Integrated assessment of solutions for the problem of waste facility in rural areas in Poland in the context of ensuring the energy safety of local communities and regional perspective

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Introduction

Poland, like Greece, is one of the few EU countries that has only slightly introduced thermal methods of their conversion into energy into their waste management systems (Perkoulidis et al.2010) In rural areas, there is a high interest in waste management in biogas plants, and the obtained biogas is used for energy purposes (Głaszczka et. al.2010). These processes require integration and evaluation from the point of view of the efficiency of energy and economic processes in the context of existing regional conditions and existing waste resources and the needs of local communities. A good approach is system analysis, previously used to analyze municipal waste management processes (Eriksson et al. 2005).

The main objective of the study was the integrated assessment of municipal and rural waste disposal methods in selected rural communities in Poland, in the context of the possibility of their use for energy purposes - in biogas plants and through the application of thermal methods.

Materials and methods

The problem formulated on the basis of studies and experience in selected EU countries: Greece (Moustakas, Loizidou, 2010, Loizidou 2016), United Kingdom (Garg at al. 2009), Sweden (Eriksson et al. 2005), Netherlands (Dornburg, Faaij 2005) and Balkan Region (Dvorsak at al. 2007), has been assessed under the conditions of Polish rural areas (Krajewski, Wiśniewski 2003).

The analysis was based on a system approach (Eriksson et al. 2005).and analysis of waste management processes in various facilities selected randomly in Poland, in various location conditions in rural areas and the environment. The proposed solution models could contribute to the establishment of a rational solid waste and biowaste management and system in agricultural regions and small towns to ensure energy and environmental safety (Krajewski, Wiśniewski 2003).

In the context of choosing these solutions, an evaluation of alternative waste management systems was carried out, taking into account local conditions and economic criteria. A programming model was applied to determine the optimal locations of collection points to ensure an efficient supply chain between waste generation sites and thermal methods processing or biogas plant. Regional waste management scenarios were assessed in accordance with multi-dimensional criteria. Selected criteria were: energy efficiency of the system, level of biodegradation of municipal waste, energy recovery and greenhouse gas emissions, the level of self-sufficiency of facilities from own waste resources, total cost of processes.

Results and Discussion

Growing concerns about the threat to the natural environment and the climate, pressure on energy and biomass recovery from waste and social impact on rational management have led to a change in perspectives for municipal solid waste treatment processes and technologies (Konstantzos at al. 2016), including agricultural areas, including thermal transformation. Municipal solid waste (MSW) thermal treatment technologies, such as mass burning, can use energy content in waste for generating electricity or combined production of electricity and heat, where heat is recovered and used to heat industrial premises or social buildings (Malamis at al. 2016), provide hot water or other economic purposes

The analysis showed that the waste management scenario, which will ensure energy production in small towns in the vicinity of rural areas, will be the best solution for agricultural regions, depending on the priorities. makers. The models also take into account that waste disposal must comply with the requirements of the new European Commission directive on waste in order for the facility to be considered as a recovery operation. A sensitivity control was carried out to assess the impact of the increased recycling rate on the calorific value of treated municipal solid waste. The necessary waste management plan for rural areas was discussed, taking into account many criteria and parameters and using appropriate tools and methodologies in this context.

Summary and Conclusions

Energy recovery from municipal waste and biowaste constitutes an important element of integrated waste management in the countries such as Poland or Greece, with advanced technological systems of generating energy from waste. Utilization of municipal waste and waste and raw materials from agricultural production for energy production brings many environmental benefits, which are primarily related to reducing environmental burden of stored waste.

Generating energy and heat from municipal waste and locally available agricultural raw materials gives local governments an opportunity to be independent and secure in terms of energy supply, as well as to develop a new area of economic activity and create conditions for the circular economy (CE). Bioenergy is an efficient way of generating energy, stimulates local labor markets as well as it is a means of achieving sustainable development in regions and ensuring a uniform distribution of scattered energy production.

The barriers to energy efficiency and rational waste management practices at a local level, especially among self-governments in rural areas, are not only the lack of technological solutions available in the area, but also the lack of awareness of local communities and decision-makers about the possibilities of using modern solutions in the waste management process and implementation of sustainable development principles in the context of the circular economy encouraged at a local level.

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