Project Summary

Project Title:	Novel Electric Reformer for Drop in Fuels from Biogas or Waste CO_2
Principal Investigator/ Project Director:	Ms. Terry Marker
Name of Applicant:	Gas Technology Institute (GTI)
Solicitation Number:	DE-FOA-0002396 (Area of Interest 1A)

Objectives: The goal of this project is to significantly reduce biogas to liquid costs by scaling up an electric reformer/reverse water gas shift reactor for conversion of waste carbon dioxide from ethanol plants or biogas from digestors to synthesis gas. The synthesis gas from the reformer will be used to make drop in fuels using the Gas Technology Institute's (GTI) Cool GTL™ (gas to liquid) Fischer Tropsch technology or be used in other gas to liquids processes. The ultimate objective is to produce biofuels from biogas or waste CO_2 from bioprocesses for less than $2.75/GGE with greater than 70% reduction in greenhouse gas emissions. In this project, the electric reformer/reverse water gas shift reactor will be modeled, designed, constructed, and tested for more than 500 continuous hours for two cases covering biogas conversion to liquids (Case 1) and waste CO_2 utilization (Case 2). Case 1 will use a throughput of 8 MMBTU/day of biogas and Case 2 is the first stage of a process that will produce 35 gallons of final fuel equivalent from waste CO_2. This project will scale up GTI's electric reformer design, which has been tested at smaller scale as the first stage of the Cool GTL process (this produces 1-2 gallons of product per day) to a larger scale.

Methods to be employed: Key steps for the project are: 1) modeling to ensure adequate heat transfer and control, 2) mounting the internal heating elements, 3) testing of the reactor, 4) engineering design plus technoeconomic analysis, and 5) lifecycle analysis. A key goal is to ensure the model correctly predicts the internal heat transfer and the reactors ultimately produces the desired synthesis gas composition of 2.2-2.5/1 H_2 to CO at expected temperatures. To achieve this, the project includes extensive mechanical, structural and electrical design, reactor performance parametric studies based on an anchored model, and the preparation of engineering design drawings and procurement specifications for a commercial electric reformer. Also, this study will accurately determine the capital cost, technoeconomic and lifecycle analysis advantages of a large commercial electric reformer as the basis of renewable fuels production.

Benefits and outcomes: This project will be a major step forward in designing an electric reformer at full industrial scale. The major benefit is to greatly reduce the reformer or reverse water gas shift reactor's capital cost, size, and waste carbon dioxide production. Through use of this technology, we will achieve drop in production of drop in bio jet diesel and gasoline fuels at $2.50/GGE, and achieve more than 80% greenhouse gas production when paired with renewable electricity.

	Standard gas fired reformer	Electric reformer
$MM Capital cost	6	2.2
Total Installed Cost $MM	12	4.4
Size ftxftxft	13ft x 13ft x 35ft	2.5 ft diameter x 7 ft long

Major participants: GTI, GasTechno, UPM, Hatch Engineering