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The contribution of geographic information systems to the dissemination of biogas technology: A review

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Abstract

The transition to green economies is a priority for both developed and developing countries, with renewable energy playing a central role. While developed and emerging economies have made notable progress in deploying renewable energy technologies such as solar, wind, tidal, and biogas, many developing countries continue to lag despite abundant resource potential. This gap highlights the need for enhanced research, innovation, and technology diffusion strategies. In the context of biogas technology, governments, organisations, and private actors have made substantial investments; however, further efforts are required to accelerate adoption.

Geographic Information Systems (GIS) offer significant potential to support the planning and diffusion of biogas technology, yet their application remains limited in practice. This study systematically reviews the role of GIS in advancing the diffusion of biogas technology. Using the PRISMA protocol, 39 peer-reviewed articles were selected and analysed through systematic review, data extraction, and thematic synthesis.

The findings indicate that GIS-based methods play a critical role in land suitability analysis, site selection for biogas plants, estimation of resource potential and production capacity, and decision support. The geographical distribution of studies shows a strong concentration in Europe (over 51 %), followed by Asia (28 %), Africa (over 13 %), and the Americas (over 8 %), with more than 99 % conducted at the local scale.

This review highlights the growing importance of GIS in biogas development while revealing regional and methodological gaps, particularly in developing countries. It underscores the need to expand the use of GIS tools to support informed decision-making and accelerate the global diffusion of biogas technology.

Keywords: Anaerobic digestion, GIS, multicriteria analysis, remote sensing, spatial analysis