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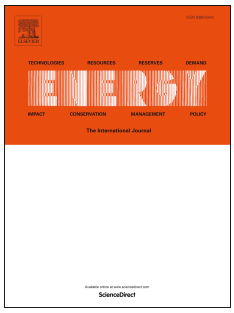

A new methanation and membrane based power-to-gas process for the direct integration of raw biogas – Feasability and comparison

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A new methanation and membrane based power-to-gas process for the direct integration of raw biogas - feasability and comparison

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Abstract

Storage options for increasing amounts of volatile energy supplied by renewable sources are of growing interest. One promising concept is power-to-gas, where electrical energy is transformed to gas that can be stored more easily. H_2 produced by electrolysis powered by excess energy is combined with CO_2 in a methanation to produce CH_4. Possible CO_2 sources are numerous, but biogas is special, as it is a renewable source itself and already contains CH_4 concentrations of up to 60 % v/v. Normally the CH_4 needs to be removed prior to methanation, requiring two gas upgrading steps.

The newly developed process described in this paper circumvents this by directly feeding biogas to the methanation. For evaluation of this concept two process chains were realized. The classic setup consisted of a catalytic methanation and membrane based gas upgrading being fed with H_2 and CO_2 from bottles. The alternative process was coupled with a two-stage fermentation to study effects of changing biogas compositions. Both process chains have been demonstrated on a scale of about $0.5\,m^3$(STP)/h. Results for both will be presented in this work and the positive implications regarding the future implementation of biogas into power-to-gas systems will be discussed.

Keywords: Biogas, Upgrading, Methanation, Membrane, Power-to-gas

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