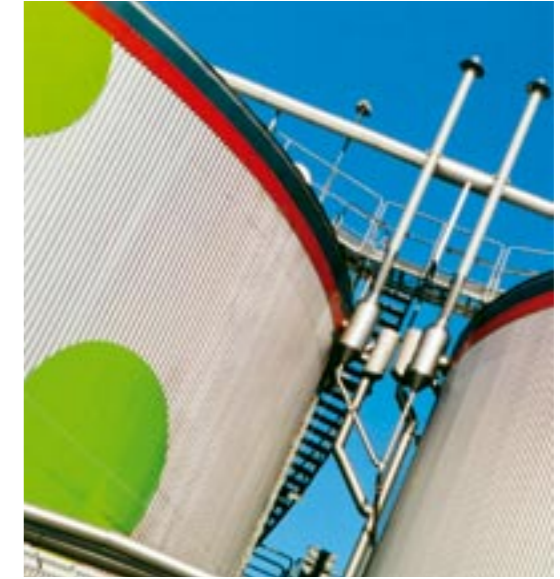




Svensk Biogas AB (Svensk Biogas Ltd) is a subsidiary to Tekniska Verken i Linköping AB (publ), with the mission to develop the biogas market locally, and globally. The business has its history from Linköping Biogas AB, which has laid a good ground for a stable and cost-effective production of biogas to automobiles. The knowledge of and concept for production of biogas/green gas is applicable on a global market.



Biogas

– *for a sustainable society*



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SvenskBiogas

Biogas – for a sustainable society

Biogas is part of the cycle of nature. The gas is formed when organic matters decompose in an anaerobic (oxygen-free) environment. This can take place spontaneously – marsh gas is one example – or under controlled conditions, such as in a digester. In Linköping, biogas is primarily used as fuel for vehicles, but it can be used to produce heat and electricity



as well – and all this without drawing fossil fuel resources from the Earth. The biogas process also gives biological fertiliser, replacing artificial fertilisers.

Two major environmental problem areas – overfertilising

and the greenhouse effect – are reduced by using biogas and biofertiliser. This results in a complete cycle for nutritive substances as well as for carbon dioxide.

By using biofertiliser the nutritive substances are returned to the farms, and by using biogas for vehicle fuel, no new carbon dioxide will be emitted to the atmosphere. You could say that the vehicles are run on solar energy which has first been stored in the green foliage and then been converted to biogas. Since biogas is a renewable form of energy it is an important part of creating a sustainable environment-friendly society.



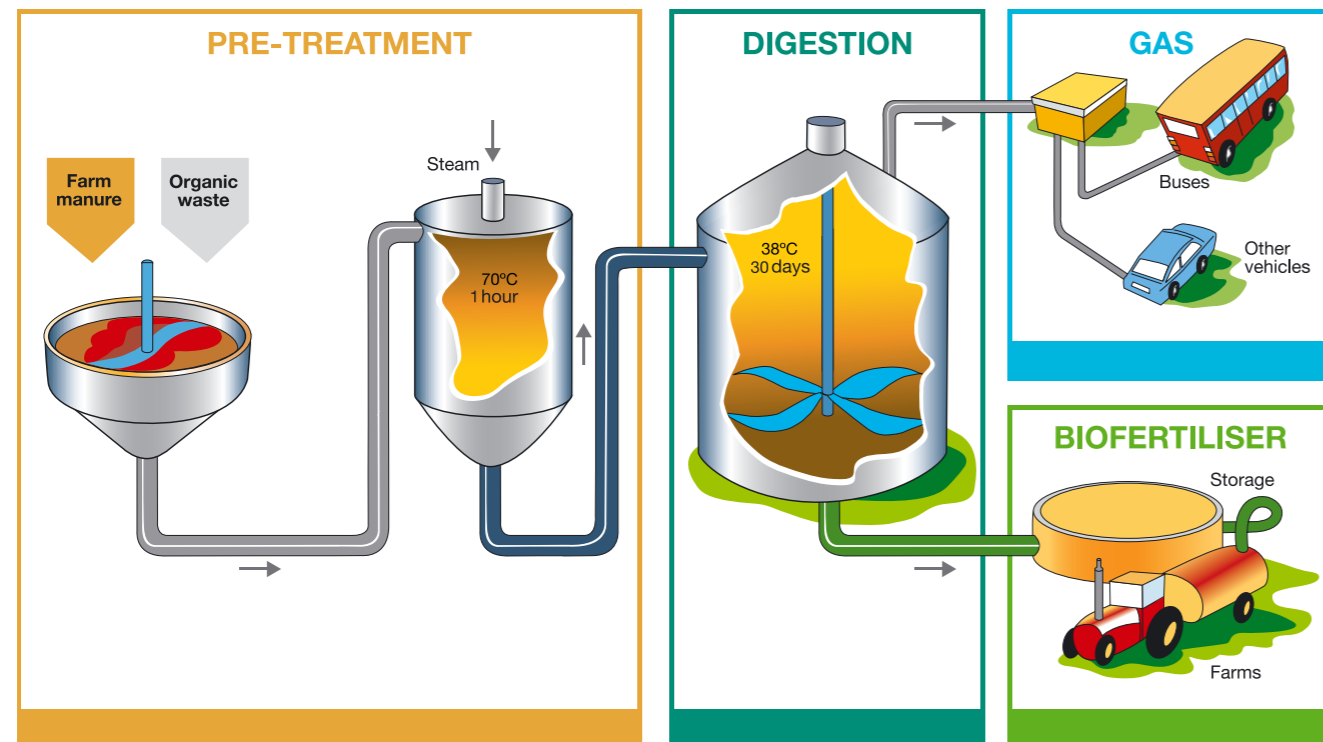
The biogas process

At the biogas plant in Linköping, various waste products are converted to biogas and biofertiliser. Production is based on organic waste material, primarily from slaughter-house remains and the food industry, together with manure from neighbouring farms.

The material is mixed into a homogeneous slurry in a reception tank, after which it is hygienized by steam-heating to above 70°C for at least one hour, in order to kill bacteria.

After cooling, the material is pumped into a digester to be broken down by different types of microorganisms in an anaerobic environment at about 38°C (a mesophilic process). The average detention dwell time in the digester is one month, and this is where the gas is produced.

When ready, the gas is piped to the upgrading facility where it is purified in a pressurized water scrubber before it is supplied as vehicle fuel.



Next to the biogas plant the sewage water treatment plant is located. The gas produced here in the sludge digestion process can also be upgraded and used as vehicle fuel. The two plants are connected with a gas pipeline.

The biogas plant is equipped with a liquid natural gas (LNG) tank. At peak biogas demand the LNG can be vaporized and mixed with the biogas in the pipeline, guaranteeing an uninterrupted gas supply.

The material remaining after digestion, the biofertiliser, is cooled to 20°C and stored at the plant a day or two before distribution to farms.

All processes in connection with the production of biogas and the treatment of waste are very energy-efficient, and only a small portion of the energy content of the biogas is used in the production and distribution processes.



Unloading slaughter-house waste from Sweden's first biogas-driven industrial vacuum truck



Monitoring the gas upgrading process

Products

Vehicle fuel

Before biogas can be used as fuel for vehicles, it must be upgraded. Removing most of the carbon dioxide will raise the methane content to 96-98 %; energy content per cubic



metre roughly corresponds to 1 litre of petrol or diesel fuel. After filtering and drying, the gas meets the Swedish Standard for biogas for vehicles (SS 15 54 38). The purified biogas is distributed to the bus depot and the public refuelling station through underground pipe lines. When demand

increases, it may be feasible to distribute the biogas by gas trailers to other refuelling stations. Fuelling a vehicle with biogas is done at a pressure of about 200 bars. All city buses in Linköping run on biogas. They are refuelled (slow-filling) during night stops at the depot, which has more than 60 parking spaces, making it the largest in Sweden for biogas buses.

Cars are refuelled at fastfill dispensers, and are usu-

ally equipped with dual fuel systems – biogas and petrol. Range varies with type of car and way of driving. The vehicles can also be refuelled and run on natural gas (CNG). Biogas is the most environment-friendly fuel in existence. The combustion of biogas gives low emissions of nitrogen- and sulphur oxides, particles and uncombusted hydrocarbons.

Biological fertiliser

The quality of incoming material is essential and has to be quality assured to produce a high quality biofertiliser replacing artificial fertiliser on farms. Nitrogen in its organic state needs to be decomposed in the soil before it is accessible to the vegetation. During the decomposition process the organically combined nitrogen is converted into ammonium nitrogen which can be directly assimilated by the plants. This means that nutrients which the earth once gave the plants growing there, are returned, thereby completing the cycle.

