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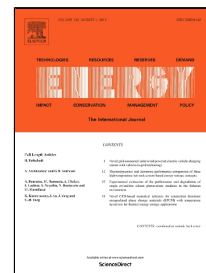
Renewable methane – A technology evaluation by multi-criteria decision making from a European perspective

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## Renewable methane – A technology evaluation by multi-criteria decision making from a European perspective.

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### Abstract

Natural gas (NG), as one fossil fuel with multiple applications, plays a major role in Europe. However, to face global climate change and accelerate the transition to a sustainable society, fossil fuels, such as NG have to be replaced in the long term. The aim of this paper is to evaluate the technical and economic aspects of emerging technology concepts for the production of renewable methane from biomass. Biochemical and thermochemical concepts are considered within the scope of this paper. To evaluate the different conversion technologies an adapted AHP (analytic hierarchy process) was developed, based on two methods AHP and utility value analysis. In total, 99 alternatives (bio- and thermochemical conversion) were evaluated.

From the multi-criteria analysis, no single technology pathway was given preference. However, the choice of substrate was found to be a critical factor in comparing the technology options. Within biochemical conversion, organic waste alternatives were favoured, for the thermochemical conversion, residual forest wood. The goal, a comprehensive comparison of two different conversion pathways on a multi-criteria scale, was achieved, and has thus provided added value for the bioeconomy and biorefinery in research and policy aspects. Further, the methodology is expandable and transferable to other criteria and technologies.

**Key words:** biomethane, bio-SNG, multi-criteria decision making (MCDM), analytic hierarchy process (AHP)

### 1. Introduction

One way to face global climate change is to substitute fossil energy with renewable energy. Among the fossil energies, natural gas is one of the most versatile. It can be very easily used for heat and power production, as a fuel in transportation, as well as in the chemical industry as a base product. Additionally, it can be very easily transported via existing infrastructure, e.g. gas pipelines and transport vessels. But natural gas is a fossil fuel with negative aspects as well. It contributes to global climate change, leading to issues of land use changes, is limited in its availability and, in the case of the European Union, has to be imported from foreign countries (IEA 2014, 77).

Due to its high primary energy share (~24%) as well as high import share (~60%) within the EU, natural gas is a major factor within the energy policy (IEA 2014, 77, 592). Therefore, it would be of great benefit if natural gas could be replaced by a renewable alternative. In concrete terms, this would mean the reduction or slowing of climate change, the preservation of natural

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