

This is one of 12 case studies presented in the report "Biogas from manure, and waste products – Swedish case studies"
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The biogas plant in Bjuv

Facts/unique: Upgrading biogas on a large-scale with distribution to the gas grid.
Bio-manure is spread by a self-propelled hose spreader.



Figure 1 The Wrangs Gunnarstorp castle in Bjuv

The estate of Wrangs Gunnarstorp, located near Bjuv in Skåne, is run by a family-owned company. The owner, Rudolf Tornerhjelm, first had the idea of building a biogas plant in the early 2000's, prompted in part by a study trip to Denmark where he saw the advantages of the technology. The estate raises 6000 pigs for slaughter each year and the manure that is produced is very well suited to the biogas process. The biogas plant was ready by November 2006. Three owners have together formed the company 'Söderåsens Bioenergi AB' to run the plant: the family-owned estate, the Danish entrepreneur who built the plant (Bigadan A/S), and the energy

company E.ON. E.ON purchases the biogas, upgrades it to the quality of natural gas, and distributes it to the gas grid.

The biogas plant at Wrams Gunnarstorp was built according to proven technology and is considered an important part of the estate's work with environmental issues, not least because of the high-quality of the bio-manure. It is practically odour-free and meets the nutrient requirements for all the arable land on the estate. The natural gas grid runs close to the estate which guarantees a market for all the biogas produced. The income from the sale of the upgraded biogas means that the project is profitable even without grants.

The biogas plant and substrate

Apart from pig manure, the substrate includes slaughterhouse waste and waste products from the Findus food processing factory in Bjuv. This factory, which is located 2 km from the estate, produces sludge from its own sewage treatment plant and organic waste products from the food processing facilities. In particular, the pea harvest produces large quantities of organic waste and sludge. These waste products are highly suitable substrates for biogas production. The biogas plant can treat up to 65,000 tons of organic material per year. The substrates are mixed in a receiving tank where they are ground to produce a homogeneous biomass. The material is then pasteurized at 70°C for one hour before it is pumped into the reactor, which has a volume of 4200 m³. The process is mesophilic (38°C), with a retention time of 21 days. The material is then transferred to a second digester tank (1,500 m³ in size), where the remaining biogas is extracted for 6-7 days.

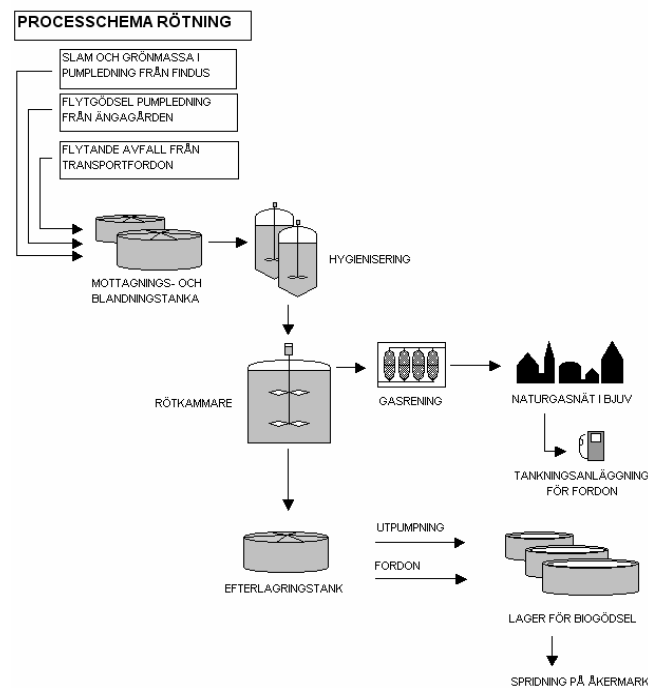


Figure 2 Process diagram of the biogas plant at Wrams Gunnarstorp, Bjuv

Upgrading and use of the biogas

All the biogas is upgraded to vehicle fuel quality using the PSA-technique. The upgrading plant, which was built at the same time as the biogas reactor, has a capacity of 600-700 Nm³ per hour. Methane leakage is less than 1%. In total, the plant produces 21,000 to 24,000 MWh of upgraded biogas per year, which is equivalent to c. 2.5 million litres of petrol.

Distribution of the biogas

E.ON buys all the biogas produced, purifies it and distributes it on the gas grid. Propane is added to reach the same energy content as natural gas. The upgrading plant is located close to the biogas reactor. The upgraded gas is piped to the gas grid, a distance of c. 3.5 km, through which it is distributed to various end-users and consumers, including gas filling stations. The annual biogas production at the estate is sufficient to supply fuel to 1,200-1,500 gas vehicles.

Bio-manure

After digestion, the bio-manure is stored in five tanks, each with a volume of 5000 m³. From there it is pumped in above-ground hoses several kilometres in length to a specially constructed self-propelled hose spreader, which applies the bio-manure to the land with a capacity of 150 m³ per hour. Approximately 45,000 tons of bio-manure is produced annually, which is spread on the estate's 780 hectares of arable land and other farmland in the neighbourhood. The bio-manure has a relatively low phosphorous content (c. 0.5 kg per m³) and a nitrogen content of 4.5 kg per m³.

Financing

The total investment cost for the biogas plant was 40 million SEK, while the upgrading facility cost 15 million SEK. The project was financed by the three co-owners of Söderåsens Bioenergi AB and one external financier. The project is financially viable without additional grant funding.

Lessons learned

The construction went according to plan, except that the upgrading plant was delayed for two months. This resulted in a loss of sales of biogas at the beginning compared with the original budget. From 2007, the plant is producing at full capacity and the biogas is of high quality (70% methane). The process was started carefully and step-wise, which proved to be a good strategy. To date, the experience with the plant has been positive, and no serious problems have been encountered.

A biogas plant of this size requires careful planning. The biogas project at Wrams Gunnarstorp took 6 years to plan and carry through. It is also important not to take too large a risk initially. The risk can be shared by co-ownership of the company, which is also a good way to ensure the participation of people with different skills.

In this case, the upgrading plant is owned by E.ON, which is considered advantageous and a natural way to share risk and responsibility within Söderåsens Bioenergi AB. It is also important to secure long-term access to raw materials and suitable land on which to spread the bio-manure. The production of renewable energy has created a new complementary business niche within the agricultural industry, which is also less sensitive to economic downturns.

Benefits for the environment and society

The biogas plant in Wrams Gunnarstorp is profitable both for the company that runs it and for the environment. The amount of purified biogas produced at the plant is equivalent to a reduction in fossil carbon dioxide emissions of a little more than 4,000 tons per year, which has reduced the total carbon dioxide emissions in the municipality of Bjuv by 3.4%. The estate's advantageous location close to the gas grid means that there is a market for all the biogas produced. The bio-manure produced by digestion is a valuable source of nutrients, so there is less need to buy in mineral fertilizer. Apart from the nutrient content, the bio-manure increases the humus content of the soil, which is particularly valuable for the heavy clay soils that are found across large areas of the estate. The hose spreading technique has reduced the transport of manure by heavy vehicles. Furthermore, complaints are no longer received about the smell of manure following spreading.

Facts 1. Basic data on the biogas plant

Start year (biogas production):	2006
Digester volume:	4 200 m ³
Process temperature:	38 °C
Start year (upgrading):	2006
Upgrading method:	PSA
Investment costs:	55 million SEK

Facts 2. Yearly inputs and outputs

Substrate:	
Pig manure	3 000 tons
Sludge and waste products from Findus	30 000 tons
Slaughterhouse waste	6 500 tons
Biogas:	
From the biogas plant	21 000 MWh
Upgraded biogas	21 000 MWh
Bio-manure:	
Bio-manure	45 000 tons

Contacts

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Suppliers

Biogas plant:	<p>Bigadan A/S www.bigadan.dk</p>
Upgrading plant:	<p>Carbotech www.carbotech.com</p>