BIOGAS IN THE SOCIETY
Information from IEA BIOENERGY TASK 37 Energy from biogas and landfill gas

INJECTION OF BIOGAS INTO THE NATURAL GAS GRID IN LAHOLM, SWEDEN

CO-DIGESTION OF MANURE AND INDUSTRIAL WASTE

SUMMARY

The Laholm Biogas plant in Sweden was started in 1992 with the purpose of reducing eutrophication in the area. It is a central co-digestion plant that receives manure and different kinds of organic waste from the region and turns this into bio-fertilizer and biogas. The biogas has since 2001 been injected into the local natural gas distribution grid and now have replaced around 25% of the regional natural gas consumption thereby reducing the CO_2-emissions by 3700 tons/year.

FACTS

- Treatment of manure and industrial organic waste
- Total biogas production corresponding to 2,4 Mm^3/year CH_4
- Biogas injection into the gas grid replacing 1,8 Mm^3 natural gas annually

Biogas from the Laholm plant is upgraded to natural gas quality in a Selexol plant with a capacity of 500 m^3/h

BACKGROUND

The Laholm biogas plant was built in 1992 as a measure to reduce the increasing eutrophication of the Laholm bay area on the west coast of Sweden. The goals for the project were also to produce biogas for the city of Laholm and to produce a certified bio-fertiliser for the farmers in the area.

Table 1: Laholm biogas plant – inputs and outputs (2004)

Input	tonnes/year
Manure for pigs and cattle	28,000
Abattoir waste	10,000
Industrial waste	3,000
Household waste	1,000
Others	6,000
Total	48,000
Output	
Bio fertilizer to farming	28,000
Other	15,000
Total	43,000

Laholm was in the 80's a city with increasing problems with nitrogen leakage from the agricultural sector in the bay area. The first indication of eutrophication was detected in the 70's and in 1980 the first indication of oxygen deficit in the sea bottom flora was detected. In 1984 the water in the bay was declared as not suitable for swimming. Measures like increased seasonal manure storage capacity, banning of spreading of manure outside the spring season etc were not sufficient to reach the desired reduction of nitrogen supply to the Laholm bay. Different supplementary measures to reduce the nitrogen leakage into the bay were studied and one of the most favourable alternatives, that later was chosen for implementation, was to build the Laholm biogas plant. The plant not only provides the possibility to treat the manure but also supplies an increased storage capacity as well as possibilities to distribute bio-fertilizer from one farmer to another.

PROJECT

Laholm Biogas AB is a company owned jointly by the local power utility company Södra Hallands Kraft AB, the local farmers association (Vallberga Lantmän) and the City of Laholm. The plant handles 28 000 tonnes/year animal manure and 20 000 tonnes/year of other waste materials, mainly waste from 15 different food industries (waste fat, vegetable waste, slaughter-house waste, fish waste etc).

The biogas plant is a conventional stirred tank reactor (2 250 m^3, residence time 25 – 30 days, 38°C, 7,5% DS) that is fed through a pre-tank, a system of heat exchangers and a batch type pasteurisation unit (1h, 70°C) that has replaced the original continuous pasteurisation unit. The plant capacity was in 2002 doubled by the erection of another similar production line and the plant now has a total capacity of around 70 000 tonnes/year.

The annual production of bio fertilizer is around 43 000 tonnes. The plant has 2800 m^3 bio-fertilizer storage capacity. The main part of the bio-fertilizer is recycled to farms in the surrounding area, at present 17 farms.
The digestion process converts organic nitrogen in the industrial wastes to ammonia thereby compensating for the increased amounts of nitrogen that will be added to the system from the industrial wastes.
The gas production from the plant is approximately 20 – 30 GWh/year with methane content of about 75%. The biogas was until 2000 used in a district

All raw material to the digesters is pasteurised in two batch type pasteurisation units

heating plant (DHP) in the vicinity to produce heat for a local district heating system, supplying 300 apartments. The gas was distributed to the DHP in a plastic pipe system, built according the national requirements for distribution of natural gas at pressures up to 4 bars. The DHP used natural gas in situations when the biogas production was insufficient. The main drawback with this system was that approximately 40% of the biogas had to be flared during periods when the heat demand was low in the district heating system. An upgrading plant was erected in 2000. The original upgrading plant was capable of upgrading 250 m^3/h biogas with a methane content of 60–75% to natural gas quality. The upgrading is performed in three steps. First sulphur is removed in a Sulfatreat® process. The carbon dioxide is then removed in Selexol® plant and finally the Wobbe number of the gas is adjusted to the same as for natural gas by adding 5–10% propane to the gas. The gas is then introduced into the same gas line that earlier was used to distribute the raw biogas to the DHP.

Table 2: Laholm biogas plant – energy statistics (2004)

	MWh/year
Total biogas production	24,000
Biogas injection into the natural gas grid	18,000

The gas installation in the DHP has been revised and a new pipe has been installed, connecting the biogas pipe to the local low-pressure natural gas grid.
During winter conditions, the main part of the gas still goes to the boiler but when the district heating load goes down, an increasing share of the biogas is injected into the local gas grid and is distributed to the city of Laholm. The interconnection of the biogas plant with the natural gas grid has resulted in an increase of biogas sales and biogas did in 2004 cover approximately 30% of the total gas demand in Laholm.

RESULTS

The Laholm biogas plant has substantially reduced the regional eurtrophication and nitrogen leakage into the Laholm bay area.
It has also reduced the CO_2-emissions by 3700 tonnes/year by annually replacing 18 000 MWh natural gas. The biogas is partly used in the city of Laholm for heating in industries and houses. A part of the biogas is also used as vehicle fuel in a filling station located on the outskirts of Laholm, thereby reducing the local emissions of particulates and hydrocarbons.

CONCLUSIONS

Co-digestion of animal manure and organic waste has contributed to solve a substantial environmental problem in the Laholm bay area in Sweden. The biogas installation has also made it possible to reduce the local emissions of CO_2 substantially by replacing fossil fuels for heating and in the transport sector.
Upgrading of biogas and injection into the natural gas grid has made it possible to use 100% of the biogas, thereby avoiding flaring of gas during the summer period.

The filling station in Laholm supplies biogas via the natural gas grid to a growing number of light duty vehicles and lorries

CONTACTS

Plant:
Contractor:
Bigadan A/S
Carsten Buchhave
Vroldvej 168
8660 Skanderborg
Tel +45 86 57 90 90
Fax +45 86 57 90 93
e-mail:mail@bigadan.dk

Operator:
Laholm Biogas AB
Åke Aronsson
Box 63
312 21 Laholm
Tel +46 430 480 00 or
+46 70 891 56 87
Fax +46 430 133 77

Biogas upgrading plant:
Contractor:
Malmberg Water
Rune Simonsson
296 85 Åhus
Sweden
Tel +46 44 23 18 00
e-mail: rune.simonsson@malmberg.se

Operator:
E.ON Gas
Staffan Ivarsson
205 09 Malmö
Sweden
Tel +46 40 24 47 13
e-mail: staffan.ivarsson@eon.se