

Data from the Central Statistical Office (GUS- Główny Urząd Statystyczny) for 2018 show that statistically each Polish Citizen produces about 311 kg of municipal waste per year. The management of waste management is a difficult and complex task in economic, ecological and social terms. Since 1 July 2013, the municipalities have been responsible for the functioning of local municipal waste management systems in accordance with the amendment to the Act of 13 September 1996 (Act of 13 September 1996 on Cleanliness and Order in Municipalities). Changes in the area of municipal waste in Poland are related to the European Union's requirements for recycling and reducing the storage of municipal waste. Rational waste management should be monitored in accordance with the established hierarchy (Act of 14 December 2012 on Waste) (i) waste prevention; (ii) preparation for re-use; (iii) recycling; (iv) energy recovery and (v) disposal. One of the recommended waste management methods is thermal transformation, with or without energy recovery. Modern technologies and solutions used in incineration plants guarantee minimisation of the amount of stored waste and eliminate its negative effects on human health and the environment. However, like any other solution of this kind, they are not error-free. The incineration of municipal waste per 1 tonne of incinerated waste produces approximately 0.25 Mg slag and 0.075 Mg fly ash, dust from dedusting, filter residues and gypsum from flue gas cleaning processes. The literature on this subject shows that storage is still the basic disposal method for fly ash or dust from dust extraction. Other processes for the use of fly ash and flue gas cleaning products must be preceded by processes for their processing. After appropriate treatment, these wastes can be used under certain conditions, e.g. for the production of building materials.

The aim of the project is to manage fly ash from the municipal waste thermal treatment plant for mineral carbonation and geopolymerisation within the framework of the closed loop concept. The recycling economy is based on the creation of a low-waste, closed economy in which the product used or destroyed is a raw material in the next (identical or different) production cycle - i.e. the primary raw material is used many times over. At the same time, the above-mentioned economic model demands that the processing of raw materials in the recycling process is more cost-effective, environmentally friendly and associated with lower energy consumption. It also assumes the creation of a system in which the redundant product is not taken to a landfill but recycled and reused in the same or a different form. It is assumed that the circular economy is a system in which there is no waste, because raw materials once used are recycled in subsequent production processes. This concept requires an innovative approach to waste management and the design of production processes with the immediate aim of re-using all types of waste. An important element in the implementation of a closed loop system is the appropriate selection of technologies and materials used in production in order to minimise the cost of recovering the raw materials used.

The implementation of the project will demonstrate the possibility of a comprehensive management of fly ash with simultaneous neutralisation of CO₂ emissions in exhaust gases. The research work adopted in the project will make it possible to test the safety hypothesis of fly ash management from the thermal waste conversion plant in order to convert the waste into environmentally friendly materials that comply with legal, technical and structural requirements.