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The evaluation of energy consumption in transportation and processing of municipal waste for recovery in a waste-to-energy plant

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Abstract

The purpose of this study is to investigate energy consumption in municipal waste collection, transportation, processing, and handling to produce refuse-derived fuel. Municipal solid waste requires various operations for treatment after collection. Many categories of waste are suitable for recycling and this treatment method is preferred. Part of the volume of the collected waste volume can be used as refuse-derived fuel (RDF) and then shipped to a waste-to-energy plant. Pre-treatment of waste requires several waste processing steps to achieve the required quality of the RDF.

Methods include energy and material flow of waste for different scenarios. The calorific values of municipal solid waste and bulky waste pre-processed refuse-derived fuel has been evaluated. Energy consumption for each step of municipal waste collection, transportation, handling, and pre-treatment has been calculated. The reference value is the calorific value of refuse-derived fuel shipped to a waste-to-energy plant. We compare the proportion of energy consumption in transportation, handling waste, and processing using data from the waste collection company in the South of Poland.

The results show energy consumption in transportation and processing bulky waste is about 5% of the energy included in a mass of shipment unit – heavy goods vehicle to cement plant. More energy is consumed in transportation and production of refuse-derived from municipal solid waste. The results show almost 11% require transportation, handling, and pre-treatment of waste. The findings allow indicating which part of the reverse supply chain consumes the highest value of the energy and helps in management for waste collection companies.

Keywords: waste transportation, waste-to-energy, refuse-derived fuel, waste processing, circular economy, energy consumption