Biomass from wet peatlands for biogas production

Biomass for energy production is one of the solutions to climate change. The growing global demand for biomass, together with the EU's Green Deal priorities, forces the biomass market to adapt to environmental, social, and economic sustainability in Europe and worldwide. Therefore, the energy crops are no longer considered an environmentally sound energy source, and new biomass from sustainable management is needed to fill in the gap. Such an emerging new source of feedstock may be biomass from biotopes management and paludiculture. Using wetland biomass for anaerobic digestion seems to be a promising and sustainable option, delivering energy and a digestate that can be applied as a valuable organic soil fertilizer. However, the choice between wet fermentation and dry fermentation technologies seems to be one of the most critical choices from the economic and environmental point of view. Our study aimed to evaluate the specific methane yield of the following wetland species: *Carex elata*, a mixture (~50/50) of *Carex elata* and *Carex acutiformis*, *Phragmites australis*, *Typha latifolia*, *Phalaris arundinacea* subjected to wet and dry anaerobic digestion. The methane production potential of studied plants differed significantly (ANOVA, $p<0.05$), and wet fermentation technology was the lowest for *Phragmites australis,* while dry fermentation technology was the lowest for *Carex elata*. The highest amount of methane was produced by digestion of a mixture of *Carex elata* and *Carex acutiformis* in both technologies. However, the overall methane production for all studied species was higher in wet fermentation technology. The differences in the specific methane yield can be attributed to the lignocellulosic composition of the studied plants since lignification affects the degradability of plant material, which affects the biogas production rate and composition.

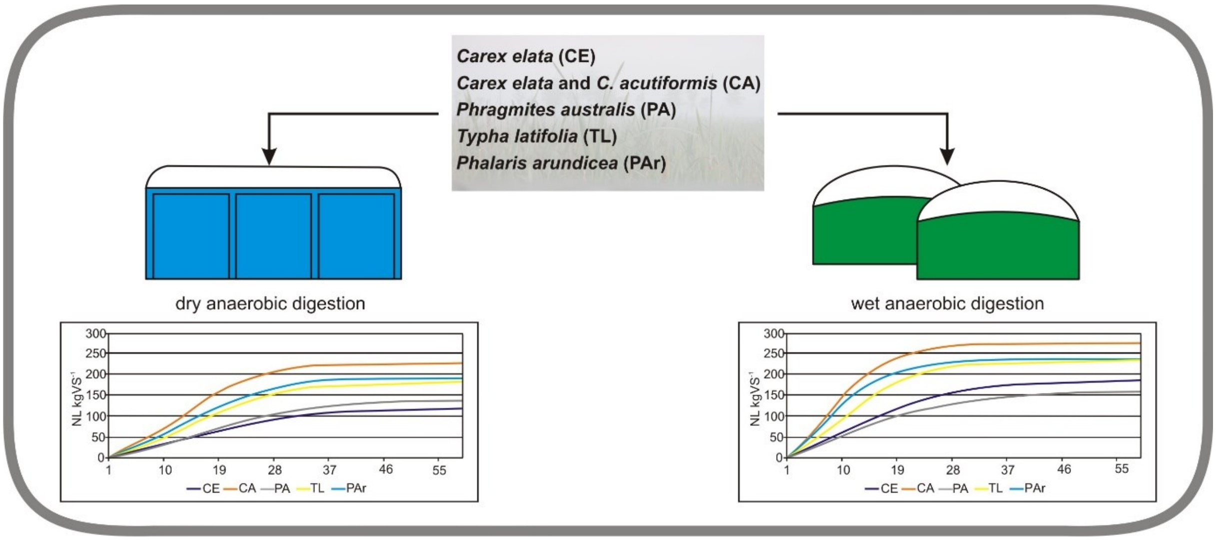

Fig. 1. The cumulative methane production in dry and wet fermentation technology

The important parameter in the feasibility analysis of biogas plant is the energy production per hectare which depends on habitat productivity. Biomass harvested as a conservation measure from low-productive natural stands may constitute 44% (*Phragmites australis*) to 76% (mixture of *Carex elata* and *Carex acutiformis*) of energy from maize. Higher energy potential can be forecasted if yields from high-productive habitats, such as paludiculture, are considered. In this case, *Typha latifolia* performs similar to maize, while *Phalaris arundinacea* constitutes 70% of energy from maize. Other plants may produce 44% (mixture of *Carex elata* and *Carex acutiformis*), 46% (*Carex elata*), and 50% (*Phragmites australis*) of energy obtained from the combustion of biogas from maize. The amount of electricity produced by anaerobic digestion of wetland biomass harvested from 1 ha of natural habitats, apart from a mixture of *Carex elata* and *Carex acutiformis*, is sufficient to supply the electricity to a house with an area of 100 m^2. Considering the higher yields that are obtainable under paludiculture conditions, the anaerobic digestion of all paludi-biomass would enable the production of electricity sufficient to supply two — or, in the case of *Typha latifolia*, four — residences with an area of 100 m^2.

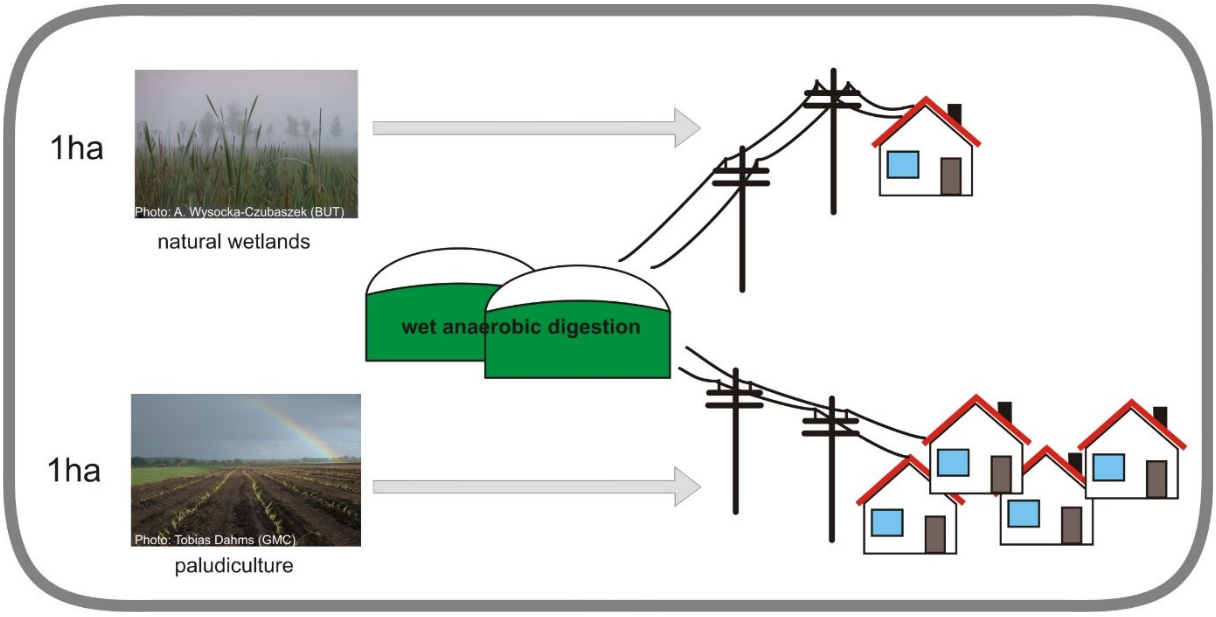

Fig. 2. The energy supply from 1 ha of low- and high-productive habitats