Enzymatic recycling of plastic waste in Latvia

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Introduction
Economic growth, urbanization and consumer consumption habits contribute to the yearly increase of the municipal solid waste amount.

Enzymatic recycling has the advantage over mechanical recycling technology since it has the capability to depolymerize plastics without degrading the quality of the material and can be applied to a wide range of plastics, including those that are difficult to recycle through mechanical means.

The proposed solution meets the objectives of promoting sustainable plastic waste recycling through the introduction of the enzymatic recycling, and, therefore, aligns with the European Union targets to promote the circular economy principles.

The objective of the research is to perform technoeconomic analysis of the possibilities to introduce enzymatic plastic waste recycling for sustainable waste management in Latvia.

Methodology
The work compared the LCA of two PET recycling methods - the existing mechanical flake production in Latvia and the proposed modernized solution by integrating enzymatic processing in the existing factory.

The functional unit is 1t PET, which allows to compare life cycle of different products – PET flakes and TPA.

The system boundaries include the processes that start with the processing of post-consumer PET bottles after collection and end with the final product produced. The waste collection, transport, utilization and end-of-life phases are excluded (gate-to-gate).

The LCA was conducted using SimaPro software ecoinvent 3.3 database. Environmental impacts calculated by the ReCiPe method.

Results
Despite enzymatic hydrolysis of PET has greater environmental impact than existing mechanical recycling, it has high potential due to allows to reach 90% depolymerization of PET to its monomers terephthalic acid (TPA) and ethylene glycol (EG) to be sold at higher market price for new plastic production, this way conserving use of resources.