T@W Good Practice Form

Setting

Title:
Demonstration of an optimised system for biogas from biological waste and agricultural feedstock

Country:	Sweden
Location:	Västerås
Start date:	Sept 2003
End date:	
Technology keyword(s):	Agriculture, Municipal waste
Host:	VafabMiljö, Västerås (Vafab Environment)

General description

Summary:
The work of establishing a biogas plant in Västerås, the ”Växtkraft-plant”, for the treatment of source separated household waste, ley crops, and other suitable organic waste, has been in progress for several years. Växtkraft in Swedish means the same as growth power. An agreement in principle between VafabMiljö (the Solid-Waste Company of Västmanland), LRF (the National Federation of Swedish Farmers) and Mälarenergi, regarding the proprietorship and operation of the plant, constituted the basis for the work. The objectives are to produce a thoroughly researched basis for the decision on the building of the Växtkraft-plant.

In April, 2003, VafabMiljö, Mälarenergi, LRF (through the company Swede Agri Invest) and 17 local farmers established the company Svensk Växtkraft AB. The company is running the project, own and operate the biogas plants – biogas reactor and upgrading unit. The purpose of the project is to create a sustainable recirculation of nutrition and energy between cities and rural areas where renewable energy can be generated.

The project has its origin in discussions with farmers on how to improve the grain production in the area of Västerås. The farming was focusing on grain production and the farmland was showing lack of organic compounds due to that and the harvest was decreasing. At the same time VafabMiljö, the local municipal waste management company was looking for methods to treat the organic household waste in an environmental friendly way. These agendas had a mutual solution in biogas production – waste management, recirculation of nutrition and grass production to help increase the organic compound in the farmland.

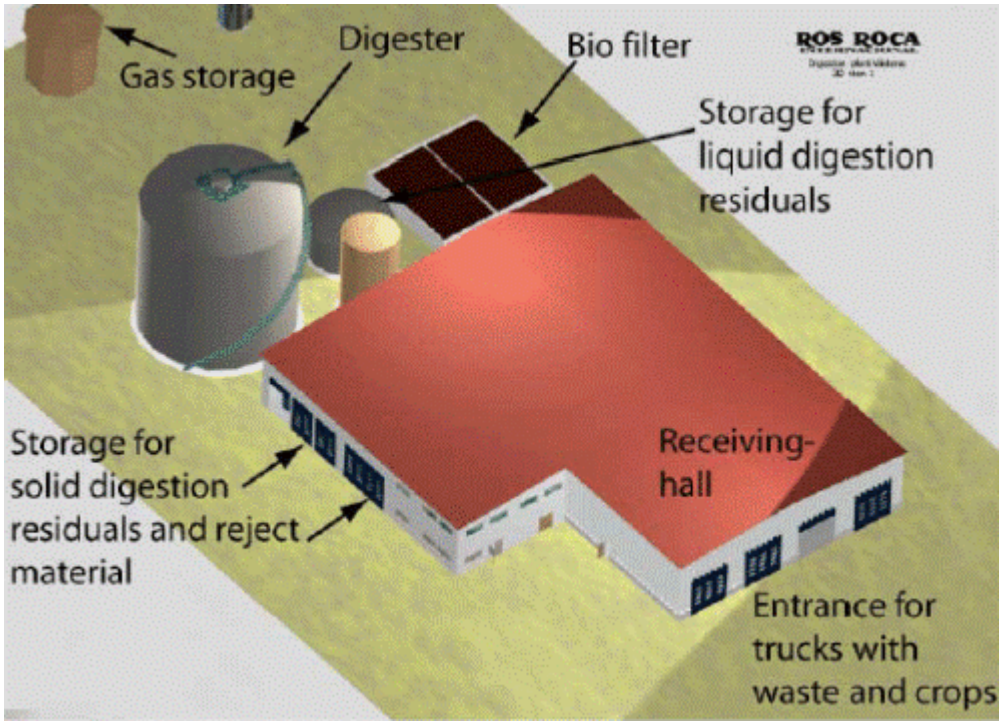

Figure 1. Drawing of biogasplant

Aims:
The aim of the project is to create a recirculation of nutrients and organic material between land and city. From grass and food waste energy is gained. The sludge effluent remaining after energy is gained is spread on the land and makes grain grown by less fertiliser and with less use of pesticides. This contributes to an environmental friendly and sustainable agriculture.

Summary of Results:
The plant generates 15 000 MWh and is added to the produced biogas from the sewage sludge. The gas is upgraded to vehicle fuel and the effluent from the plant is spread as fertiliser on farmland. At the moment 24 biogas fueled buses run in Västerås and further more are planned – in 2007 there will be 40 buses running on biogas in Västerås as well as around 10 vehicle for transporting waste and about 500 cars. The carbon emissions will decrease by 3 450 ton per year.
The production of biogas will generate fertiliser containing 150 ton nitrogen, 30 ton phosphorous and 90 ton potassium.

Planning Time: n.a

Planning issues: n.a

Operation Time: n.a

Feasibility Study: n.a

Technical details

Technical details:
What makes this project unique is that grass and organic municipal waste is co-digested and that the farmers and the municipality has joined and formed a company to perform the project

The biogas-plant is situated adjacent to the other installations at the waste treatment plant at Gryta, in the northern outskirts of Västerås. In the plant, organic waste, ley crop and grease trap removal sludge are treated by digestion in a closed process.

The plant annually treat:

- 14 000 tonnes of clean, source-separated organic waste, with a dry matter content of 30 %, from households and institutional kitchens
- 4 000 tonnes of grease trap removal sludge, with a dry matter content of 4 %, from grease separators in institutional kitchens and restaurants
- 5 000 tonnes of ensilaged ley crop from a contracted ley acreage of 300 hectares cultivated by farmers who are also part-owners in the plant. The silage have a dry matter content of 35 %

The main characteristics of the plant are:

- A receiving hall where reception and quality control of incoming waste and separation of foreign material will take place. The hall is designed to enable a flexible handling of waste and silage including necessary storage capabilities
- A receiving bunker for reception of all kind of liquid waste. The bunker can also be used for feeding of solid waste in case the walking floor is not in operation
- A flexible and redundant pre-treatment of the waste. The three turbo mixers can be used independent from each other
- A separation of the digestion residuals into one solid and one liquid phase without addition of any chemicals. The solid residue will mainly be used as a phosphorous fertilizer and the liquid part as a nitrogen fertilizer
- A process that minimizes the need for addition of fresh water by circulation of process water (liquid digestate) for the dilution of the solid waste and the ley crop. Thereby the amount of liquid digestate to be transported to the farmers is minimized
- A closed process with collection and treatment of all exhaust air in a scrubber and a bio filter in order to avoid any odour problems in the surroundings of the plant. The air is preheated before it enters the bio filter in order to ensure the intended function of the bio filter during winter conditions

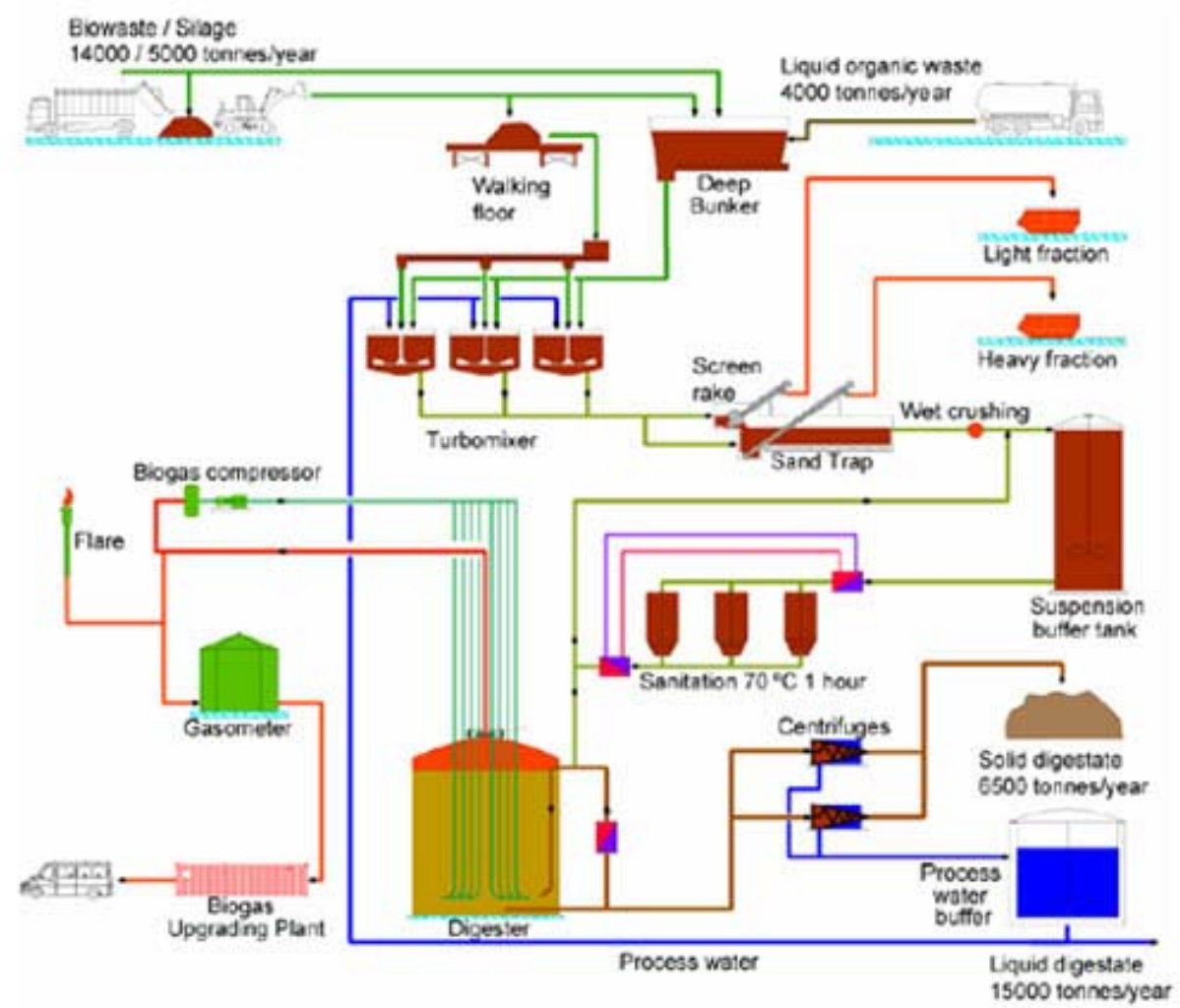

Figure 2. Flow chart of the biogasplant

The gas from the plant is distributed via an 8 km long pipeline to the sewage plant where further gas from the sewage plant is added and upgraded to vehicle fuel and distributed to the filling station. Biogas not sold as vehicle fuel is used for production of electricity and heat in an existing gas-engine at the Gryta waste treatment plant. The produced heat is led into the district heating system in Västerås. About 75 % of the gas production will be used as vehicle fuel while the rest will be used for CHP production.

At the bus depot, a reserve store with liquid natural gas is installed as a back-up in case of a decline in the gas supply. This reserve capacity is necessary, since buses that have been adapted for biogas fuel, can run only on gas, and are therefore totally dependent on daily deliveries of gas.

The main characteristics of the biogas system are:

- Fast filling of buses and refuse collection vehicles. Filling time less than five minutes
- Very high availability due to
  - double high pressure compressors with 100% redundancy
  - few critical components in the fuelling system
  - liquid natural gas as reserve in case of break down of gas production

    - big high pressure storage possibility to fill up 40 buses without use of high pressure compressors
- A public filling station for cars and other small vehicles

The plant for the up-grading of the biogas is located close to the new biogas plant at Gryta.

The main characteristics of the up-grading plant are:

- Use of simple and proven water scrubber technique for the purifying of the biogas
- Surplus heat from the purification is used in the biogas plant
- High availability
- Advanced measurement and surveillance system for controlling the process and the gas quality
- Used process water is treated before it is led to recipient
- The outgoing air-gas mixture is treated in a chemical scrubber and in a bio filter in order to avoid odour problems
- The loss of methane in the process is guaranteed to be less than 2% and is expected to be less than 1%. Further reduction of methane is presumed to occur in the bio filter

From the biogas plant one liquid and one solid phase of digestion residuals is obtained. The solid phase is handled as “normal” farm manure and is spread with conventional manure spreaders, i.e. the residuals must be dry enough to allow stacking. The liquid phase is pump-able and possible to spread with conventional slurry spreaders.

By the separation of the residuals into two phases the plant nutrients is divided too, so that the solid phase can be considered as a phosphorus fertilizer and the liquid phase as a nitrogen fertilizer. Pending the spreading, digestion residuals are mainly stored adjacent to the cultivated acreage. Liquid residuals are stored in covered tanks in order to minimize the ammonia losses during storage. The basic principle for the design and placing of the stores is to minimize the transport distances in connection with spreading.

Solid and liquid residuals are distributed between the farmers in proportion to their contracted acreage of ley. The quantity of solid digestate, with a dry matter content above 25%, amounts to 6 500 tonnes per year. The liquid digestate amounts to 15 000 tonnes per year. The dry matter content of the liquid phase is approximately 2%. In order to avoid any built-in restrictions for the use of the digestate, no restrictions will be placed on the use of the digestate (for example for which crops digestate may be used). Instead, it is up to each farmer to use the digestate in the best way with regard to the conditions on the farm in question. The digestates can replace mineral fertilizer on 1 200 to 1 600 hectares of cereals.

Energy data

Energy data:
The plant produces biogas equivalent to 15 000 MWh for vehicle fuel. With additional gas from the sewage treatment plant (8 000 MWh) 40 city buses, 20

cleaning vehicles and 500 cars will be supported with fuel. The gas that is not sold as vehicle fuel is used for CHP production

Energy saved/generated: 23 000 MWh

Monitoring: n.a

Environmental data

Environmental data:
The gas replaces about 2.3 million litres of petrol and thereby reduces a lot of emissions – mostly carbon dioxide by 3 450 ton per year. The production of biogas will generate fertiliser containing 150 ton nitrogen, 30 ton phosphorous and 90 ton potassium and has been approved by the food industry for use in grain crop. The fertiliser is improved due to the digestion and the nutrition is easier for the plants to take up

Project GHG-emissions: In common units, tonnes CO_2equivalent/year

GHG-emission reductions: CO_2 3 540 000kg/y

"EAU, CER, ERU, AAU":

Methodology: n.a

Baseline n.a

Monitoring: n.a

Contribution to Sustainable Development:
The biogas production plant contributes to sustainable development in many different areas. The project helps develop rural areas and local economic life through cooperation between farmers, institutional kitchens and municipalities' f. ex.

Economic data:

Financing: SEK 67 Million (app €7 Million) is subsidies from the national government

Capital cost: SEK 150 Million (app €16.5 Million)

Operational Costs: n.a

Payback: n.a

Energy Production costs: n.a

Other savings: n.a

Additional Information

Printed or electronic reports or other literature available:

Title:

The Växtkraft-project in Västerås

Växtkraft – Process description of the Biogas plant in Västerås

Växtkraft – Presentation of a system for the use of biogas as fuel for buses and cars

Cost: Free

Address for download of electronic document: http://www.agroptigas.com
http://www.vafabmiljo.se

Project Web site: http://www.agroptigas.com
www.vafabmiljo.se

Contact information:

Type of Organisation: Host company

(e.g. technology supplier, service provider, host company, financing body, project management)

Technology keyword(s) specific to this organisation: Municipal waste, Agricultural waste

Organisation / Agency: Svensk Växtkraft AB

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Description of the Organisation for inclusion in the database of Technology and Service Providers:

Other contacts: