Agricultural By-products for Biomethane Production: Opportunities for a Sustainable Bioenergy Conversion

Giovanni Ferraria\*, Francesco Marinelloa, Andrea Pezzuoloa

aDepartment of Land, Environment, Agriculture and Forestry, University of Padova, 35020 Legnaro (PD), Italy

\*Corresponding authors: giovanni.ferrari.7@studenti.unipd.it, 049/8272764

**Keywords.** Agricultural By-products, Livestock waste, Biogas plants, GIS, Rural environment.

**Abstract.**

The use of agricultural by-products for bioenergy production can contribute to the achievement of sustainable development goals. In order to evaluate the potential role of such biomasses, an exploitation model for biomethane production has been developed. Thus, this work aims to analyse diet reconversion for biogas plants, based exlusively on agricultural by-products and livestock manure, taking into consideration the actual Veneto region scenario.

Data on crops (AGEA) and livestock (National Livestock Register) available in the study area have been collected and processed in order to map a realistic distribution of by-products on the territory. The study considers exploitation of existing working anaerobic digesters, simulating no construction of new plants, in order to minimize the economic and environmental costs. The Veneto Region offices (AVEPA) has provided support for the description of existing biogas plants location, diet and installed power. A model has been created on QGIS software to associate by-product availability with digestion facilities: such model allowed to characterize the distribution of by-products, with the attractiveness of the plants inversely proportional to the distance from the biomass production areas. Furthermore, the potential energy of by-products for each plant was compared to the energy currently produced. This comparison allowed to determine which plants might exhibit a stable reduced or increased power, based on the spatial availability of the by-products.

Preliminary results indicate that 23% of plants would not maintain their current energy production and should decrease their installed capacity by more than 50%. This result mainly affects larger plants distributed in areas with high plant density even in the casee of high grain production availability. A smaller reduction is expected for 30% of the plants, ranging from -50% to 0%. Based on the model, 9% of plants could increase their installed capacity by less than 50%, while for 37% of them might increase more than 50%. The latter result is particularly concerning for small plants, isolated or near areas characterizede by intense livestock production.

These results demonstrate the potential of agricultural by-products for energy production and the possibility of converting the production system with low costs for plant owners. Further analysis determine is the most cost-effective locations which should be considered to install upgrading facilities for biomethane production. This analysis will consider the existing methane distribution network and the potential capacity of the plants.