

# GICON®



## Biogas plants

from conception to construction  
from one source

# THE RIGHT BIOGAS TECHNOLOGY FOR EVERY FEEDSTOCK

## GICON® MASTERS THE ENTIRE SPECTRUM OF BIOGAS TECHNOLOGY

No matter whether you want to transform organic waste or renewable raw materials, structurally rich or liquid substrates, household waste OR food waste –

GICON® offers you the optimal biogas technology in combination with a feedstock pre-treatment tailored to your needs.

The product of the fermentation process is on the one hand energy in the desired form as biomethane or electrical energy and heat through combined heat and power generation, and on the other hand conditioned fermentation residues for further utilization.

### FEEDSTOCK

STRUCTURE- AND IMPURITY-RICH



STRUCTURE POOR



STRUCTURE-POOR AND LIQUID



### BIOGAS TECHNOLOGY

HIGH-SOLIDS ANAEROBIC DIGESTION



WET FERMENTATION OF WASTES



WET FERMENTATION OF AGRICULTURAL RESIDUES





## BIOGAS PLANTS AND INFRASTRUCTURE FROM ONE SOURCE

GICON® develops, plans and erects biogas plants and can draw on experience in project management, construction and commissioning of more than 300 plants. The team of GICON® biogas experts has more than 150 years of combined professional experience. The engineers and planners have also been commissioners and plant operators themselves.

GICON® employs highly qualified and experienced staff. For complex tasks, interdisciplinary teams with all the necessary competencies are formed to manage projects from a single source throughout all phases – from conception and planning to the permitting phase, commissioning and operational optimization.

In this way, GICON® provides optimal process and system solutions for the respective initial situation of the client. Biogas plants from GICON® process any form of fermentable feedstocks and subsequently provide energy in various ways. Even small plants can be operated profitably and efficiently.

The result is a future-oriented energy generation system that is safe, environmentally friendly, flexible and inexpensive to use.

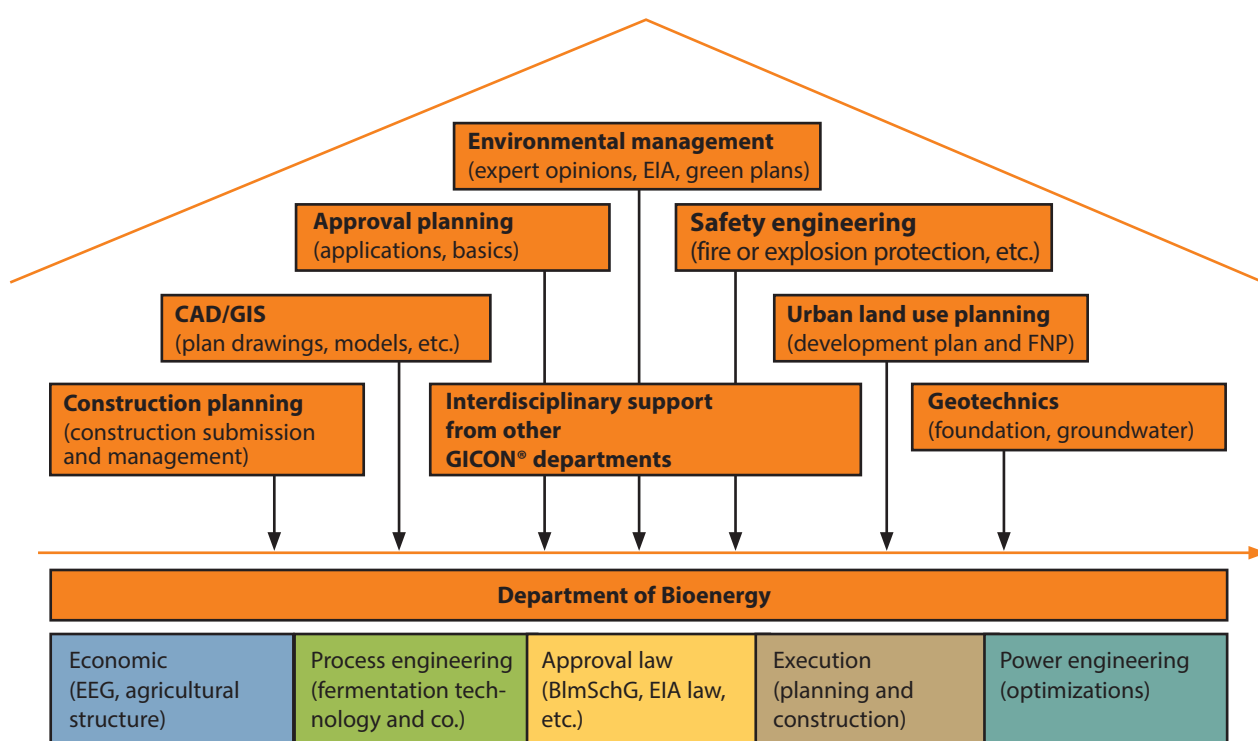
## RANGE OF SERVICES

- Holistic concept and project development, preparation of feasibility studies, costing, preliminary and approval planning, general planning, project coordination and control, detailed design
- Complete engineering services for agricultural and industrial biogas plants up to commissioning
- Flexibilization through subsidized addition of additional CHP capacity
- Technical inspections of existing plants, preparation of refurbishment concepts and technical support for their implementation (repowering)
- Procurement of individual components, taking into account local suppliers, supervision of the construction site and commissioning
- Operational optimization and engineering service for existing plants
- Research and development for the optimization of biogas technologies
- Test fermentations in our own large-scale pilot plant to simulate real operation and to prepare and secure investments
- Preparation of legally-sound expert opinions
- Preparation of operating manuals and operator documents

# GICON® BIOENERGY: INTERDISCIPLINARY FOCUS OF SERVICES

We offer comprehensive and process-independent planning services for industrial and agricultural biogas plants as well as biogas upgrading and biomethane utilization – from concept to commissioning.

- Feasibility studies, concepts, economic feasibility studies
- General planning, technical and administrative project management
- Design and approval planning for new plants to be erected as well as retrofits, extensions and flexibilizations incl. tectures
- Preparation of technical specifications, functional tenders, delivery and service specifications
- Moderation and technical leadership of HAZOP hazard discussions
- Preparation of incident, explosion protection and fire protection concepts
- AwSV technical planning, suitability determinations and coordination with experts
- Technical management and support of contract award negotiations
- Construction planning, such as production halls, calculation of storage capacities and modeling of enclosures
- Preparation of control descriptions and functional specifications for EI&C
- Construction and commissioning management: regular on-site appointments at construction sites, Site H&S Coordinator
- Participation in planning, construction and commissioning meetings as well as their moderation and taking minutes
- Inspection of project progress, execution of factory acceptance tests
- Documentation and coordination: preparation of protocols and project documents (e. g. acceptance and defect notifications), operator documents, TRAS120 certificates
- Scheduling, cost and quality control



Specialist competencies for the entire project and value chain

We plan the following biogas processes:

- Wet fermentation in cylindrical vessels with central agitator
- One- to three-stage wet fermentation in stirred tanks
- HSAD with plug flow reactor (upright/lying)
- HSAD in batch process (box or tunnel fermenter)
- Fixed bed reactors



# OPTIMIZATION AND EXPANSION OF EXISTING BIOGAS PLANTS

## AGRICULTURAL BIOGAS PLANTS

In agricultural biogas plants, residual materials such as liquid manure, solid manure and feed residues are used, often together with silages from energy crops that have been grown specifically for biogas production. The respective plant configuration is adapted to the quantity and properties of the feedstocks used in order to make optimal use of them. The energy released during the process can be sold in the form of electricity and heat or as upgraded biomethane. In addition, a fermentation product is produced that can be applied to fields as a high-quality fertilizer. Through processing, marketable products can be produced here as well.

GICON® does not offer off-the-shelf biogas plants, but plans individual solutions to meet the requirements of the site and to enable the greatest possible added value for the client.

Also retrofits, modernizations or extensions of existing plants are individually planned by GICON® in close coordination with the client. If desired, GICON® will also take over the organization and management of the construction measures as well as the commissioning or support during the operation of the plant.



## EEG AND FLEXIBILIZATION

The Renewable Energy Sources Act (EEG) to promote the production of natural gas equivalent and electricity from renewable sources has been amended many times since its inception and is now once again the focus of political attention. Biogas plants that can produce electricity on demand, i. e. those whose combined heat and power (CHP) units do not have to run continuously to process the resulting biogas, receive subsidies. The amount here depends primarily on the degree to which they are overbuilt, i. e. on how much more electricity production capacity (CHP) there is compared to the generation capacity for biogas (size of the biogas plant). If the CHP units can be switched off for large parts of the day and the electricity can only be produced and fed into the grid when prices on the energy exchange are particularly high, further additional income can be gained. The revenues that can be generated from this so-called load shifting have increased considerably in recent times.

Due to the high electricity prices, other distribution models for electricity are becoming increasingly interesting:

- Sale at a fixed compensation rate to an electricity trader
- Sale to neighboring farms or housing developments
- Use for own needs

Under certain circumstances, it may also be worthwhile to switch to biomethane production – especially if there are no nearby consumers for the heat produced.

GICON® is available to advise its clients in order to find the most favorable variant for the location. If the new construction of a biogas plant is planned, it should generally be equipped with 45 percent as large CHP unit or 15 percent biomethane CHP unit (based on the rated output) as would be required for the processing of the biogas produced. The biomethane variant is particularly interesting if a good heat sink is available.

## ASPECTS FOR CONSIDERATION

The following aspects must be considered when planning the flexibilization of a biogas plant:

- Term in the first remuneration period (flex premium)
- Direct marketing and remote controllability of CHP output
- Grid compatibility and transfer or feed-in point
- Possibility of connection to an existing natural gas network
- Proof of flexible operation in the environmental report
- Permitting procedure, if necessary notification in accordance with §15 BImSchG (Federal Immission Control Act)
- Gas and heat storage capacity
- Electricity and heat demand of the biogas plant and in the neighborhood



## GICON® SERVICES

After the comparison of variants and the client's decision for a degree of expansion, GICON® takes over the preliminary planning, the approval planning and the coordination with the authorities. The application for approval can also be prepared and submitted by GICON®. Due to many years of experience at GICON®, the procedures can usually be quickly processed and positively decided by the authority. GICON® also offers tendering procedures for the components, organizes the construction work, takes over the construction supervision and leads the commissioning. The scope of the contract depends entirely on the client's requirements.



# BIOGAS PLANTS FOR WET FERMENTATION

## (WASTE AND FOOD RESIDUES)

### BIOGAS PLANTS FOR WET FERMENTATION

Organic waste, food scraps and food waste, as well as organic production waste and used cooking fats can be energetically converted to biomethane, electricity and heat in a very efficient way in waste fermentation plants. Depending on the type and composition of the waste streams to be treated, various process engineering solutions are available that have been successfully tested in practice.

One of the central tasks in the design phase is to work out the optimum solution from a process engineering and economic point of view.

This concerns in particular:

- The selection of the most suitable process technology for the treatment and conditioning of the waste (e. g. shredding, removal of impurities, hygienization)
- The selection of the most suitable type of digester (classic stirred tank digester, centrally stirred digester or the plug flow process)

- The selection of the process for the utilization of the biogas (CHP or biomethane plant)
- The selection of the process for further processing of the fermentation product (e. g. production of nutrients and/or compost, purification to feed-in quality, reduction of the required storage volume)

In order to achieve optimum functionality of the planned plant, care must be taken to ensure that the various process engineering processes are optimally coordinated.

Our employees have many years of experience in the planning, construction and operation of waste fermentation plants with all technologies currently available on the market. We offer our clients the development of customized and supplier-independent concepts and help you with our experience to implement them successfully.

You will find an overview of our interdisciplinary range of services on page 4 of this brochure.





# BIOMETHANE / CO<sub>2</sub> RECOVERY

Biomethane plants consist of:

- Raw biogas production
- Raw biogas processing
- CO<sub>2</sub> capture with off-gas treatment, common technologies include:
  - Physical-chemical washing
  - Chemical washing
  - Physical washing / pressurized water washing
  - Amine washing
  - Pressure swing adsorption (PSA)
  - Membrane separation
  - Other, e. g. cryogenic processes and
  - Biogas feed-in plant / fuel utilization

Biogas plants with high or exclusive use of manure, waste and residual materials or raw gas from sewage and landfill gas plants do not only produce CH<sub>4</sub> and CO<sub>2</sub>, but also relevant concentrations of H<sub>2</sub>S, NH<sub>3</sub>, H<sub>2</sub>, depending on the desulfurization process air (N<sub>2</sub>, O<sub>2</sub>) and so-called minor components or trace gases, such as hydrocarbons/VVOCs (BTEX, MEK, alcohols, terpenes), aromatics (toluene, benzene, xylene) or silicon organics (siloxanes).

The CO<sub>2</sub> separation works even better if only CH<sub>4</sub> and CO<sub>2</sub> are fed to it. This can be ensured with the following raw biogas upgrades:

Coarse desulfurization:

- Dosing of iron preparation into fermenter (precipitation)

- Air/oxygen metering in gas space  
this method is not state of the art due to corrosion problems on vessels and feedthroughs and gas quality to be considered when feeding.

Fine desulfurization:

- Bioscrubber
- Activated carbon filter

Removal terpenes / ketones:

- Gas scrubbing after biogas compression

Make your plant fit for the biomethane future with GICON® using the following checklist:

- Alternative concepts for the time after the EEG
- Advice on new regulations regarding renewable energies
- Regional cooperations
- Manufacturer-independent comparison of biogas upgrading processes
- Power-to-gas
- Sustainable fuel
- CO<sub>2</sub> recovery
- Green hydrogen
- Process optimization of the existing biogas upgrading facility
- Mandatory certifications
- Compliance with inspection intervals
- Greenhouse gas reduction quota
- Asset sales



# Biogas upgrading – GICON® reference projects



**Project:** Bergheim-Paffendorf biogas upgrading plant  
**Client:** Malmberg Bioerdgastech GmbH  
**Scope of services:** Project management and engineering support during project execution, interface coordination, supervision of erection and commissioning, process of the biogas upgrading plant: pressurized water scrubbing for 1,400 Nm<sup>3</sup>/h raw biogas  
**Performance period:** 2015 to 2018



**Project:** Bernburg organic waste fermentation  
**Client:** MVV Biogas GmbH  
**Scope of services:** Preliminary planning, design planning, approval planning, monitoring of the approval procedure, tendering and award of contracts, construction and commissioning management, biogas upgrading plant process: physico-chemical scrubbing for 550 Nm<sup>3</sup>/h raw biogas  
**Performance period:** 2018 to 2022



**Project:** Gommersdorf biogas plant  
**Client:** SAS HOPLA GAZ  
**Scope of services:** Design and implementation planning of the process technology, supervision of the construction site and execution of the commissioning, process of the biogas upgrading plant: pressure swing adsorption for 350 Nm<sup>3</sup>/h raw biogas  
**Performance period:** 2019 to 2021

**Project:** Welbeck biomethane plant  
**Client:** BayWa r.e. renewable energy GmbH

**Scope of services:** Preparation of tender documents and engineering support during construction and commissioning, interface coordination, technical project management, process of the biogas upgrading plant: pressurized water scrubbing for 700 Nm<sup>3</sup>/h raw biogas

**Performance period:** 2015 to 2018



**Project:** Westheim biogas upgrading plant  
**Client:** Stadtwerke Bietigheim-Bissingen GmbH

**Scope of services:** Wel, planning, tendering, award of contract and supervision of construction and commissioning for the extension of the composting plant by a biogas upgrading plant, technical project management and coordination, process of the biogas upgrading plant: membrane separation for 880 Nm<sup>3</sup>/h raw biogas

**Performance period:** 2017 to 2020



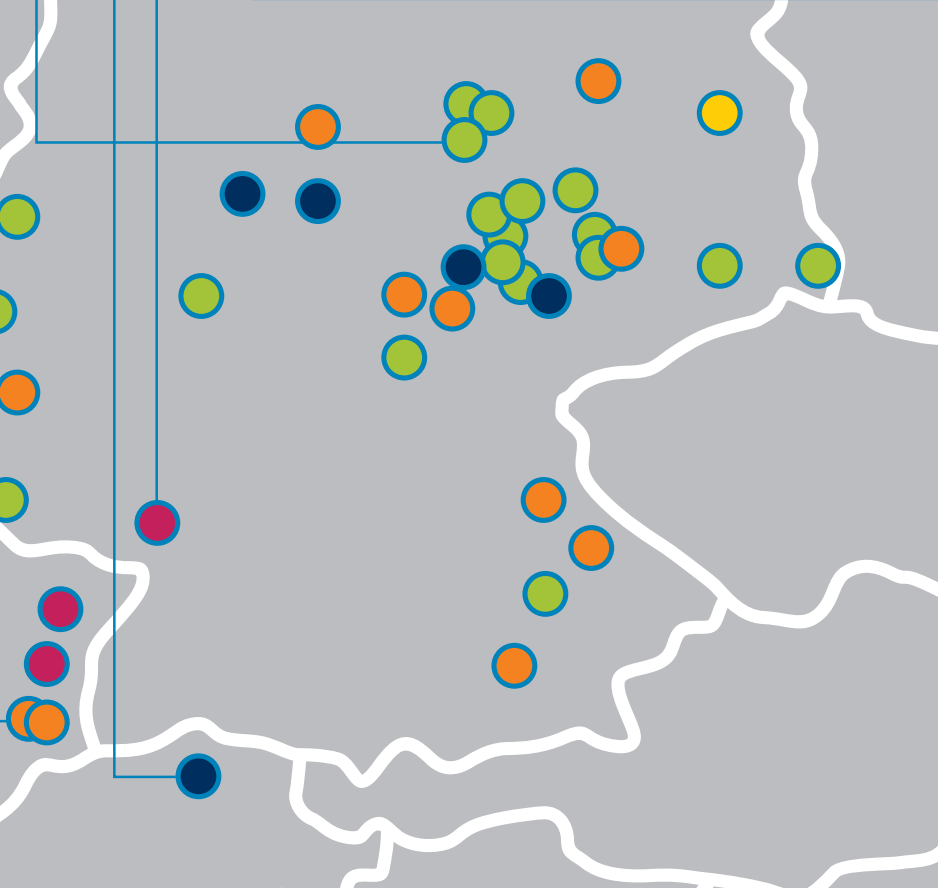
**Project:** Extension of the Werdhölzli digestion plant  
**Client:** Biogas Zürich AG

**Scope of services:** Wel, general planning, preliminary planning, design planning, approval planning, support of the approval procedure, tendering and award of contracts, construction and commissioning management, process of the biogas upgrading plant: amine scrubbing for 1,000 Nm<sup>3</sup>/h raw biogas

**Performance period:** 2019 to 2024



- Physical-chemical washing
- Pressure swing adsorption
- Amine wash
- Membrane separation
- Methanization



# GICON®

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