Mathematical Modeling and Optimization of Novel Waste-and-Gas-to-Liquid (WGTL) Processes

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Municipal Solid Waste (MSW) is a form of biomass consisting of everyday trash and garbage and includes food wastes, papers, product packaging, textile, wood, plastic, metals, glass, leather, etc. Thermal treatment of MSW has the potential to produce energy, liquid fuel and chemicals from waste. Incineration is the most common type of thermal treatment while pyrolysis and gasification are the two emerging technologies that can be employed. Recent discoveries of unconventional natural gas resources in the United States have lowered gas prices and expanded the country's energy supply. Methane is a greenhouse gas and its global warming potential (GWP) is 25 times that of carbon dioxide. It is then desirable to develop technologies that can tap into the combined resources of MSW and Natural Gas so as to produce liquid transportation fuels, bring them to the market, and reduce emissions at the same time.

In this presentation, we will focus on (a) the mathematical modeling of a MSW gasifier and its predictive performance calibrated through multiple sets of experimental data; (b) the integration of the MSW gasifier into a superstructure of process alternatives for the production of liquid transportation fuels; and (c) preliminary results for the optimization of a novel waste and natural gas to liquids process.