IEA Bioenergy Task 37

BIOGAS IN SOCIETY
A Success Story from
IEA BIOENERGY TASK 37
"Energy from Biogas"

BRUCK AN DER LEITHA (AUSTRIA)

MEMBRANE UP-GRADING OF BIOGAS TO BIOMETHANE FOR GRID INJECTION

PUBLISHED: APRIL 2013

SUMMARY

The biogas plant at Bruck an der Leitha located in Lower Austria between Vienna and Bratislava, was put into operation in 2004 The biogas plant is part of the Energiepark Bruck/Leitha which was founded in 1995 and also produces electricity from wind and solar energy, as well as heat from a biomass-fired heat-only boiler. The renewable energy generated is distributed by national and regional energy providers to private households or companies.
In addition to the production of heat and electricity by a CHP (combined heat and power plant), biogas is upgraded to biomethane by membrane technology. Electricity is fed into the grid, heat into the district heating network (with the biomass heating plant) and the biomethane into the national gas grid. This kind of upgrading plant is the first in Austria and is the first membrane upgrading plant worldwide. It has been in operation since January 2008.

Fig. 1a: General photos of the Bruck an der Leitha biogas plant

HISTORY OF THE PROJECT

In 1995, different members of the city council for environmental issues came up with the idea of the Energiepark Bruck/Leitha. The aim was to combine energy production with environment and climate protection, as well as to stimulate regional development.
Since its foundation, different technologies for the production of renewable energy have been installed around Bruck/Leitha. The Energiepark started with the utilisation of biomass for district heating in 1999. One year later, wind power plants were installed. In 2002, the Austrian Renewable Energy Law ("Ökostromgesetz") came into effect, which made renewable energy more economically attractive, so a biogas plant was put into operation in 2004. Further facilities were then added to the Energiepark including for solar energy (2010) and electro mobility (2010). A facility for algae production has been built and scheduled to start production by the end of 2012.

Fig. 1b: General photos of the Bruck an der Leitha biogas plant

PROCESS DESCRIPTION

Substrates

The biogas plant in the Energiepark uses about 30,000 tonnes of input material/feedstock each year, mainly organic residues but also crops from farmers in the region. Most of the input material to the biogas plant is organic residue from the food and beverage industry or past the "sell-by date" food.

Biogas plant

The biogas plant (Fig. 1) consists of five digesters. The three main, first step digesters are each 3,000 m³ in size, and the two second step digesters are larger, each with a volume of 5,000 m³.

Table 1; Summary of the biogas plant size and output data

Main digesters	3 x 3,000 m³
Second digesters	2 x 5,000 m³
CHP	2 x 836 kW_{el}
Biomethane	100 m³ CH_4/h

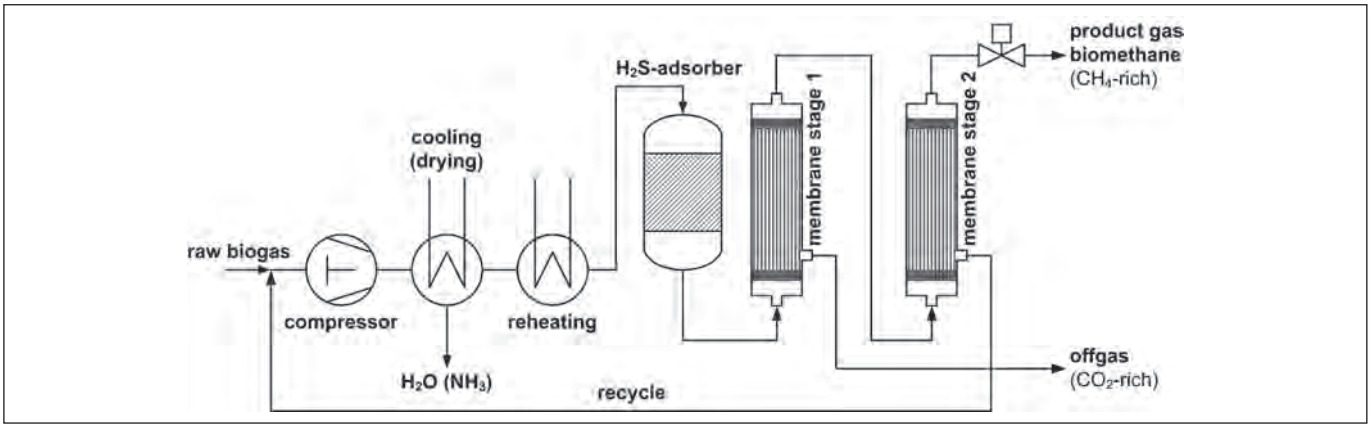


Figure 2: Schematic diagram of the main steps in the membrane up-grading process at Bruck.

Figure 3: View of the shipping container used for the membrane up-grading equipment (left) and the membranes themselves inside the container (left side of right photo).

Desulphurisation of the biogas

The wide range of substrates used in this biogas plant means that levels of hydrogen sulphide (H_2S) in the biogas can vary greatly. The Technical University of Vienna and the Energiepark set up a project for desulphurisation of biogas to address this issue. The desulphurisation unit installed is based on chemical-oxidative scrubbing using sodium hydroxide and hydrogen peroxide. The system includes a new measuring system with a short detection time, and the levels of sodium hydroxide and hydrogen peroxide can be adjusted accordingly. This gives the system the advantage of being able to deal quickly with changes in H_2S load.

Biogas Up-grading

In 2007, the membrane upgrading system for biogas was installed in Bruck by AXIOM and the Technical University of Vienna. It is the first membrane unit to achieve >97 Vol.-% CH_4. Under normal operating conditions the upgrading plant converts 180 $m^3 \cdot h^{-1}$ of biogas to 100 m^3 methane per hour. The biogas up-grading unit consists of a two-stage gas permeation system. Different permeabilities of individual gases through the membranes results in separation of methane from other gases. The waste gas containing most of the carbon dioxide present in raw biogas is mixed with the raw biogas that is not up-graded and which is used in the CHP unit. The >97 Vol. % CH_4 (biomethane) from the membrane separation is ready for final conditioning before injection into the natural gas grid.

This method of up-grading does not require chemicals or other reactants and so does not require associated recovery processes. As a consequence the process is easy to handle, readily adaptable for automation and provides significant potential reduction of costs compared to more commonly used biogas up-grading processes such as water absorption.

Combined Heat and Power

Electricity and heat are the main products generated out of the biogas at Bruck/Leitha. Two CHP units, each with a capacity of 836 kW_{el}, produce electricity and thermal energy, up to 12,000,000 kWh and 15,000,000 kWh, respectively. The heat is used for district heating and supports the biomass-burning facility. The electricity is sold to the national electricity grid.

Digestate utilisation

Approximately 30,000 t of digestate accumulate every year. Local farmers collect the digestate from the biogas plant and use it as biofertiliser. More and more local farmers are recognising the positive effect of digestate as fertiliser.

RESULTS

The implementation of the biogas plant into the Energiepark Bruck is proved to be very successful. The hours of operation of the membrane up-grading unit are approximately 8,000 h a year with a life time of 4 to 5 years. The combined use of heat distribution facilities allows the biogas plant to use all of the waste heat from the CHP unit. Another success of this facility is that the Energiepark and the biogas plant are often involved in national and international projects.

CONCLUSIONS

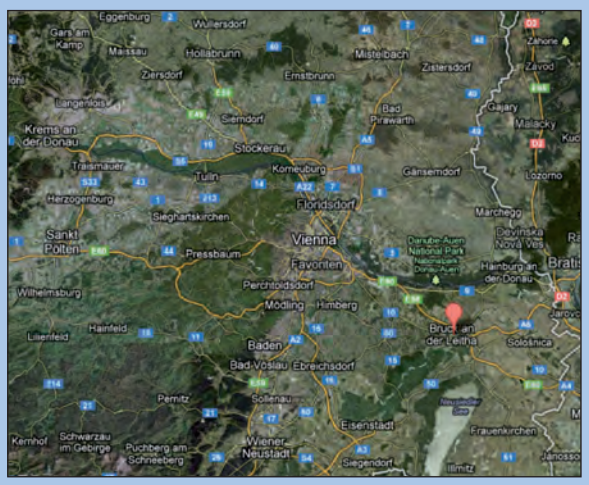
The biogas plant in Bruck/Leitha demonstrates a very good way to use a biogas plant for valorisation of waste in combination with energy and fertiliser production. Additionally, the integration of a biogas plant in an energy park means it is possible to combine it with other renewable energy production facilities and gives a good opportunity to maximise the achievement of sustainability goals and to increase the local value chain. The creation of new jobs is not the only positive effect of this energy park in Bruck/Leitha.

CONTACTS

Biogasanlage Bruck/Leitha GmbH

Szallasweg 1
A-2460 Bruck an der Leitha

biogas@energiepark-bruck.at
www.energiepark.at



IEA Bioenergy Task 37 "Energy from Biogas"
http://www.iea-biogas.net/