Biogas Regions
Shining Example

Agricultural biogas plant Thomas Karle, Kupferzell

The first biogas plant of Thomas Karle was constructed with simple technology. Mr. Karle's motivation to start producing biogas was to increase the value of his farm by using the liquid manure from fattening pigs, leaves of sugar-beets and organic residues from his farm. To produce the necessary amount of gas Mr. Karle increased the quantity of digested energy crops and added leftovers from the fruit juice and other plant production. While using organic wastes (i.e. lettuce, vegetables and fruit leftovers), leftovers of the juice industry and sugar-beet as a substrate, Mr. Karle transforms what could be a waste product into a resource.

Biogas plant Thomas Karle © Karle

Mr. Karle is an innovative operator who actively looks for new and economically sound opportunities to combine effectively the operation of his farm and his biogas plant. He participated also in research projects by FUL1 and EURALIS Saaten, which were focused on studying crop rotation systems for different combinations of energy crops as: green rye, corn, corn combined with sunflowers, sudan grass (sorghum sudanense), among others. Mr. Karle's aims to take part of the project were to study the crops and gain experience with their application in a biogas plant and to develop rotation systems that suit the given conditions on his agricultural land.

Biogas plant Thomas Karle © IBBK

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A microgas turbine was installed in 2007. With this the heat generated in the biogas plant is used in a solar assisted technology, which causes low emissions of pollutants and noise, to dry the digestate. This was the first time that such a technology was built. Its development and supervision is done by the Hohenheim University. Two main reasons motivated the investment in this technology for the drying of the digestate. First, according to the German Renewable Energy Act the operator of a biogas plant receives an extra bonus if he uses the surplus heat. Second, the biogas plant is operated in a region with a lot of livestock production which results in a nutrient surplus for the available agricultural area. Drying the digestate minimizes the volume and weight of it making transportation into other areas more economical. It makes also feasible to export nutrients from a region which lacks of agricultural areas to others that require fertilizers. With this system an organic fertilizer is produced. It is marketed with the name of NADU (www.nadu-hohenlohe.de). Finally, another advantage is that thanks to this system the efficiency of the biogas plant is greater than 90%.

Biogas plant Thomas Karle © Karle

key data

Operator…… **Thomas Karle**

Location…….. **Kupferzell Füßbach**

Start of Operation (old plant)…… **2001**

Start of Operation (new plant)…….... **2004**

Mikrogas turbine and drying of digestate…… **2007**

Amount of gas produced ……**2,2 Mio m³** per year

Costs ……..**1.200.000 Euros**

Agricultural area: approx. 100 ha arable land

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feedstock

Marc of fruits and vegetables……**2.000 tons** per year

Whole plant silage (maize, rye)…….. ..**3.000 tons** per year

Organic waste (salads, vegetables)…….... **6.000 tons** per year

Rape seed……**600 tons** per year

Pig liquid manure……**200 m³** per year

Cattle manure……..**1.000 m³** per year

Mash and leftovers from fruit juice production……**4.000 m³** per year

production data

Available area for the output of the biogas fertilizer …….. **280 ha**

1 CHP (New plant):

Thermal power of the gas engine …… ……approx.…**360 kW**

Electric power of the engine……approx.….**320 kW**

Generated thermal energy……**5,67 Mio kWh/a**

Generated electric energy …….. **3,24 Mio kWh/a**

2 Micro gas turbines (combined with gas cleaning by Greenvironment)

Thermal power of the gas engine ……..**2x120 kW**

Electric power of the engine……**2x 65 kW**

Generated thermal energy……**2,075 Mio kWh/a**

Generated electric energy …….. **1,079 Mio kWh/a**

Altogether

Generated thermal energy……**7,745 Mio kWh/a**

Generated electric energy …….. **4,319 Mio kWh/a**

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Utilisation of heat ……..**drying of the output of the biogas fertilizer, houses of the owners (7,5 %)**

Power consumption (electricity) of the plant itself ……...**7 %**

Annual delivery of electricity to the (regional) electric grid company **3.5 Mio kWh per year**

Electric grid company……**EnBW**

technical plant description

Old plant

Digester ……... **600 m³**

zinc plated stainless steel slabs (by Schmack Biogas AG)

Mixing: pneumatic mixer (2001), propeller mixer on swivel arm and adjustable propeller mixer (2003)

New plant

Digester ……..**1600 m³**

stainless steel *(Welltec Biopower GmbH)*

Storage tank…… **2,000 m³**

covered with air supported double membrane cover

Mixing: 2 long mixers (by ENVICON, type Biobull

Feed-in system (moving floor conveyor)……**45 m³**

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Operating temperature……**40°C**

Residence time in the digester …… **~ 75 days**

Average expenditure of human labour ……..**4 hours** per day

Surplus heat: Drying of digestate using a thermo system resembling a green house and the so called the „elektrisches Schwein® (electrical pig)“

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