



Producer of the Cleanest
Propellant in the World



The Skellefteå Biogas Plant



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The biogas plant digests Skellefteå's waste to produce vehicle propellants and soil conditioners for agricultural and forestry uses. This procedure reduces carbon dioxide emissions and allows nutrients such as phosphorus to be restored to the soil in the form of sludge pellets.

Treatment Prior To Digestion

1 Reception

The incoming material consists mainly of household scraps, manure, slaughterhouse waste and blood. There are four reception halls designed especially to receive the waste products.

2 Pre-treatment

Scraps and manure pass through a sand trap to separate anything that has been wrongly sorted. This reduces the risk of disruptions in operation and unnecessary wear on plant machinery. The mass is diluted with lukewarm water to form a thick mixture from which the heavy particles sink to the bottom of the sand trap and are removed from the process while the light-weight organic matter continues to the grinding process. Blood and slaughterhouse waste go directly to grinding from the reception hall.

3 Grinding

The mixture is ground to facilitate a good digestion process.

4 Buffer Tanks

In order to obtain an even flow into the digestion chamber, the ground and diluted mixture is temporarily stored in the two buffer tanks. To prevent the digestion bacteria from thriving and initiating the digestion process at this stage, the tanks are ventilated and large agitators are used to stir the sludge.

5 Sanitation

To prevent the spread of infection, the sludge is heated to 70°C for an hour to kill any harmful bacteria before digestion. The temperature is then reduced in a heat exchanger to approximately 55°C to give it the right temperature for the rest of the process before it is pumped into the digestion chamber.

Digestion

6 Digestion Chamber

The mixture is pumped continuously into the digestion chamber, where it stays for about 18 days. Thriving in this oxygen-free environment, the methane bacteria degrades the organic matter at the same time as biogas is produced.

The process is now divided into two, one to take care of the residue from digestion and one for handling the gas.

Sludge Handling

7 Digestion Residue Storage

At the same time as the mixture is pumped into the digestion chamber, the treated sludge runs into the digestion residue storage tank, where it is kept until sent to dewatering.

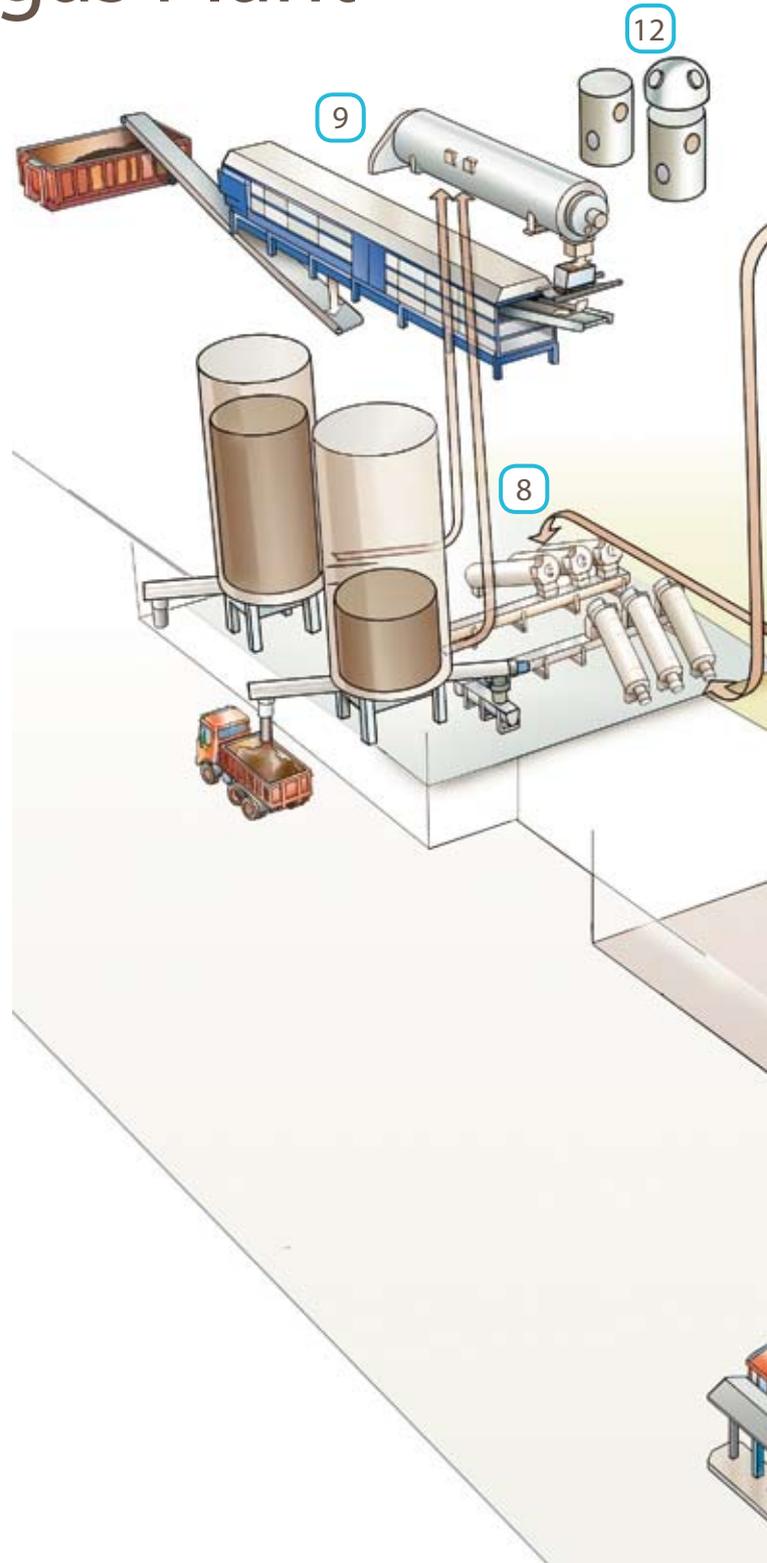
8 Dewatering

The sludge is dewatered to make it dry. After dewatering, the sludge can be unloaded via the dry sludge silo and used for soil preparation, etc., or continue to the drying process.

The dewatering section of the biogas plant also treats the digestion residue from the Tuvan sewage treatment plant. Different processing lines are used to keep the sludge from the biogas plant and sewage treatment plant separated.

9 Drying

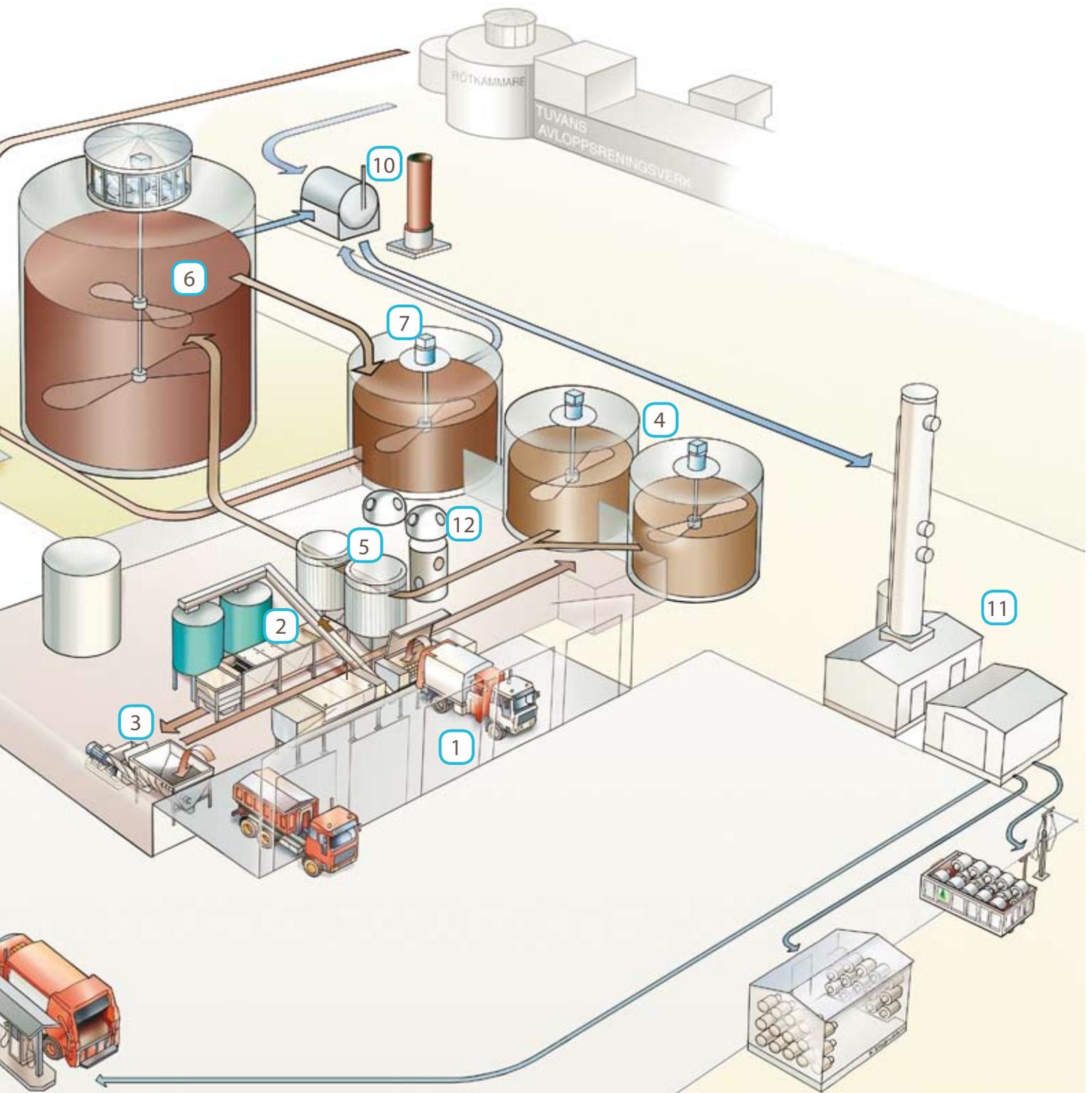
The dewatered sludge is compressed and dried into pellets with the two types of sludge being dried at different times. Sludge pellets from the biogas plant can be used for soil improvement purposes in agriculture and forestry while pellets made from the sewage sludge is used for forestry.



Gas Handling

10 Gas Holder and Bleeder

The gas that is produced in the digestion chamber from the biogas plant is mixed with gas from the Tuvan sewage treatment plant in the gas holder, which regulates the pressure in the system and controls the bleeder. Most of the raw gas is used as fuel in motor vehicles while a small amount is burnt to produce heat. The bleeder is used when neither vehicle propellant nor heat can be produced.



11 Gas Cleaning and Storage

The raw gas consists mainly of methane and carbon dioxide. Treated wastewater is used to remove the carbon dioxide in the cleaning process and then piped back to the Tuvan sewage treatment plant. The cleaned gas is then dried and compressed.

The gas can then be pumped in a gaseous form directly into vehicle tanks, gas bottles fitted on demountable bodies or storage. About 2.1 million cubic metres of vehicle gas (equal to roughly 2.1 million litres of diesel or petrol) are expected to be produced annually in the future. A pipeline is planned for transporting the gas from the plant site to the town centre.

General

12 Deodorising

Before the ventilated air is exhausted, it is treated in one of the plant deodorising stations. Unpleasant odours are removed by cleaning the air with ozone-saturated water and then allowing it to pass through a carbon filter.

Heat and Steam

Heat and steam for the process is produced from biopellets in the nearby central boiler run by Skellefteå Kraft and in order to minimise energy usage, there are a number of heat exchangers installed in the biogas plant.

Fact File on the Skellefteå Biogas Plant

What is digestion?

Digestion means that methane bacteria are used to decompose organic matter. An oxygen-free environment is required for these bacteria to thrive. Biogas, comprising methane and carbon dioxide (CO₂), is formed during this decomposition.

The bacteria are present naturally in organic matter, which means the process starts spontaneously under the right conditions. This occurs naturally in marshland, while the same conditions are created artificially in a digestion chamber.

Volumes and Capacities

- The digestion chamber is 3,800 m³.
- The plant is estimated daily to be able to receive
 - 22 tonnes of household waste
 - 15 tonnes slaughterhouse waste, blood and manure
- After being treated in the plant, the weight of the matter is reduced by about 85%.

Vehicle Gas

- Vehicle gas is usually in normal cubic metres (1 Nm³=1 m³ gas at 1.01 bar pressure and temperature 0°C).
- Ten kilograms of household waste or five kilograms of slaughterhouse waste are required to produce 1 Nm³ of vehicle gas.
- 1 Nm³ of vehicle gas contains as much energy as 1.1 litres of petrol.
- Emissions of carbon dioxide are reduced by about 2.5 kilograms for every litre of petrol or diesel that is replaced by vehicle gas.
- The biogas produced in the two digestion chambers can provide 2.1 million Nm³ of vehicle gas.
- 2.1 million Nm³ of vehicle gas is the equivalent of the petrol consumption of 1.400 passenger cars using 10 litres per 100 km and driving 15,000 km per year.

Plant

- The plant took two years to build.
- Capital cost was 140 million SEK.
- There are seven employees working day shift at the treatment plant and the biogas plant.
- The process runs round-the-clock.
- Three heat exchangers together recycle 4.000 MWh annually. This equals the energy consumption of around 160 normal-size houses.

