

# BIOMETHANE PLANTS

300 to 2000 Nm<sup>3</sup>



# ÖKOBIT IN THE SPOTLIGHT

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As a major manufacturer and planner of biogas plants with over 130 national and international projects, ÖKOBIT is one of the most sought-after full-service suppliers within the biogas industry. We develop and build technically intelligent, substrate-flexible biogas and biomethane plants which perfectly correspond to the specific local conditions of our clients.

ÖKOBIT is an owner-operated company with a solid capital base and an exceptionally wide range of services and expertise. Our team of experienced engineers, business experts, as well as

energy and environmental engineers works with full commitment on the implementation of environmentally compatible biogas concepts operating on the highest level of economic efficiency. ÖKOBIT relies on established and exceptionally flexible technology concepts and ensures their effective and safe implementation. As a general contractor, in addition to expert advice and profitability calculations, we take on all tasks from planning and approval to turnkey plant construction.

## WHAT MAKES ÖKOBIT SPECIAL.

From development to operation: ÖKOBIT offers you all the services required for a biogas plant from a single source.

As enthusiastic engineers with business foresight, we use the best biogas technology available on the market. This technology is selected according to strict quality guidelines or specially designed and further developed in-house.

As yield-oriented business experts with technical expertise, we verify the economic viability of every project.

We actively seek a continuous exchange with our customers and operators and regularly conduct plant visits to take up and put into practice ideas and suggestions resulting from practical experience.

Our safety engineering exceeds industry standards. The safety-related acceptance of our biogas and biomethane plants is carried out during an independent inspection by an authorized expert.

ÖKOBIT is involved in research projects, associations and committees with the common aim of continuously developing industry standards further.

ÖKOBIT is fully committed to biogas and is made up by people dedicated to bioenergy who are always available for anyone interested in the subject.



# 13 GOOD REASONS FOR BIOGAS FEED-IN

The most efficient option for using biogas – direct feed-in to the public natural gas network – is becoming increasingly interesting from a commercial point of view. This usage, however, first requires the biogas to be upgraded to natural gas quality in a biomethane plant.

## BIOMETHANE

- ✔ protects our climate
- ✔ reduces dependency on energy imports
- ✔ promotes regional development
- ✔ is environmentally friendly
- ✔ secures local raw material cycles
- ✔ is based on a natural process
- ✔ stabilizes the energy system
- ✔ uses existing infrastructure
- ✔ exhibits a versatility of applications
- ✔ supports efficient combined heat and power systems
- ✔ is a highly efficient biofuel
- ✔ brings partners together
- ✔ is the intelligent option for the future

Source: dena-biogaspartner, 2011

ÖKOBIT is a partner of the dena "biogas partners" project

*Biomethane plant Semd*



# UPGRADING PROCESSES

## HIGH-PRESSURE WATER SCRUBBING (HPWS)

Within high-pressure water scrubbing, compressed biogas is upgraded to methane gas quality using only water with absolutely no chemicals. The methane content (methane purity) is at least 97%.

Upgrading by means of HPWS does not require any specific raw gas quality. Fluctuations in quality have virtually no effect on the operating costs and economic viability of the upgrading plant.

The methane-containing waste gas generated through this process has to be post-treated before being released - methane-free - into the atmosphere.

### Advantages:

- Reliable process, proven in practice
- No use of chemicals
- No waste disposal costs
- No process heat required for regeneration

## AMINE SCRUBBING

Amine scrubbing is an absorption process using a chemical rather than a physical "washing agent".

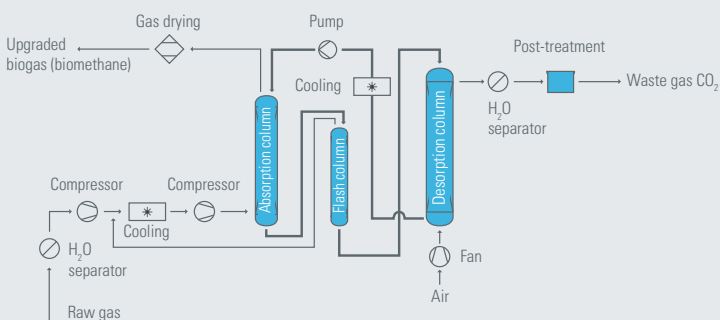
The biogas is dried and desulphurized prior to the separation of the  $\text{CO}_2$ . The absorber – an aqueous monoethanolamine (MEA) or diethanolamine (DEA) mixture – enables the reversible absorption of carbon dioxide. Chemical washing agents usually have the highest loading capacity and selectivity in respect of  $\text{CO}_2$ .

### Advantages:

- High  $\text{CO}_2$  loading capacity
- Unpressurized process
- Very high methane purity
- Low methane loss
- No thermal post-treatment of the waste gas necessary

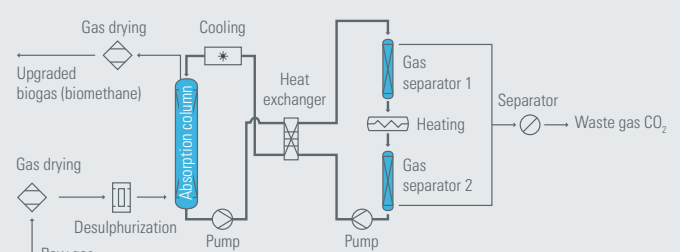
Example illustrations of upgrading processes:

## High-pressure water scrubbing (HPWS)



© ÖKOBIT GmbH

## Amine scrubbing



© ÖKOBIT GmbH

## PRESSURE SWING ADSORPTION (PSA)

The pressure swing adsorption process primarily uses kinetic effects to separate undesirable gases out of the raw gas. Activated carbons and hydrocarbon molecular sieves generally act as adsorbers.

The biogas is first compressed, then cooled and desulphurized. During this process, the gas is usually dehumidified to such an extent that separate gas drying is no longer necessary. The CO<sub>2</sub> adsorption is then achieved through the use of different pressure levels in various tanks.

The continuous operation requires several adsorber units. Depending on the desired methane content of the biomethane four to nine tanks (adsorbers) are operated.

The methane-containing waste gas generated through this process has to be post-treated before being released - methane-free - into the atmosphere.

### Advantages:

- Reliable process, proven in practice
- No use of chemicals
- No occurrence of waste water
- No process heat required for regeneration
- Generally no downstream gas drying necessary

## ORGANIC AND PHYSICAL SCRUBBING

Like high pressure water scrubbing (HPWS), organic and physical scrubbing processes, such as Genosorb or Selexol, are physical absorption processes using a non-toxic, non-corrosive physical solvent.

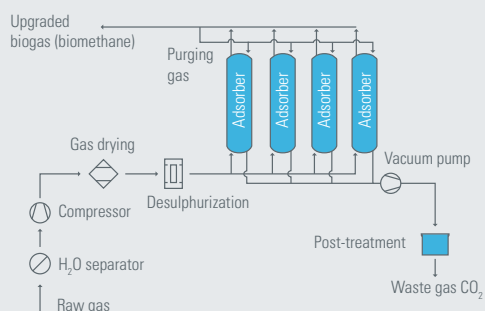
While pure water is cheap and abundantly available, gas scrubbing via an organic or physical washing agent has the advantage that relatively more CO<sub>2</sub> is absorbed by the same volume of liquid (higher loading capacity). Therefore, the plant can be smaller in size.

The methane-containing waste gas generated through this process has to be post-treated before being released - methane-free - into the atmosphere.

### Advantages:

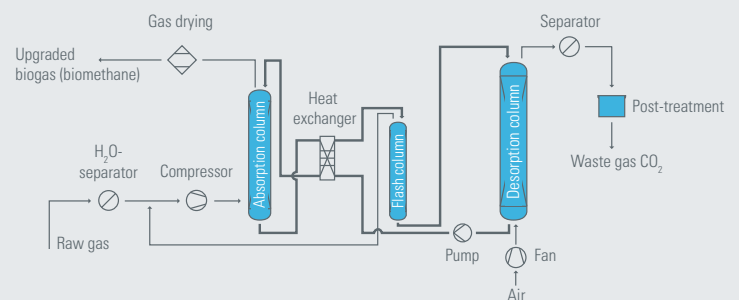
- Regeneration of washing agents using low-temperature waste heat
- Low washing agent losses
- Good CO<sub>2</sub> loading capacity
- Low expenditure for downstream gas drying

## Pressure swing adsorption (PSA)



© ÖKOBIT GmbH

## Organic and physical scrubbing



© ÖKOBIT GmbH

# ESTABLISHED PRACTICE

ÖKOBIT turned its attention to biomethane in 2006 and has since then implemented a large number of projects using different upgrading processes and technologies.

ÖKOBIT provides advice independent of manufacturer and process. We choose, together with you, the best upgrading process and coordinate the overall design according to your requirements and local conditions. Besides the requirements defined by the gas network operator, the choice of the upgrading technology depends on the reliability and economic efficiency of the various processes.

We implement our ÖKOBIT MEGALINE or ÖKOBIT CUSTOMISED PLANT systems to generate raw gas for an optimum biomethane production.

## ADVANTAGES OF THE ÖKOBIT BIOMETHANE PLANT:

Joint selection of the most cost efficient upgrading process, independent of manufacturer

Control of the whole plant using the ÖKOBIT PROCESS CONTROL SYSTEM

Prefabricated container system ensuring rapid execution of construction work

Long-standing experience with different upgrading technologies and manufacturers

Raw gas production using the efficient ÖKOBIT MEGALINE or CUSTOMIZED PLANT systems

Optimum maintenance concepts for maximum operational reliability

## MEGALINE: THE MODULAR PLANT SYSTEM

01 MIXING TANK

02 DOSING UNIT

03 DIGESTER

04 POST-DIGESTER

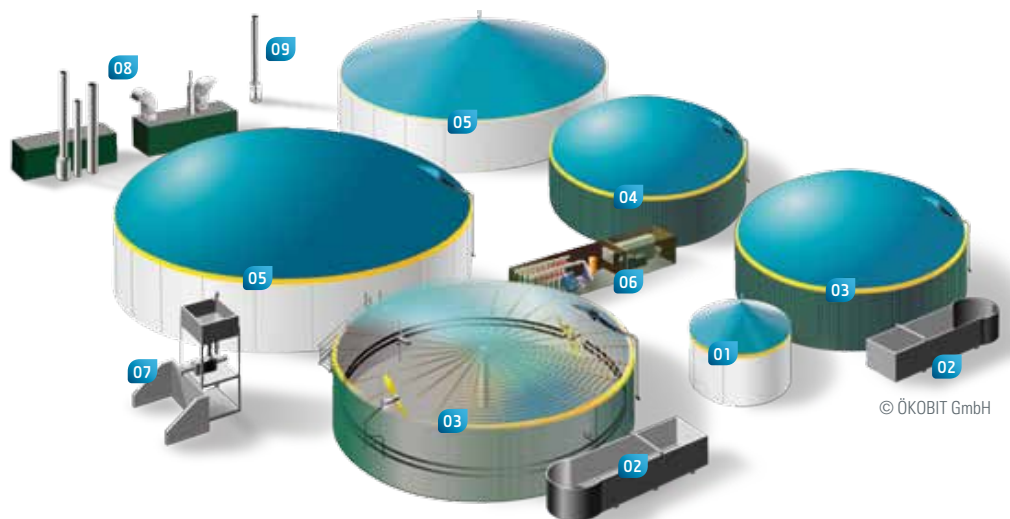
05 FERMENTATION RESIDUE STORAGE TANK

06 PUMP CONTAINER

07 SEPARATOR

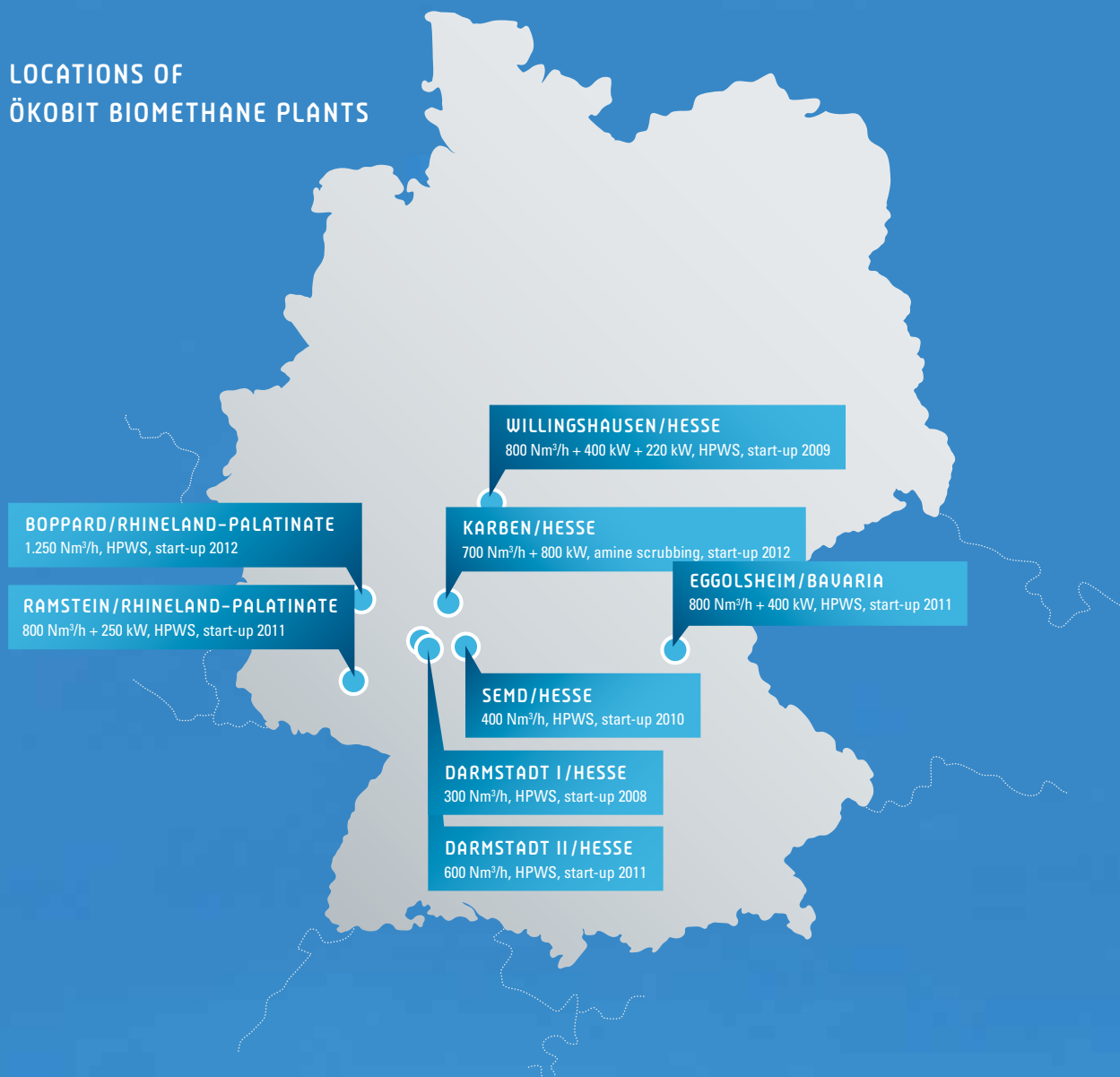
08 CHP/GAS UPGRADING

09 GAS FLARE



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## LOCATIONS OF ÖKOBIT BIOMETHANE PLANTS



As a general contractor we successfully transferred the first biogas in-feed project in Hesse, the Darmstadt-Wixhausen biomethane plant, from paper into practice in 2007/2008. The plant upgrades 300 Nm<sup>3</sup> of raw gas per hour. Following the extension of the plant in 2011, 900 Nm<sup>3</sup> is fed to the upgrading plant, representing a biomethane production of almost 4 million Nm<sup>3</sup> per year. ÖKOBIT is also responsible for the overall operation of the HSE biomethane plant.

*Biomethane plant Darmstadt-Wixhausen*





## PROJECT: WILLINGSHAUSEN/HESSE

### TECHNOLOGY

1 mixing tank, 2 digesters, 1 post-digester, 3 fermentation residue storage tanks, separation, pump container

Upgrading concept: High-pressure water scrubbing + CHP + micro gas network with satellite CHP

### RATING

Plant rating:  $800 \text{ Nm}^3/\text{h} + 400 \text{ kW}_{\text{el}} + 220 \text{ kW}_{\text{el}}$

Biogas production/year: 9.1 million  $\text{Nm}^3$

Biomethane production/year: 3.5 million  $\text{Nm}^3$

$\text{CO}_2$  saving/year: 13,200 t

### SUBSTRATES

Renewable primary products + semi-liquid manure

### OPERATION

Construction period: 8 months, year of construction: 2009, extension: 2011

Investor/operator: Schwälmer Biogas GmbH & Co. KG



“We experienced ÖKOBIT is a business partner you can rely on. For us as developers of challenging biomethane projects, this is the key success factor . The potential of the ÖKOBIT technology was even sufficient to install an additionally 400 kW CHP unit to the existing layout.”

*Customer comment by Dr. Andreas Möller and Thomas Knieling, CEOs of ABICON GmbH*

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