



Low cost feedstocks for biogas plants – challenges and solutions 2

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This talk shows two concepts for improving anaerobic digestion application

1. Co-digestion case study



2. Future perspective



Municipal WWTP biogas plants are promising solutions for waste valorization



Unused capacity

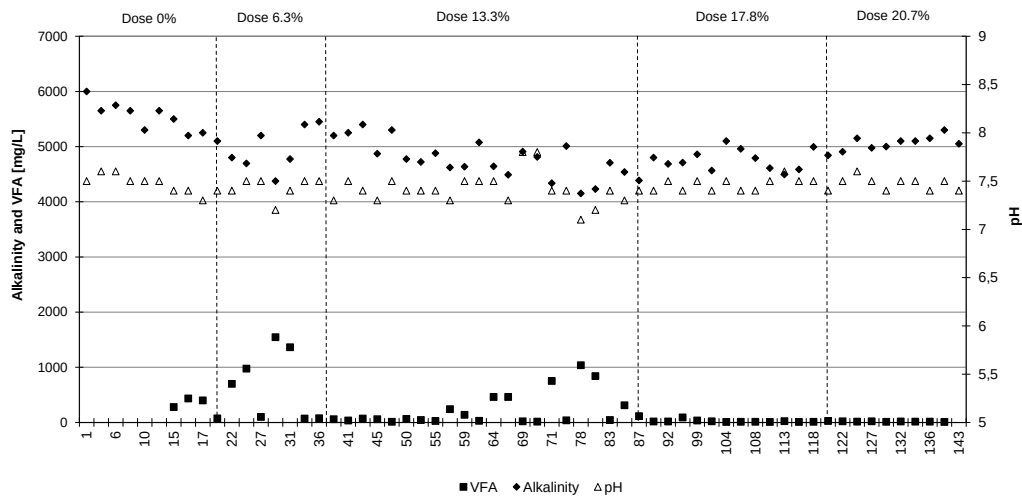
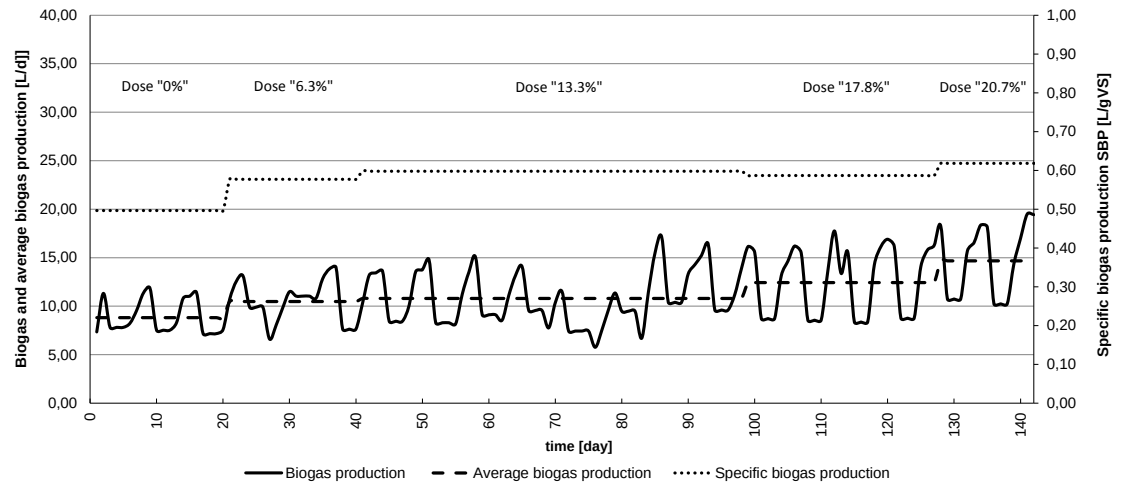
$$V = 6 \times 4\,900 \text{ m}^3 = 29\,400 \text{ m}^3$$

$$\text{OLR} = 2.20 \text{ kgVS/m}^3 \cdot \text{d} \quad (\text{design})$$

$$\text{OLR} = 1.45 \text{ kgVS/m}^3 \cdot \text{d} \quad (\text{before tests})$$



Biogas production during lab-scale trials of anaerobic digestion fed with mixture of PS/WAS and poultry industry waste



Budy-Gorzna M., Smoczynski M., Oleskiewicz-Popiel P.: Enhancement of biogas production at the municipal wastewater treatment plant by co-digestion with poultry industry waste. *Applied Energy* 2016, 161:387-394.

Two years full-scale co-digestion trials at the municipal WWTP biogas plant



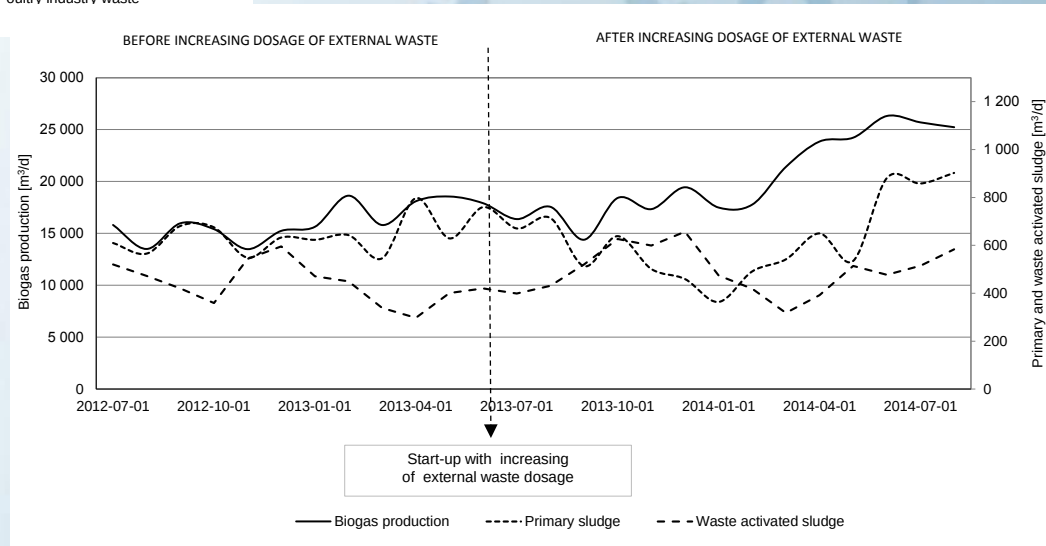
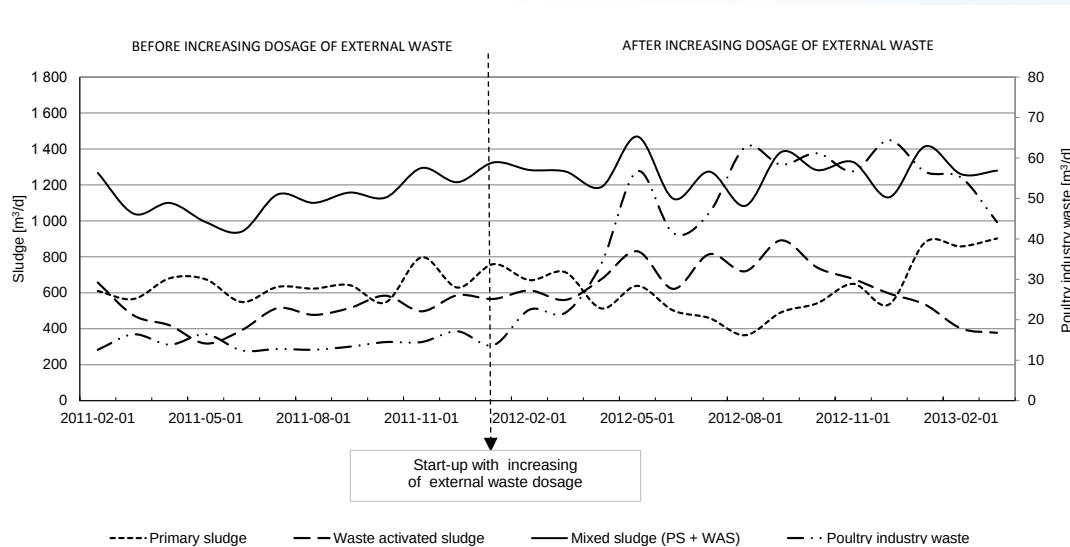
Pump dosing waste to AD



Unloading point

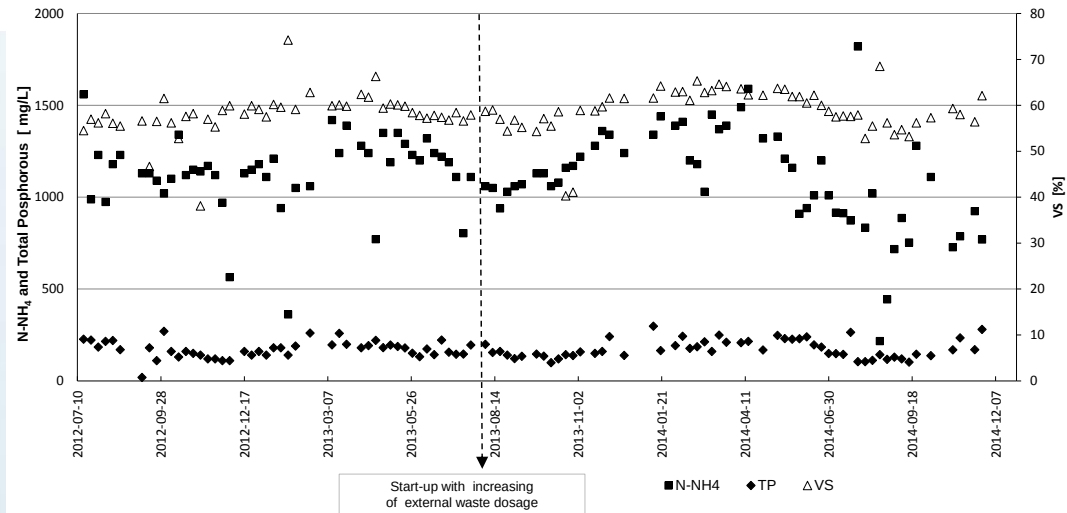
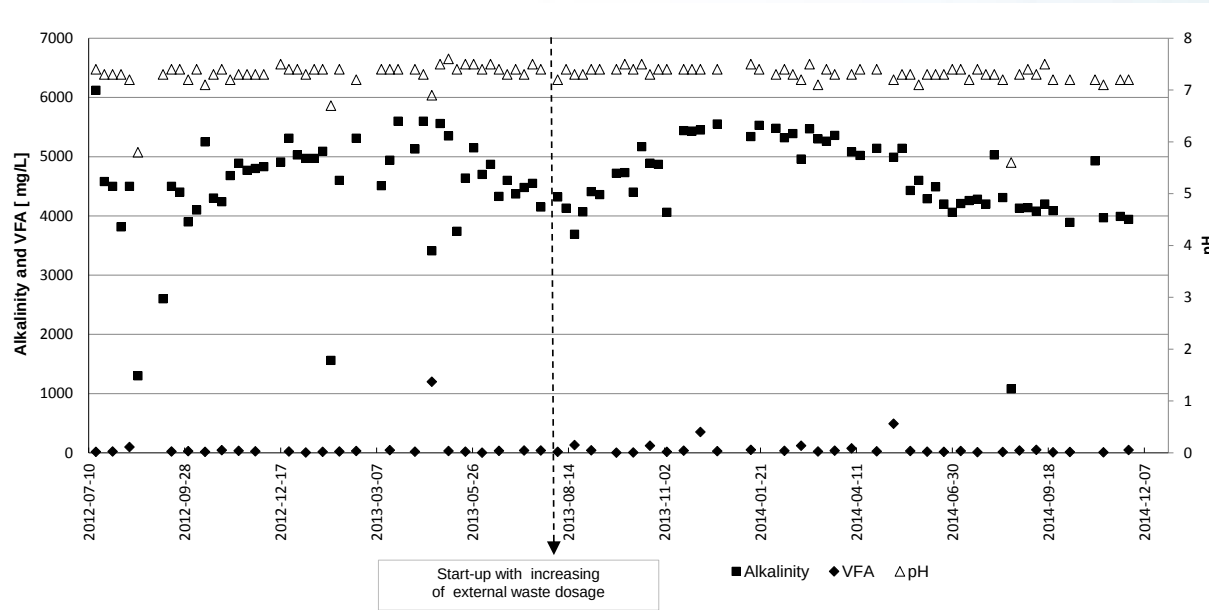
Heating tank for waste

Two years full-scale co-digestion trials at the municipal WWTP biogas plant



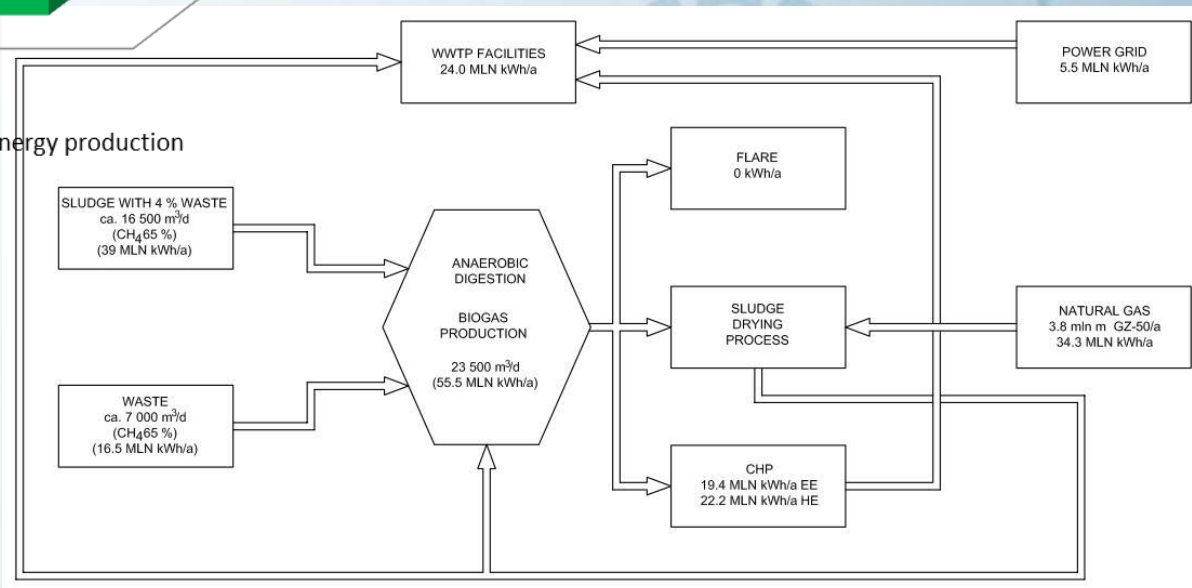
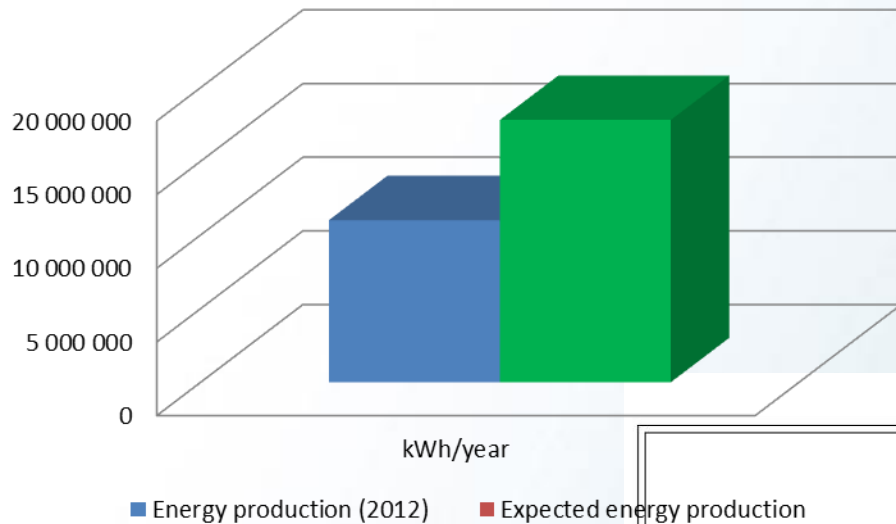
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Two years full-scale co-digestion trials at the municipal WWTP biogas plant

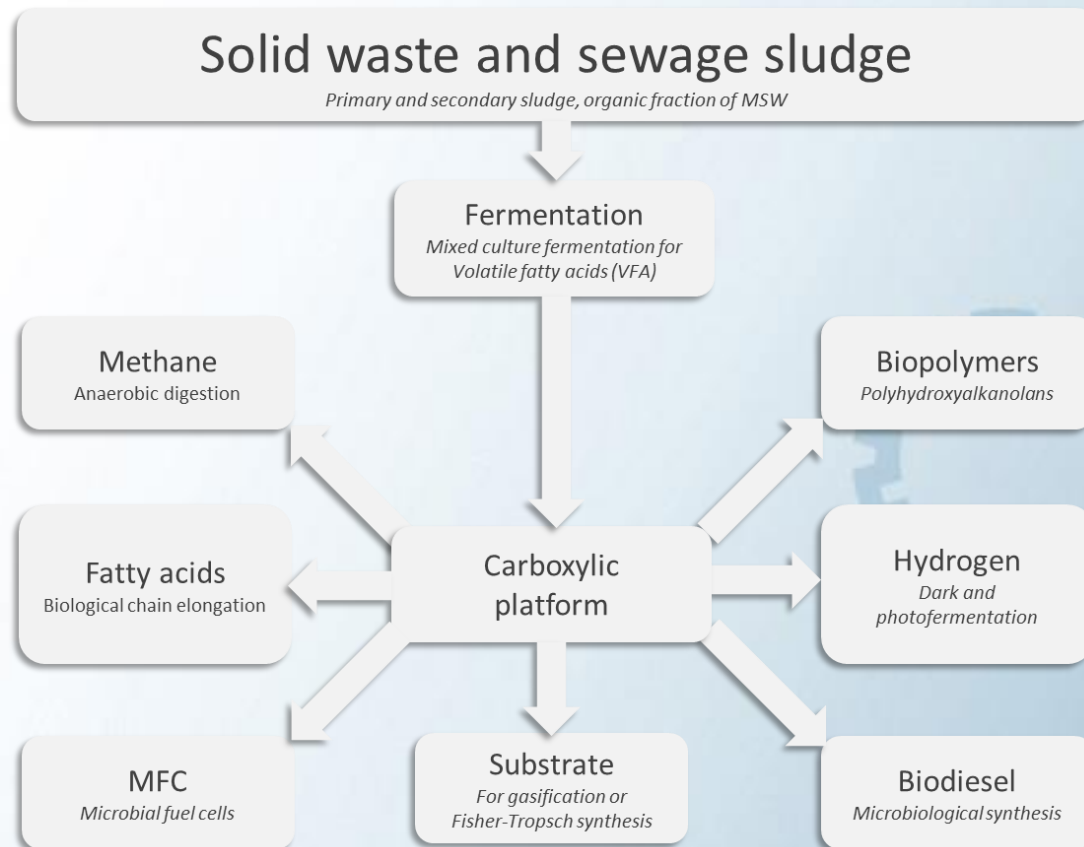


The co-digestion has potential to convert the additional biogas into 19.4 mln kWh/yr. It would increase share of energy_{el} from 57% to over 80%.

Expected increase energy production from biogas

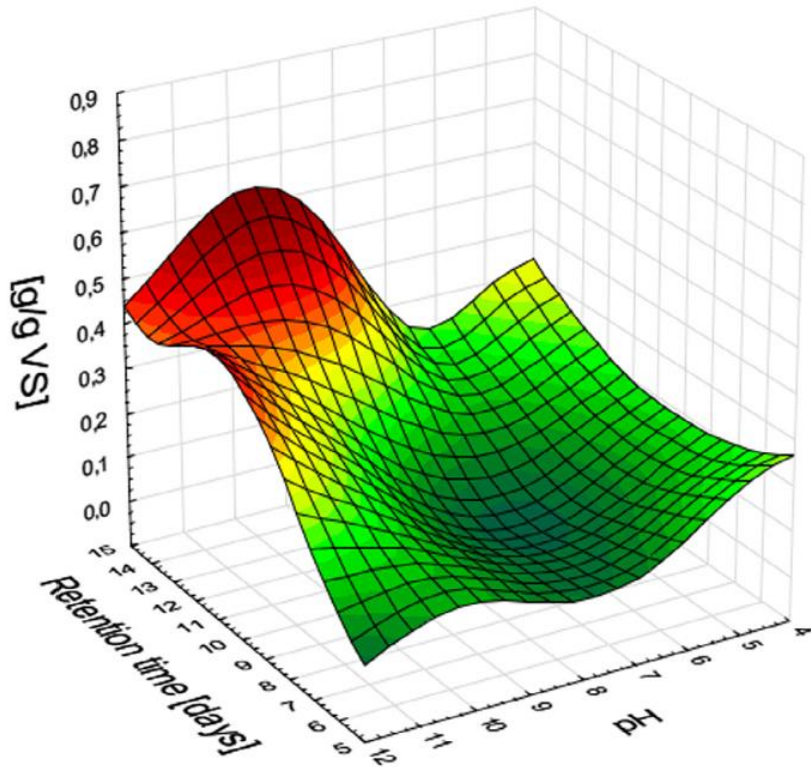


Why low cost feedstock and not high value products?



Carboxylic platform

E. Jankowska et al. / Bioresource Technology 190 (2015) 274–280

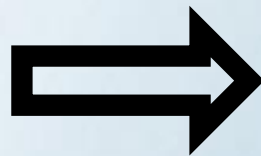


- higher rate was achieved at higher pH values
- High pH is favorable for hydrolysis of sewage sludge, the proteins and carbohydrates are released
- pH determines the fraction of undissociated acids in the broth which were able to permeate cell membranes
- at lower pH, more energy is needed for transport of undissociated acid whereas at higher pH, energy can be gained from transport of the free form of the acid

Jankowska E., Chwiałkowska J., Stodolny M., Oleskiewicz-Popiel P.: Effect of pH and retention time on volatile fatty acids production during mixed culture fermentation. *Bioresource Technology* 2015, 190:274-280.

Summary

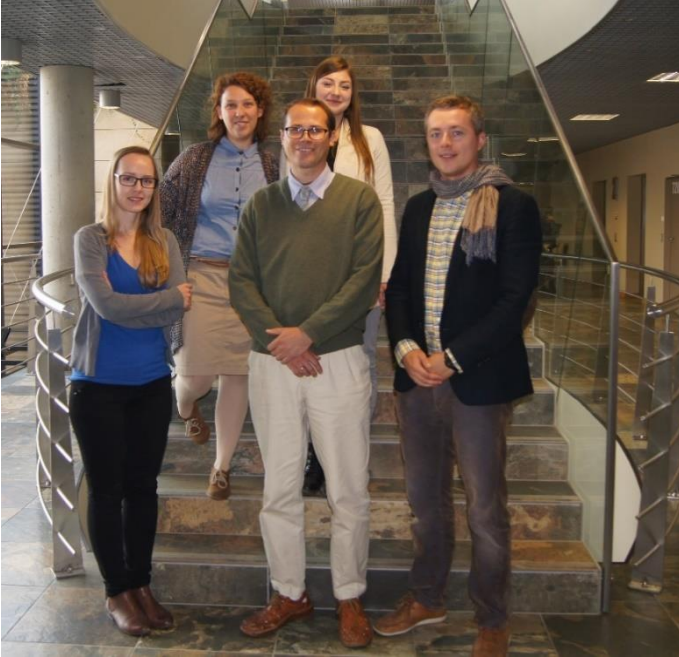
- Integration of municipal WWTP with agro-industrial low cost feedstock is a promising option in Poland
- The disadvantage is digestate utilization from WWTPs
- Carboxylic platform might be the future of AD for better process' economics
- Downstream processing for VFA and MCFA is a key bottleneck in technology implementation



Further research will include:

- Integration of agricultural and municipal AD
- Molecular biology analysis for better understanding of the process behavior and thus its control
- Novel applications for mixed culture fermentation

Acknowledgments



- Ewelina Jankowska, PhD-student
 - Joanna Chwiałkowska, PhD-student
 - Anna Duber, PhD-student
 - Dr Lukasz Jaroszynski, researcher
 - Magdalena Budych-Górzna, PhD-student
-
- National Center for Research and Development, Project no.: (Caprobiome) (LIDER/013/261/L-5/13/NCBR/2014)
 - National Science Centre Project no.: (MixFerment) (2012/05/D/ST8/02289)



Thank you!

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