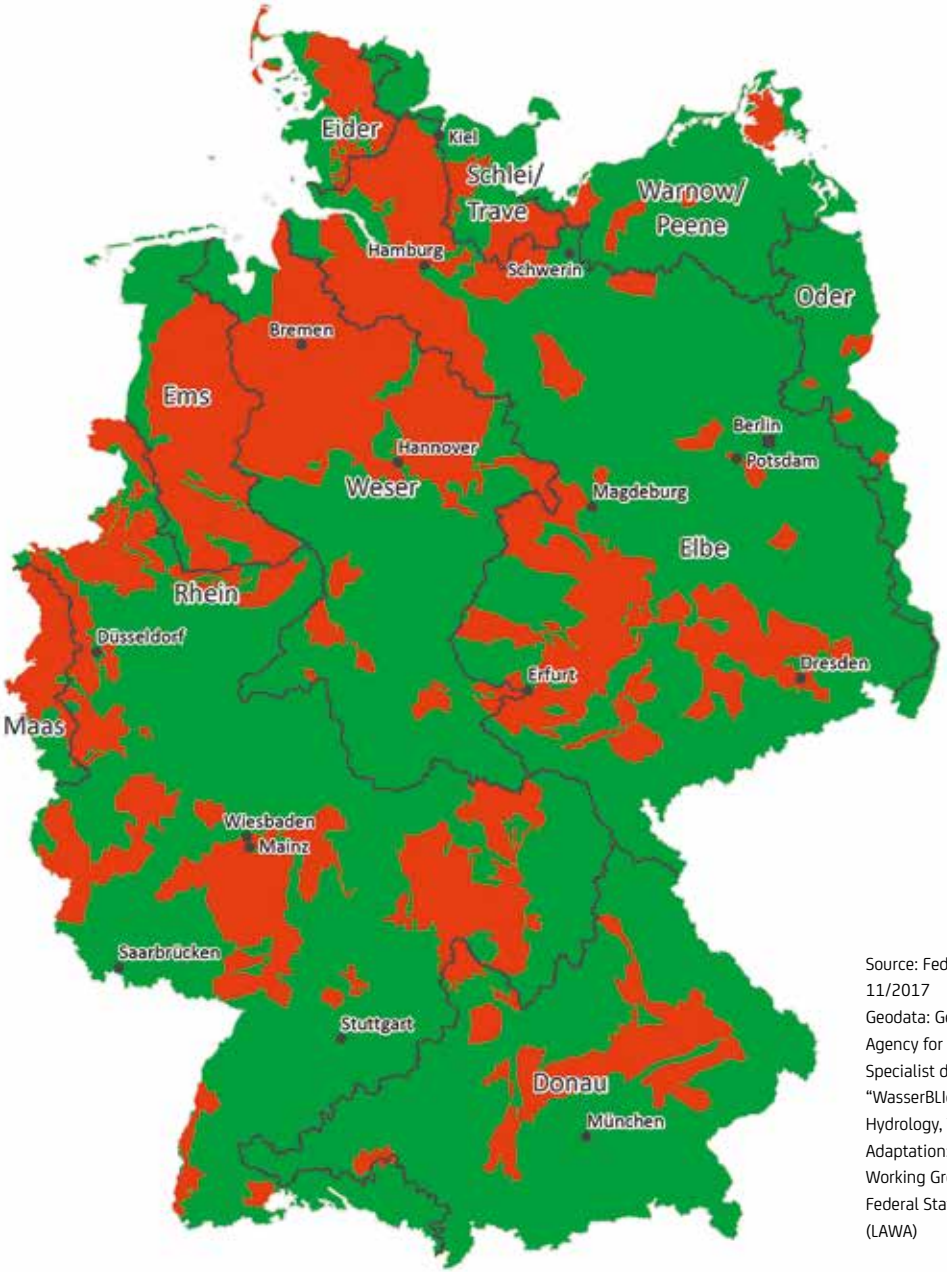
Overview of nitrate pollution in groundwater bodies in Germany.



Good

Poor

Source: Federal Environment Agency, 11/2017
Geodata: GeoBasis-DE / German Federal Agency for Cartography and Geodesy, 2015
Specialist data: Reporting portal "WasserBLIcK," Federal Institute for Hydrology, Version 23 March 2016
Adaptation: Federal Environment Agency, Working Group on water issues of the Federal States and the Federal Government (LAWA)

Why sewage sludge incineration makes sense.

In response to excess fertilisation of agricultural fields and the resulting contamination of groundwater, legislators have introduced new regulations for the treatment of sewage sludge. The aim is to reduce the volumes of nitrate and pollutants entering soil and groundwater. Moreover, for economic reasons, farmers prefer to use fertilisers they produce themselves, such as liquid manure and fermentation residues, instead of sewage sludge as fertiliser. The revised regulations introduce increasingly strict rules for the recovery of sewage sludge: The Fertiliser Ordinance adopted at the end of March 2020 limits the times and areas in which sewage sludge can be applied to fields. The amendments to the Sewage Sludge Ordinance adopted in 2017 reduce the agricultural use of sewage sludge and stipulate phosphorus recycling.

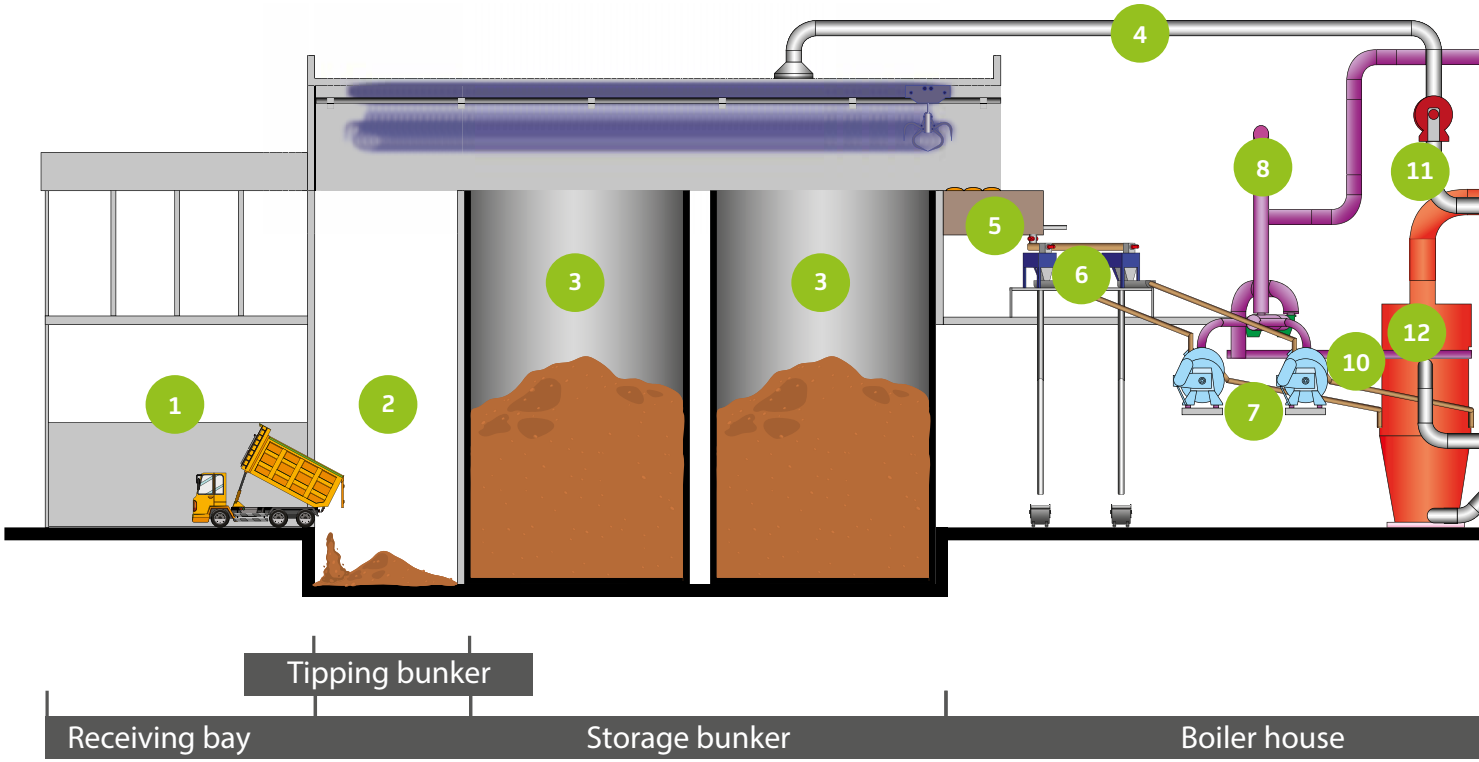
Experience shows that sewage sludge incineration is an especially efficient and environmentally compatible recovery method for sewage sludge. For one thing, thermal treatment safely destroys the harmful organic substances, microplastics and medication residues contained in sewage sludge and kills off possible pathogens. At the same time, flue gas cleaning transforms nitrogen compounds into atmospheric nitrogen and concentrates phosphorus salts in the ash. Only this method enables a phosphorus recycling rate from ash of more than 80 per cent in downstream processes.

With its experience in waste utilisation with energy recovery, EEW is the ideal provider of solutions for sewage sludge incineration and is expanding its offerings. In the enclosed flyer, you can see an overview of our current construction projects.

How does a sewage sludge mono-incineration plant work?

Diagram of the process technology, using the example of the planned sewage sludge mono-incineration (SSI) plant in Stapelfeld.
A description of the process flow can be found on pages 8 and 9.

1. Receiving bay (sealed)
2. Tipping bunker
3. Storage bunker
4. Bunker extraction
5. Push floors
6. Contaminant separator
7. Contact dryer
8. Pipe to EfW plant (vapour)
9. Pipe to vapour treatment plant (optional)
10. Pipe to SSI plant (vapour)



11 Primary air blower

12 Fluidised bed firing

13 Waste heat boiler

14 Steam drum

15 Primary ash filter

16 Heat displacement system

17 Acidic scrubber

18 Alkaline scrubber

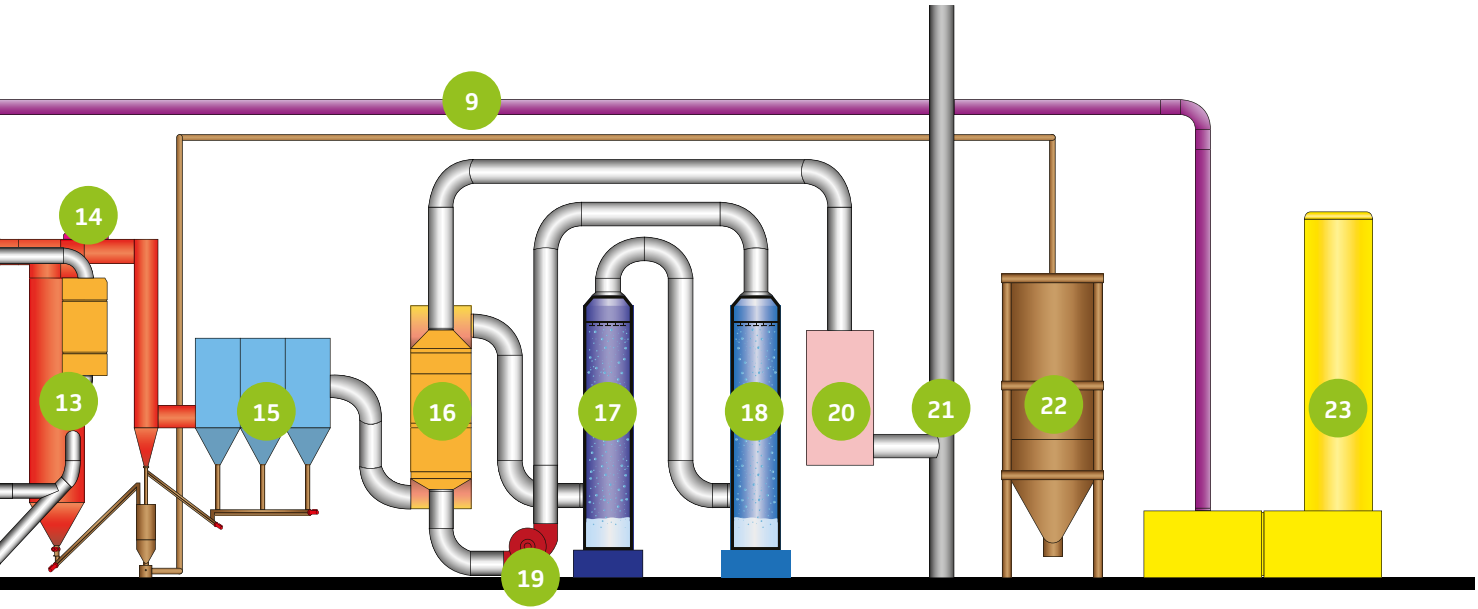
19 Induced draught fan

20 Sound absorber

21 Stack

22 Silo primary ash SSI plant

23 Vapour treatment plant



Flue gas cleaning | Residue storage | Vapour treatment

Mechanically dewatered municipal sewage sludge (around 24 per cent DS (dry substance) by weight) is delivered in covered tipper trucks or container trucks to the **receiving bay** 1 , an air-lock zone sealed off with gates, where it is unloaded into the tipping bunker. After it is tipped out, the sewage sludge is transferred from the **tipping bunker** 2 via a sewage sludge crane to the **storage bunker** 3 , where it gets mixed. The exhaust air from the receiving bay, tipping bunker and storage bunker is extracted by a fan (**bunker extraction** 4) and used as combustion air in the **fluidised bed firing** 12 . This reliably ensures that no unpleasant odours in the exhaust air are emitted from the receiving and bunker areas.

The sewage sludge is lifted from the bunker by the sewage sludge crane and then dispensed by two **push floors** 5 , which each lead to a **contaminant separator** 6 . Once the contaminants have been removed, a screw conveyor transports and distributes the sewage sludge onto the two **contact dryers** 7 . To dry the material to around 43 per cent dry substance (DS) content, the sewage sludge comes into contact with the steam-heated surfaces. The water released from the sludge during the partial drying, along with the condensable organic substances and permanent gases (e.g., carbon dioxide), forms the exhaust vapour. This vapour is transported by **pipe** 8 10 to be combusted in the **fluidised bed firing** 12 and in the EfW plant at the site, or it can be transported by a **pipe** 9 to an **exhaust vapour treatment plant** 23 for processing.

The combustion technology used is a stationary fluidised bed system. The fluidised bed is created by the **primary air blower** 11 blowing air into the firing system from below as swirl gas. The entire fuel bed – consisting of sewage sludge and ash components – is thereby kept suspended. The turbulent two-phase flow in the fluidised bed leads to a very intense heat and material transfer between the burning particles and the gaseous phase. This ensures that the dried sewage sludge completely combusts at temperatures in excess of 850°C. This leads to lower generation of pollutants (nitrogen oxides) and enables efficient primary binding of nitrogen oxides through the addition of a chalky product, such as calcium carbonate. The denitrification of the exhaust gas occurs via an SNCR process, where the non-catalytic reduction agent ammonia water solution (NH4OH) reacts with the nitrous oxides (NOX) resulting from the combustion process to produce environmentally neutral nitrogen (N_2) and water vapour (H_2O).

To safely achieve the minimum temperature mandated by section 6 of the 17th Ordinance implementing the Federal Immission Control Act (17. BlmSchV), an ignition and auxiliary burner is used when the plant is started up from a cold state. The ignition and auxiliary burner – operated with extra light heating oil – is specially optimised for the combustion of sewage sludge in a fluidised bed.

To utilise the heat contained in the flue gas, a **waste heat boiler** 13 is installed immediately after the secondary incineration chamber. Feed water is added to the boiler, which partially vaporises in evaporator heating surfaces. In the **drum** 14 , this steam is separated from the water and the water flows back into the evaporator heating surfaces. On superheater heating surfaces, the steam is superheated to 400°C at a pressure of 40 bar. The live steam, together with the steam from our EfW plants, is then used to generate electricity in existing highly efficient turbine generators. Moreover, we use it to supply district heating for households and industrial customers. Feed water for the boiler is supplied by systems shared with the EfW facilities. In the primary separation stage, a **primary ash filter** 15 captures the fly ash from the flue gas. Boiler ash as well as dust from the primary ash removal are both collected in the **primary ash silo** 22 and transported away for phosphorus recycling.

The wet stage of flue gas cleaning requires cooling of the flue gas following the primary ash removal. To achieve a stack outlet temperature of around 140°C, a **heat displacement system** 16 removes heat from the flue gas stream prior to the scrubbing stage and adds it again after the scrubbing stage. This process is an energy-efficient solution, as otherwise we would need to use produced steam, which would then no longer be available for energy production.

The wet stage of flue gas cleaning consists of two consecutive wet scrubbers. Owing to their physico-chemical properties, the **acidic scrubber** 17 and **alkaline scrubber** 18 bind different toxic gas components. The acidic scrubber separates alkaline components, heavy metals and ammonia slip from the SNCR process. In the alkaline scrubber, acidic toxic gas components (in particular sulphur dioxide) and volatile heavy metals (in particular mercury) are captured.

Following the final scrubbing stage and the two highly efficient droplet separators, the clean gas is then reheated to 140°C using the heat displacement system. The clean gas is then diverted by an **induced draught fan** 19 through the **stack** 21 in a controlled manner, so that it can be transported away by the free air flow.

Sensors are installed in the stacks to measure the emissions that must be recorded. Data from these continuous measurements are reported electronically to the responsible authorities.

What can I do if I want to dispose of sewage sludge today?

Until our sewage sludge mono-incineration plants in Helmstedt, Stapelfeld, Stavenhagen and Delfzijl are available, we can co-incinerate your sewage sludge at our existing thermal waste utilisation plants. We would be pleased to develop a solution to suit your needs. As we have a nationwide plant network, we can provide many local authorities in Germany with a regional waste management solution.

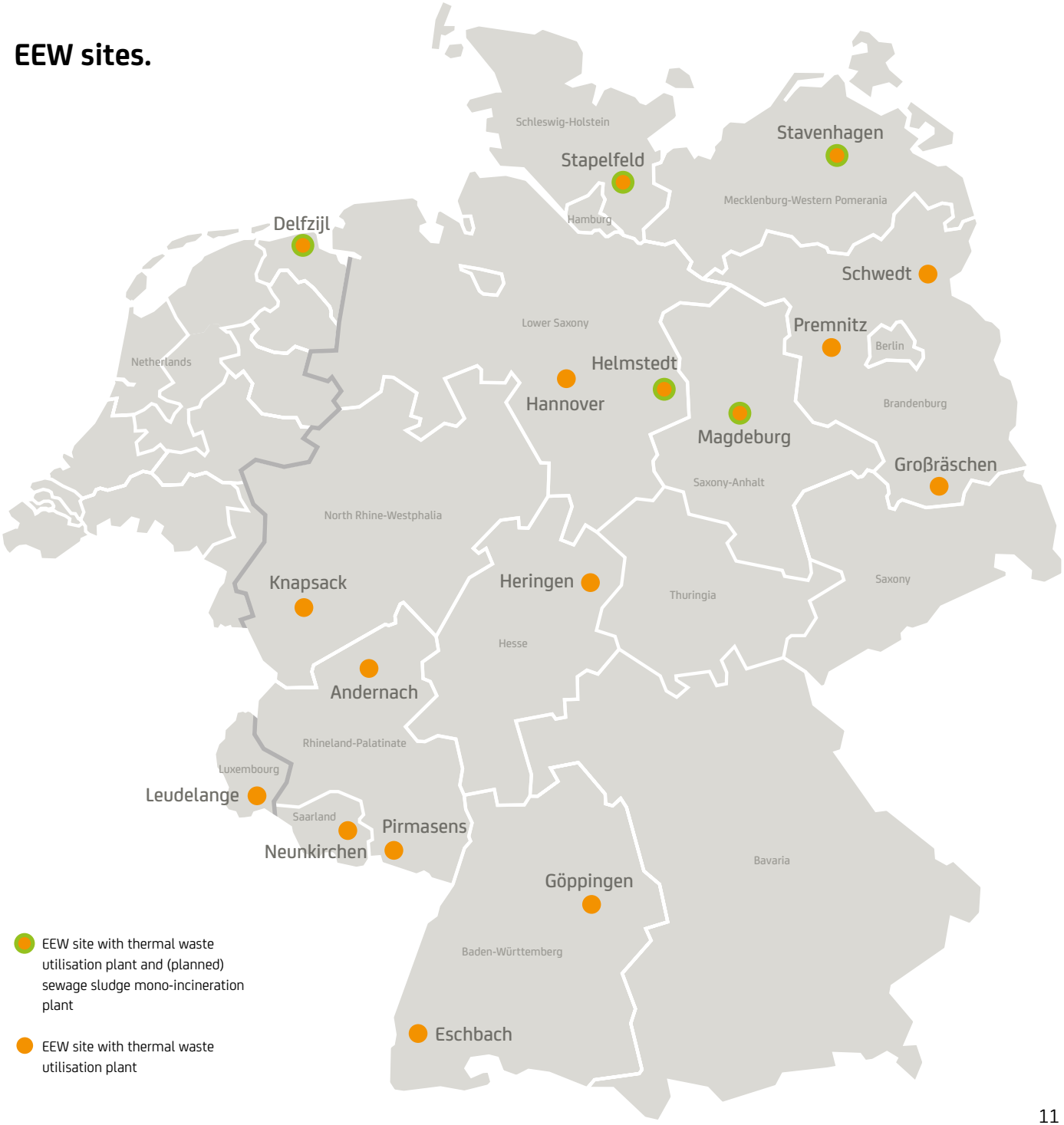
Does this waste management service need to be put out to tender? If so, how?

The obligation to award contracts by tender depends on the thresholds set out in the EU Directive on public procurement. Your EEW contact person will be happy to discuss your individual situation and the advantages of long-term acceptance security for you.

What happens if an EEW plant is unavailable?

We guarantee reliable waste management capacity for our municipal partners – even when the market gets tight. Each EEW plant operates for at least 8,000 hours per year and the time availability is more than 90 per cent. If one plant is idled for maintenance or an unplanned downtime, our other plants can step in (see map of sites on the right). We have a back-up network within the EEW Group which is unique in Germany. We can thus guarantee secure waste management capacity around the clock, 365 days a year.

EEW sites.


Schleswig-Holstein
Stapelfeld
Stavenhagen
Mecklenburg-Western Pomerania
Hamburg
Delfzijl
Schwedt
Lower Saxony
Premnitz
Berlin
Netherlands
Helmstedt
Hannover
Brandenburg
Magdeburg
Großräschen
Saxony-Anhalt
North Rhine-Westphalia
Knapsack
Heringen
Thuringia
Saxony
Hesse
Andernach
Rhineland-Palatinate
Luxembourg
Leudelange
Saarland
Pirmasens
Neunkirchen
Bavaria
Göppingen
Baden-Württemberg
Eschbach
EEW site with thermal waste utilisation plant and (planned) sewage sludge mono-incineration plant
EEW site with thermal waste utilisation plant

Sewage sludge ash as a resource for phosphorus recycling.

Sewage sludge as a raw material.

The conventional method of sewage sludge recovery – application on fields and green spaces – has many disadvantages compared with thermal recovery. Many of the pollutants contained in the sewage sludge can end up in the soil and groundwater. Thermal recovery, on the other hand, has a considerable advantage: It lays the foundation for the vital resource phosphorus to be reclaimed from the sewage sludge ash. With a recycling rate of at least 80 per cent of the phosphorus contained in sewage sludge, thermal recovery is therefore an especially sustainable process and turns the waste product sewage sludge into an important raw material.

How must sewage sludge be processed before it is sent to EEW?

For (co-)incineration, mechanical dewatering is necessary to achieve a dry substance content of between 21 and 35 per cent. Moreover, we must discuss whether you use phosphorus in a biological phosphorus precipitation process or a chemical precipitation method, or if you use synthetic polymers as flocculating agents. Sludge precipitated with polymers should be semi-solid and crumbly-dry and should contain as much phosphorus as possible for recycling from the ash.

How does the sewage sludge get to EEW?

We have decades of experience in managing complex material streams. We accept the sewage sludge where it arises. Partner companies transport the sludge in containers or tipper trailers to our plants – no matter if it is straight from the settling lagoon, has undergone pre-dewatering and is therefore pumpable, or is mechanically dewatered and therefore semi-solid. In any case, we have partners who will also suction up the sludge from the settling lagoon and mechanically dewater it.

Must certain additives be added to the sewage sludge?

No. For precipitation or to improve mechanical dewatering, you can add polymers to the sewage sludge. The addition of lime is not recommended because it impairs combustion, leading to increased costs.

Must the sewage sludge be dried before EEW will accept it?

No, you can save yourself the cost of investing in a drying system. Our plants are designed to accept sludge with an average dry substance content of 24 per cent. It is only necessary to mechanically dewater the sludge to between 21 and 35 per cent. The sewage sludge mono-incineration plants have a dryer that raises the dry substance content to around 43 per cent, so the sewage sludge burns without other inputs.

What happens with the sewage sludge ash?

From 2029, recovering phosphorus from the sewage sludge ash will be mandatory. Until then, there is a transition phase where the sewage sludge ash can be sent to landfill. In the meantime, processes are being developed to ensure the recovery of phosphorus. Together with partners, we are planning to produce fertiliser from the recycled phosphorus for use in agriculture.

Plants need phosphorus to grow, so there is no substitute for phosphorus fertiliser.

A vital resource: phosphorus.

Phosphorus is essential to life – for all people, animals and plants. It is a component of DNA, bones and teeth, and plays a key role in cell metabolism. Phosphorus is also largely responsible for plant health and development. It is therefore an essential component of fertilisers and indispensable in the agricultural sector. It cannot be substituted by any other substance in fertiliser. And since phosphorus cannot be synthesised, it is of vital ecological importance. State-of-the-art thermal recovery of sewage sludge can return phosphorus into the natural cycle and thus make a crucial contribution to protecting the environment and resources.

Who takes responsibility for phosphorus recovery?

We assume responsibility for the phosphorus recycling obligation on your behalf. By 2029 at the latest, we will ensure that the phosphorus will be recovered from the ash of all of the sewage sludge treated by EEW. To guarantee this, we are not only keeping a close eye on the technological developments of the various reclamation processes, we are also engaged in our own research and development.

How can I develop a concept for phosphorus recycling as of 2023?

As of 2023, sewage treatment plant operators must document how they plan to recover phosphorus from sewage sludge. Reclamation of phosphorus will become mandatory as of 2029, which will require considerable investments. It therefore makes sense to develop a concept for this early on and to rely on EEW as a partner who takes on responsibility for legally compliant phosphorus recycling. We will be happy to support you.

3D visualisation of the new sewage sludge mono-incineration plant at EEW's Delfzijl site.

Want to know more?

If you have any further questions or would like a customised offer, please contact our local team.

You can find further information at:
www.wegweisende-klaerschlammverwertung.de

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