IEA Bioenergy Task 37

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

LINKO GAS

A REFERENCE PLANT FOR CENTRALIZED CO-DIGESTION OF ANIMAL MANURE AND DIGESTIBLE WASTES IN DENMARK

PUBLISHED: NOVEMBER 2013

SUMMARY

The Linko Gas centralized biogas plant in Lintrup was built in 1990 as a manure based mesophilic (37°C) anaerobic digestion (AD) plant. In 1999 the plant was totally refurbished and switched to thermophilic operation (53°C) with an additional post-digestion step. The effect of these measures was a doubling of the methane production at the plant.

Table1: KEY FIGURES (2012)

Animal manure	630 tons/day
Organic wastes	140 tons/ day
Biogas production	19.7 mill.Nm³/year(2012)
Total digester capacity	14600 m³
Process temperature	53°C
Pasteurisation	MGRT 10 hours at 53°C
Utilization of biogas	1121 kW biogas engine (1)
Utilization of biogas	1047 kW biogas engine (2)
Utilization of biogas	1033 kW biogas engine (3)
Transport vehicles	4 x 30 m³ tankers and 1 x 25 & tanker
Investment costs	43.6 mill. DKK
Government grants	16.8 mill. DKK
Contractor	Krüger Ltd
Operation start-up	1990 (mesophilic)
Refurbishment	1999 (thermophilic)

The biogas plant is operated as a cooperative company, owned by 50 local farmers who supply animal slurry to the plant and are members of Linko Gas A.m.b.A.
The aim of Linko Gas A.m.b.A. is to maintain and operate a manure based biogas plant that co-digests the animal slurry supplied by its members with other types of feedstock. The biogas plant is intended to assist its members to redistribute their excess slurry in the neighbouring area, to solve the odour problems caused by application of raw slurry as fertilizer and to help the farmers involved to establish and manage the mandatory slurry storage capacity.

Figure 1: General view of the Linko Gas Biogas Plant (Photo: Linko Gas)

Figure 2: The digesters of 2400 m³ each. (Photo: Linko Gas)

Figure 3.1: Heat exchanger **3.2:** 30 m³ slurry transport tanker (Photo: Linko Gas)

TECHNICAL SPECIFICATIONS

The plant processes yearly about 280,000 tons biomass, consisting of 230,000 tons of animal manure and slurries from 50 livestock farms (cattle and pig) with 50,000 tons of digestible wastes. In Denmark, manure based biogas plants are allowed to co-digest various organic wastes, representing up to 25% of the total feedstock mixture.

The biogas plant co-digests 47% pig and 53% cattle slurry with digestible wastes from fish and food processing industries, pharmaceutical industry, abattoir intestinal contents and sewage sludge from a waste water treatment plant.

Digesting sewage sludge requires pasteurisation of the biomass feedstock. This is achieved through a minimum guaranteed retention time (MGRT) of 10 hours at the thermophilic process temperature of 53°C to ensure pathogen reduction equivalent to pasteurisation at 70°C for one hour, as required by the European animal by-products regulation (1069/2009).

The heat exchanging system pre-heats the feedstock mixture using the heat from the digestate exiting the AD tanks. After the main thermophilic (53°C) co-digestion step, the digestate is pumped in to an insulated post-digestion tank, where digestion continues at 42°C.

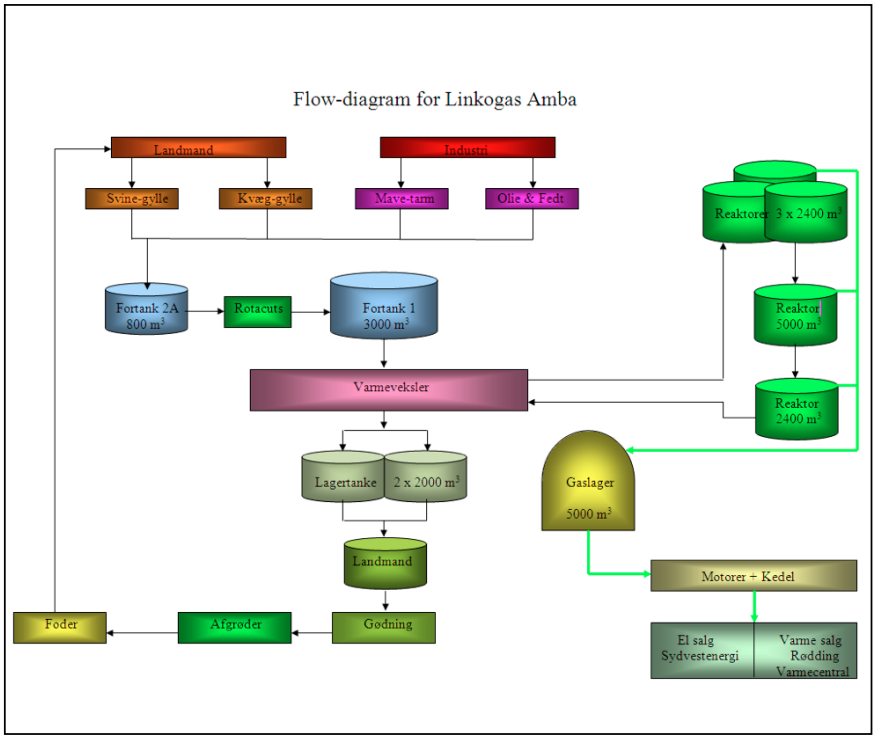

Figure 4: The flow diagram of the biogas plant

UTILIZATION OF BIOGAS

The biogas produced is piped via a 7 km low pressure gas transmission system from the central plant to Rødding combined heat and power (CHP) plant, where it is used in two biogas engines to produce electricity (max. 2080 kW output) and district heating (max. 2600 kW output). At the biogas plant, the biogas is used in a 1121 kW engine for process heating, and in a 900 kW back-up gas boiler.

Figure 5: Caterpillar 3516, 1121 kW, at the biogas plant in 2010 (Photo: Linko Gas)

UTILISATION OF DIGESTATE AS FERTILISER

The farmers supplying slurry to the biogas plant receive back digestate, with the amount of nutrients calculated not to exceed the allowed limits for their crops according to Danish harmony rules for nutrient management. The surplus, which is about 30% of the digestate produced by the biogas plant, is sold to about 50 crop farms in the nearby area. The pH and the dry matter of raw slurry and of digestate are determined in the mini laboratory at the biogas plant following periodic sampling. Along with these measurements, a declaration of the content of macro-nutrients added when digestate is transported to the farmers. The digestate must be stored in one of the 78 specially built concrete storage tanks located close to the fields where digestate will be applied as fertiliser.

Figure 6: Taking samples for dry matter content analysis of raw slurry and digestate at the biogas plant's own laboratory (Photo: Linko Gas)

FINANCIAL RESULTS

Linkogas has a good and stable financial performance, with a current income constantly above the level of break even. Being one of the reference biogas installations in Denmark, Linkogas receives many visitors annually, from Denmark and from around the world, interested in good performing biogas technologies.

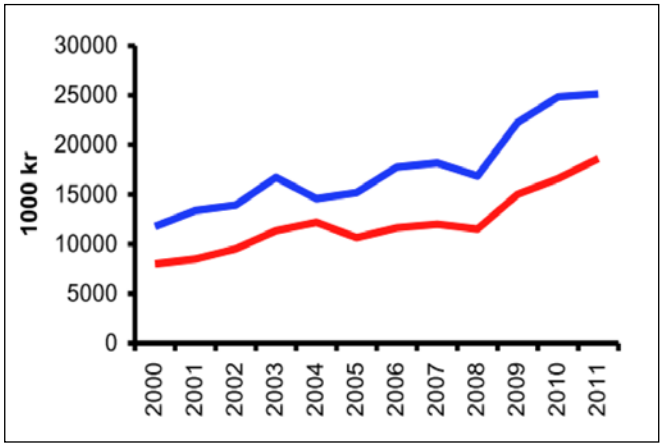

Figure 7: Linko Gas: Turnover [blue –] and expenditure [red –] Source: Danish Biogas Association, 2012.

PLANS FOR THE FUTURE

The plans for the future are to maintain the positive economic performance that Linkogas has achieved over several years. The board wish to enlarge the Linkogas plant. The first step will be to expand the treatment and production capacity by 25%, and to add the extra step of upgrading biogas to natural gas quality biomethane for injection into the natural gas grid.

CONTACTS

For visiting the plant or for more information, please contact:

Linko Gas Biogas Plant

Tornumvej 15, Knorborg
6660 Lintrup, Denmark
Tel: +45 7585 5344
email: info@linkogas.dk
www.linkogas.dk

Martin Fey

Operations manager

Tel: +45 2427 5999
email: mkf@linkogas.dk