Title: Removing Physical and Chemical Bottlenecks for Hydrothermal Waste-to-Energy through Intensified Conditioning of Blended High Solid Waste Slurries

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Objectives: This project aims to establish scientific and technological strategies for feedstock preconditioning that yield a high quality, conversion-ready engineered Municipal Solid Waste (MSW) feedstocks that enables downstream conversion into sustainable liquid fuels. Specific objectives are to 1) identify critical material attributes in food waste and its blends that provide superior properties for high solid slurries and processability, 2) establish preconditioning strategies that enable buffering of transitory MSW supply through by wet and reactive storage, 3) identify, partition and destroy PFAS from MSW, and 4) establish an economical pathway for MSW to sustainable aviation fuels (SAF) that reduces greenhouse gas emissions (GHG) by >70%.

Project Description: This project addresses key technological and logistical bottlenecks associated with feedstock storage, conversion-readiness, and presence of contaminants. The workplan, as described in the figure below, develops a superior HTL feed with a chemical fingerprint and physical morphology that is more amenable to hydrothermal conversion with high solid slurries. Logistical bottlenecks regarding feedstock transportation, production transients, and accessibility are addressed by new storage and blending technologies that buffer supply chain fluctuations and enable local sourcing for decentralized SAF manufacturing.

Project Impact: The production of SAF from MSW using distributed, local technologies has the potential to transform our aviation industry as it moves toward carbon neutral technologies. From a scientific perspective, the top-down approach of food waste hydrothermal liquefaction (HTL) to SAF leverages the highly energy dense polymeric carbon backbone already present in the waste feedstock. By establishing pre-conditioning technologies that provide access to that structural backbone, the proposed work can establish a sustainable pathway for aviation fuels.

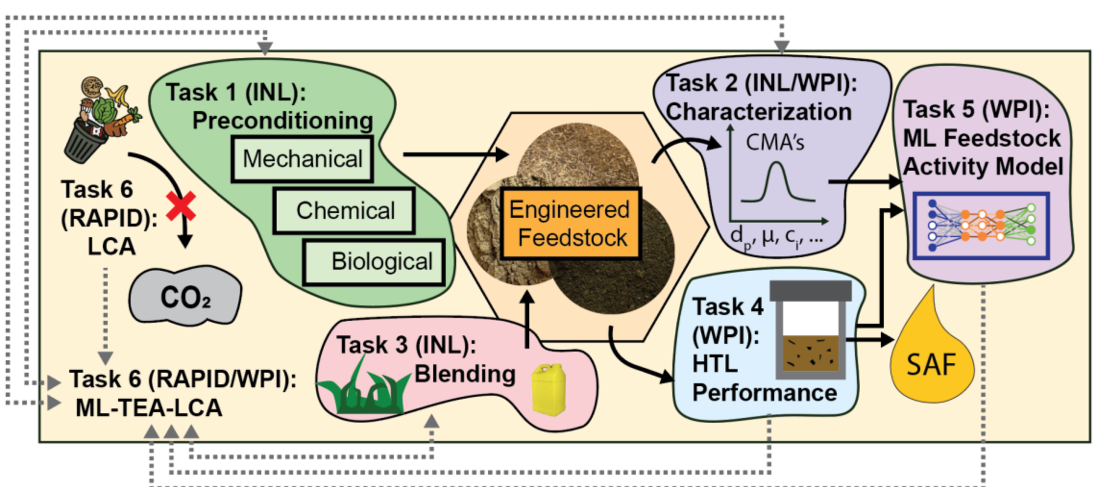

Figure 1: Project Scope: *INL preconditions (1) and characterize (2) wet-wastes. WPI performance tests (4) and models (5) feedstock activity relationships to engineer optimal blends (3). A global ML-TEA-LCA model relates feedstocks, preconditioning and blending to HTL performance and GHG emissions to direct experiments identify ultimate engineered feedstock with minimal MFSP to SAF.*