

In Germany, some 4,000 plants produce biogas which is used to generate electricity. The latest trend is for plants to convert biogas into biomethane, which is then fed into the gas grid. By 2020, some 6% of the gas that flows through the German grid must be from renewable sources.

Biogas finds its way into the German grid

| by *Stefan Schroeter*

The formation of biogas is a slow, but steady process. Bubbles of gas gradually form on the surface of a fermenting, greyish-brown mixture of maize silage and liquid manure. They then release a mixture of methane, carbon dioxide and hydrogen sulphide. This process can be clearly observed through two portholes in a fermentation tank at the biogas plant in Könnern.

'The same process is taking place here as in the stomach of a cow,' explains Harald Krüger, operations manager at the plant, which is located halfway between the cities of Halle and Magdeburg in eastern Germany.

The difference is that the cow releases the methane gas it produces in this way into the atmosphere, thus contributing to the greenhouse effect. Conversely, the biogas in the huge fermentation tanks at Könnern is drawn off, dried and separated from the associated gases of carbon dioxide and hydrogen sulphide using a technically sophisticated water scrubber

system. By adding energy-rich propane gas and an odorant, the biogas is upgraded to natural gas quality. This biomethane is fed into the pipeline of the regional provider Mitgas, which is only 200 metres away.

Some years ago, the operators of Germany's first biomethane plants were locked in a dogged dispute with pipeline operators about quality parameters and feed-in costs. At Könnern at any rate, this is a thing of the past. The operator of the plant, Agricapital, has forged an alliance with Mitgas, which not only operates the feed-in technology but also buys up and brings to market the entire annual production of 6 million cubic metres of biogas. The price Mitgas pays for this is roughly 3 to 4 times the price of normal natural gas.

The largely automated plant, which started up in February 2008, has been running smoothly now for many months, says Krüger. 'It has fed more biomethane

into the grid than planned.' The main focus of Krüger and his three colleagues is to organise deliveries of raw materials (maize silage and liquid manure) from neighbouring farmers and to monitor the plant's control systems. Minor complications were only experienced during the start-up phase. These had to do with the water scrubber technology, which was installed by the experienced Swedish manufacturer, Malmberg, for the first time in a container.

Mitbiogas |

Mitgas manages to sell its biomethane without subsidies. The company offers the product of the Könnern plant to consumers under the name of "Mitbiogas". For a small surcharge, consumers get gas to which 5% biomethane is added. One of the major customers is the "Platsch" leisure pool in Oschatz, which has made a name for itself as the first carbon-neutral water park in Germany by using the biomethane.



Large quantities of maize substrate are needed for the large-scale facility at Güstrow. Photo: Nawaro

The power produced by means of biogas gets a fixed feed-in tariff under Germany's Renewable Energy Sources Act (Erneuerbare Energien Gesetz or EEG). In addition, when the power is produced through co-generation, in which the heat is fully used, there are extra bonuses. According to Mitgas, in this way the owner of a co-generation plant can get a return of almost 24 cents per kWh, six times as much as the peak load price in the first days of June on the European Energy Exchange in Leipzig. Nevertheless, according to Mitgas plant manager Jens Horn, it has become difficult to sell biomethane to cogeneration plants. This is because a new compensation measure was introduced last year for cogenerated electricity from natural gas. Especially for larger cogeneration plants it is more profitable now to use natural gas rather than biomethane.

Another way to market biomethane is by selling it as an environmentally friendly

automotive fuel. During a trial promotion in December 2008, Mitgas sold 100% biomethane as fuel for natural gas vehicles at three filling stations in the region at a special promotional price. Yet at this moment Mitgas is not planning to start selling biomethane in this way on a large scale, says Horn. It is still too expensive for that. He thinks that biomethane could be competitive if it could get a tax reduction larger than the tax reductions that are currently in place for natural gas and LPG. In spite of these obstacles, Mitgas cannot complain about the sales of its biomethane. On the contrary, the company has agreed to buy more of the product from Agricapital – at a lower price.

Gas grid access |

The process of upgrading biogas to natural gas quality and feeding it into the natural gas grid is still in its infancy. Many biogas plants have been built in Germany that produce electricity in specially modified

engine power plants. This type of electricity does get a feed-in tariff. According to figures from the German Biogas Association (GBA), in 2008, there were some 4,000 biogas plants which generated a total of 11 billion kilowatt hours of electricity, as much as the consumption of some 3 million households. GBA General Manager Claudius da Costa Gomez of the GBA says he expects 780 new biogas plants to be connected to the grid in 2009 with a total installed capacity of 200 MW.

The number of biogas plants that feed gas directly into the natural gas grid is considerably smaller. At the end of 2008, GBA counted only 13 such plants, which together fed 48 million m³ of biomethane into the grid, which amounts to 0.056% of total German gas consumption. However, according to the findings of the DBFZ, Germany's Biomass Research Centre, three further plants were added by the end of March and 35 were under construction

Climate effects

Whether upgrading biogas to biomethane and feeding it into the grid system reduces greenhouse gas emissions largely depends on the production process that is used. This has been pointed out by several research institutes in a project report for Germany's Federal Environment Ministry. In biomethane plants where fermentation residues are stored in open tanks and gas purification is less than optimal, methane may be emitted into the atmosphere. The scientists conclude that, compared to natural gas, biomethane from such plants does not provide any reduction in greenhouse gases. They also advocate the use of liquid manure as the main input material in biogas production, in order to avoid the emissions caused by its use elsewhere that can be harmful to the environment. So far, only 15% of the liquid manure that accumulates in Germany has been used for biogas production. The authors further recommend that the biomethane be burned in cogeneration plants.

or in the planning stages. Small energy providers such as the municipal utilities of Aachen, Braunschweig and Hanover, but also larger companies such as Eon and RWE are involved in such projects.

The projects are being stimulated by the German government, which amended the country's Gas Grid Access Ordinance in 2008 for this purpose. The legislation stipulates that biomethane plants take precedence when it comes to being connected to the gas grid. Plant operators and grid operators must each bear half of the costs associated with the grid connection. As a result of the new measures, the earlier conflicts about grid access have become a thing of the past. In the Ordinance, the government has set a target of 6 billion m³ of biomethane to be fed into the grid each year by 2020, which amounts to 6% of then expected current consumption. For 2030 the target is 10 billion m³ – around one tenth of then expected consumption. The DBFZ believes that these targets can be achieved, if the available biogas potential is utilised. But the role of biomethane in the total energy market will always be rather limited, DBFZ-biogas expert Frank Scholwin believes. Still it offers gas suppliers a chance to improve the image of natural gas. Moreover, there are hopes in Germany that Eastern Europe can become a major producer of biomethane in future.

Larger plants |

Now that the first biomethane facilities are operating successfully and supplying to the grid, investors are looking at the possibility of larger plants. In Könnern, the biogas specialist Agridea, headquartered

in Lübbecke near Hannover, is already building a biomethane plant in the immediate vicinity of the Agricapital facility which is four times as large. Operations manager Krüger views the project with scepticism as the two facilities will have to compete for the supply of feedstock from the neighbouring farmers in the future. He expects that the feedstock for the new facility will have to be transported over greater distances, as the surrounding farms will not be sufficient to produce the volumes required.

The project being undertaken by Leipzig-based Nawaro in Güstrow near Rostock is even greater in scope than the Agridea facility. Here, a €100 million plant is being built which is to supply 46 million m³ of biomethane each year to the grid operated by Ontras, the eastern German gas pipeline operator. According to Nawaro, this volume would be enough to supply a small town of 50,000 people with energy. Nawaro has already found a buyer for some of the biomethane, namely Verbundnetz Gas (VNG), the eastern German gas trader and owner of Ontras. VNG, which supplies utilities and industrial customers, intends to bring the biomethane from Güstrow to market through its distribution network. VNG is also involved in the construction of several biogas projects through its subsidiary, Balance. Moreover, its grid subsidiary Ontras reported last year that 20 biogas plants will soon be connected directly to its own gas grid, though it declined to give further details.

Germany's other major gas suppliers have also recognised biomethane as a growth market. In July 2008, Eon Ruhrgas

together with biogas specialist Schmack, launched a facility in Schwandorf near Nuremberg, which generates 8 million m³ of biomethane annually, which is fed into Eon's regional gas grid. According to Eon, this was the largest biomethane facility in Europe at the time.

Eon Ruhrgas markets the biomethane via its own distribution network to municipal utilities and other customers, who can use it to generate EEG electricity. In contrast to Mitgas, Ruhrgas describes this market as lucrative. 'Demand exceeds supply,' a spokesperson reports. In the meantime, Eon's subsidiary, Eon Bioerdgas, has been building and operating its own biomethane facilities. The first two plants, with capacities of 8 million and 4 million cubic metres, are currently under construction.

RWE, together with its subsidiary, Innogy, is building a biomethane plant in Güterglück near Magdeburg, which will have an annual capacity of 5 million m³. The facility will become operational in the summer. The plant is being built by Schmack, a company that also works with Eon. The biomethane is to be marketed by the sales subsidiary RWE Energy. 'Power and heat production in highly efficient cogeneration plants is the most obvious and currently most cost-effective approach,' says an Innogy spokesperson. 'Success will depend on systematically identifying customers who need large amounts of heat.'

RWE is also planning to market biomethane as a "bio heat product" for heating purposes and as a renewable fuel for powering natural gas vehicles.

Innogy has announced its intention to build up to ten more facilities similar to the one in Güterglück by 2012, at a cost of €150 million. Interested municipal utilities look set to be able to take a stake in these facilities. Innogy has been operating a small biogas facility in Neurath-Grevenbroich since 2007. The gas produced here is not, however, fed into the grid, but converted into electricity in a power plant. In the meantime, the company has been treading new technological ground in the production of biomethane. Working with the Westphalia-Lippe Agricultural Association, it plans to build and operate facilities which will produce high-quality energy sources almost exclusively from liquid manure. According to Innogy, the fermentation residues that are produced are to be completely upgraded in a newly developed, complex procedure, producing a high-quality fertiliser, which can be used for agricultural purposes, and purified water. Innogy intends to start building a pilot facility near Düsseldorf in the autumn. The plant is to start operating in the spring of 2010. It will supply around 6 million m³ of biomethane into the public grid each year. If this project is successful, Innogy plans not only to build further plants in the region, but also to apply the concept in other regions in Germany and Europe.

Wingas has hardly ventured into biogas as yet, but it has now formed an alliance with the municipal energy provider infra fürth, to jointly develop a biogas facility. This will be located in the town of Fürth near Nuremberg, and will have an annual capacity of 6 million m³. The gas will be fed into infra's regional natural gas grid. Scheduled date of completion is 2011. Wingas views the production of biogas as being closely linked with existing agricultural structures and therefore primarily as a business involving regionally based energy suppliers who already get their natural gas through Wingas. 'We are supporting our customers in developing these projects by providing technical conceptual design and planning, both in terms of systems



Photo: Navaro

€12 billion for biomethane

According to the German Energy Agency, dena, 1,200 to 1,800 biomethane plants will have to be built if the target of supplying 6 billion m³ of biomethane to Germany's gas grids by the year 2020 is to be reached. The agency puts the investment needed in plant technology at up to €12 billion. 1.2 million hectares of cultivated land is required to grow the raw materials needed such as maize and cereals. In addition to today's conventional process of producing biomass through fermentation, thermochemical gas production from solid biomass could also be playing a role by 2020. Plans are currently in place to build Germany's first large-scale facility for producing gas from wood in the small town of Senden. The biogas produced here is to be used to produce power and heat in a co-generation plant, in which the heat is fully used.

for upgrading gas and core technologies', says a Wingas spokesperson.

Nationwide marketer |

Energy trader EGT Energievertrieb, based in the small town of Triberg in Baden-Württemberg, is looking to establish itself as a nationwide marketer of biomethane. The company buys the renewable energy source from a biomethane plant in nearby Tuningen and has been supplying it throughout Germany since February. EGT's customers can choose whether they prefer to supplement 10 to 50% of their natural gas supply with biomethane or to switch completely to the green product. Prices vary accordingly. EGT offers a three-year price guarantee.

Biogas is also increasingly used to power cars. Since 2006, the Raiffeisen

farmer's cooperative in Jameln has been operating a biogas filling station near Hamburg. It sells biogas of natural gas quality which it produces in its own facility. As filling station-owner Hans-Volker Marklewitz explains, 150 vehicles from the region regularly fill up at his station. In 2008 he sold 160,000 kg of biomethane (450,000 m³). The price of the fuel is very competitive. One kilogram of biomethane, which contains the same amount of energy as 1.5 litres of petrol, costs 92.9 eurocents. Since February, the cooperative has been selling its biomethane under the Sungas brand owned by the Volkswagen Group, which manufactures several types of natural gas vehicle. VW regards the cooperation with the filling station in Jameln as a pilot project. 'We do intend to expand it,' says a VW spokesperson. ■