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A profitability analysis of small-scale biomethane plants

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Abstract

European countries aim to achieve a more competitive, safe and sustainable energy system. Biomethane is a promising renewable energy carrier and the main point of strength is its flexibility. In fact, this resource can be injected directly into the public gas grid, or can be converted into electricity and heat in cogeneration units, or can be used in the transport sector as vehicle fuel. Literature analysis highlights as the role of subsidies is strategic to develop the biomethane production and countries, as Germany, Sweden, United Kingdom, Switzerland and Netherlands, have registered a significant growth in the last years.

This paper proposes a mathematical and economic model useful to evaluate the profitability of biomethane injected into the gas grid. The indicators used are Net Present Value and Discounted Payback Time. The baseline scenario analyses three different small-scale sizes (50 m³/h, 100 m³/h and 150 m³/h) concerning two typologies of substrates (municipal solid waste msw and a mixture of maize and manure residues). A sensitivity analysis on the main critical variables (subsidies, investment costs of biogas production, transport costs of substrates and percentage of maintenance and overhead costs in biogas production) is conducted. The profitability of biomethane, also for small-scale plants and when are recovered a wide range of waste, can contribute to develop the circular economy and consequently, it plays a role in a sustainable future.

Keywords: biomethane, economic analysis, small-scale plants, subsidies, sustainability