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Newsletter IEA Bioenergy Task 37: 10/2023

New Developments / RNG in Transport

Topics:

Strategies for emission control on biogas upgrading plants

IEA Bioenenergy Task 37 Workshop

The workshop will take place at 9:30 -12:30 CEST, at the Restaurant Gnadenthal, Reusspark 10 in 5524 Niederwil, Switzerland, and is also be available online.

The upgrading process of biogas to Biomethane results in a gas stream containing (bio-) methane and a second gas stream containing the CO2 and an unwanted part of the biomethane, called methane slip. This CO2 rich gas stream either directly emitted to the atmosphere or its content of methane is oxidised before the release into the atmosphere, according to the applicable regulations. National regulations on the handling of the methane slip differ substantially in EU countries, France has recently changed the thresholds, in Switzerland new regulations are discussed. The presentations address the options for the reduction of the emissions and put the options for emission reduction into a context with GHG balances and national situation in Switzerland and France.

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New Developments

Automated biogas plant ensures power and heat supply for villages

In the PowerLand 4.2 project, the University of Hohenheim, Reutlingen University of Applied

Sciences and Novatech GmbH developed a control system for a fully automated biogas plant that supplies renewable electricity and heat on demand for villages, especially in the production gaps of sun and wind. The control system was successfully tested in a real laboratory. Thanks to energy demand forecasts and adapted, flexible feeding, biogas plant operators can use this approach to save on investments in larger gas storage facilities. Exchange electricity prices are not sufficient signals for this. Instead, an intelligent control system is needed for the biogas plant's combined heat and power unit (CHP). This must know and process information about the local electricity and heat demand, fill levels of the biogas and heat storage tanks, and the generation of all other renewable plants on site for the next few days, and use this to derive sensible schedules for the CHP unit and anticipatory feeding plans for the digesters.
More (in German)

Production of chemical compounds at pilot scale biogas plants

How can chemicals for the bioeconomy be produced on a large scale from regional residues? This question is being investigated by a team of researchers from the German Biomass Research Centre (DBFZ) and the Helmholtz Centre for Environmental Research (UFZ) together with industrial partners. Medium-chain carboxylic acids such as caproic and caprylic acid are high-value specialty chemicals with applications in the lubricants, in pharmaceuticals, cosmetics, feed, and food sectors. The new process – in which complex substrates can be converted to chemicals without pre-treatment steps – is based on anaerobic fermentation followed by a separation and purification cascade to recover the medium-chain carboxylic acids from the fermentation broth. These acids can then be further processed into different chemicals (e.g., esters), depending on the scope of application. The entire process chain is being demonstrated at a Technology Readiness Level (TRL) of 5-6 at the DBFZ's multi-purpose demonstration plant. The process gives biogas plant operators the possibility of including value-added chemicals into their product spectrum, opening new business opportunities on the way.
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Decentralised system for demand-oriented collection of food waste

Enormous amounts of food waste (FW) are produced worldwide, requiring efficient disposal strategies, both economically and ecologically. Anaerobic digestion to produce biomethane is among the most promising strategies, but requires proper solutions for storage and delivery of the waste material. In a study by the University of Insbruck, Austria, a decentralized system for demand-oriented FW storage and its practical usability was assessed. FW was stored under batch and fed-batch strategies at 5 °C, 20 °C and 30 °C for 28 days. The results showed that FW can be stored without cooling since bacterially produced lactic acid rapidly stabilized the material and inactivated pathogens. While FW storage worked well under all storage conditions and strategies, 16S analysis revealed a distinct microbiota, which was highly characteristic for each storage temperature. Moreover, FW storage had no negative impact on methane yield and stored FW contained readily degradable substances for demand-oriented biogas production.
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Evidence of sustainable truck operation

According to Gasum, the Swedish truck manufacturer Scania is currently testing a digital solution together with Neste, the Finnish specialist for sustainable fuels. It allows easy tracking and verification of a truck's use of renewable fuels. The solution involves data from the Scania Fleet Management portal being enriched with fuel emission data provided by Neste. The result: accurate, up-to-date data for reporting on greenhouse gas

emissions (GHG) which can also be used for sustainability communication by Scania customers, thereby demonstrating the climate impact achieved through use of renewable Neste fuels as compared to fossil fuels. Currently the digital solution is tested in cooperation with logistics companies, including Havi Logistics GmbH, a food logistics service provider that operates in 37 European countries. Up until now it has been a major challenge to check the extent to which a truck actually runs on renewable fuel: as in the case of CNG and biogas and also LNG and bio-LNG, the same trucks can be used with both fossil and non-fossil fuels. The common goal of Neste and Scania is for the solution currently being tested to be used by all manufacturers and all types of renewable fuels in the future.

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GERG and other entities started the THyGA project

The existing gas infrastructure is a vital asset for energy delivery and security of supply, capable of long-term and high-capacity storage of energy. Blending hydrogen with natural gas will take advantage of this asset. To ensure the safety and determine the performance of a system with an increasing hydrogen concentration, an effort in pre-normative research is required. In this context, the new THyGA project (Testing Hydrogen Admixtures for Gas Appliances) sets out to develop and communicate a detailed understanding of the impact of blends of natural gas and hydrogen on end use applications, specifically in the domestic and commercial sector. The main goal of the project is to enable the wide adoption of H2NG (hydrogen in natural gas) blends by closing knowledge gaps regarding technical impacts on residential and commercial gas appliances. The project consortium will identify and recommend appropriate standards that answer the needs and develop a strategy for addressing the challenges for new and existing appliances. Among other targets, up to 100 residential and commercial gas appliances will be tested to provide a generic protocol for different levels of H2 in natural gas, that can be adapted for virtually any appliance.

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Liquid poultry litter digester prototype makes struvite, biogas, and clean water

Arkansas Agricultural Experiment Station researchers have assembled a novel prototype system that could help alleviate the issue of excess nutrient runoff in watersheds from poultry litter. The system turns chicken litter into a more biologically stable fertilizer called struvite, captures methane, and recycles most of the water it uses. Struvite is the common name for magnesium ammonium phosphate, a crystal-like substance that often coats the inside of sewage pipes and causes blockages. Struvite can, however, be created by chemical engineers from solid wastes or wastewater as a fertilizer with slow-release potential because most of it is not water soluble. The substance is taken up by plants as magnesium, nitrogen and phosphorus as the roots acidify the soil around it, so excess nutrient runoff is limited. A two-year experiment station field study in east Arkansas showed struvite performed just as well, and in some cases better, as mined phosphate on corn, soybeans and rice. Mined phosphate is a finite resource prone to price fluctuations.

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Biogas from horse manure: Dry fermentation in garage systems

More and more biogas plant operators are setting out to harness the tremendous potential of horse manure. But this manure cannot be readily used in agricultural plants. There are two options: upgrade a wet fermentation system for co-fermentation with the difficult material or invest in specialized plant technology such as dry fermentation. If horse manure is to be used in agricultural biogas plants with wet fermentation processes, substrate

preparation and, if necessary, foreign matter separation are essential. Trials with a cross-flow hugger showed that an additional methane yield of up to 26% can be achieved. The electricity demand of the cross-flow chipper was between 13.8 and 20.5 kWh/t fresh mass, which corresponded to 3% of the amount of electricity generated with the substrate. Dry fermentation that can easily cope with the straw rich material are an alternative to liquid systems. These work with cyclically operated fermenter boxes (garages), that are loaded and emptied with a front loader. The substrate stack is sprinkled with thin-bodied percolate. The "trickle ability" (percolation) of the substrate must be ensured by the structural material.
More (in German)

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Gasunie to convert natural gas pipeline into biogas carrier

Gasunie recently took the decision to convert a 60-kilometer natural gas pipeline in The Netherlands between Emmen and Ommen for the transport of regional *green gas* to the Gasunie high-pressure network from the beginning of 2024. The first gas is expected to flow in the beginning of 2025. This fits with the Dutch ambition from the Climate Agreement to produce two billion m^3 of *green gas* by 2030. This increasing volume is causing more and more congestion in the regional pipelines through which the various producers transport their *green gas*. All together around 15 small scale and 3 large scale biogas plants are planned to be connected to the pipeline through regional grids operated at 8 bars. The grid will be opened for Hydrogen eventually.
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Biogas-powered fuel cells as prime power in data centers

In recent years, the world has witnessed a dramatic increase in the demand for data centers. McKinsey forecasts that data center demand in the US will grow 10 percent every year until 2030. As the demand for data centers grows, so does their energy consumption, and along with it, their environmental impact. Researchers and engineers have been exploring various ways to make data centers more energy efficient and environmentally friendly, and one of the solutions gaining attention is the use of green gas fuel cells as the prime power in data centers. A renewable and low-carbon fuel, biogas as the prime power allows data centers to significantly reduce their carbon footprints. Additionally, green gas fuel cells are highly efficient. These fuel cells have an energy conversion efficiency of up to 60 percent.
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RNG in Transport

Carbon-neutral over 1.3 million km

Europe's first biomethane powered Peterbilt truck with its large, vertical chrome exhaust pipes is still an eye-catcher after 28 years on Swiss roads. The idea of a US truck powered by RNG began with Swiss environmental pioneer Walter Schmid: he wanted a truck in Switzerland that ran on a Detroit Diesel Corporation engine – a purely gas-powered engine, not one of the dual fuel motors. But it took some time for the imposing Peterbilt to make it onto Swiss roads. The standards relating to the new CNG technology were not easily available back then, and a lot was uncharted territory for the Swiss authorities when it came to issuing an official approval. The reason for buying an American truck was simple: In the United States, this type of engine had been successfully used with CNG for regular bus transport in San Francisco. For 28 years now, the RNG truck has been running 1.3 million km without problems on its Detroit 60 Series engine with an impressive output of 440 hp and eight tanks on board holding a total of 150 kilos of biomethane.
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Trucks and LDV's: Iveco to register over 1,600 CNG vehicles in France by 2022

Despite rising fuel prices, Iveco continues its offensive in the natural gas vehicle segment. While Iveco is committed to electric and hydrogen power through its partnership with American manufacturer Nikola Motor, it is not abandoning its range of gas-powered vehicles. In the year 2022, the manufacturer has registered 1,619 CNG vans and trucks in France. This represents a 2% increase on the 1,587 registrations achieved in 2021. In the "Light" segment, the Daily achieved its best market share in over 10 years, with more than 17,600 vehicles invoiced, all energies combined, over the past year. On the gas side, the Iveco Daily CNG totaled 832 registrations in 2022, 21% more than in 2021. In the medium segment (7.5 t - 15.9 t), the Iveco Eurocargo CNG remains the leader, with 138 units registered in 2022. In the heavy-duty segment (+ 16 t), the Iveco S-Way gas range is the only one not to progress.

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World's second-largest liquefaction plant for bio- and synthetic fuels

The world's second-largest liquefaction plant for bio- and synthetic fuels is being built in the heart of Germany, in Burghaun in the district of Fulda by the company *Reefuelery* because of its central location and excellent connection to the network of Alternoil, a subsidiary of the Avanca Group, which specialises in sustainable energy and logistics solutions, currently comprising 36 LNG filling stations. This network is to be expanded to 60 sites by the end of 2023. Alternoil, Erdgas Südwest and BMP Greengas (one of Europe's leading biomethane marketers) are now pooling their strengths and expertise to produce the 100% climate-neutral fuel for heavy-duty transport. Once the plant is complete, 180 tons of bio-LNG/LBG can be produced per day providing enough fuel to run 4500 trucks.

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Brazil: Adecoagro starts supplying biomethane to its fleet

A few weeks ago, part of Adecoagro's fleet was supplied with biomethane produced from sugarcane stillage at the Ivinhema Plant, in the Brazilian state of Mato Grosso do Sul, and inaugurated a new stage in the trajectory of sustainable businesses. Adecoagro is one of the main food and renewable energy companies in South America. With three plants in Brazil, two in Mato Grosso and one in Minas Gerais, and an annual capacity to process 13.7 million tons of sugarcane. Adecoagro is using around 3% of the stillage generated to produce 6,600 Nm3/day of biomethane, equivalent to 6,000 liters of diesel/day. With the construction and inauguration of another biodigester at the Ivinhema plant in the second half of the year, it will double its capacity. This will allow the replacement of the equivalent of 4.3 million liters of diesel, enough to supply 66 sugarcane trucks.

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