



Technology Collaboration Programme
by IEA

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Newsletter IEA Bioenergy Task 37: 12/2022

IEA Inputs and new developments of RNG

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Task 37: Integrated biogas systems – sustainable solutions beyond energy

IEA Bioenergy Task 37 (Energy from Biogas) organizes a zoom webinar on 15 December 2022 on biogas systems, their integration in complex energy systems and related trans-sectoral benefits. Biogas systems are more than plants for mere energy provision. They can for instance enhance recycling of nutrients, reduce air pollution, improve water quality and soil fertility – depending on the infrastructure they are integrated in. Biogas systems offer a variety of production and gas utilization options combining for a highly customizable technology. The webinar starts with examples of integrated biogas solutions, focusing on the diversity and multifunctionality of biogas and biomethane pathways in a circular economy. The second presentation will discuss the sustainability assessment of biogas systems by means of multicriteria analysis and discuss most favorable solutions. The third presentation compares different approaches and concludes with recommendations for sector development. Participation is free of charge but registering is mandatory.

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IEA gas market report Q4 2022

This year's winter gas season opens with extreme natural gas price levels and volatility, caused by unprecedented uncertainty of supply as Russia steeply curtails its pipeline deliveries to Europe. The result is considerable market tension in alternative sources of supply. Security of supply has become a top priority in Europe and other importing regions as a total cut-off in Russian flows to Europe cannot be ruled out, creating further tensions and demand destruction for all competing LNG importers. The

gas crisis has caused a series of market adjustments. European buyers have strongly increased their LNG procurement, resulting in market tightening and demand destruction in various importing regions. This has also had a visible impact on LNG contracting behaviours, with a return to more traditional features such as fixed-destination and longer-duration contracts. This quarterly report includes the IEA's annual Global Gas Security Review and an analysis of short-term gas market evolution to 2023.

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IEA World Energy Outlook 2022 published

World Energy Outlook 2022 shows the global energy crisis can be a historic turning point towards a cleaner and more secure future. The global energy crisis triggered by Russia's invasion of Ukraine is causing profound and long-lasting changes that have the potential to hasten the transition to a more sustainable and secure energy system, according to the latest edition of the IEA's WEO. For the first time, global demand for each of the fossil fuels shows a peak or plateau across all WEO scenarios, with Russian exports in particular falling significantly as the world energy order is reshaped. In the WEO's Stated Policies Scenario, which is based on the latest policy settings worldwide, these new measures help propel global clean energy investment to more than USD 2 trillion a year by 2030, a rise of more than 50% from today. As markets rebalance in this scenario, the upside for coal from today's crisis is temporary as renewables, supported by nuclear power, see sustained gains. As a result, a high point for global emissions is reached in 2025. At the same time, international energy markets undergo a profound reorientation in the 2020s as countries adjust to the rupture of Russia-Europe flows.

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New Biomethane Micro Liquefaction and CO2 liquefaction projects

Italy's Ecospray and Germany's Ruhe signed new agreements for the supply of two biomethane plants and three CO₂-liquefaction plants for customers of Green Line Liquid Anlagenbau – an affiliated company of Ruhe company group. Each project involves the construction of a complete system for pre-treatment, upgrading, liquefaction of biomethane and the liquefaction of CO₂, with associated storage and cryogenic tank filling. The first project is expected to produce eight tons per day of bio-LNG, while the second one is set to produce three tons per day. The construction of these plants is ongoing and it will be commissioned according to the schedule. Ecospray developed two micro-liquefaction systems with modular capacities of 1 to 50 tons per day. The processes follow the principle of the Claude and Linde cycles respectively, based on compression and expansion of the biomethane without the use of cooling methods like nitrogen.

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Inauguration of Switzerland's first industrial power-to-gas plant

Limeco has realized Switzerland's first industrial power-to-gas plant in Dietikon, in collaboration with eight Swiss energy suppliers and the municipal utility alliance Swisspower, which as gas purchasers, are helping to finance the investment of around 14 million Swiss francs. With the plant, the project partners have achieved an important goal: proving that power-to-gas plants can function on a large scale and thus contribute to the country's supply of renewable gas. With Hitachi Zosen Inova Schmack GmbH and Siemens Energy AG, proven specialists in process engineering and the various components of the power-to-gas process are also on board. With an electrolysis capacity of 2.5 MW, the plant produces around 18,000 MWh of synthetic renewable gas per year. Thanks to it, up to 5,000 tons of CO₂ can be saved annually. The renewable electricity comes from a waste-to-energy plant, the biogas from the wastewater treatment plant. Hydrogen and sewage gas are mixed in a bio-reactor where Archaea produce the synthetic biomethane.

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CMA SGN co-invest into a 200,000 tons per year biomethane plant

The CMA CGM Group, a global player in maritime, land, air and logistics solutions, and ENGIE, a leading

global provider of low-carbon energy and services, today announced their intention to co-invest in the Salamandre project, the first industrial and commercial 2nd generation gasification unit, and their intention to produce up to 200,000 metric tons of renewable gas per year by 2028, to meet the needs of CMA CGM and the shipping industry. With a majority industrial shareholding by ENGIE and the CMA CGM Group, the site is planned to be located in Le Havre, with the support of the Le Havre Seine Métropole urban community, as part of the "Le Havre, Smart Port City" future investment program. The unit will be fueled by dry biomass from local wood waste and solid recovered fuels, and will use the pyrogasification technique. The site aims to produce 11,000 tons of biomethane per year starting in 2026.

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Hydrothermal gasification, the future of biomethane production?

As part of the Gazhyvert 2 project, the CEA and the grid operator GRDF have joined forces to facilitate the development of a hydrothermal gasification demonstrator. This technology could represent up to 12% of the total production of green gas in France by 2050. GRDF announced its support for the emergence of hydrothermal gasification, which makes it possible to produce biomethane from sewage sludge by reusing the heat generated by the process. The Gazhyvert 2 project, launched jointly by GRDF and the French Atomic Energy and Alternative Energies Commission (CEA), aims to define the adaptations needed to industrialize this technology by 2025.

According to GRDF, the total potential for green gas production in France by 2050 is 420 TWh. Hydrothermal gasification could account for up to 50 TWh of this production, alongside other technologies such as biogasification - which will remain the majority in volume - power-to-gas or pyrogasification.

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GERG project: Optimization of gas quality testing

GERG's (The European Gas Research Group) "Biomethane Injection Best Practices" research project, launched in April 2022, aims to identify best practices for biomethane injection in the European Union. The research project therefore focuses in particular on quality testing in the context of biogas upgrading for CO₂ capture (to achieve fuel quality). Since the price of upgraded biogas is currently not yet competitive with natural gas, the search is on for solutions that are as cost-effective as possible. Three well-known research centers in Europe are carrying out the project: Danish Gas Technology Centre, KIWA; Netherlands and DNV Group (UK). The project aims to promote the exchange of experience and answer the following questions: with which technologies and tools the utilities have had the best experience and which technologies, developments and innovations have proved particularly successful? The research project is expected to last four months. One of the expected objectives is to identify best practices in different areas of biomethane injection to enable a reduction in investment and operating costs while maintaining or increasing safety levels.

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DAWN – the first industrial demonstration plant to produce solar fuels by Synhelion

Synhelion is a spin-off of ETH Zurich and a pioneer in solar fuels, which are produced by reversing the combustion process. The fact that the production process can be powered exclusively by solar heat – and without the use of electricity – was first demonstrated in 2019 in a mini-refinery on the roof of ETH Zurich. The CO₂ might come from industrial off-gas or biomass. Located in Jülich, Germany, DAWN will be the first facility demonstrating the entire process from concentrating sunlight to producing synthetic liquid fuel on an industrial scale. The DAWN plant consists of a 20-meter-high solar tower and a heliostat field with a mirror surface of 1'500 m². The solar tower houses three innovations developed by Synhelion: a solar receiver, a thermochemical reactor, and a thermal energy storage that enables cost-efficient operation around the clock allowing to produce several thousand liters of fuel per year. The fuels produced (solar kerosene and gasoline) will be used to demonstrate various applications.

SWISS will be the first airline to fly on Synhelion's solar kerosene.

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Anaergia to supply liquefied biogenic carbon dioxide to European energy

Anaergia announced an agreement with European Energy for the provision of liquefied biogenic carbon dioxide. Under the terms of the agreement Anaergia is to supply European Energy with up to 60,000 tons per year of liquefied biogenic carbon dioxide for a period of 10 years. Anaergia will provide the liquefied CO₂ from the anaerobic digesters that will operate at its plant being built in Tønder, Denmark. European Energy, a multinational renewable wind and solar energy producer, will produce green e-methanol from this biogenic CO₂. The green e-methanol will be used to power the first container vessel that global container logistics services provider A.P. Moller – Maersk is having built to operate on this carbon neutral fuel.

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SoCalGas breaks ground on first-of-its-kind technology to produce hydrogen from RNG

Southern California Gas Co. (SoCalGas) announced the construction of a first-of-its-kind advanced hydrogen generation system at SunLine Transit Agency in Thousand Palms, California. The project, called H₂ SilverSTARS, will produce hydrogen from RNG and help fuel SunLine's fleet of 17 hydrogen fuel cell electric buses. At scale, this demonstration project has the potential to provide clean hydrogen at any location adjacent to a natural gas pipeline, which will help reduce greenhouse gas emissions and accelerate California's climate and clean air goals. The demonstration will test STARS' technology, which was developed at the Pacific Northwest National Lab. The technology uses a combustion free process, so that it produces fewer greenhouse gas emissions compared to a conventional steam methane reforming process. Since the compact system is based on low-cost 12×1-inch, 3D-printed reactor disks and heat exchangers, it can be easily installed at fueling stations to help meet the demand while advancing climate and clean air goals. After its installation, the first STARS system will produce up to 80 kilograms of clean hydrogen a day, that's enough to fuel three of SunLine's zero-emission buses per day.

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First green hydrogen production from manure and slurry directly on the farm

The association around the freshly founded Btx Energy GmbH from Hof presented the first commissioned plant for the production of green hydrogen from sustainably produced biogas from a funded project "BioH₂Ref". On Oct. 28, 2022 the plant was inaugurated at an intermediate site at Naturenergie Glemstal in Hemmingen, Germany. The steam reforming technology used is familiar from the natural gas sector, but in this case uses renewable biogas - primarily from residual materials - and is tailored to agricultural operations. The plant produces high-purity hydrogen directly on the farm. The turnkey container plant was developed and built by the specialist for small-scale plant construction from the Verbund, E-flox GmbH from Renningen. Particular attention was paid to simple and clearly defined interfaces for retrofitting existing plants. The sophisticated reformer technology of the sister company WS Reformer GmbH is used. New developments in both process and catalyst design are incorporated for use with biogas.

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Galileo's Micro Bio Box

Galileo Technologies designed, installed, and commissioned one of its innovative Microbox-Bio stations for integrated production of compressed renewable natural gas (RNG). The installation was performed at the Liberty Dairy Farm project in Wisconsin, United States. Conceived as an end-to-end solution, the Microbox-Bio station is designed to upgrade up to 300 scfm (square feet per minute) of raw biogas and deliver compressed RNG at 3600 psi (pounds per square inch) to be transported by road for injection

into natural gas pipelines. Completely factory-assembled, the plug-and-play configuration of the station accelerates time to market and RNG monetization. It features an amine washer to remove high H₂S concentrations, activated carbon to remove additional H₂S and VOCs and a hollow fiber membrane to remove CO₂. Microbox-Bio units upgrade and compress biogas obtained from manure at two dairy farms owned by Liberty in Wisconsin. The first one was installed in November on a farm that houses 1,700 dairy cows, and the second one is processing the waste from a herd of 2500 cattle. Since these units were designed for 550 m³/hr throughput, they are able to operate down to a 30-40% turndown. They yield an exceptional quality product gas, at 99.9% methane with a negligible methane slip, at an average of 800 ppm.

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Novel biogas plant in Saarland to utilize horse manure

Ökobit, based in Föhren near Trier, Germany, has developed a novel small-scale biogas plant for the utilization of horse manure, straw and remaining of grain. Together with research partners, the company is now building an 80-kW dry digestion biogas plant for the fermentation of solid manure in Saarland as part of applied research project Febio). The aim of the small-scale plant is to use dry fermentation to develop an economical solution for substrates like horse manure, which are difficult to ferment in stirred tank reactors. The advantage of the new plant type is its simple construction and operation, which can be set up by future operators in the builder-owner model offered by Ökobit. Residual materials, such as horse manure, grain waste or landscape management greenery, have so far contributed only in small quantities to the total biogas production. Dry fermentation in a bunker silo design offers a clear advantage, as there are no moving components in the substrate space and the operation is therefore mechanically very robust. The bunker silo fermenter can be compared to a long garage without a roof, which is sunk into the ground and covered with a tarpaulin after filling or emptying.

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UK : 10 Biomethane plants use “green” CO₂

Ten of the 90 plants in the UK injecting biomethane into the grid are storing and selling their CO₂ instead of venting it to the air. Most of them market the CO₂ via the French gas giant Air liquid. Not so Rainbarrows JV Energen who is directly marketing the highly purified CO₂ (99.7%) to the food industry. The plant produces 700 to 750kg of CO₂ per hour. King Charles is the largest shareholder of Energen next to four farmers. The driver to install a CO₂ separation is the diminishing rate of subsidies which dropped in the UK down from 16.6 €cents/kWh in 2012 to 6 €cents/kWh. With the high current market prices a plant can survive but the investment in the separation plant is intended to secure the long-term financial viability even when the subsidies for feed-in are ending after 11 years.

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