

Denmark's largest on-farm plant provides biogas directly to the gas network

Three brothers from Balling, near Skive, have built Denmark's largest on-farm biogas plant. They upgrade the gas themselves and deliver it directly to the natural gas network.

In October 2014 biogas began to flow from Denmark's largest on-farm biogas plant into the natural gas network through an 11 kilometre long service line that connects Madsen Bioenergi's production plant with HMN's main gas pipeline.

The brothers upgrade the gas at the plant, so that it becomes CO₂ free and can be mixed with ordinary natural gas. The biogas which then enters the network is CO₂-free.

Production of biogas by coincidence

Madsen Bio Energy in Balling, just outside of Skive, is owned by three brothers Kim, Boe and Per Madsen.

All three are farmers. Kim Madsen is a pig farmer, Per Madsen breeds and sells piglets and Boe Madsen is a crop farmer. The brothers also cultivate 350 hectares of crops together.

The biogas plant is located centrally in between the three brothers' farms.

It was a bit of a coincidence that the three brothers started producing biogas, explains Boe Madsen. Both he and his brother Kim were educated in other areas before they became farmers, and in addition to agriculture, they worked as freelance fitters for machinery manufacturers in the winter. Things changed for them when the economic crisis hit.

"In 2009, when the crisis was at its peak, there was very little to do in the machinery industry, so we started looking for something else. There was a lot of talk about biogas, and we thought it could be a good direction to explore," explains Boe Madsen.

Plans begin to take shape

Originally, the Madsen brothers thought that

they could deliver biogas to their local community. The local district heating plant in Balling was due to be disbanded, so the brothers suggested that they could deliver biogas to produce heat.

However, Skive municipality had other plans for how the village should be heated and proposed instead, that the Madsen brothers could produce biogas, upgrade it and deliver it to the natural gas network.

Boe Madsen explains, "We contacted some advisers who believed that it would be at least ten years before it would be viable to deliver directly to the network. But in the space of just a few months, we could tell that this was the way things were going, and we began to work on our plans".

Odourless Biogas Plant

Initially, the brothers had to agree with the municipality where the biogas plant should be located. Skive municipality preferred a location at a landfill site, which was ten kilometres from the location the brothers had in mind. The brothers wanted to locate the facility on their farmland, even though this was only 800 meters from the village of Balling.

"We weren't afraid of the neighbours' reactions, as our intention was to build a plant that wouldn't disturb others," says Boe Madsen.

The brothers convinced the municipality to allow them to site the plant on their land and together they took the initiative to hold a public meeting on the farm.





FACTS

Annually, the plant will receive approximately 100,000 tonnes of cattle and pig manure and biomass.



The annual supply to the gas network from Madsen Bioenergy is expected to be about four million cubic meters of methane



This is enough gas to power at least 3000 cars, driving 20,000 kilometers of per year.



Madsen Bioenergi I/S will thus account for a CO₂ reduction of over 6,000 tons per year.

"We literally threw 115 letters in post boxes in and around the area and invited people to meet at our house."

60 of those invited turned up for the meeting in the farm's machine shed and heard the brothers' and the municipality's briefing on the planned facility.

"We talked about what we intended to build, where it would be located, and how we would prevent unwanted odours. We also explained how it would work in terms of transport and other practical issues," says Boe Madsen.

After the meeting, Skive municipality invited the neighbours on a bus tour to Lemvig Biogas, a biogas facility that had previously had problems with odours. The problems with odour had been eradicated by means of a filter; the same filter which was due to be installed at the Madsen Brothers' plant.

These targeted efforts to inform the community were successful.

"When our project went to a public hearing, there was not one single objection," Boe Madsen says.

The project progresses quickly

The fact that there were no objections from local residents in the area meant that the project was completed much faster than is normal for this type of plant, explains Steen Hintze, Project Manager from Skive Municipality.

"It's quite unique to be able to get a project like this off the ground in around three years. In many parts of the country people can struggle for up to five or ten years to get a similar type of facility established."

In addition to the Madsen brothers' persistent and tenacious effort, Steen Hintze acknowledges the importance the ØKS Interreg Programme has had on the project.

"With the support of ØKS, Skive municipality has been able to ensure the project has run smoothly from an administrative perspective has run smoothly, and we've helped to get things approved. In addition, we've helped the Madsen brothers find buyers for their biogas, namely HMN. We've also taken the next step by working with HMN to establish filling station, so that it's now possible to purchase biogas in Skive," says Steen Hintze.

Business development and jobs

In total, the project has invested around 100 million Danish kroner including investment in a biogas plant, an upgrading facility and eleven kilometres of pipes from the brothers' facility out to the main pipeline north of Skive.

As Steen Hintze says, "The project has created business for the farmers and regional companies have supplied components to the biogas upgrading facility. On top of this, a local company that built the filling station has since been awarded a contract for five other stations in Denmark. The municipality has taken an initiative that has created local jobs,

and that's the angle we always try to take in everything we do."

Inspiration from other plants

Together with an advisor, Per, Kim and Boe Madsen planned and designed the facility that now produces biogas at their farm just outside of Balling. Before they started the project they took inspiration from several existing plants.

"We travelled around and looked at many of the plants here in Jutland, one in Zealand, and we were in Germany three or four times. Primarily we looked at the technical side of things. In Denmark no two plants are the same, so we had to find out what we wanted. Our plant is a combination of everything we have seen," says Boe Madsen.

The biogas plant is designed primarily to treat manure and is also fed with energy crops such as corn, grass and beets.

For several years Madsen Bioenergi has ensiled straw in order to get better at supplying the biogas plant with second-generation energy crops.

The plant's technical details are described on Madsen Bioenergi's website:

<http://www.madsenbioenergi.dk>

On the website, you can also keep updated with developments in the project.

Biogas Upgrading Without Energy Wastage Via CO₂ Compression

AMMONGAS can upgrade your biogas without initial compression, thereby avoiding the unnecessary use of energy to compress CO₂, only to release it into the atmosphere 2 minutes later.

Because CO₂ comprises 40% of biogas' volume and more than 60% of its weight, AMMONGAS is able to dramatically reduce energy use - to 0.1kWh per m³ of biogas, including compression of the pure methane to 5-7 bar.

The AMMONGAS process also generates waste heat at a high temperature, most of which can be re-used (at 80°C), making the net heat demand low.

In addition, AMMONGAS upgrading plants have a wide range of other benefits, including:

- High quality in stainless steel
- High efficiency (methane > 99%)
- Very low methane loss (< 0.1%)
- No waste water

- Small dimensions
- No requirement for pre-plant H₂S removal
- A smaller absorber without pres-

- sure means not just a lower price, but also lower service costs
- Ref. plants in Denmark and Norway