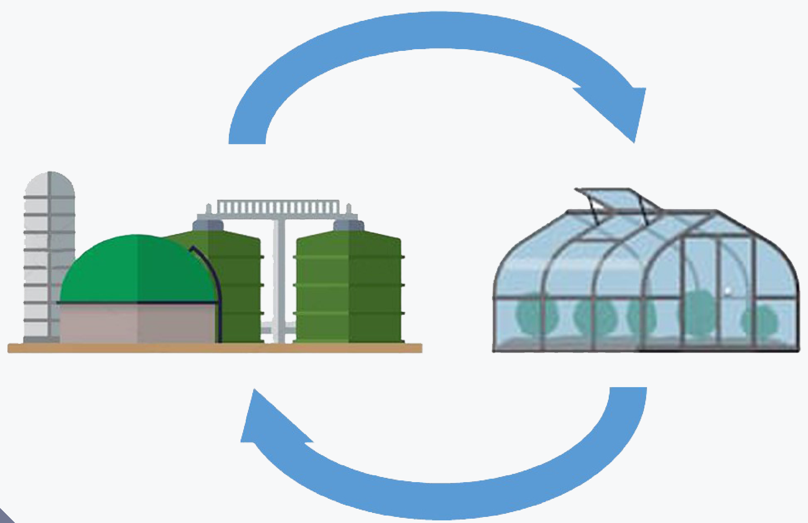

Green_BioHeat

BIOGAS CHALKIDIKI

EXPLOITATION OF BY-PRODUCTS FROM BIOGAS PLANTS FOR GREENHOUSE HEATING

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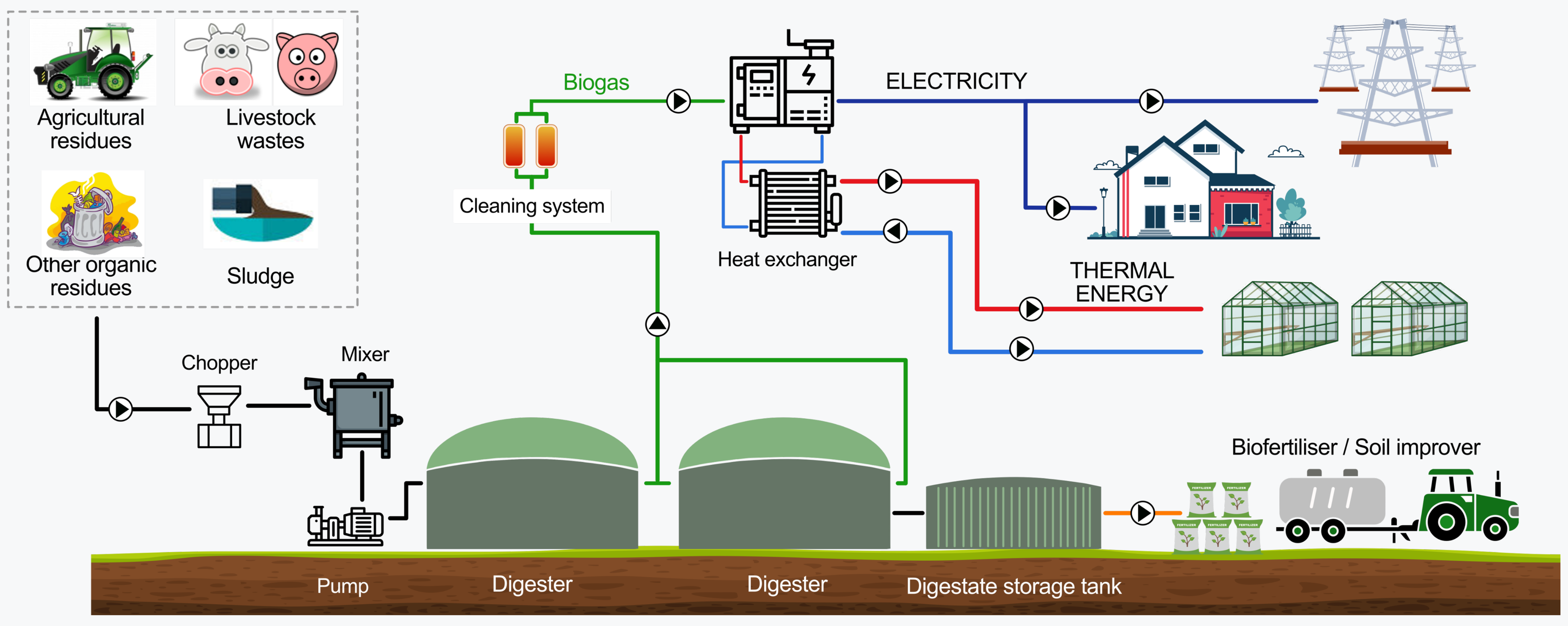
Introduction

The costs associated with heating and cooling in greenhouses may end up to 70-85% of the operational expenditures (Ahamed et al., 2019). Consequently, many producers are exploring alternative energy sources to meet the winter heating requirements of greenhouses.

A promising solution for cost-effective and environmentally friendly heating is the utilization of biogas derived from production plants, coupled with combined heat and power (CHP) systems. By capturing and utilizing the heat and electricity generated by the CHP system, greenhouse operators can significantly reduce energy costs.

This approach offers a synergistic relationship between biogas plants and greenhouse cultivation, enabling the reuse of energy and the recycling of carbon and other inorganic substances (Ntinas et al., 2021).



Aim

The study examines the energy requirements of a greenhouse cultivating tomato plants, along with the technical characteristics of the combined heat and power (CHP) system employed. Additionally, experiments were conducted to assess the biogas production potential of various feedstocks used in the plant, aiming to identify the most effective feed mixture that maximizes energy recovery.

Greenhouse description

A modified gothic type greenhouse was constructed at the premises of BIOGAS CHALKIDIKI plant (40°21' N and 23°15' E), Nea Tenedos, Greece and was used for the study.

The greenhouse had a total area of 112.5 m^2 and was covered with UV stabilized polyethylene (PE). The ridge and side height of the greenhouse was 4.7 and 3.0 m, respectively.

Results

Based on the available construction and meteorological data for the specific region, the pilot greenhouse being investigated, situated within the premises of BIOGAS CHALKIDIKI, exhibits a heating demand of 13.33 kW. After considering the technical specifications of the currently utilized combined heat and power (CHP) system, it has been determined that the most suitable exhaust gas exchanger for compatibility is the INNIO Jenbacher model N-25-300/2000-1H-1AX-P. This particular exchanger is designed in a horizontal configuration and possesses the capability to handle the entire exhaust gas output from the biogas plant, generating a heat output of 231 kW. Notably, the efficiency of this heat exchanger surpasses the heating requirements of the greenhouse facility

Results

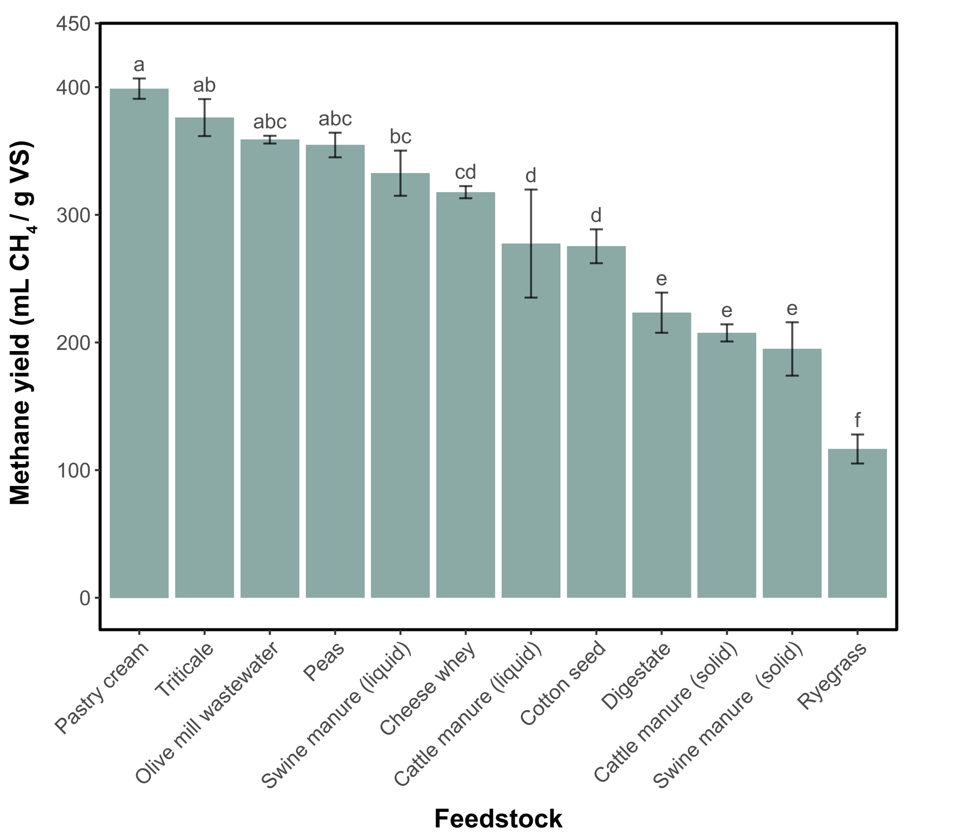


Fig.1: Methane potential of different influent feedtsocks

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REFERENCES

1. Ahamed, M.S., Guo, H. and Tanino, K., 2019. Energy saving techniques for reducing the heating cost of conventional greenhouses. Biosystems Engineering, 178, pp.9-33.
2. Ntinas, G.K., Bantis, F., Koukounaras, A. and Kougias, P.G., 2021. Exploitation of Liquid Digestate as the Sole Nutrient Source for Floating Hydroponic Cultivation of Baby Lettuce (Lactuca sativa) in Greenhouses. Energies, 14(21), p.7199.