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STREAMS TOWARDS GLASS SUSTAINABILITY

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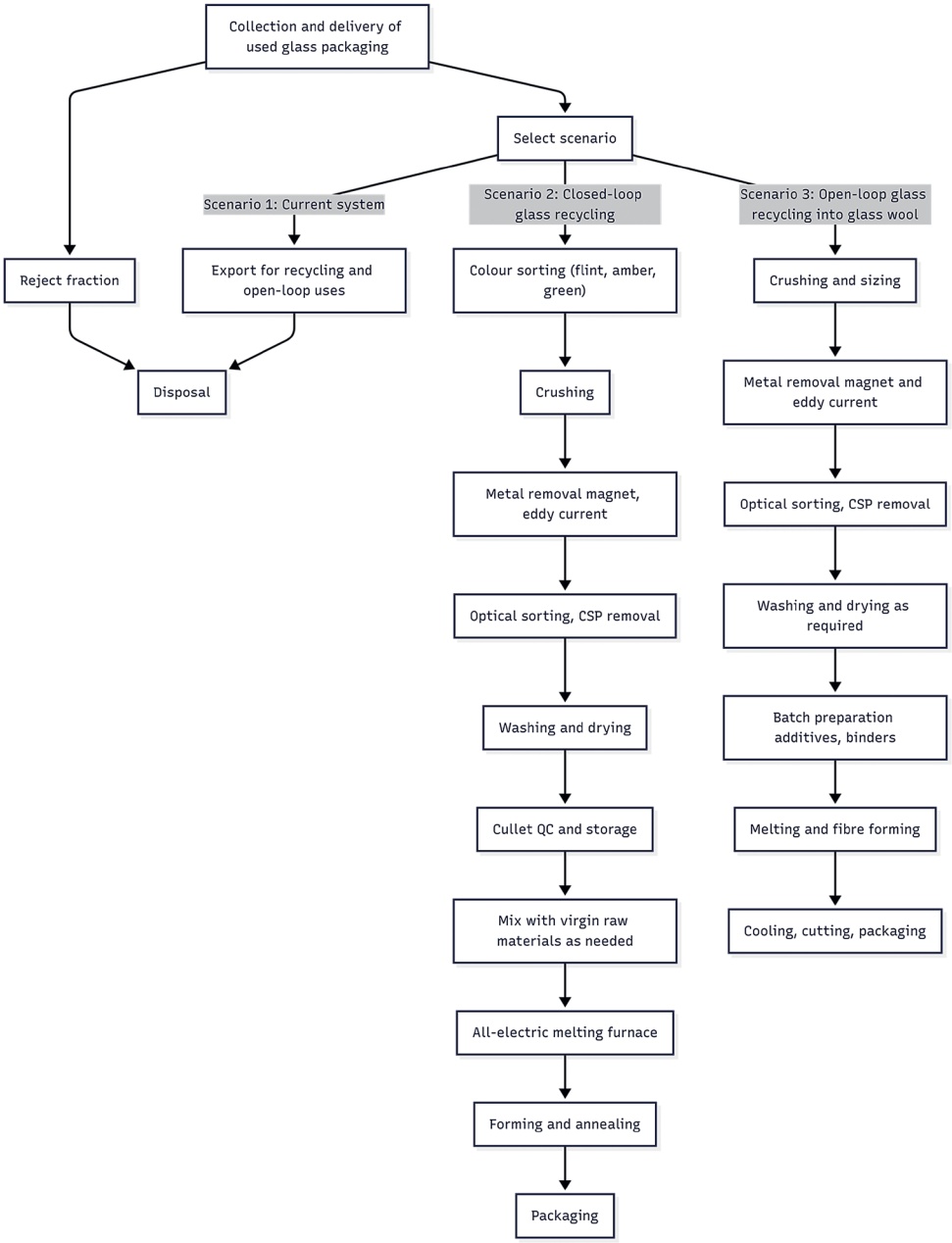
Abstract – The authors identify the largest recyclable streams still landfilled in Latvia or exported from Latvia and focus on packaging glass due to its high circularity potential and the lack of domestic closed-loop glass recycling into new container glass. Official waste statistics (2023–2024) were analysed to quantify landfilled and exported flows by waste class and to identify priority streams (> 5000 tons per year). A scenario-based material flow algorithm was developed for glass waste and linked to a plant concept design. Three scenarios were compared: 1) current system (mainly glass export and local downcycling), 2) domestic closed-loop glass recycling (sorting, washing, and cullet remelting into new container glass), and 3) open-loop glass recycling - glass wool manufacturing. A techno-economic (TEP) and life cycle assessment (LCA) framework was applied across scenarios. Municipal waste landfilled totalled 418301 tons in 2023 and 363336 tons in 2024, dominated by mechanical-treatment residues and biodegradable fractions, for which national waste management plans already include recycling measures. Packaging glass shows a clear capacity gap – export for recycling reached 29438 tons in 2023 and 36272 tons in 2024, while domestic recycling remains limited to lower value applications. The scenario analysis shows that domestic closed-loop glass recycling is technically feasible given the observed glass flows. Its environmental performance is expected to depend primarily on the electricity supply, achievable cullet share, cullet quality, transport distances, and furnace energy source. Domestic closed-loop glass recycling would reduce reliance on export and support higher material circularity. The scenario algorithm and conceptual plant design provide a framework for completing the final TEP/LCA and for screening investment options.

Keywords – Circular economy; closed-loop recycling; Life Cycle Analysis (LCA); packaging glass; Techno-Economic Performance (TEP) assessment



Scenario based material flow algorithm

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