Agricultural based Biogas Plants in Europe

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Taiwan
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Engineering Office, specialized in Design and Engineering of Biogas Plants

Foundation: 1999

Team: 20

Experience: > 30 Years

References: ca. 150 Biogas Plants

in: Germany, Japan, Netherlands, Austria, Switzerland, Lithuania, Italy, Slovakia, Canada, USA, Spain, France, Ireland, Russia, India, China and Argentina

Partner in: Japan, Canada, Bulgaria, France, Poland, Italy, Spain, Serbia, Greece and China
Service offerings of Krieg & Fischer in the field of Biogas

- Studies
- Concept Development
- Calculations
- Permits & Approvals
- Engineering
- Tendering and Commissioning
- Supervision of Construction
- Start-up
- Optimization/Retrofits
- Supervision and Consulting
Key account, selected
Biogas Plants in Europe

Dinteloord

Mc Donnell

Noyon

Montargull

Im Brahms

Wiesenau

Szepietowo

Forcate
Agricultural substrates

- Manure, dung from cattle, pig, poultry etc.

- Agricultural wastes as sugar beet pulps, straw, green cut, crop residues, food remains

- Energy crops as corn silage, whole plant silage, or grass silage
Biogas Plant Todendorf, Germany

- Built: 2002/2003
- Substrate: Pig manure, grass silage
- Digester: 2,400 m³ Steel tanks
- CHP: 2 x 180 kW\textsubscript{e} dual fuel engine
- Digester, secondary digester with gas holder roof
- Heat utilization in the pig farm
Biogas Plant Todendorf, Germany

Todendorf with 20,000 pigs, belongs to the biggest pig farms in Germany
In the biogas plant pig manure is digested together with grass silage
In Todendorf the produced biogas is used in two dual fuel engines with 180 kW_{el} each. The produced electricity is fed to the public grid. The heat produced in cogeneration is used in the farm.
Biogas Plant Todendorf, Germany

The heat produced in cogeneration is used in the farm
Biogas Plant Wiesenau, Germany

- Built: 2007
- Input: Cattle manure, cattle dung, corn-, grass-silage
- Digester: 4,300 m³ steel tank
- CHP: 2 x 526 kWₑ gas engine
- Gasholder above secondary digester and storage tanks
Biogas Plant Wiesenau, Germany

Storage of silage

Stables

Biogas plant I
2004/2005

Biogas plant II
2007
Biogas Plant Wiesenau, Germany

- Liquid manure
- Silage and dung with straw
- Use of digestate as fertilizer
- Storage tank
- Secondary Digester
- Storage tank
- Biogas plant 1
- Biogas plant 2

CHP
Biogas Plant Wiesenau, Germany

Dairy farm
Wiesenau
Biogas Plant Bretagne, France

- Built: 2012
- Substrate: Pig manure, sewage sludge, fats, food residuals
- Digester: 2 x 1,100 m³ concrete tanks
- CHP: 400 kW<sub>e</sub> gas engine
- Two digester and secondary digester with gas holder roof
- Digestate treatment with separation, heat utilization
Biogas Plant Böckermann, Germany

- Built: 2004/2005
- Input: Corn silage
- Digester: 4.079 m³ steel tank
- CHP: 2 x 536 kW$_e$ gasengine
- Gasholder above secondary digester, heat usage
Biogas Plant Montargull, Spain

+ 40° C
Ambient Temperature

- Built 2007
- Input: Pig manure, FOG, slaughterhouse waste water sludge
- Digester (2,080 m³) and secondary digester with gas holder roof
- Special gas cooling system adopted to high ambient temperature
- CHP: 364 kWₑ
- Invest 820,000 €
Biogas Plant
Im Brahmov
Moldau
CZ

Heat utilization

- Built: 2005
- Substrate: Kitchen waste, pig manure, horse dung
- Digester: 2 x 1,205 m³ concrete tank
- CHP: 4 x 190 kW\textsubscript{e} gas engine
- Mesophilic process, engineering with hydrolysis
- Distribution of heat in heating pipes beside others to the castle hotel with thermal bath
Biogas Plant Forcate, Italy

- Built: 2010
- Input: Grass- and corn-silage
- Digester: Concrete tank 1,700 m³
- CHP: Gas engine 365 kWₑ
- Separation, thermophilic operation
Biogas Plant Belgorod, Russia

- Build: 2012
- Substrate: Pig manure, sewage sludge, slaughterhouse waste (entrails, rests of skin with bristles, meat particles), corn silage
- Digester: 2 x 3,035 m³ steel tank
- CHP: 2 x 1.2 MWₑ
- Two primary digester, two secondary digester, mesophilic
- Adoption to cold climate
Biogas concept

Manure → Solid substrate → Solid input device → Biogas plant → Biogas → CHP → 42% Electricity, 38% Heat

Digestate → Fertilizer
Biogas concept with upright digester

**Substrate**
- manure
- organic waste
- energy crops

**Gas utilization**
- CHP (power, heat)
- direct use (heating, cooking, light)
- upgrading (gas grid fuel, fuel cell)

**Input device**
- piston pump, screw etc. (solids)
- pump (fluids)

**Storage Tank**

**Upright digester**

**Secondary digester**

**Mixer**

**Pump**

**Heat exchanger**

**Biogas**

**Digested substrate**
- storage and use as fertilizer
- treatment
Biogas concept with flat digester

**Substrate**
- manure
- organic waste
- energy crops

**Input device**
- piston pump, screw etc. (solids)
- pump (fluids)

**Gas utilization**
- CHP (power, heat)
- direct use (heating, cooking, light)
- upgrading (gas grid, fuel, fuel cell)

**Storage Tank**
- Biogas
  - Digester
  - Pump
  - Secondary digester
  - Digested substrate
    - storage and use as fertilizer
    - treatment
Biogas concept with a horizontal digester

**Substrate**
- manure
- organic waste
- energy crops

**Input device**
- piston pump, screw etc. (solids)

**Stirrer paddle**

**Digester**

**Biogas**

**Pump**

**Secondary digester**

**Gas utilization**
- CHP (power, heat)
- direct use (heating, cooking, light)
- upgrading (gas grid fuel, fuel cell)

**Substrate**
- energy crops

**Storage Tank**

**Digested substrate**
- storage and use as fertilizer
- treatment
Biogas concepts

Local usage

Transport of biogas

Transmission of biomethane

Biomethane feeding-in
Digestate

before

Digester

after
Digestate

- Use as liquid fertilizer and spread on land

- Treatment
  - solid digestate → composting (solid fertilizer) → drying (fuel…)
  - fluid digestate
    - use as process water
    - further treatment (reverse osmosis, ultra filtration)
Treatment of digestate
Decanter
Treatment of digestate
Separator
Treatment of digestate
Reduction of liquid
Treatment of digestate
Belt dryer
Treatment of digestate
Drum dryer
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