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Biomethane and Hydrogen – Partners in the grid

Biological hydrogen methanation systems – an overview

The rise in intermittent renewable electricity production presents a global requirement for energy storage. Biological hydrogen methanation (BHM) facilitates wind and solar energy through the storage of otherwise curtailed or constrained electricity in the form of the gaseous energy vector biomethane. Biological methanation in the circular economy involves the reaction of renewable hydrogen – produced during electrolysis – with carbon dioxide in the raw biogas to produce methane, typically increasing the methane output of the biogas system by 70%. In this paper by the MaREI Center in Cork under the lead of Task 37 manager Jerry Murphy, several BHM systems were researched and a compilation of such systems was synthesized, facilitating comparison of key parameters such as methane evolution rate and retention time.
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New method for the methanation of carbon dioxide from Anaerobic Digestion

Scientists from DBI Gas- und Umwelttechnik GmbH and the TU Bergakademie Freiberg have developed a novel catalytic method for the direct methanation of CO2 from the biogas process with electrolysis hydrogen. The process enables the production of a gas with 95% methane that can be fed into the natural gas grid. The methane is produced without prior separation of carbon dioxide from the raw biogas in a two-stage reactor system. The main innovation of the new process is the innovative catalyst based on iron oxide instead of nickel. The background of the project was the storage of fluctuating surplus energy from wind or solar installations. In the developed process, biogas is fed directly into a two-stage reactor system without prior CO2 separation. In addition to the partial conversion of the CO2, the pre-reactor is also used for the fine purification of the biogas, in which, for example, traces of hydrogen sulphide and silicon compounds are separated. In the subsequent methanation reactor there are catalyst-filled reactor tubes working at a process pressure of 12 bar. The concept guarantees a long catalyst life in the second stage. The novel catalysts are based on iron and are characterized by higher resistance to impurities, lower costs and lower environmental and health risks compared to conventional nickel catalysts. The process developed has been successfully tested on a small technical scale in extensive series of trials.
More (in German only)

Impact of use of potential of biomethane and hydrogen on network

The European Commission has published a study giving a better understanding of the potential of biomethane and hydrogen to contribute to the decarbonization of the EU energy system, the impacts this will have on the gas infrastructure and the extent to which gas network operators and regulators are prepared to cope with these impacts. In none of the three scenarios for 2030 or 2050 studied, the

gas demand exceeds 4,100 TWh/yr. At the same time a conservative technical biogas/biomethane EU28 production potential of 1 150 TWh/yr is estimated. Hence biomethane can cover alone 25% of the future gas consumption. In addition, the additional annual hydrogen production potential from electrolysis of renewable electricity for the EU would amount to 6 500 TWh in 2030, increasing to 7 900 TWh in 2050 after deduction of the expected electricity consumption.
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The value of gas infrastructure in a climate-neutral Europe

The study of Frontier focuses on the value of gas infrastructure as an enabler of cross-sectorial emission reductions and is underpinned by a system-wide cost analysis approach, with a specific regional focus on Belgium, the Czech Republic, Germany, Denmark, France, the Netherlands, Sweden and Switzerland. Frontier finds that the existing gas infrastructure is well positioned to help overcome the key challenges of decarbonization like storage and transportation of energy. This is based on extensive existing gas storage capacity, which is sufficient to cover today's gas demand in these countries by more than three months (compared to electricity storage with less than four hours), and a well-established Europe-wide gas transportation system, which exceeds the electricity transmission capacity by large. Furthermore, the continued use of gas networks avoids substantial investments related to electrifying end-user appliances and expanding electricity networks. Calculations show that the eight countries analyzed together can save €30-49 bn per year in 2050 through the continued use of gas networks. Various renewable and low-carbon gases available which can be transported via the gas grid and contribute to decarbonization efforts. These gases include biomethane, green hydrogen and synthetic (green) methane from electrolysis (power-to-gas) and blue hydrogen, i.e. hydrogen produced from natural gas with the related carbon output either stored or re-used. Such gases could serve as reliable fuel for electricity generation and thus serve as back-up to balance intermittency of renewable supply, cover seasonal heating demand, contribute towards dearbonizing the transport sector (particularly heavy-duty), and provide a low-carbon solution for high temperature heat and feedstock needs in industry.
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Gas decarbonization pathways 2020-2050

The Gas for Climate consortium recently published the Gas Decarbonisation Pathway 2020-2050 study analyzing the transition towards the lowest cost climate neutral system by 2050. This new study highlights that additional EU climate and energy policies are needed to position Europe on the road to minus 55% by 2030 and net zero by 2050. The European Green Deal can facilitate these developments among others by adapting the EU policy framework to make gas infrastructure future-proof in an integrated energy system and a key asset for the sustainable and cost-efficient decarbonization of the European economy and stimulating the supply of biomethane and hydrogen by a binding mandate for 10% gas from renewable sources by 2030. Coupling the electricity, gas and heat sectors provides the greatest overall benefits for the European energy system.
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Switzerland: 11 percent more biomethane injected in 2019

In 2019, 11% more biogas was fed into the grid in Switzerland (including Liechtenstein) than in the previous year, a total of 409 GWh. The figure confirms the trend that more and more renewable gas is being produced in Switzerland. The Swiss gas industry aims to increase the share of renewable gases in the gas-supplied heating market to 30% or 5000 GWh by 2030. With the additional biogas imports of aprox. 600 GWh in 2019, close to 20% of this target was achieved. In fact, there are already the first cities that have started to add 30% renewable gases to the standard natural gas product. The Swiss gas industry is committed to the goal of a climate-neutral energy supply by 2050 and is pursuing a decarbonisation of the gas supply. It is doing this, on the one hand, by promoting renewable gases from

biogas or by converting surplus renewable electricity that can be made available in winter by means of power-to-gas. Actually, there are 38 biogas plants in Switzerland feeding biomethane into the grid; others are under construction or planned. Around one third of all gas-supplied households in Switzerland now choose a product containing a percentage of biogas ranging from 10 to 100%. To promote domestic biogas production, the gas sector has its own funding model. The money, coming from a levy on natural gas sales, supports investments and feed-in contributions for three years.
More (in German)

Less biomethane fed into the natural gas grid in Germany

2019 was a black year for the German biomethane industry. A continuing drop in prices, long periods of drought and a lack of growth prospects put the industry under pressure, stated the German Energy Agency (Dena) in its annual survey "Biomethane 2020 industry barometer". According to the survey, 2019 was the worst year since data collection began in 2012. New plant construction stagnated with only 3 new plants going into operation. The total processing capacity amounted to 133,734 m^3/h at 210 locations as of April 2020. But also, electricity production from biogas fell for the first time, falling below 10 billion kWh. According to Dena, major reasons were the lower market prices and weakening profitability. However, the long-term outlook is slightly more positive. New legislation will bring additional demand in heating. DENA hopes that this will provide impetus for the use of biomethane cogeneration plants in neighborhood concepts.
In contrast to Germany, the international trade was developing steadily. The import of biomethane is particularly popular in the Swiss market. The export of German certificates to Switzerland in 2019 remained at the previous year's level, although suppliers from Denmark, Great Britain and the Netherlands could offer cheaper products because biomethane in these countries receives subsidies for feeding into the natural gas grid.
More (in German)

Gasum strengthens LNG and biogas offering with new acquisitions

The Nordic energy company Gasum has closed the acquisition of Linde AG's LNG and Biogas business in Sweden and Norway and Nauticor's Marine Bunkering business in Germany. The businesses generate annual revenues of more than EUR 100 million. The transaction strengthens Gasum's strategy by developing the Nordic gas market and creating a platform for a broader offering to its customers in the maritime, industry and road transport segments. The acquisition also accelerates Gasum's growth strategy for cleaner transport solutions in the Nordic heavy-duty vehicle market. In the transaction, several assets were transferred to Gasum: LNG terminals in Sweden and in Norway; bunkering vessel Seagas; bunkering vessel Kairos and 48 gas filling stations in Sweden and Norway.
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