BEKON

ENERGY FOR THE FUTURE
DRY FERMENTATION

Innovative Solutions for Municipalities and
Waste Management Companies

BEKON COMPANY

ENERGY FROM **ORGANIC WASTE**

Today it is more important than ever that resources are used as sustainably as possible. From an economic and ecological point of view, the value of organic waste as a raw material is frequently underestimated. Once this waste material is successfully subjected to efficient and professional processing, it can be turned into high-quality compost, allowing simultaneous generation of gas, electricity and heat. Waste treatment centres then become profitable investments for waste management companies and municipalities.

Company Profile BEKON

BEKON was founded in 1992 in Germany and currently employs approximately 50 people. The company is a worldwide technological leader in the construction of batch biogas plants for generating electricity from waste. The first BEKON system went online in 2003 and has been operating successfully ever since.

The BEKON dry fermentation process presently features approx. **30 patents** which are constantly being amended as a result of the ongoing findings of research and development.

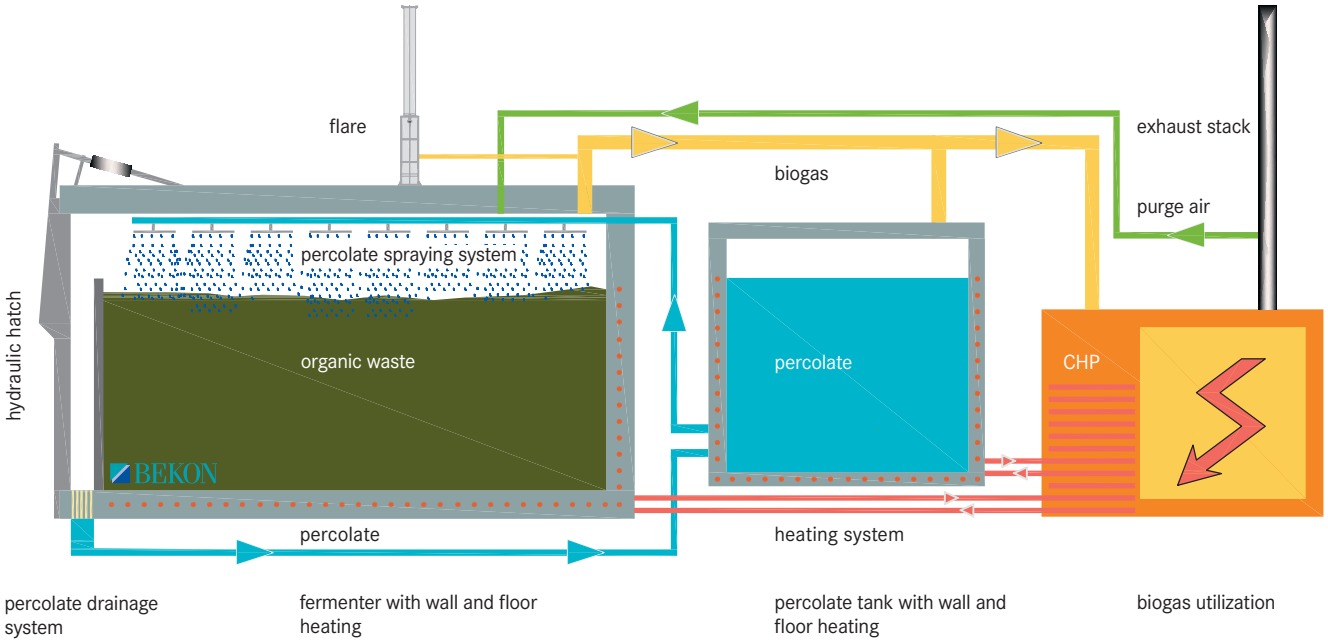
With BEKON, the full potential of organic waste or biomass arising from both agricultural and municipal facilities can now be exploited. The BEKON technology generates biogas using naturally occurring microorganisms. The fermented material is then composted and processed into a high-quality organic fertilizer.

Our objective is to offer municipalities and waste management companies innovative technologies that are able to return organic waste into the natural nutrient cycle. At the same time this means that optimum use is made of the waste material's energy potential.

Bestleistungen im Energiebereich
Best performance in the energy sector
Les meilleures performances énergétiques
I migliori progetti di risparmio energetico

Watt d'Or 2012

THE **BEKON** TECHNOLOGY



Production of biogas by dry fermentation

The superiority of BEKON technology is already apparent from the wide diversity of suitable substrates. Bulk materials with a high dry-substance content can be digested without need for any complex pretreatment of the fermentation material. The principle is quite simple: in the absence of air and following inoculation by previously fermented material, the biological waste begins to digest, immediately resulting in the production of biogas.

The BEKON process is a single-step fermentation process that employs **batch operation**. 'Single step', in this sense means that the various degradation reactions (hydrolysis, acidification and methanisation) constitute one process step.

Filling the digesters using batch operation

The organic waste is collected in a tipping building and taken to the garage-shaped fermenter by wheel loader. Inoculation takes place by mixing the fresh material with material that already has been in a fermenter. Once it has been filled, the fermenter is closed off by a hydraulic hatch and the process of organic waste fermentation initiated. Excess cell fluid (percolation liquid) discharged during the fermentation process is collected by a drainage system and returned to the fermenting material in a cycle to keep it moist. Wall and floor heating is used to keep the temperature of the microorganisms constant. In this way, the conditions in the fermenter are maintained at an optimum level for the bacteria used in **biogas production**. This requires neither further mixing of the materials nor the addition of further material.

Continuous generation of electricity and heat

The biogas thus produced is generally utilised in combined heat and power (CHP) units for **generating electricity and heat**. Continuous operation of the CHP is ensured by filling and operating several fermenters at staggered time intervals. The electricity generated is fed into the electrical grid and is remunerated or sold on, subject to the national feed-in tariffs.

Only a small proportion of the excess heat produced is required for operating the plant. The majority of the heat energy generated is utilised externally; for example, it may be fed into a local or district heating grid or used for drying materials.

Generation of biomethane

Alternatively to power generation, the produced biogas can be processed into biomethane. This can then be fed into the natural gas grid or used as vehicle fuel (compressed natural gas). Thereby the generated energy can be stored and used in a wider market.

SUSTAINABLE CYCLE FOR THE **FUTURE**

Digestate turned into quality compost

Once the fermentation process is finished, each fermenter is fully emptied by a wheel loader. The BEKON process generates a dry fermentation residue which means that it is not necessary to separate or press the digestate allowing further compost processing. Part of the material is used for inoculating new biomass and is returned to the cycle.

BEKON has developed an enclosed **tunnel composting** process for treating the dry fermentation residue. The exhaust air emitted by tunnel composting is cleaned using a biofilter, thus avoiding the emission of odours.

The final composting stage generally takes the form of windrow composting. The final compost is a valuable organic quality fertiliser used in agriculture and gardening, possibly generating additional revenue.

Innovation – thermophilic dry fermentation

The BEKON process can be operated at both mesophilic (37 - 40°C) and thermophilic (50 - 55°C) temperatures.

The thermophilic treatment (50 - 55°C) of biological waste ensures that it is safely sanitized in accordance with the biowaste ordinance. The BEKON process complies with the Animal By-Product Regulation (ABPR), the German BioAbfV and the Swiss VTNP.

This **hygienisation process in the fermenter** is not affected by weather influences and there is no need for the standard and time-consuming monitoring of the post-composting phase.

The thermophilic microorganisms are characterised by a high metabolism which leads to a biogas yield up to 20 % higher than other technologies. The fast thermophilic process enables a reduction of the retention time in the fermenter, leading to a higher throughput for each fermenter.

BEKON's first thermophilic plant has been operating successfully in Thun (Switzerland) since the end of 2010.

This was followed in December 2013 by a second thermophilic plant in Steinfurt (Germany) with an annual capacity of 45,000 tons of source separated waste.

Types of organic waste that can be processed using the BEKON technology

> source separated waste
> green waste
> organic fraction of municipal solid waste
> other organic waste materials

The BEKON process is also suitable for all types of bulk or stackable biomass without any preliminary treatment being required.

Wide range of suitable organic waste materials

Besides municipal source separated wastes, other organic wastes with a **high dry-substance content** can be processed for energy production. Contaminants only have a minor effect on the BEKON process. The robust wheel loader operation enables also the use of difficult input materials.

Modular construction, easy maintenance

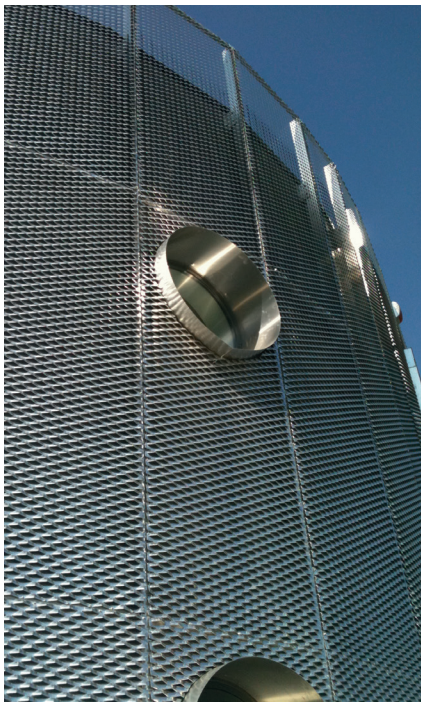
Fermenters are constructed as water retaining concrete structures and are technically gas-tight. The **wall and floor heating system** (patented) is integrated into the concrete wall and floor sections during plant construction in order to optimise the organic degradation processes in the fermenter. The plant's modular construction consisting of several fermenters allows for expansion if desired to increase the plant capacity.

Maintenance costs for the overall plant are very low. Thanks to its patented process, BEKON does not need to use any stirring equipment in the fermenter. The hydraulic hatch of the fermenter is opened upwards to ensure that the integrated inflatable sealing cannot be inadvertently damaged while the wheel loader is loading or unloading. BEKON plants are regarded as **extremely reliable** in their operation because of the robust technology and sophisticated construction. BEKON's technological leadership is established by these factors.

Simple, robust technology with low operating costs

BEKON provides proven and **reliable technology** which can be ideally employed alongside existing composting facilities. The existing infrastructure with wheel loaders can be used ideally. No pumps or mixers are necessary for operation. The material for fermentation generally requires no pre-treatment. For these reasons the machine and personnel operation costs are less expensive compared to the wet fermentation process.

BEKON TECHNOLOGY ADVANTAGES



Automatic software system with remote control

The controlling system is designed **for fully automatic operation**; it clearly visualises the entire fermentation process, including the percolation cycle, temperature regulation and production of the CHP modules. To control the various process parameters is easy and user friendly. Moreover the plant can be comfortably monitored worldwide via the Internet using a mobile device (e.g. smartphone or iPad).

Superior safety concept

The **complex safety** system integrated in BEKON plants **is patented** and includes a patented fermenter flushing process. This process ensures that the transfer from the methane atmosphere in the fermenter head space to the air atmosphere (before emptying the fermenters) and vice versa (after filling the fermenters) can be performed safely. Therefore a dangerous air-methane mixture can never form up inside the fermenter and odour emissions are avoided. Moreover the fermenters are operated at a slight overpressure (20 mbar). Overall the innovative and patented developments of BEKON technology facilitate to maintain high technological standards while allowing the operator to enjoy maximum safety.

Three-way profitability

BEKON's customers profit three times by feeding **electricity and heat** into local grids and by producing and marketing **quality composts**.
BEKON fermentation plants show above-average gas yields which particularly makes them cost-effective.

Flexibility from biogas to biomethane

The BEKON process is flexible with respect to the use of biogas. Besides being suitable for use in CHP modules, it can also be used as biomethane – **following treatment of the biogas to bring it up to the quality of the natural gas grid**. This means that the biomethane can be fed directly into the natural gas grid or used in compressed natural gas vehicles.

AN IMPRESSIVELY **WIDE RANGE OF SERVICES**

General contractor: As a general contractor, BEKON is responsible for all phases of the plant construction, including its cost-effective operation. The scope of BEKON's offer is determined solely by the customer's requirements. Planning, designing and constructing a biogas plant is carried out under consideration of all relevant legal requirements, guidelines and standards and always takes the latest scientific findings and technology developments into account.

Technology supplier: As a technology supplier, BEKON takes over the general design, supply of core components, monitoring of critical construction phases, commissioning and proof of compliance with the agreed service parameters. Other works are carried out either by the customer or through a general contractor.

Financing
Upon request, BEKON can also help you to find financing or investment partners. The wide experience that BEKON has gained from the **construction and successful commissioning of numerous plants** (see list of references) results into an excellent network of reliable partners and financial supporters.

Design
BEKON designs each individual plant exclusively in accordance with the **customer's particular circumstances** and land availability or as an expansion of an existing composting plant. Furthermore as an experienced partner with an established design team, BEKON takes care of all permit formalities.

Construction and commissioning
Thanks to the modular structure of BEKON's fermentation plants, construction phases are clearly defined with manageable time intervals. BEKON takes care of **construction site supervision and commissioning** of the plant. Implementations are of course CE and UL compliant and in line with international ISO standards. The **technology's performance** is confirmed by a test operation to be followed by a performance test run by BEKON.

Operational management
BEKON can also take over the operational management and monitoring of the plant. The focus is to maximize **profitability, continuity and safety**. The plant owner always has access to the plant's performance data using the remote monitoring function via the Internet.

Maintenance, repair and service
BEKON offers an optimum service agreement with regular maintenance intervals and short audits. The main benefits of the BEKON technology are **reliability, high cost-effectiveness and low maintenance requirements**.

Long-standing experience
As market leader in the field of dry fermentation, BEKON stands for particularly efficient processes and high gas yields. Numerous certifications and patents prove that BEKON has the necessary Know-How for the efficient construction of dry fermentation plants. The steadily growing number of **international reference projects** is proof of the reliability of BEKON plants.
Thanks to its proven expertise and professionalism BEKON has so far successfully installed 20 plants in four countries. Further markets in the USA, China and Mexico have been successfully developed as a result of targeted internationalisation.

BEKON REFERENCES AND CURRENT CONTRACTS

GERMANY

Munich – pilot plant

Input	SSOW*
Electrical power	190 kW
Plant capacity	6,500 t/a
Process	Mesophilic
In operation since	07/03

Kusel

Input	Renewables
Electrical power	330 kW
Plant capacity	7,500 t/a
Process	Mesophilic
In operation since	01/07

Munich – expansion

Input	SSOW*
Electrical power	570 kW
Plant capacity	18,500 t/a
Process	Mesophilic
In operation since	11/07

Saalfeld

Input	SSOW*
Electrical power	1,050 kW
Plant capacity	20,000 t/a
Process	Mesophilic
In operation since	11/07

Melzingen

Input	Renewables
Electrical power	526 kW
Plant capacity	13,000 t/a
Process	Mesophilic
In operation since	06/08

Göhren

Input	Renewables
Electrical power	625 kW
Plant capacity	14,000 t/a
Process	Mesophilic
In operation since	06/08

Erfurt

Input	SSOW*
Electrical power	660 kW
Plant capacity	20,000 t/a
Process	Mesophilic
In operation since	11/08

Rendsburg

Input	SSOW*
Electrical power	1,050 kW
Plant capacity	30,000 t/a
Process	Mesophilic
In operation since	11/08

Vechta

Input	SSOW*
Electrical power	330 kW
Plant capacity	10,000 t/a
Process	Mesophilic
In operation since	12/08

Ostrhauderfehn

Input	Renewables
Electrical power	526 kW
Plant capacity	12,000 t/a
Process	Mesophilic
In operation since	12/08

Pohlsche Heide

Input	SSOW*
Biogas upgrading	500 Nm^3/h
Plant capacity	40,000 t/a
Process	Mesophilic
In operation since	11/09

Bassum

Input	SSOW*
Electrical power	526 kW
Plant capacity	18,000 t/a
Process	Mesophilic
In operation since	11/09

Schmölln

Input	Renewables
Electrical power	1,000 kW
Plant capacity	16,000 t/a
Process	Mesophilic
In operation since	11/09

Iffezheim

Input	SSOW*
Electrical power	527 kW
Plant capacity	18,000 t/a
Process	Mesophilic
In operation since	08/13

Steinfurt

Input	SSOW*
Electrical power	1,054 kW
Plant capacity	45,000 t/a
Process	Thermophilic
In operation since	11/13

Ostrhauderfehn – expansion

Input	Renewables
Electrical power	150 kW
Plant capacity	5,000 t/a
Process	Mesophilic
In operation since	08/14

Rendsburg – expansion

Input	SSOW*
Electrical power	350 kW
Plant capacity	17,000 t/a
Process	Thermophilic
Start of construction exp.	10/15

ITALY

Cesena

Input	SSOW*
Electrical power	1,000 kW
Plant capacity	35,000 t/a
Process	Mesophilic
In operation since	12/09

Naples

Input	SSOW*
Electrical power	1,000 kW
Plant capacity	35,000 t/a
Process	Mesophilic
In operation since	08/11

Voltana

Input	SSOW*
Electrical power	1,000 kW
Plant capacity	35,000 t/a
Process	Mesophilic
In operation since	12/12

Rimini

Input	SSOW*
Electrical power	1,000 kW
Plant capacity	35,000 t/a
Process	Mesophilic
In operation since	12/12

SWITZERLAND

Baar

Input	SSOW*
Electrical power	526 kW
Plant capacity	18,000 t/a
Process	Mesophilic
In operation since	10/09

Thun

Input	SSOW*
Electrical power	950 kW
Plant capacity	20,000 t/a
Process	Thermophilic
In operation since	12/10

Krauchthal

Input	SSOW*
Electrical power	250 kW
Plant capacity	12,000 t/a
Process	Thermophilic
Start of construction exp.	03/16

USA

Santa Barbara

Input	OFMSW**
Electrical power	2,262 kW
Plant capacity	70,000 t/a
Process	Thermophilic
Start of construction exp.	07/15

Gloucester City

Input	SSOW*
Electrical power	1,200 kW
Plant capacity	65,000 t/a
Process	Thermophilic
Start of construction exp.	07/15

MEXICO

Culiacan, Sinaloa

Input	Agri-waste
Electrical power	100 kW
Plant capacity	4,500 t/a
Process	Thermophilic
Start of construction exp.	05/15

*SSOW: Source segregated organic waste

**OFMSW: Organic fraction of municipal solid waste


Munich

Pohlsche Heide

Bassum


Napels


Cesena


Vechta


Baar


Thun


Erfurt


Steinfurt

For more information about us and our reference projects, please visit www.bekon.eu or contact us directly.

We look forward to hearing from you and would be happy to advise you personally.

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