Project Summary

Project Title:	Carbonaceous Chemistry Improvement of Municipal Solid Waste (MSW) with Artificial Intelligence (AI) for Gasification
Principal Investigator:	Matthew Davidson
Name of Applicant:	Gas Technology Institute (GTI)
Solicitation Number:	DE-FOA-0002636 (Area of Interest 1A)

Description and Objectives: The Project Team is proposing a 30-month project to develop advanced pre-processing technologies to enable a new commercialization pathway for the GTI U-GAS® fluidized bed gasification technology. This will be the centerpiece of a sustainable aviation fuel (SAF) production plant using non-recycled municipal solid waste (NMSW) as feedstock. The project objectives include: 1) Characterize chemical properties of NMSW using advanced infrared (IR) sensors to build the database, 2) Develop a predictive model using AI and machine learning to correlate NMSW components to proximate and ultimate analysis and high heating value or high heat value (HHV) prediction, 3) Establish targets and limits on contaminants for NMSW that are applicable to U-GAS fluidized bed gasification, 4) Meet U-GAS feedstock specifications by increasing HHV dry basis by 20%, reducing Chlorine to <1000 ppm, and reducing inorganic (Na, Mg, Fe) content to <2% and Ca <10% of overall feed using processing methods such as blending, booster stream addition, fractionation, and decontamination, 5) Develop the AI driven real time feed control algorithm to improve carbonaceous chemistry of NMSW, 6) Enhance NMSW feed using torrefaction pre-processing, 7) Verify the enhanced NMSW feedstock performance via bench scale fluidized bed gasifier unit, and 8) Perform technoeconomic analysis and lifecycle analysis to demonstrate feasible SAF production via NMSW gasification conversion to meet >70% greenhouse gas emission reduction.

Methods to be employed: GTI proposes to develop a novel artificial intelligence (AI) sorting algorithm that will produce consistent, high-quality feedstock from NMSW sorted and discharged from the Material Recovery Facility of Wasatch Front Waste & Recycling District. The proposed NMSW empirical model and AI feed control algorithm will enhance this feedstock quality for the gasification process to be more effective and improve syngas quality. The project is targeting to improve three key chemical quality characteristics of NMSW: HHV, Cl content, and inorganics (Na, Mg, Ca, Fe) content. The enhancement in NMSW feedstock qualities will be verified with the bench scale gasification testing.

Benefits and outcomes: The proposed project will open new market to suppliers and waste for end-of-life solution to NMSW. The project will have a significant impact by enabling a potential leap forward in the utilization of such waste by opening new conversion technologies through quantifying NMSW variability, developing conversion-specific specifications, demonstrating advanced pre-processing technologies to actually achieve feedstock specifications suitable for gasification technology. This research will enable utilization of a previously unusable feedstock for producing SAF via gasification conversion technologies and via FT synthesis.

Major Participants: Gas Technology Institute (GTI) is teaming with the Idaho National Laboratory (INL) and West Virginia University (WVU), Wasatch Integrated Waste Management District (Wasatch) and Gershman, Brickner & Bratton (GBB).