



# Biogas projects – Operators and their plants

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- > Energy for 10,000 m<sup>2</sup> of tomato greenhouses in Mecklenburg-Western Pomerania
- > First plant in the Czech Republic heats nursery and primary school
- > The world's largest natural gas quality processing plant in Güstrow

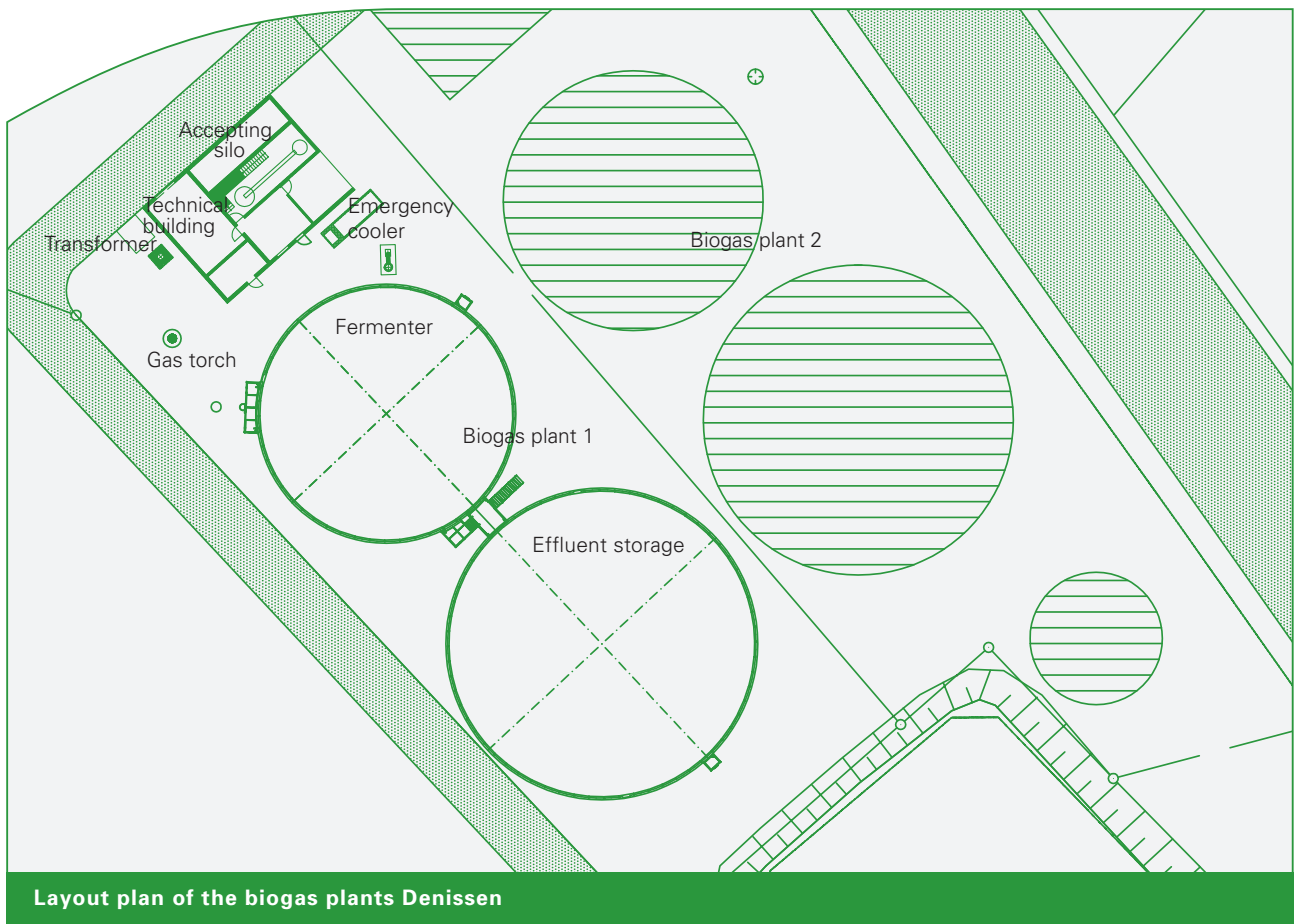
EnviTec Biogas





## Rudie Denissen, owner of a large-scale agricultural business

Rudie Denissen operates a highly efficient approx. 1,000 ha farm together with his wife in Mecklenburg-Western Pomerania. The Denissen family believes in controlled production in order to be able to offer guaranteed quality competitive products: they grow asparagus in heated fields and strawberries in foil tunnels. Two biogas plants supply the necessary heat.



Layout plan of the biogas plants Denissen

### The biogas plants on the Denissen farm.

Denissen operates two biogas plants of which each essentially consists of two tanks and one technical building containing the CHP, the mixer and electro-technology facilities. There is one gas-tight fermenter and one fermentation residue tank.



← The waste heat from the biogas plant heats the foil tunnel for the strawberries.

→ The fields in which the asparagus grows are partly heated in order to be able to harvest and market the product earlier.

→→ A 10,000 m<sup>2</sup> large greenhouse is heated using the waste heat from the biogas plant.



## “The consistent use of waste heat means enormous savings for us.”

The Denissen family decided in 2005 on the first biogas plant which they completed together with EnviTec Biogas. The second plant followed in 2007. Both biogas plants together create approx. 1,000 kW of electrical power per hour and utilise the liquid manure from their own cattle and silage from its home grown maize. The farm now has almost 1,000 ha of land, 620 dairy cows and 600 young cattle. The biogas plant is fitted with a computer system, which independently regulates and monitors the plant.

Only renewable raw materials from agriculture and all the liquid manure occurring on the farm are used in both biogas plants. The silage is mixed with the farm's own liquid manure in a 6 m<sup>3</sup> mixing tank and pumped into the fermenter. This gas-tight tank has a net volume of about 2,500 m<sup>3</sup> and is fitted with a heating unit. At a regulated temperature of approx. 37° C, the methane bacteria ferment the substrate into biogas and high quality agricultural fertilizer, the fermentation residue.



Tomatoes, asparagus and strawberries are temporarily stored in the large hall prior to delivery.



### No emissions – good for the environment and the surroundings

After it has cooled down and been desulphurized, the produced biogas is directly combusted in a combined heat and power unit and converted into electrical power and heat by a generator. The CO<sub>2</sub> released on combustion of the biogas was previously removed from the atmosphere by the plants. As the biogas installations produce CO<sub>2</sub> neutral power, the environment is saved from the production of about 4,000 tons of CO<sub>2</sub> per year. The fermented substrate is temporarily stored in two 4,130 m<sup>3</sup> fermentation residue tanks until it is put to another agricultural use. The liquid manure loses its typical smell due to fermentation in the biogas plant and is to be used in fertilization with improved concentration of nutrients.



The heating unit provides a consistent climate in the greenhouse.



The liquid manure from the stables is used as input material.

### Exemplary efficiency on the Denissen farm

The consistent use of waste heat on the Denissen farm shows the full potential that biogas offers. 100 % of the power is fed into the local grid. Cooling water which is available as 80 to 90° C hot water all year long is used among other things to heat the building and the tomato greenhouse.



## Václav Grubauer, operator of the biogas plant in Lipa, Czech Republic

The plant in Lipa was the first biogas plant that EnviTec took into operation in the Czech Republic. The waste heat from the 500 kilowatt biogas plant supplies a primary school and a nursery with energy.



Layout plan of the biogas plant in Lipa

### The biogas plant in Lipa

The 500 kW<sub>el</sub> plant consists of a fermenter and a technical building. A newly built lagoon serves as a fermentation residue storage. The building contains the CHP, the mixing and the electro-technology facilities.



The substrate residues are stored in an open lagoon following fermentation.

When in the winter the children in the primary school and the nursery in Lipa (Czech Republic) listen to the words of their teachers, they will surely have no idea why it is so comfortably warm in their classrooms. It is actually the waste heat from an EnviTec biogas plant that provides this pleasant learning environment as this is fed by the district heating pipeline of the 500-kilowatt plant in Lipa.

This plant is the first that EnviTec has taken into operation in the Czech Republic. The total sales-related volume in 2008 was around nine million euros corresponding to a total connected wattage of about 3.6 megawatts of electricity.

The Czech Republic offers perfect conditions for the construction of biogas plants: renewable energy and particularly biomass are promoted under the law here as is the case in Germany. Since 2008, the Government has set feed prices at 15,5 cents per kilowatt hour – guaranteed for 20 years.

The average farm in Western Germany spans an average 70 to 80 hectares while there are in the Czech Republic alone 3,000 farms spanning more than 1,000 hectares – and about a quarter of these are planning their own biogas plants. Not least due to the funding from the European Union: EnviTec is currently building plants that are subsidized at between 30 – 50 per cent. And many banks in the Czech Republic are prepared to completely finance biogas plants.

More and more plants are also in a position to recycle waste from the sugar beet industry. “This progressively reduces the proportion of expensive renewable raw materials. Here in the Czech Republic, we can recycle 49 % of by-products,” says Václav Grubauer.

→ The Czech Republic promotes the construction of biogas plants by up to 15,5 cts per kW/hr.

→→ The children of Lipa are pleased with the heat provided by the biogas plant.







Besides liquid and solid manure, food waste is being used more and more in the Czech Republic as input material.

Plants up to now worked mainly with maize silage, liquid manure and solid manure, which is mixed with water.

EnviTec is also a leader in technology at the Valovice location. "In the future, waste heat will be converted into energy." After all, 80 kilowatts per hour is produced in this way; the energy gain is increased by around 15 per cent. This procedure, also called the Organic Rankine Cycle Process (ORC) has not been used before in the Czech Republic.

**»Here in the Czech Republic, there are fields stretching as far as the horizon. There is a lot more potential for biogas.«**

The fact that the farmers can also replace the commercial fertilizer used until now with digestate makes biogas plants more attractive for them. They benefit in three ways: they receive energy from the biogas, use waste heat as district heating or convert this likewise into energy and use the digestate as fertilizer.

This development will also please the children in Lipa. After all, the increasing recycled fertilizer that up to now was stored in open tanks simply stank.





picture: NAWARO BioEnergie AG

## Felix Hess, Chairman of NAWARO BioEnergie AG

BioEnergiepark near Güstrow is unique in the world regarding its size and capability. Biogas is produced to industrial standards from renewable raw materials such as maize, cereals and grass cuttings on a surface of 20 hectares, that is about 27 football pitches. A combination of especially efficient plant technology, high total capacity thanks to industrial management and de-central application of the biogas fed into the natural gas network make it possible to dwarf the overall efficiency of traditional smaller biogas plants.



Layout plan of the BioEnergiepark near Güstrow

### BioEnergiepark near Güstrow

In this BioEnergiepark, 10,000 m<sup>3</sup> of biogas will soon be produced, upgraded to natural gas quality and fed into the natural gas grid per hour. This equals an installed electrical connected wattage of 22 MW<sub>el</sub> per hour. The total plant consists of five modules which produce 2,000 m<sup>3</sup> biogas per hour each. That corresponds to a capacity of around 4.4 MW<sub>el</sub> for every module.



It was completed on the very day of German Unity: BioEnergiepark near Güstrow had its topping out ceremony and also half-time following completion of the world's largest plant for the production of natural gas from biogas. Federal Minister Wolfgang Tiefensee also did not want to miss it:



The total bioenergy park spans 20 ha.

## **The world's largest natural gas quality processing plant – energy for 50,000 households**

Together with around 200 guests, he marvelled at the plant on 2nd October and declared himself a fan: "Alternative energies are one of the ways forward for Eastern Germany. The creation of this plant sets new standards for the efficient use of renewable materials for energy production." This is a very welcome project in a region battling with 20 per cent unemployment. Ninety specialist employees have already built the tanks for the subsequent biogas production, the so-called fermenters.

←← Biogas fed into the natural gas network can be transported over long distance and then used directly on location.

← The biogas park will supply a small town of 50,000 residents with energy.

→ In Güstrow, 10,000 m<sup>3</sup> of biogas are upgraded to natural gas quality and fed into the gas grid per hour.



#### Facts and figures at a glance

<b>Plant configuration</b>	22 MW el./ 54 MW th.
<b>Size of park surface (lease)</b>	20 ha
<b>Needed space for substrate cultivation</b>	10,000 ha
<b>Jobs created</b>	55 FTE
of which directly in the NAWARO®-Park	35 FTE
of which indirectly (transport sector)	20 FTE
<b>Products (annual)</b>	450,000 t
of which maize silage	380,000 t
of which cereal (according to price change)	1,000 t
of which cereal and whole plant silage	60,000 t
of which grass silage	8,000 t
<b>Output</b>	
Biomethane, p.a.	460,000 t
dry digestate/press cake	85,000 t
Liquid manure	140,000 t
<b>Building time for the entire park</b>	18 months
Planning time beforehand	12 months
Introduction of permit phase beforehand	6 months
Permanently registered staff in the park	182
Persons working on the park daily	90
Construction companies registered on the premises	16
<b>Total investment (without cash assets and financing costs)</b>	100,000,000 EUR

All figures are estimates. Details of NAWARO BioEnergie AG are partly rounded up. Version: September 2008.

There will be around 160 employees at the highpoint of construction in spring and 55 full-time jobs here, from secretary to engineer.

It is therefore no wonder that the Mayor Arne Schuldt is enthusiastic: "I congratulate NAWARO BioEnergie AG on its decision to build one of the most modern industrial plants in the field of renewable energy here in our city." This will be part of the network by 2009 and it will be feeding 46 million cubic metres of biogas into the public gas network each year by 2010. This is enough to supply a small town with 50,000 residents.

A specially developed procedure upgrades the biogas into biomethane so it can be fed into the natural gas network. The first feed into the gas network is planned for June 2009.

“With this dimension, NAWARO BioEnergiepark Güstrow is making a substantial and permanent contribution to energy supply from renewable sources,” says Felix Hess, Managing Director of NAWARO Engineering GmbH and Chairman of NAWARO BioEnergie AG. His company placed the order for the plant with EnviTec Biogas and will be taking care of permanent operation. He is pleased that the construction plans are four weeks ahead of schedule.



A total of five modules produce 10.000 m<sup>3</sup> biogas.

Dr. Eckhard Pratsch, Site Manager and Director of NAWARO Engineering GmbH, a subsidiary of NAWARO BioEnergie AG, says: “We want to move into the office building in early March.” It’s clear that we will meet this target as we have already completed approx. 14 million euros of construction work. 20 fermenters for subsequent biogas production, three fermentation residue tanks and the ground floor of the office building have been completed.” This will require investments totalling around 100 million euros. Private investors may invest in the fund, which finances half of the plant. The other half is financed by bank credit.



←← Fifty-five full-time jobs will be created on completion of the project.

← The operation of the plant requires 450,000 tons of biomass each year.

→ Biogas is produced from renewable raw materials on a surface of 20 hectares.

This is also a reason for the local farmers to be happy as the company gets the biomass needed to take the plant into operation from them, a total of 450,000 tons a year. "We have made long-term agreements with the farmers for the supply of the energy crops," says Pratsch, explaining the concept. In return, the farmers receive the so-called press cake, which is used as humus dung as well as liquid fertilizer. Both products arise from digestate from biogas production.

The responsible project manager of EnviTec Biogas, Joachim Karschuck, carries out his job with pride: "The gas can be used everywhere in Germany, not just on location. That's great." He thinks developing and using this technology is fantastic, not least when he thinks of his two sons and his ecological conscience.



A special process is used to convert the biogas to biomethane.

"This is, so to say, my contribution to the future." Olaf von Lehmden, CEO of EnviTec Biogas, says: "This project shows that biogas can contribute to gas supply in Germany and can reduce dependency on imports."



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