Tri-reforming of Methane and CO_2: A Novel concept for Catalytic Production of Solid Waste Syngas with Desired H_2/CO Ratios for Liquid Biofuels

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Project Proposal:

Proposed is a novel tri-reforming process which involves a synergetic combination of CO_2 reforming, steam reforming and partial oxidation of methane in a single gasification reactor for cost effective production of industrially useful synthesis gas for use in Fischer-Tropsch synthesis (FTS). Municipal solid waste biomass gasification processes (H_2 and CO_2 are available in a 1:1 effluent) are just entering the early commercial phase and offer many opportunities for improvement. These improvements are urgently needed to reduce capital cost and facilitate commercial deployment, thus creating new industry and new employment for Florida. **Here is directly where the proposed effort is targeted.** The novel tri-reforming concept represents a new way of thinking for both conversion and utilization of CO_2 and CH_4 without separation that can be applied to industrial flue gas as well. The tri-reforming catalytic system proposed can not only produce synthesis gas (CO + H_2) with desired H_2/CO ratios (1.5–2.0), but also could eliminate carbon formation which is usually a serious problem in the CO_2 reforming of methane. Therefore, the proposed tri-reforming can solve two important problems that are encountered in individual processing. The incorporation of low partial pressures of O_2 in the partial oxidation reaction generates heat *in-situ* that can be used to increase energy efficiency and O_2 also reduces or eliminates the carbon formation on the reforming catalyst. **Our group at USF has already developed a process that converts MSW to Diesel and JP-8 funded by the FESC program. This project will optimize and leverage that effort.**