

<https://doi.org/10.7250/CONNECT.2023.076>

BIOMETHANE PRODUCTION AND UTILIZATION PATHWAYS: AN MCDA-BASED IMPACT ASSESSMENT IN SARDINIA, ITALY

Carla ASQUER^{1*}, Francesco ROMAGNOLI²

¹ *Sardegna Ricerche, Renewable Energy Centre, VI Strada Ovest, Z. I. Macchiareddu (Cagliari), 09010, Italy*

² *Institute of Energy Systems and Environment, Faculty of Electrical and Environmental Engineering, Riga Technical University, 12/1 Azenes Street, Riga, LV1048, Latvia*

* **Corresponding author.** E-mail address: asquer@sardegna ricerche.it

Abstract – Biogas from the anaerobic digestion of organic substrates represents a renewable and sustainable fuel widely deployed in Sardinia, supported by the high share of rural areas and the generation of agro-industrial residues and by-products. On the wave of new economic incentives, interest is gradually shifting to biomethane. Nonetheless, the possible uses of biomethane are compelled by the local energy system, which defects in the implementation of the natural gas grid and gas fuelling stations. This is the reason why heat and power production may still be considered one of the most plausible biomethane utilization. Multiple options for upgrading biogas into biomethane exist. Chemical absorption represents an established and reliable upgrading solution. However, innovative alternatives such as biological methanation have emerged characterized by high sustainability and versatility. In the present paper, six scenarios for biomethane generation and utilization are presented and analysed to determine an integrated impact benchmark for each of them. The impact assessment is structured in criteria that depict the environmental, economic, technological and social dimensions. It is carried out using the Multi-criteria Decision Analysis. An in-depth literature review allowed to identify quantitative and qualitative indicators for each dimension according to a rationale described in the paper. The results describe the processes and technologies involved and determine the integrated impacts for the considered scenarios. The method adopted emphasizes the regional worth of the assessment process, and the critical importance of collecting technological data at the pilot or commercial scale, given the distinctiveness of the experiences developed at the laboratory-scale.

Keywords – *Assessment; biomethane; impact; multi-criteria decision analysis*