Assessing the Impacts of Biomethane Scale-Up in Europe: A Global Value Chain Analysis

Topic: Input-Output Modelling: Energy policies (2)
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Biomethane is emerging as a key pillar of Europeâ€™s energy transition under the REPowerEU plan of 2022, with the EU targeting 35 billion cubic meters (bcm) of annual production by 2030, produced either as biogas or upgraded to biomethane. As a renewable substitute for fossil natural gas in transport, buildings, industry, and power applications, it contributes to emissions reduction, waste valorisation, and energy security. At the same time, large-scale deployment raises important questions about its broader economic and societal implications. This study examines the sustainability impacts of scaling up biomethane production in Europe. First, we analyse how the investment and operation of innovative biomethane plants influence economic activity, environmental performance, and structural change along global value chains. This includes both the construction of new biomethane facilities and the substitution of fossil natural gas in final energy use through biomethane deployment. The resulting impacts are summarized across the main pillars of sustainability, including economic effects, societal outcomes such as job creation, and greenhouse gas (GHG) emissions. Second, we evaluate how these economy-wide impacts relate to selected Sustainable Development Goal (SDG) indicators, providing an integrated perspective on the broader sustainability implications of biomethane expansion. To do so, we apply a multi-regional input-output (MRIO) modelling framework with a global value chain perspective, following Wiebe et al. (2026) (1) and based on the 2023 edition of the OECD Inter-Country Input-Output (ICIO) database. Industry-scale investment and operational cost data are derived from three innovative biomethane demonstration cases located in Spain, France, and Belgium. These cost structures are mapped to ICIO sectors to represent the construction and operation of biomethane plants within the MRIO framework. The scenarios are thus modelled in two stages. The first stage captures the short-term effects associated with the investment phase, reflecting the construction of envisioned industry-scale biomethane facilities and the resulting demand for construction, machinery, and related inputs. The second stage represents the operational phase, capturing the longer-term effects of plant operation together with the substitution of fossil natural gas by biomethane in final energy use. Preliminary results for the Spain case study - a wastewater treatment plant biogas to biomethane facility with a 2,000 mÂ³ compressed biomethane storage system - show differences between the investment and operational phases among regions and economic sectors. During the investment phase, positive short-term value added and employment gains are observed in Spain and the rest of Europe, with additional spill overs to the rest of the world through imported machinery and equipment. The strongest gains occur in economic sectors such as construction, machinery and equipment, electrical equipment, and professional services. At the same time, GHG emissions increase in the short run due to higher activity in energy intensive manufacturing. When translating the impacts into SDG indicators, we observe short-term increases in total GHG emissions (SDG 13.2.2) and material extraction indicators (SDG 12.2 and 8.4.1). In contrast, the operational phase, assuming 10 percent substitution of conventional fossil gas used in municipal transport through biomethane compression for use as compressed natural gas, induces structural adjustments along global value chains. Reduced demand for fossil fuel inputs contracts natural gas extraction, petroleum refining, and related transport activities, particularly outside Europe. At the same time, Spain retains positive value added and employment effects in sectors linked to plant operation, including waste management, gas supply, and related services. These shifts generate substantial reductions in GHG emissions, especially in energy producing regions. When effects are mapped to SDG indicators, the operational phase shows improvements in total emissions (SDG 13.2.2), fossil energy intensity (SDG 7.3.1), and emissions per unit of value added (SDG 9.4.1). Overall, the findings suggest that

biomethane scale-up can support decarbonization while generating economic-wide effects. The distribution of benefits depends on domestic industrial capacity and supply-chain linkage, highlighting the value of coordinated energy and industrial policies to maximize local gains alongside climate objectives.

(1) https://doi.org/10.1080/09535314.2025.2602033