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CARBON FOOTPRINT OF ELECTRICITY FROM ANAEROBIC DIGESTION PLANTS IN ITALY

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Abstract

In the context of biogas sustainability assessment, a promising way to reach greenhouse gases (GHG) reduction and fossil energy savings is the anaerobic digestion (AD) of both animal manure and energy crops.

Nowadays, more than 1,100 AD plants are working in Italy, mostly located in Northern Regions. To those plants with an electrical power lower than 1 MW, strong public incentives were given, therefore, several of them have been put into operation; this entailed increasing cereal silage prices, feedstock transportation distance and issues about digestate management and heat valorization.

In this study the Carbon Footprint (CF) of electricity production from biogas has been evaluated considering five AD plants located in Lombardy and Piedmont. A Life Cycle Assessment (LCA) approach and a cradle-to-grave perspective have been considered. Different plant sizes (100, 250, 300, 300 and 998 kW) and feeding rate (maize and pig slurry, only maize, only pig slurry and only cow slurry) have been studied.

The CF was calculated for a 100-year time frame based on GHG emissions, indicated as mass of CO₂ equivalents (kg CO₂eq), according to IPCC. The Functional Unit (FU) is 1 kWh of electricity fed into the electric grid. The CF saving for electricity produced by the AD plants ranges from -0.208 to -1.07 kgCO₂eq/kWh, being mainly related to the substitution of energy production from fossil fuel. Electricity from biogas has a big potential to reduce GHG emissions: valorization of surplus heat and reduction of transport distance can support the lower GHG emissions achievement of this bioenergy system.

Key words: anaerobic digestion, climate change, Greenhouse Gases, renewable energy, LCA

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