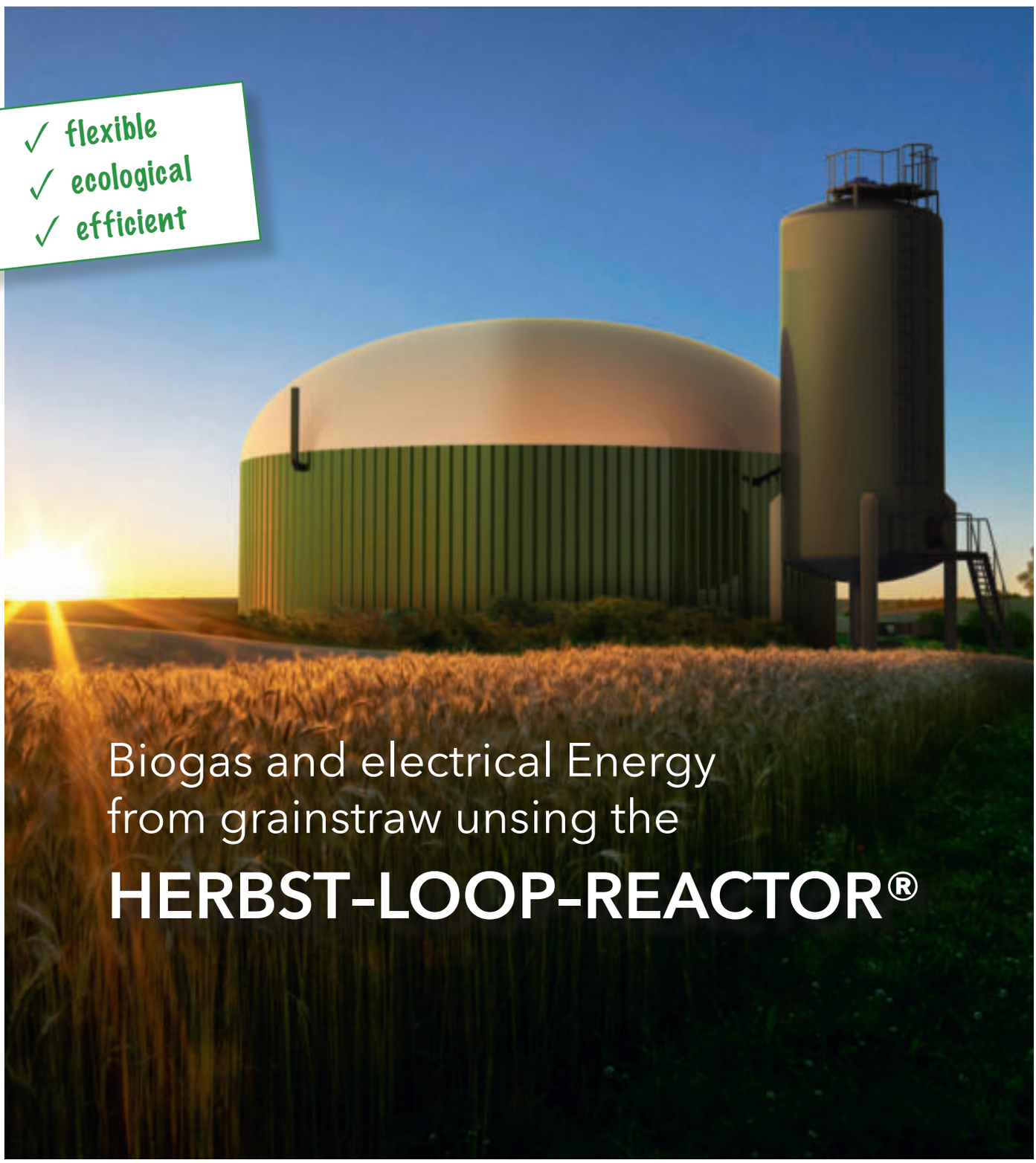
HERBST UMWELTTECHNIK GMBH

We offer the clever solution!



Biogas and electrical Energy
from grainstraw unsing the

HERBST-LOOP-REACTOR®

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SUSTAINABLE AND CLEAN

Your biogenic residue as an energy source

THE PROBLEM

Up to now, most of the organic residues produced on a farm could either not be converted into biogas at all or only incompletely.

THE SOLUTION...

... is the Herbst-Loop-Reactor® process. This process uses the advantages of mesophilic fermentation and anaerobic hydrolysis.

By combining the two process stages, even difficult to ferment by-products such as straw and solid manure can be efficiently converted into biogas. This makes your operation more independent and reduces operating costs.

Herbst-Loop-Reactor® or in short: " Herbst-Reactor".
Illustration of the size ratios of the thermophilic (left) and mesophilic fermenter (right) in the Herbst-Loop-Reactor® process

ADVANTAGES

CONVENIENT AND EFFICIENT

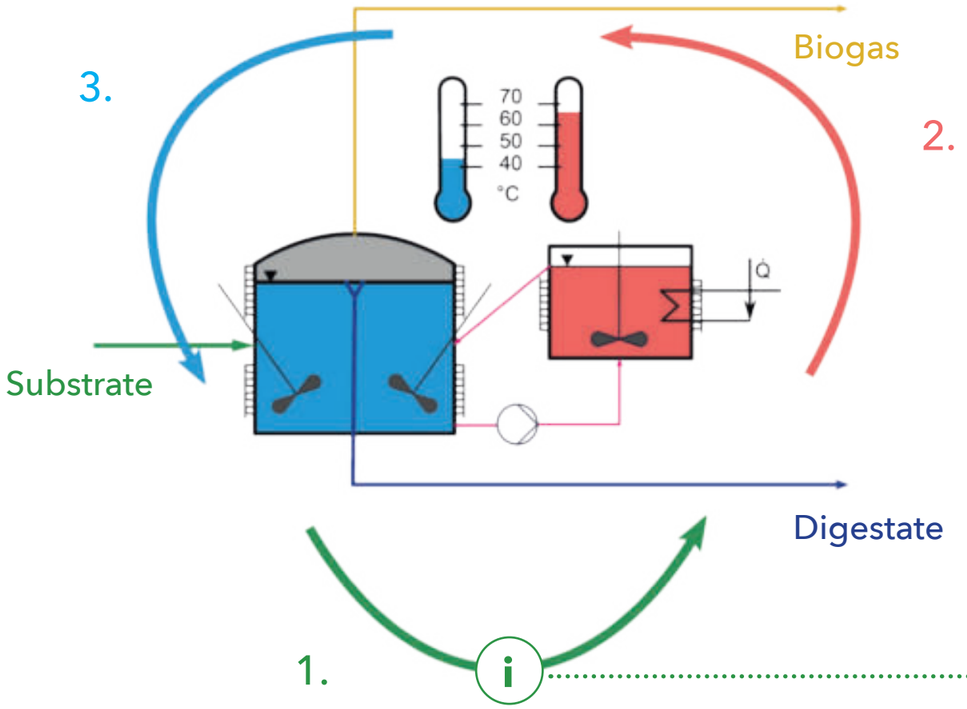
This is how you benefit from the Herbst-Loop-Reactor® process.

- High specific biogas yield: approx. 400m³/t of Straw
- Atmospheric system pressure
- High methane content in the biogas: > 60%vol.
- CO2-neutral recovery of biogas, electrical and thermal energy
- Low energy demand
- Operation possible with 100% suspended straw substrate
- Utilisation of unused straw & other organic residues
- Solid Digestate with dry matter content >25%
- Retrofitting to conventional biogas plants possible
- No special components → low investment costs
- Increse of volume specific fermenter capacity
- Maximum system temperature: 70°C
- Reduced viscosity → less agitating energy required
- High methane content in the biogas: > 60%vol.

SOPHISTICATED AND EFFICIENT

This is how the Herbst-Loop-Reactor® works.

The Herbst-Loop-Reactor® process essentially combines a mesophilic and a thermophilic fermenter. During the fermentation process of approx. 30 days, the straw substrate flows through the mesophilic and the thermophilic fermenter approx. 6 times alternately. This process design leads to an effective breakdown of the organic matter and thus to the highest possible biogas yield.



BIOGAS IN THREE STEPS

1. Degradation of easily fermentable substances

In the first process step, the decomposition and methanisation of easily fermentable substances in the straw suspension takes place within the mesophilic fermenter.

2. Digestion of hardly fermentable organic matter

In the second process step, substances that are difficult to ferment are broken down to form acetic acid in the thermophilic fermenter. This enables the economic use of previously unused organic residues.

3. Methanation of acetic acid

In the third process step, the previously formed acetic acid is converted by mesophilic archaea into biogas or methane. Biogas can also be produced in a targeted manner by time-controlled pumping over, thus increasing the flexibility of the plant.

Advantage over upstream aerobic hydrolysis

The first process step does not yet distinguish the Herbst-Loop-Reactor® from the conventional biogas process. Compared to aerobic hydrolysis, however, the gas yield is additionally increased.

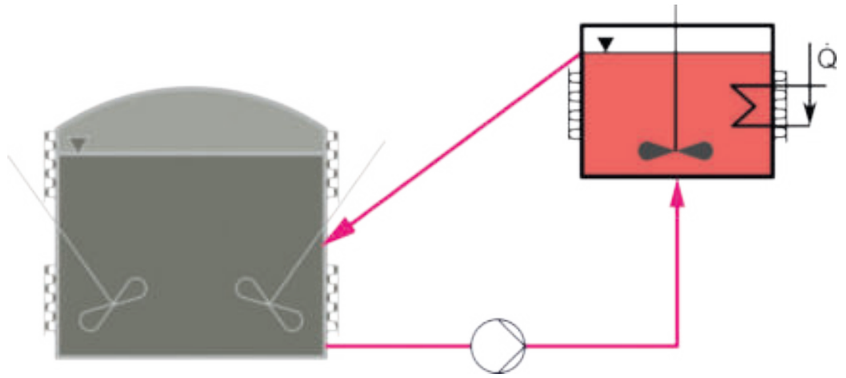
THERE IS MORE.

Increase your biogas yield by up to 50% - through repowering.

By retrofitting an Herbst-Loop-Reactor® to your existing biogas plant, you can significantly increase the biogas yield. Depending on the additionally introduced biomass, the fermenter capacity can be increased by up to 50%.

It should be noted that with this particular process design, biomass that is difficult to ferment and which has so far found no energetic use, can be used. As an alternative to increasing capacity, you can save on expensive silage for the same output and substitute it with inexpensive straw or other organic residues.

How does it work? Quite simple.



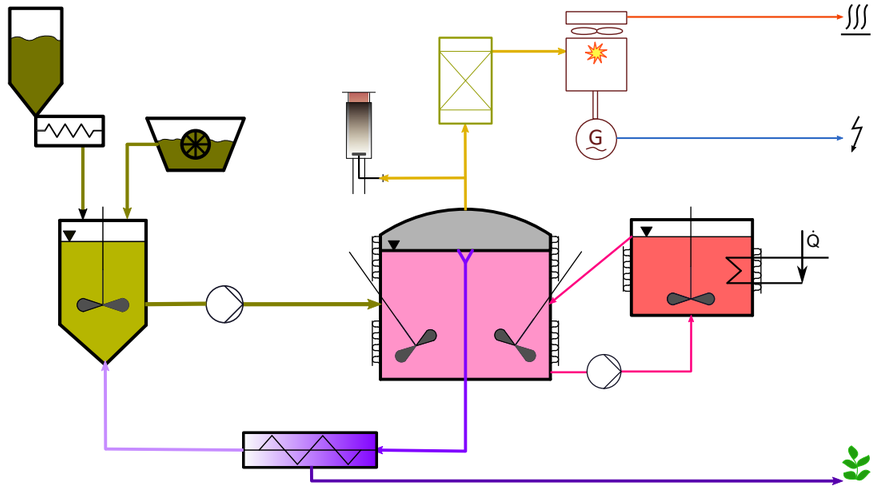
REPOWERING

By integrating a thermophilic fermenter, your existing plant can also be operated according to the Herbst-Loop-Reactor® process. Now you can also use biogenic residues that are difficult to ferment! Due to the improved digestion of the biomass, you increase the biogas yield with the same fermenter size. At the same time, the viscosity in the fermenter is reduced, which saves agitation energy and enables higher solids contents in the substrate. Depending on the substrate composition, an optimised process also eliminates liquid fermentation residues.

CONCEPT OF A BIOGAS PLANT

Let's do the math - it is worth it.

The Herbst-Loop-Reactor® process cannot only be implemented as a new plant. Retrofitting to existing plants is also possible. In the following, two balances for the repowering of a 75kW and a 500kW plant are listed, as well as the dimensions of a 500kW new plant.



Repower 75 → 110kW

Plant	
Nominal electrical power	110 kW_{el}
Nominal thermal power	140 kW_{th}
Mesophilic fermenter (existing)	600 m^3
thermophilic fermenter (new)	70 m^3
Feed	
Substrates:	
Straw	400 t/a
Liquid manure	3.300 t/a
Maize silage	800 t/a
Total amount of substrate	4.500 t/a
Output	
Electrical energy (net)	810 MWh/a
Thermal energy (net)	850 MWh/a
Digestate / fertiliser	3.900 t/a
Dry matter content	13 %
→ Additional yield approx.	50 %

Repower 500 → 750kW

Plant	
Nominal electrical power	750 kW_{el}
Nominal thermal power	990 kW_{th}
Mesophilic fermenter (existing)	3.600 m^3
thermophilic fermenter (new)	400 m^3
Feed	
Substrates:	
Straw	2.200 t/a
Liquid manure	3.500 t/a
Maize silage	9.100 t/a
Total amount of substrate	14.800 t/a
Output	
Electrical energy (net)	5.670 MWh/a
Thermal energy (net)	5.940 MWh/a
Digestate / fertiliser	11.000 t/a
Dry matter content	23 %
→ Additional yield approx.	50 %

Plant 500kW

Plant	
Nominal electrical power	500 kW_{el}
Nominal thermal power	660 kW_{th}
Mesophilic fermenter (existing)	2.500 m^3
thermophilic fermenter (new)	280 m^3
Feed	
Substrates:	
Straw	4.200 t/a
Liquid manure	3.500 t/a
Total amount of substrate	7.700 t/a
Output	
Electrical energy (net)	3.780 MWh/a
Thermal energy (net)	3.950 MWh/a
Digestate / fertiliser	5.100 t/a
Dry matter content	29 %

Advantages

More power with

smaller fermenter volume

→ Reduced by up to 27%

Less and cheaper substrates:
straw or straw-like residues mixed with
liquid manure or as 100% stable manure
Substrate cost reduction of up to 81%
compared to maize silage

Fermentation residue reduced by 51%
No more liquid fermentation residue
due to reduced water input from the substrate

ORGANIC FERTILIZER

Worthy of transport through the Herbst-Loop-Reactor®.

Due to the low water content in the substrate, only little liquid enters the biogas process. Accordingly, the dewatered digestates have a high solids content. The filtrate water produced during the digestate dewatering process is reused 100% in the process. Liquid digestate or other residues are therefore not produced in this newly developed fermentation process. The low water content in the digestate means that less water has to be transported for the same fertilising effect. As the digestate still contains a lot of organic carbon, this fertiliser supports the natural humus build-up in the soil. The result is a healthy soil with a high water storage capacity.

Further treatment of digestate

If the ammonium is to be separated from the filtrate water and the phosphate recovered, a process-supplementing ammonia stripping or MAP precipitation is applied. The products of these processes are ammonium sulphate in solution or as pellets as well as magnesium-ammonium phosphate (MAP or also struvite).
By supplementing these fertilizer recovery technologies, you can produce marketable mineral fertilizers with a very high degree of transportability and simultaneously make your substrate mixture more flexible. Stable plant operation is then also possible when using substrates with a high ammonia production such as dry chicken manure.

WE RESEARCH FOR YOU.

Take advantage of our scientific insights.

With the help of our technical laboratory we are able to determine process data experimentally, with which the planned process or the production plant to be built can be optimised even before construction. Thus, with the Herbst-Loop-Reactor® you get a novel and perfected product which meets all economic and ecological requirements.

FUNDING

Our research projects on biogas production and the avoidance of liquid digestates and wastes are funded by the Federal Ministry of Education and Research (BMBF) and the Federal Ministry of Economics and Energy (BMWi).

Bundesministerium für Bildung und Forschung

Bundesministerium für Wirtschaft und Energie

LIVE THE FUTURE NOW.

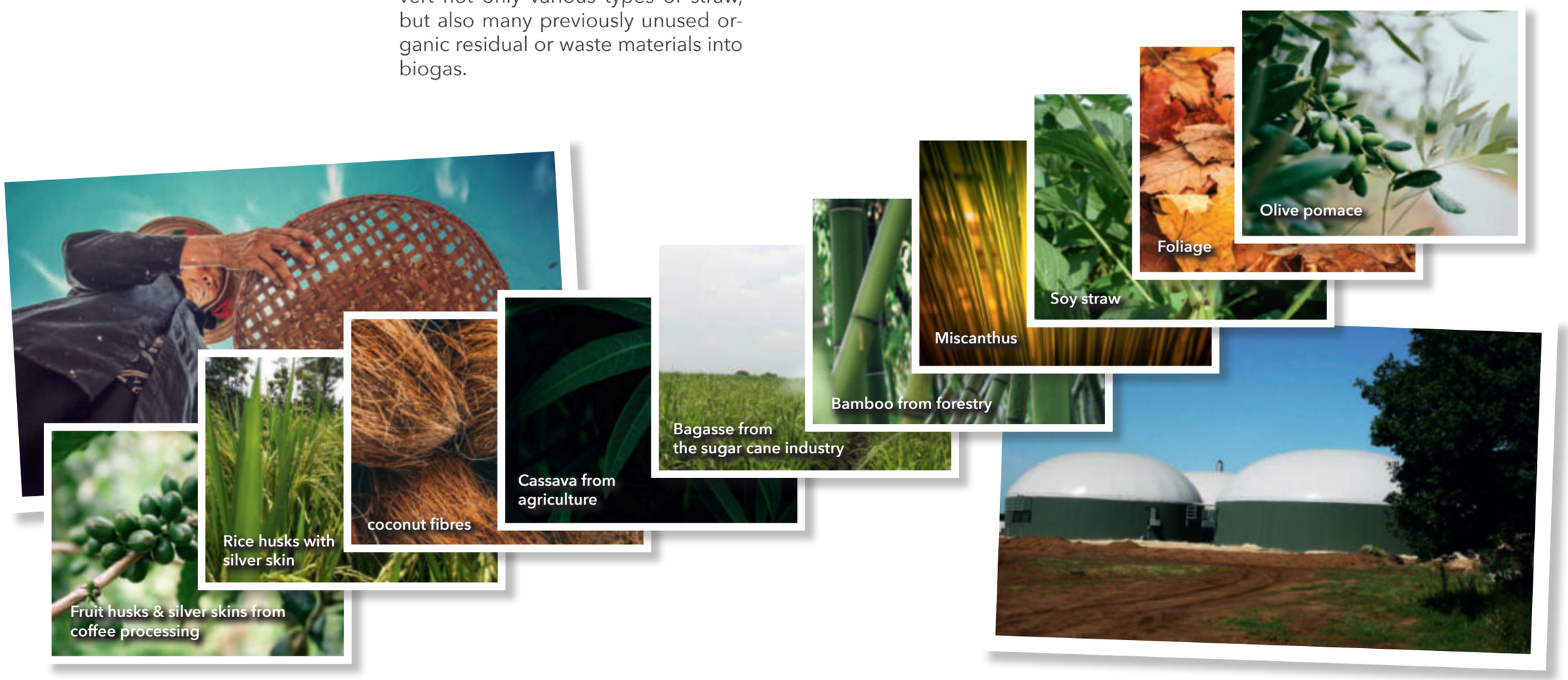
There is no such thing as not possible!

Two successfully completed R&D projects in Vietnam and Germany, in which we were able to ferment both rice and cereal straw, resulted in the new Herbst-Loop-Reactor® process. Driven by this success, we investigated additional substrates in our laboratory plant. This showed that with our new process we can efficiently convert not only various types of straw, but also many previously unused organic residual or waste materials into biogas.

RESEARCH

PROGRESS

In the past, these organic residues could only be fermented insufficiently or not at all. We have found a way to produce biogas from these materials as well.



OUR SERVICE FOR YOU

Get the most out of your Herbst-Loop-Reactor®.

Would you like further support in the planning and optimisation of your biogas plant?
Let us know what you are planning. Together we will find the optimal way.

Our services

- Consulting on the Herbst-Loop-Reactor® process
- Individual design of the process according to your specifications
- Determination of the gas potential of unconventional substrates
- Planning, design and construction of complete or retrofitted biogas plants
- Full-time support for optimised plant operation
- Provision of a tasty crate of beer for you after handover of the functioning biogas plant

Our additional services

- Substrate analyses
- Process monitoring
- Individual plant optimisation

Your advantages

- Stable and optimised plant operation
- Maximum efficiency and performance
- Use of non-standard or exotic substrates

HOW YOU CAN REACH US.

We are gladly there for you.

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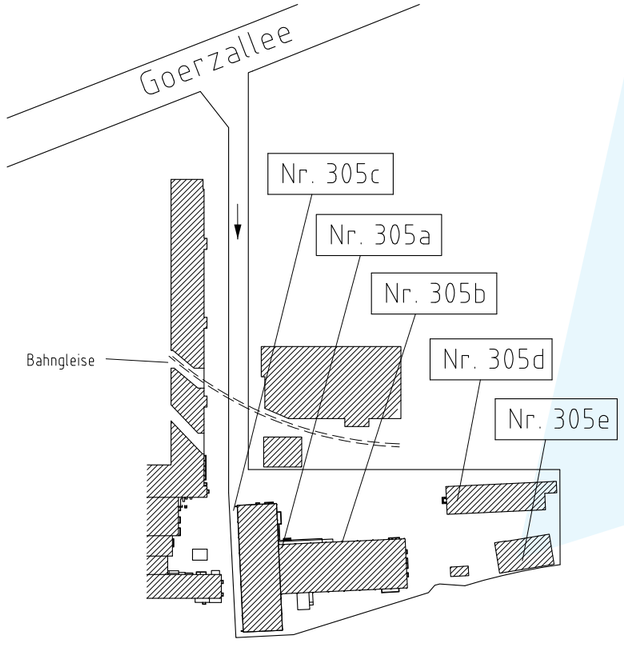

ABOUT US

STILL KNOWN?

Herbst Umwelttechnik GmbH has been a DIN EN ISO 9001:2015 certified company since 2019. The certification was granted for the planning, production and maintenance of process engineering plants.

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We offer the clever solution!

This brochure was printed climate neutrally.