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EnerFuel – Production of Fuels and Energy Carriers from Biogenic Residues and Plastic Waste for the Development of Regional Value Chains

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The limited recyclability of heterogeneous waste streams, combined with the increasing demand for low-carbon energy carriers, requires a robust thermochemical conversion pathway capable of handling variable feedstocks. A key challenge is the conversion of mixed biogenic and polymer residues into synthesis gas under conditions that ensure both stable reactor operation and consistent product composition.

The EnerFuel project addresses this challenge through the development of integrated process concepts for waste-to-syngas conversion, followed by upgrading routes toward hydrogen and liquid fuels. The simultaneous achievement of high feedstock flexibility, operational stability and efficient carbon utilisation is central to the approach. The methodology combines experimental investigations at pilot scale with model-based process analysis. Gasification experiments are conducted to characterize reaction behavior, syngas composition, and long-term stability, while process simulations and sensitivity analyses are employed to evaluate system performance and identify key operating parameters. A particular focus is placed on fuel engineering. Tailored pelletization strategies are developed to produce homogeneous composite fuels from mixed plastic and biomass fractions. These engineered fuels are designed to enhance feeding characteristics, mitigate operational instabilities, and improve syngas quality, including the suppression of tar formation.

The project emphasizes technology transfer and industrial applicability through close collaboration with small and medium-sized enterprises. Experimental findings, simulation tools, and optimized fuel formulations are systematically translated into practice to support reactor design and process optimization under industrially relevant conditions. Running from 2025 to 2028 and co-funded by the European Regional Development Fund, the project aims to deliver a validated framework for scalable and reliable waste-to-fuel conversion systems. The expected outcomes contribute to improved resource efficiency, reduced dependence on fossil fuels, and the strengthening of regional value chains.