In times of fluctuating renewable energies and overstressed electrical grids, the production of synthetic natural gas (SNG) and thus the utilization of the existing natural gas grid for power distribution is a promising option for future renewable energy systems. Innovative concepts are developed focusing on the integration of an electrolysis unit into the biomass-derived SNG production process (thermochemical pathway). Different system designs and configurations are analyzed containing the following components: Fluidized and entrained flow biomass gasifiers, gas cleaning, methanation and gas upgrading as well as state-of-the-art electrolysis units. Process concepts are modeled using the process simulation software AspenPlus allowing the drafting of the complete process, with the aim to provide feasible solutions and the evaluation and comparison of those concepts among each other. Main focus of the study is on the integration of mass and heat flows and the optimal process design as well as operation conditions. Results show a diverse and complex situation: Methane yields vary...
from 28.2 to 97.5 % depending mainly on the hydrogen addition from electrolysis with advantages when using entrained flow gasifiers. However, almost complete carbon conversion to SNG can be reached with almost no loss of CO2 within the process. Cold gas efficiencies vary from 54.2 to 73.8 % which is above the stand-alone systems approving the positive synergy effects. Overall efficiencies are between 68.4 and 75.3 % but show a decreasing trend with increasing hydrogen addition and increasing electrolysis size, respectively. However, performance data, efficiencies and methane yields have to be considered closely and properly before coming to a conclusion because of different scale effects and huge deviations in electrolyzer size between 170 and 2600 kW. Thus, an economic evaluation has to be done in order to give a complete evaluation. Furthermore, all concepts depend largely on a very cheap supply to excess power in the electrical grid.

Stichworte: biomass, catalytic conversion, innovative concepts, allothermal gasification, synthetic natural gas (SNG), small scale application

Kongress- / Buchtitel: 21st European Biomass Conference and Exhibition

Kongress / Zusatanzinformationen: Production and supply of biomethane

Jahr: 2013


Revied: nein

Sprache: en

Volltext / DOI: http://doi.org/10.5071/21stEUBCE2013-3CO.11.5

Occurences:
- Einrichtungen > Fakultäten > Fakultät für Maschinenwesen > Institut für Energietechnik > Lehrstuhl für Energiesysteme (Prof. Spliethoff) > Publikationen > 2013
- Einrichtungen > Forschungszentren > TUM Campus Straubing für Biotechnologie und Nachhaltigkeit (TUMCS) > Professur für Regenerative Energiesysteme (Prof. Gaderer)