



Green gas plant converts biogas into natural gas-quality fuel

Turning waste into a "green" energy source

Until 2035 the former landfill in Schoterroog will provide enough landfill gas for the green gas plant to take in up to 280 m³ gas per hour and use it to produce the equivalent of 190 m³ of natural gas. This satisfies the volume of gas required to supply about 500 households.

The Dutch engineering firm Gastreatment Services (GtS) specializes in the creation and distribution of biogas. The Gastreatment Power Package[®] developed by GtS can be used to convert biogas from landfills, wastewater treatment plants or farms into fuel with the quality level of natural gas. This biogas can be used to power machines and automobiles or as an environmentally-friendly household energy source. On November 1, 2012, GtS put its first green gas plant into operation on the site of a former landfill at Schoterroog, near Haarlem in the Netherlands.

"We have already constructed four such plants internationally, but this one in Haarlem, on the site of the former Schoterroog landfill and next to the wastewater treatment plant of the Hoogheemraadschap Rijnland water authority, is the first green gas system we have built in the Netherlands," explains Mathieu de Bas, Director and Co-Founder of Gas Treatment Services. The plant employs a complex process to convert biogas given off by the decommissioned landfill into fuel gas of natural gas quality, plus liquid CO₂ as a by-product.

Converting landfill gases to fuel gas with natural gas quality

In the mid-seventies and eighties, Schoterroog had a 22,000 m² waste dump. In 1992, when it became apparent that the landfill had been contaminating the groundwater, it was sealed to then state-of-the-art standards. As was usual at

the time, the methane and other gases given off by the biological degradation of garbage were captured and flared off together with the biogas from the wastewater treatment plant – much to the annoyance of the province of North Holland and the municipality of Haarlem. Local officials wanted to use the gas to generate energy under their sustainability programs.

In 2009, GtS and the energy supply company Essent took the initiative and joined forces with the province of North Holland, the municipality of Haarlem, the waste management company Afvalzorg and the water authority Hoogheemraadschap Rijnland to develop a treatment plant that would clean and upgrade biogas from the former landfill and wastewater plant in order to produce biogas of natural gas quality. This purified gas can be used for cooking appliances and



The green gas plant developed by Gastreatment Services, which was installed on the edge of a former landfill site at Schoterog in the Netherlands, processes the gases emitted by decomposing organic waste to produce biogas of natural gas quality.



Mathieu de Bas, Project Manager and Co-Founder of Gastreatment Services, in front of a control cabinet in the green gas plant

heating as well as for fuel. A further advantage of this process is that greenhouse gases will no longer escape into the atmosphere.

"The former landfill at Schoterog will supply sufficient landfill gas until 2035. Initially there will be about 800,000 m³ per year, falling to an estimated 600,000 m³ after 2025," explains Mathieu de Bas. The system can take in up to 280 standard cubic meters of gas per hour and use it to produce 190 cubic meters of natural gas equivalent, satisfying the natural gas consumption of about 500 households. "We deliver this natural gas to the energy supplier Essent, who sells it to the municipality of Haarlem," says Mathieu de Bas.

Compressors maintain a constant 2 mbar underpressure to prevent landfill gas from escaping into the atmosphere. Gas from the 16 gas wells distributed over the area is regulated by valves and piped into the green gas plant.

The biogas plant is designed on the basis of a separation process in which excess CO₂ is removed from the gas mixture and conveyed in liquid form to a number of customers, or used as a coolant in the GtS treatment plant itself. Landfill gas contains water vapor, CO₂, nitrogen, methane, and various impurities. The plant first cools the gas down to 5 °C at a pressure of 30 mbar to remove water vapor. The water condenses and is drained away to the neighboring wastewater treatment plant. Compressing the gas mixture and cooling it to -25 °C removes the volatile organic compounds (VOCs) and siloxanes. Finally, the gas is filtered to remove any remaining impurities and is then passed over a catalyst.

In the next step, the gas is cooled down to -60 °C, which separates off liquid CO₂. Cooling still further, down to -80 °C, produces solid CO₂, which is then melted again and stored in liquid form in a cryotank (at 20 bar and -30 °C). The liquid CO₂ is ultimately used, for instance, by transportation companies in refrigerated trucks and by metal processing facilities for welding or shrink joints. The green gas produced is either fed into the natural gas distribution network or subjected to a further liquefaction process and then stored. This means that in the event of a system failure, GtS can continue to supply gas for a further 14 days.

PC-based control system fulfills high computing-power requirements

To control its green gas plant, GtS decided on a PC-based control platform from Beckhoff, comprising a C6930 Industrial PC, real-time TwinCAT PLC software and Bus Terminal I/O modules. "The great advantage of this Industrial PC is that it delivers the high level of CPU power needed by the sophisticated control processes – for cooling and rewarming, increasing and decreasing the pressure, regulating the replacement of pressure drums, continuous measurement of pressures and temperatures – plus controlling the overall process," says Jurjen Verhoeff, office and Marketing Manager of the Dutch distribution partner Beckhoff Industrial Automation Link, based in Haarlem. "In addition, the computing power of the Industrial PC is sufficient to support SCADA software packages for trend analysis and the storage of historical data, giving the operator a better overview and more convenient operation," adds Jurjen Verhoeff.

"The wide range of available Beckhoff I/O modules guarantees us a customizable solution that is able to communicate with all the sensor types involved in the process," explains Mathieu de Bas. All temperatures are measured using the KL3314 measurement terminal while pressures are measured with the KM3702. Temperatures are recorded at a total of 162 points, and pressures and flow rates at a further 67 points. "Another advantage of the I/O modules used is their Ex certification, enabling us to use them in rooms subject to explosion hazards up to Zone 2," concludes the GtS Managing Director.

Further Information:

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