



**Title:** TRIFTS Catalytic Conversion of Biogas to Drop-in Renewable Diesel Fuel

**Lead Organization:** T2C-Energy, LLC

**Project Team**

**Principal Investigator (T2C-Energy):** Devin Walker

**Principal Investigator (University of South Florida):** Dr. John Kuhn

**Team Members:** T2C-Energy, University of South Florida, and Argonne National Lab

**Technical Topic Area:** AOI 4 (Systems Research of Hydrocarbon Biofuel Technologies)

**Summary:**

There are 2,451 landfills, 1,241 wastewater anaerobic digester (AD) facilities, and 282 agricultural AD facilities in the United States. These sites generate over 800,000 standard cubic feet per minute (scfm) of biogas representing a fuel equivalent of 3.7 billion GGE yr. The biggest challenge to this industry is its largely decentralized nature. Existing biogas projects include direct heating, electricity generation, and enrichment of methane for pipeline use or for NG-powered vehicles. T2C-Energy has developed and patented a novel catalytic technology we have trademarked TRIFTS® for the direct conversion of biogas to drop-in transport fuels. This project is focused on optimizing this new TRIFTS® technology at a relevant engineering scale capable of utilizing both the CO<sub>2</sub> and CH<sub>4</sub> portions of biogas and incorporating them into the hydrocarbon backbone of the final product of the process (renewable drop-in diesel). This renewable source of diesel resembles its petroleum counterpart both physically and chemically and can be used in current day engines with no engine modifications necessary. The heavy equipment and waste hauling trucks can therefore unload and refuel at the same landfill or AD site with a renewable diesel fuel derived from the very waste they hauled. Thus, a closed loop process is created from feedstock to end point user. We have previously collaborated with the US DOE to build a mobile pilot facility for the purpose of testing the technology onsite at multiple landfills and AD's. The unit was designed to convert a 9-24 scfm slipstream of raw biogas into renewable transport fuel. Successful demonstrations and testing at engineering scales are a proven pathway to commercialization and provide confidence to all stakeholders for scale-up. This project focuses on rigorously testing our TRIFTS® technology at the engineering scale to convert a diverse range of biogas feedstocks derived from MSW, wastewater, animal waste, food waste, and crop residues into high quality renewable, drop-in diesel fuel. These feedstocks present variations in biogas feed compositions and varying levels of impurities that offer unique challenges. We therefore seek to prove the robustness of the TRIFTS® process over this broad biogas range and efficiently convert them into middle distillate hydrocarbons in a highly profitable manner and at scales that were traditionally not thought economically feasible. The biogas variations, catalytic parameters, process dynamics, system performance, process LCA, and fuel product quality will all be monitored and studied over sufficiently long term periods (over 500 hours per site) in order to optimize efficiency, productivity, and economics of the TRIFTS® process and incorporate into the scale up of TRIFTS® plant designs. Economic opportunity; job creation; production of drop-in renewable fuel, fertilizer, freshwater; and the creation of circular economies within the US at the rural and metropolitan levels are direct impacts of this project.