IEA Bioenergy

Bioenergy Success Stories

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BioPower2Gas in Germany

Development, simulation and evaluation of optimal performance-adjustable biogas technologies

Year of implementation:	2013 - 2016
Location:	Germany • BioPower2Gas plant: Viessmann Industrie Deutschland GmbH, Allendorf (Eder) • Biomethane combined heat and power plant: EAM EnergiePlus GmbH, Philippsthal • Flexible biogas plant: Bioenergiedorf Jühnde, Jünde
Technology:	Power to Gas: surplus renewable electricity and CO_2 from biogas are converted to methane by microbiological means
Principle feedstocks:	Not relevant
Products/markets:	Synthetic natural gas that can be used by natural gas customers, but also within the mobility sector as fuel for CNG vehicles. In this case a leading car manufacturer with a CNG vehicle fleet is the contractual purchaser.
Technology Readiness Level (TRL):	TRL 8 – system complete and qualified

DESCRIPTION

During the three years of the project various power controlled biogas technologies have been analyzed, experienced in practice and compared in terms of their capability to generate electricity demand-actuated. Especially the possibility of direct marketing of renewable energies as well as the support of the distribution grid to avoid grid bottlenecks played a key role. Among others, a new "BioPower2Gas"-method (methanation of hydrogen that is produced with surplus renewable electricity and CO_2 from the biogas plant) was installed by the company MicrobEnergy. The method was successfully tested and due to become practice-approved. Results were obtained by the practical experiences and additionally by simulations. The following three plant concepts were tested, demonstrated and evaluated:

- **BioPower2Gas plant** (location Allendorf (Eder)): Biogas plant extended by an electrolyzer and a detached tank for methane production. The plant draws peak current from renewable energy plants, produces hydrogen (H_2), which is along with CO_2 converted into synthetic methane and additionally cleans the biogas to a level of gas quality that can be fed into the gas grid. All methane is fed into the national gas grid. A leading car manufacturer with a CNG vehicle fleet is the contractual

purchaser. The maximum production of synthetic biomethane in the plant is 15 Nm³/h.

- **Biomethane CHP plant** (location Philippsthal): combined heat and power (CHP) plant, which is provided with biomethane from the natural gas grid and flexibly demand-actuated feeds electricity into the grid. To guarantee a steady supply of the attached local heat supply grid the CHP is extended by a thermal storage system.

- **Flexible biogas plant** (location Jühnde): Biogas plant with increased CHP power. In addition it is provided with a gas and thermal storage system to flexibly react to the dynamics of supply and demand.

BioPower2Gas pilot plant in Allendorf

In order to run the plants optimized legal possibilities have been used and economically optimized plant configurations and operating modes were analyzed theoretically. Furthermore the optimized roadmap of the plant was approved practical. Algorithms for the provision of individually optimized plant schedules considering the markets and restrictions of the plant were developed. In addition business models (to be generated within the project) with grid operators and electricity distribution were taken into consideration. The three plant concepts were realized at the locations Allendorf, Philippsthal and Jühnde (Germany).

Stakeholders involved:	MicrobEnergy GmbH – Viessmann Group, CUBE Engineering GmbH, EnergieNetz Mitte GmbH, EAM EnergiePlus GmbH, IdE Institut dezentrale Energietechnologien gGmbH, Bioenergiedorf Jühnde eG
	Project supporters: Federal Ministry for Economic Affairs and Energy (BMWi), Projektträger Jülich (PtJ)
	Academic advisor: Deutsches Biomasseforschungszentrum (DBFZ)

Contribution to Sustainable Development Goals:	The project contributes to the following SDGs: • SDG 7 (access to sustainable energy): Significant contribution to increase the integration of renewable energies by providing negative and positive operating reserve to stabilize the electricity grid especially at the level of distribution grids. • SDG 13 (climate change): the project contributes to a further reduction of greenhouse gases in the energy system
Employment:	*No information available*
Replicability and scale-up potential:	Replicability and scale-up potential can be medium to high, depending on the availability of useable CO_2 sources, natural gas feeding points into the grid and the availability of excess renewable electricity.
Success factors:	Omission of EEG reallocation charge for electricity in Germany, used for electrolysis in the process of biological methanation. Occurrence of suitable locations for BioP2G plants (useable CO_2 source must be in place, natural gas feed point, for example biogas plant or fermentation gas storage of a wastewater treatment plant) and availability of excess electricity from renewable energy resources (referred to countries with minor amount of renewable energy electricity). Establishment of legal certainty related to flexible electricity feed-in of biomethane-CHP.
Constraints:	EEG reallocation charge for electricity, used for electrolysis in the process of biological methanation in Germany. Legal uncertainty related to flexible electricity feed-in of biomethane-CHP. Absence of suitable locations for BP2G plants (lack of CO_2 source, natural gas feed point, technical infrastructure). Limited availability of excess electricity from renewable energy.

Flexible biogas plant in Jühnde, Germany

Info provided by:	Tobias Heidrich (IdE, University of Kassel)
	Thomas Heller (Viessmann – MicrobEnergy)
More information:	http://www.biopower2gas.de/start/
	http://www.biopower2gas.de/mediathek/
	http://www.schmack-biogas.com/en/press/vermarktungsstart-fuer-synthetisches-erdgas-aus-der-power-to-gas.html
	https://www.energetische-biomassenutzung.de/fileadmin/Steckbriefe/dokumente/03KB089_Endbericht_BioPower2Gas.pdf