Possibilities of biogas enhancement by hydrogen addition as contribution to the energy transition

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Abstract

Although 59 % of renewable energies are provided from biomass in Germany, bioenergy is cur-rently rarely observed in the energy policy discussion. As a result of rearrangements in the fund-ing policy, fluctuating renewable energies such as wind and solar power continue to develop while the bioenergy sector is stagnating. But the stock of bioenergy plants represents a valuable bridge between the neglected heat and transport sectors and offers the possibility to utilise sur-plus wind and solar power. The political and social discussion in Germany about the topic of smart grids, power-to-gas and other concepts to reduce the impacts of fluctuating energy provi-sion are in full swing. Another current aim of the German government is to reduce the propor-tion of energy crop in the bioenergy sector. As result biogas operators are encouraged to use alternatives, for example biodegradable waste and residues from agriculture, landscape cultiva-tion or food processing. Caused by an enhanced biowaste collection rate from municipalities and increasing amount of biowaste has to be treated by specialized biogas plants. At the same time these plants has to be prepared for a flexible energy production. One opportunity is power-to-gas together with an adapted biogas upgrading system. The hydrogen (H2) addition could play a role in the future energy system. What we usually have in mind when we talk about biogas processing is drying, desulphurization and separation of gases. Biogas enhancements with H2 addition uses the existing carbon dioxide (CO2) of the biogas and does not carry it out unused, like the separation technologies. The hydrogen can be derived from surplus wind or sun electric-ity. Many studies, mainly with standard energy related biogas concepts, have been reported that remarkable contributions could be achieved by H2 addition to the fermentation process. A sig-nificant increase of methane amount and pH values has been observed. Several authors describe the process of the biomethanation with H2 addition and the changes in the microbiology in the reactor. The methane production correlated to the mass transfer efficiency of the injected hy-drogen. The efficiency of mass transfer can be improved by an adapted reactor design. Typical-ly, two technologies are considered: in-situ and ex-situ biogas upgrading. In the planed paper previous studies with H2 addition were reviewed and evaluated to reflect the state of art. Based on this an optimised biomethanation model for a waste digestion plant will be developed, what is new. This is to be validated by continuous running biogas reactors at the research project "Net-work Stability with Wind and Bioenergy, Storage and Loads (Netz-Stabil)", an Excellence Initia-tive of the Federal State Mecklenburg-Western Pomerania funded by the European Social Fund for Germany (ESF).

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