

# AUSTRIAS FIRST FEEDING OF UPGRADED BIOGAS TO THE NATURAL GAS GRID

## SUMMARY

Austria's first biogas feeding-plant is operating in Upper Austria since June 2005. This pilot project is run by Erdgas OÖ. and OÖ. Ferngas AG and supplies the existing natural gas grid with biogas up-graded to natural gas quality. An existing biogas plant that used biogas for generation of electricity serves as a gas production plant.

The project is operated by Erdgas OÖ, and its partner OÖ. Ferngas AG, and is supported by the Agricultural Chamber of the State of Upper Austria as well as the state of Upper Austria.

## ENERGY FOR ABOUT 40 FLATS

From 10 m<sup>3</sup>/h of raw gas, about 6m<sup>3</sup>/h of purified biogas is produced and distributed. This equates to an annual energy production of 400.000 kWh, equivalent to the average annual requirement of 40 household apartments. This represents a CO<sub>2</sub> reduction of 108.000 kg/a when compared to commonly-used oil heating. The refined biogas fulfills the quality requirements of the ÖVGW directive G31. Refined biogas can also be used as fuel for vehicles or for cogeneration (for example stationary fuel cells) and is not dependent on the location of gas injection.



Austria's first biogas feeding-plant injects purified biogas into the existing gas grid.

## INCREASE IN EFFICIENCY

Feeding biogas to the natural gas system enables a higher degree of efficiency to be achieved than with the conventional production of electricity (using biogas). Despite refining losses and subsistence of heat and electricity, a remarkable 80% of energy remains to be utilized.

## 80 % ENERGY RECOVERY

Biogas refinement to supply the natural gas grid results in a loss of about 5% (refinement consumption and energy required). In addition, the energy requirement including the heating of the biogas-plant requires about 15% of production. The overall efficiency therefore reaches a remarkable value of 80%. At a suitable site along the gas system, this energy can then be utilized in heating installations, CHP units etc. Through the use of a biogas supply, a higher potential in terms of cost reduction and new applications (cars powered by compressed natural gas, fuel cell) is possible.

## ADVANTAGES AND SYNERGY EFFECTS

Regional usage of energy is more efficient and has a higher degree of overall efficiency using biogas transformation as opposed to previous conventional methods of generating electricity. To optimise energy consumption, the following principle should be recognised: "Thermal utilisation when heat is required – generation of electricity when electricity and heating or cooling is required." As a renewable energy source, biogas makes a positive contribution to the Kyoto-Protocol. At the plant in Pucking, up to 108 tons of CO<sub>2</sub>, which has an important influence on climate, are reduced per year while still using the existing infrastructure. The end-user can benefit from the ease-of-use of natural gas in a more familiar, efficient and flexible manner.

## PROJECT OBJECTIVES

The pilot plant was built to inject purified biogas into the natural gas system. Unlike the utilisation of biogas to generate electricity at the site of production, the entire energy content is provided to the consumer.

## TECHNICAL PIONEER WORK

From a technical point of view, the upgrading of biogas is the main focus of the project.

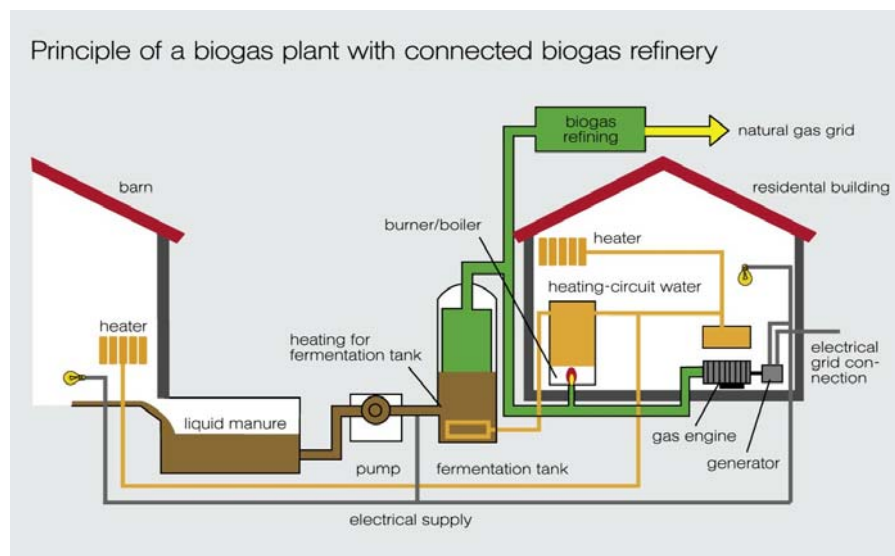
The CO<sub>2</sub>-separation by a pressure swing adsorption technique is an approved system, which is being used industrially for the purification of biogas for the first time in Austria.

## BASIS FOR FUTURE PLANTS

From the economic point of view, the project's assistance in the acquisition of data is essential. The analysis of this data provides a basis for future applications of biogas-plants.

## CONCLUSION OF THE PROJECT

This project is a demonstration plant. The extensive measurement-technology in place facilitates concurrent studies but farly exceeds the needs of a future industrial sized plant.



Overview of the biogas plant pilot project

The operational runtime of the purification plant was set at 3 years from the start up. During this time heaters of selected customers in nearby housing areas are checked regularly and the economic feasibility of further locations is tested.

## PREMIUM QUALITY BY REFINING

The biogas produced is refined in several process steps to meet natural gas standards. The necessary purification process includes desulphurisation, drying and the separation of CO<sub>2</sub>. These process steps are being implemented for the first time on such a scale in Austria.

Under these conditions, this process achieves higher energy yields than the production of biodiesel. The quality of this gas and the injection into the natural gas grid results in a decreasing import quota (EU-target).

## SITE OF THE PLANT

The biogas pilot feeding-plant was built at the existing biogas plant of the Linsbod family in Pucking. The substrate consists of a mixture of manure from:

- 10.500 hens
- 50 breeding pigs

This substrate yields a raw biogas production of about 10 m<sup>3</sup>/h, which was previously used in a combined heat and power plant. The biogas, which is upgraded to natural gas standard, is injected into the OÖ. Ferngas AG gas grid. After desulphurisation, CO<sub>2</sub>-separation and drying, the purified biogas from the



existing biogas-plant is injected into the gas grid via a transfer station.

The particular challenge of the project is cleaning and refining the biogas so that it reaches the high quality standards of natural gas. The fulfilment of these conditions is a requirement for injecting and using biogas without problems.

## HIGH METHANE CONTENT IN NATURAL GAS

The high proportion of methane and the low levels of nitrogen, oxygen and hydrogen sulphide are characteristic for the quality of natural gas. The biogas to be refined is taken out of the pipeline via a valve between the biogas-plant (including the storage tank) and the CHP unit.

## DESULPHURISATION

Passing the first quality check, the main components of the raw biogas are analysed and the biogas reaches the desulphurisation stage.

This component of the plant is based on a biological process, which converts H<sub>2</sub>S into sulphate and then discharges it. The system is designed to reduce the concentration of the incoming biogas from 2000 ppm down to a maximum of 200 ppm.

During the second quality check, the biogas is analysed again and enters the CO<sub>2</sub>-separation and drying stage (based on pressure-swing adsorption).

## DRYING AND CO<sub>2</sub>-SEPARATION

When entering the system, the biogas is completely purified from H<sub>2</sub>S any remaining by activated carbon. CO<sub>2</sub> is adsorbed by an adsorption material (activated carbon, molecular sieves). Methane, which has less affinity to the adsorbent, leaves the plant with a methane concentration of 97% and is injected into the gas grid at the transfer station.

Opening biogas feeding-plant.

*left to right: Elisabeth und Franz Linsbod (Owners Fuchsn'hof), Dr. Gerhard Siegl (Chairman OÖ. Ferngas AG), Ing. Dr. Johann Grünberger (Chairman OÖ. Ferngas AG), LR Dr. Josef Stockinger (Agricultural Affairs Council), Klaus Dorninger MBA (Managing Director Erdgas OÖ), Ing. Franz Reisecker (Vicepresident of the agricultural chamber)*

## PURIFICATION WITH CARBON

Adsorbents made out of activated carbon are used to remove unwanted gas components, for the desulphurisation as well as for the accumulation of methane.

In the case of the activated carbon process the adsorbent is not reversible; therefore the activated charcoal has to be replaced regularly. In the case of CO<sub>2</sub>-separation, the adsorption is reversible. The molecular sieve is regenerated cyclically by changing the pressure, maintenance is required after several years only.

The third quality control assures the gas quality meets the requirements of the current G<sub>31</sub> (ÖVGW) guidelines. Should the biogas not meet the required quality standards, it is possible to switch the valves automatically at each check-point, passing the biogas back to the gas engine.

*Erdgas OÖ and OÖ. Ferngas AG are among the leading natural gas companies in Austria. The safe supply of ecologically friendly and competitively priced energy to customers are foremost in all our activities. To continue living up to these demands in the future, the testing of new innovations and future technologies is one of the company's main focuses. The project partner of Erdgas OÖ for this project are Biogas Johann Hochreiter GmbH, Profactor, Awite Bioenergie GbR and Schmack Biogas*

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