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Sizing of a biogas plant in the teaching farm of ULST

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Abstract:

In this research, a biogas plant have been sized by analysing energy consumption in the campus of University of Life Sciences "King Mihai I" from Timisoara (ULST) and by analysing in laboratory the (bio)methane production potential of the biomass available in the teaching farm or ULST. This study recommends the development of an anaerobic digestion technology having as main components two digesters and a cogeneration of heat and power unit of 100 kW installed power. This study represent the base for assessing the feasibility to design, construct and operate an anaerobic digestion technology for the production of biogas and the cogeneration of electricity and thermal energy within the ULST campus and teaching farm.

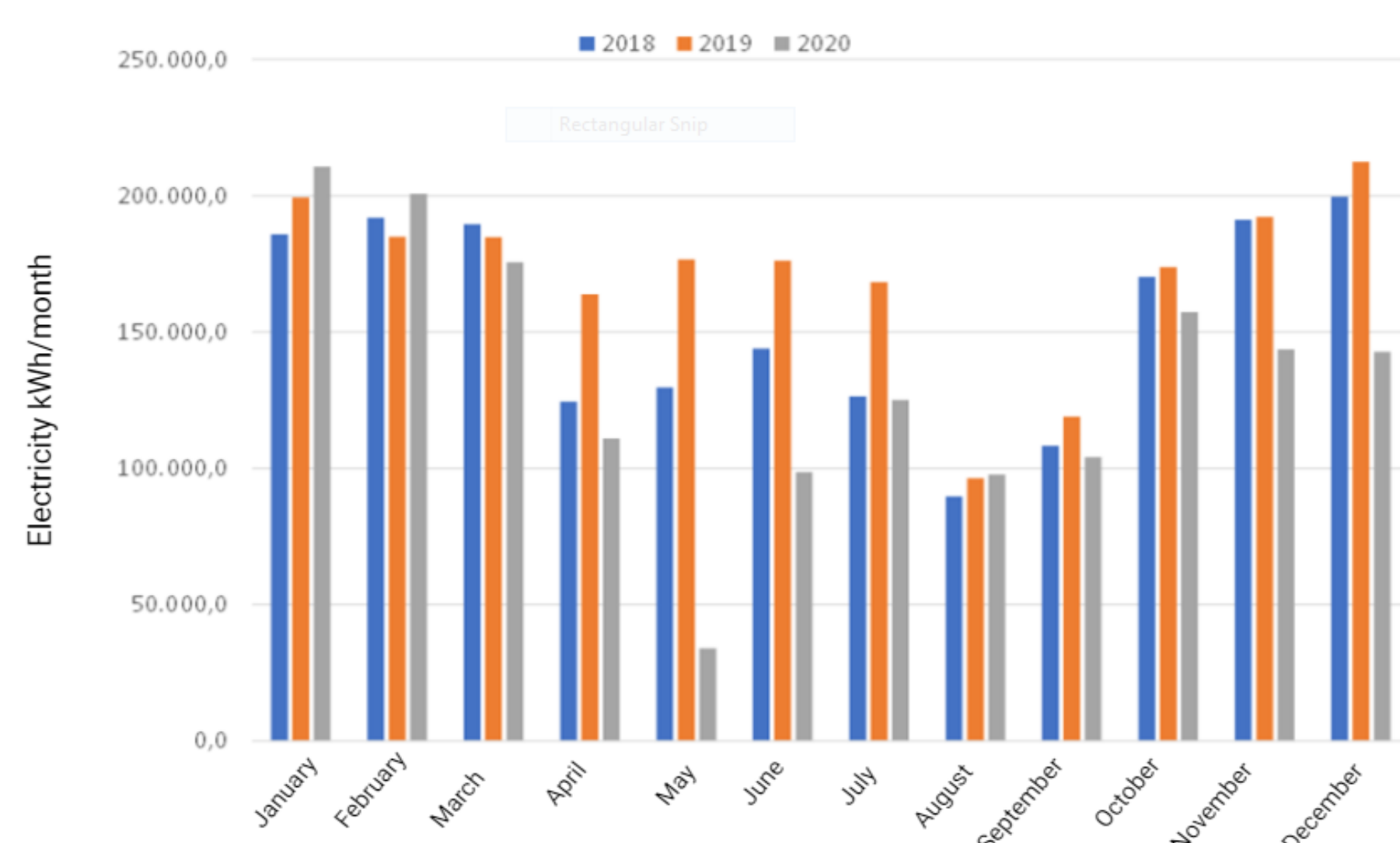
Keywords: anaerobic digestion, biogas plant, feasibility, plant sizing

Material and method

The size of a biogas plant can be established according to:

The energy requirement of the consumer

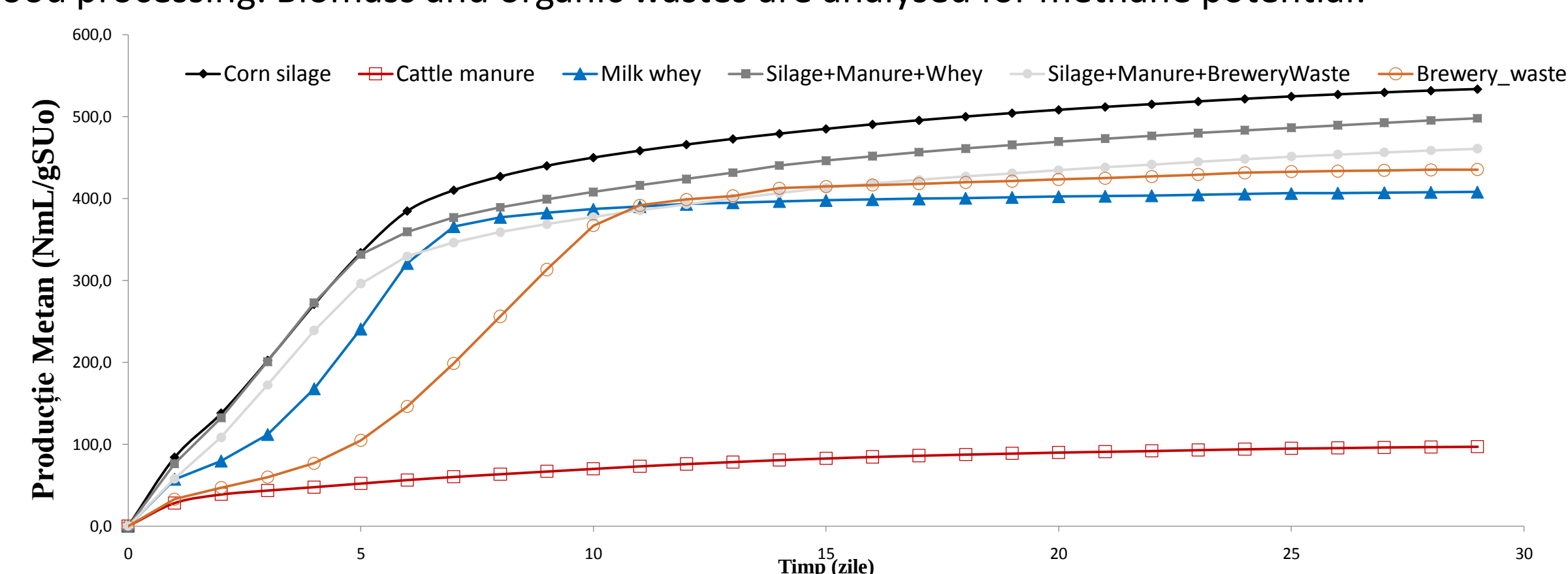
While the energy need of the consumer can be evaluated by analysing the energy consumed on one-year period, or more accurate as the average consumption of the last three years.



Depending to the type, quantity and characteristics of the available feedstock biomass

The biogas potential production of the available biomass suitable for anaerobic digestion need to be assessed in laboratory

The campus consists of two main areas: the didactic and research area, and the didactic station (SDT) which includes an animal farm, agricultural crops, greenhouse, orchard, vineyard and a food processing. Biomass and organic wastes are analysed for methane potential:



Results and discussions

Anaerobic digester should be designed to mix organic materials containing straw and other biomass, such as corn silage: • Manure = 3.5 tons/day (7% dry matter); • Straw = 0.5 tons/day (25% dry matter); • Silage (maize, sweet sorghum) = 6.5 tons/day (33% dry matter). This mixture of biomass and organic wastes can be used in a **biogas plant delivering 80-110 kWh electricity**.

Additionally, approximately 2370 tons of CO₂ equivalent per year can be saved:

Kg CO ₂ eq/y	Current CO ₂ eq	CO ₂ eq forecast	Saving
Campus Electricity	693.961	629.526	64.436
Manure	69.919	0	69.919
Didactic resort Timișoara	4.158.660	2.079.330	2.079.330
under TOTAL ULST	4.922.540	2.708.856	2.213.684
Electric energy to the national grid		160.656	160.656
		TOTAL	2.374.340

The technological approach selected for processing of the organics in the didactic farm is mesophilic anaerobic digestion, submerged fermentation system of the digesting medium with a content of 10-12% dry matter, in two CSTR (continuous stirred tank reactors).



Conclusions

The administration of organic wastes by anaerobic digestion represent a smart approach applicable in various sectors of the economy, including agriculture, food processing or municipal administrations. The designed biogas plant and its future development will mitigate the increase in costs related to the university's energy consumption. The biogas plant can represent an example of sustainable management of biological resources, reduction of the negative impact on the environment of economic activities and strategy for achieving energy security.

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