*This handbook is published by the Swedish Gas Centre, the Swedish Gas Association and the Swedish Biogas Association and these associations take full responsibility for the contents. The Swedish Environmental Protection Agency and Swentec (Swedish Environmental Technology Council) provided financial support for the production and translation of this handbook.*

# The biogas plants in Kristianstad

Facts/unique: Collaboration between partner organisations and individuals, complete biogas system. First in Sweden to co-digest food wastes, manure etc.

One important driving force for the construction of the biogas plant at Karpalund in Kristianstad was the need for local food-processing plants to treat their waste. In addition, the local authority was introducing a new system for household waste collection, and they wanted to develop appropriate treatment methods for the resulting source-sorted food wastes. The new biogas plant in Karpalund, run by a waste management company owned by the local authority, started operations in December 1996. In the mid-1990's, the question was also raised as to how to make better use of the biogas produced at the sewage treatment plant that had, up to that time, been 'flared off'. At the same time, discussions began on the best way to use the biogas produced at Karpalund in the long-term. All this finally led to the construction of the first stage of a new upgrading and distribution system for biogas. The first upgrading plant, located at the sewage treatment plant, opened in 1999 and is run by the technical office of the municipality of Kristianstad (C4 Teknik).

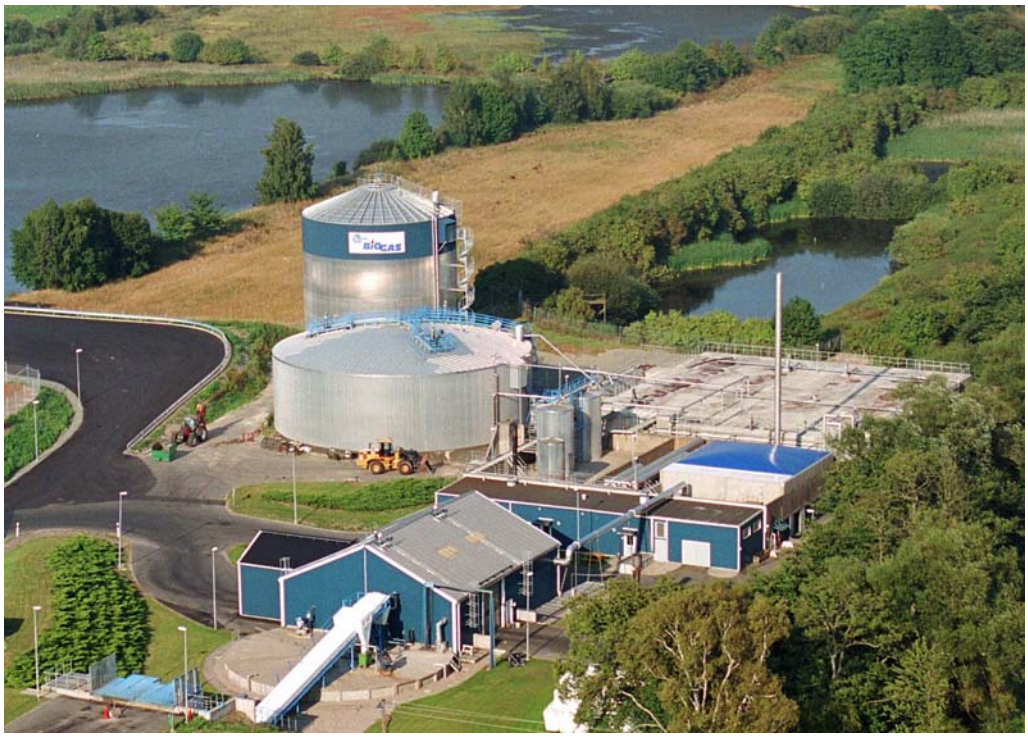


**Figure 1** The biogas plant at Karpalund, Kristanstad

Several new investments were made in the following years to extend the biogas system in Kristianstad. These investments increased the capacity of the biogas plant, while an additional upgrading plant opened in 2007. The system is still being extended. For example, a KLIMP grant has been received to build a new biogas reactor at Karpalund to replace one of the older reactors, which will instead be used as an intermediate storage facility for the digestion residues. A new facility for the pre-treatment of agricultural crops is also planned, and two gas turbines will be installed to generate electricity from the biogas.

One of the strengths of the biogas project in Kristianstad is the number of co-operating partners involved. Thus, households and the agriculture and food industries co-operate by delivering substrate to the biogas plant. Production and distribution of the gas is carried out in a collaboration between the local authority, the energy company Eon, and the bus company, Skånetrafiken. The plant at Karpalund was the first in Sweden to co-digest source-sorted household waste, manure and food industry wastes. Kristianstad now has a complete biogas system with two production plants, two upgrading facilities, its own pipeline distribution system for biogas and several filling stations. Landfill gas from the Härlövs landfill is also collected and used. Kristianstad is working towards the long-term goal of becoming a municipality which does not consume fossil fuels.

## The biogas plant and substrate

The biogas plant at Karpalund has two reactors, 4000 and 4500 $m^3$ in size. The process is mesophilic (38°C), and the reactors are continuously mixed one-step

processes with a retention time of 22 days. The substrate consists of source-sorted household waste collected in paper bags, liquid manure and slaughterhouse, distillery and dairy wastes. The plant has a capacity to treat 80,000 to 100,000 tons of raw waste per year. The new reactor will increase the capacity to 150,000 tons per year. The food waste is first chopped and then mixed with the remaining substrate. The raw material first passes through a magnetic separator and a fine mill on its way to the mixing tank where it is stored for 3 to 7 days before further treatment. Prior to digestion, the material is heated and pasteurized at 70°C for at least one hour in three parallel tanks.

## Upgrading and use of the biogas

The biogas plant at Karpalund produces c. 40,000 MWh of biogas per year, and the sewage treatment plant contributes a further 6,000 MWh. Both upgrading plants employ the water wash technique. In 2007, Eon bought 13,300 MWh of biogas as vehicle fuel, equivalent to more than 1.4 million litres of petrol. The production of upgraded biogas is expected to increase in the coming years. Some of the biogas is used for heating. The gas being produced at the disused landfill at Härlövs near Kristianstad has also been collected since 1989 in a comprehensive pipe system. Until 1995 the gas was flared off, but since then it has been used as a fuel in the municipal power station (Allöverket).

## Distribution of the biogas

The biogas produced at the Karpalund plant is led through pipelines to the sewage treatment plant and to Allöverket for upgrading. The gas pipe network in Kristianstad has a total length of 10 km. The first public filling station opened in 1999 at the sewage treatment plant. A common bus depot for Skånetrafikens entrepreneurs opened in 2002 at Allöverket. Another filling station for biogas opened in 2004 in northern Kristianstad.

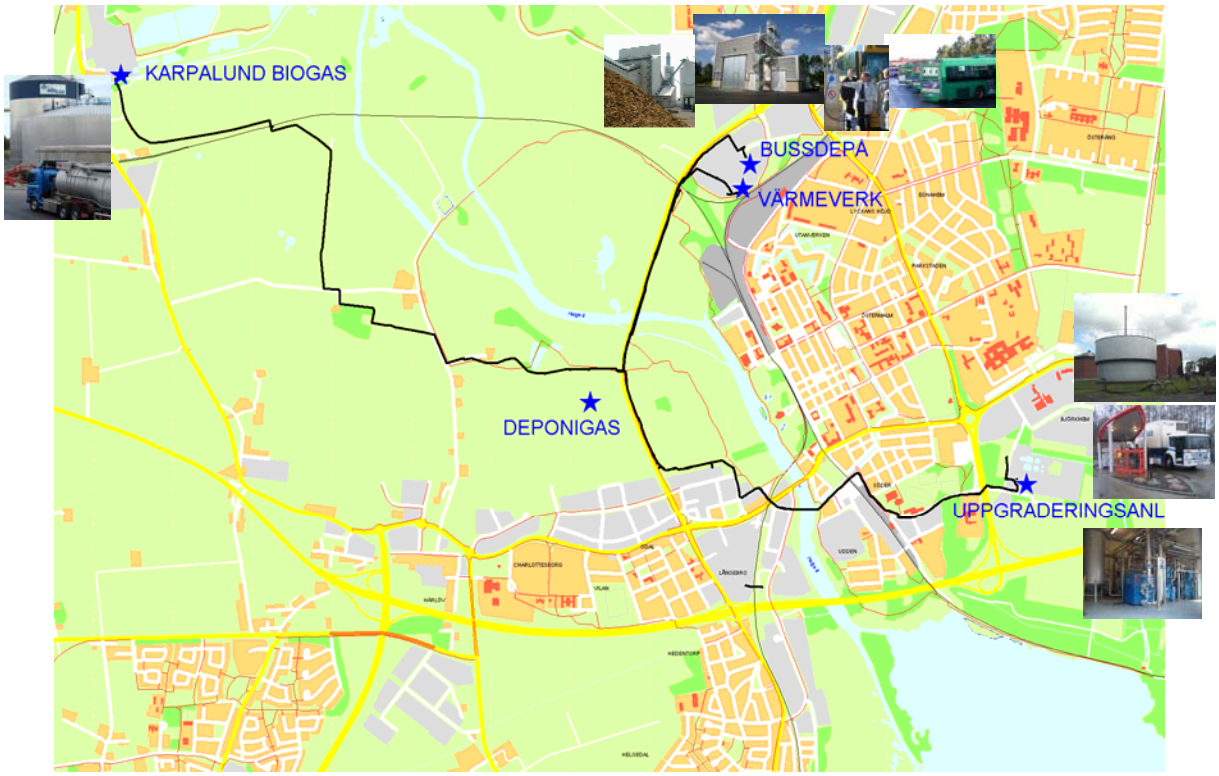

**Figure 2** Map of biogas distribution, Kristianstad

## Bio-manure

After digestion, the bio-manure passes through two screw sieves where undesirable materials such as plastics and coarser particles are removed. The bio-manure is de-watered and the excess water is returned to the reactor. The bio-manure is stored in a closed gas-tight tank which is mixed. The certified bio-manure is spread on nearby agricultural land owned by farmers who supply manure as raw material to the plant. Each ton of bio-manure contains 55 kg of nitrogen (43 kg as ammonium), 4.5 kg of phosphorous and 16.5 kg of potassium.

## Financing

The total investment cost to date is c. 107 million SEK, which has been partly financed through state grants (19 million SEK), mainly from LIP and KLIMP. The development of biogas in Kristianstad will be economically viable in the long-term, given that the demand for alternative fuels is continually increasing.

## Lessons learned

Collaboration with farmers has been of strategic importance for the development of the project. It would be difficult to construct and operate a biogas plant without this co-operation. Policies adopted by the local authority in Kristianstad to reduce the consumption of fossil fuels have also played an important role, especially the environmental policy adopted in 1998, the declaration of intent to become free of fossil fuels which followed a year later, and the climate strategy which was adopted in 2005. These policies have been adopted with complete political consensus, which is also an important factor. The collaboration between the various partners participating in the biogas project has been successful.

## Benefits for the environment and society

The development of biogas has improved the local environment in Kristianstad. For example, the air has become cleaner as fossil fuels are replaced by biogas. Carbon dioxide emissions have been reduced by more than 11,000 tons of carbon dioxide equivalents per year. In 2007, more than 1.4 million litres of petrol were saved and this figure is expected to increase in the coming years. Incineration of organic wastes has decreased by 40,000 tons per year.

Many actors participate in the biogas project, which has strengthened links between the town and the surrounding rural areas. Information campaigns have increased the environmental awareness of the local population. They are also encouraged to drive biogas vehicles. For example, the local authority awards local 'climate grants' to companies and public establishments that buy gas vehicles. Their owners can also park free of charge in municipal car parks. A car pool for

environmentally-friendly cars, the definition of which includes biogas cars, has also recently started.

Together with Linköping, Kristianstad has the most complete biogas system in the world. The production of biogas exceeds local consumption, so Kristianstad has become an exporter of biogas, supplying filling stations in Hässleholm, Olofström and Ystad. The development of biogas in Kristianstad will be further strengthened by the opening of new filling stations in the surrounding region. A denser network of filling stations will make it even more attractive to buy biogas cars, which will further benefit the environment.

Facts 1. Basic data on the biogas plant

| | |
|---|---|
| Start year (biogas production): | 1996 |
| Digester volume: | 4 000 $m^3$ and 4 500 $m^3$ |
| Process temperature: | 38 °C |
| Start year (upgrading): | 1999 and 2007 |
| Upgrading method: | Water wash |
| Total investment costs: | 107 million SEK |

Facts 2. Yearly inputs and outputs

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|---|---|
| Substrate: | |
| Source-sorted food wastes | 5 500 tons |
| Slaughterhouse waste | 35 000 tons |
| Liquid manure | 22 000 tons |
| Others | 10 000 tons |
| Biogas: | |
| From the biogas plant | 40 000 MWh |
| From the sewage treatment plant | 6 000 MWh |
| Upgraded biogas | 13 300 MWh |
| Bio-manure: | |
| Liquid bio-manure | 63 000 tons |

Contacts

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Suppliers

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| Biogas plant: | Krüger A/S<br>www.kruger.se |
| Upgrading plant: | Malmberg<br>www.malmberg.se |