Technology for Enhanced Biodiesel Economics: KSE, Inc.

Dr. James R. Kittrell

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Problem Statement

Biomass conversion processes must be highly efficient in order to provide a near-term contribution to the U.S. energy balance.

• Biodiesel is recognized as an important potential fuel, which is obtained by the relatively simple esterification of fats or seed oils at mild conditions.

• In the manufacture of biodiesel, the production of each gallon of biodiesel produces about one pound of byproduct glycerol. If biodiesel is produced to meet only 3% of the U.S. diesel fuel demand, over 1.8 billion pounds of glycerol will be coproduced.

• The current annual worldwide demand for glycerol is only 0.5 billion pounds.

• Biodiesel economics would be depressed, and even the physical disposition of byproduct glycerol becomes a challenge.

• To fully exploit the potential of biodiesel, an effective glycerol upgrading technology is needed to produce products for a very large market.

Technology Description

Utilize novel catalytic reaction technology to directly convert glycerol into propane in a single, low cost reactor.

• Reform a portion of the glycerol to produce hydrogen at mild conditions, due to favorable glycerol equilibrium conditions.

• Utilize the hydrogen produced to hydrogenate the remaining glycerol to propane.

• Both reactions will be conducted simultaneously in a single reactor

• Single reactor operates in overall hydrogen balance; exothermic heat of hydrogenation supplies the endothermic heat of reforming

• Catalysts are to be identified that catalyze both reforming and hydrogenation reactions

• The key to this technology is the development of a novel, liquid phase catalyst system which can both reform and hydrogenate glycerol in a single reactor.

Expected Results

Expected results are:

• A novel catalyst system capable of directly converting glycerol to propane. The overall catalyst system includes not only the composition of the primary catalyst component, but also solvents, co-catalysts, promoters, or other components essential to the performance of the total system.

•Confirmation of thermodynamic predictions of favorable glycerol conversion to hydrogen at low temperature and pressure, compared to conventional methane reforming to hydrogen.

• Evaluation of catalyst system performance for both reforming and hydrogenation steps. Key performance criteria are catalyst activity, selectivity, and stability.

• A process design and cost estimate for a commercial facility based on the new technology.

• A competitive technology assessment of the new technology compared to the current systems using methane reforming to produce external hydrogen.

Potential Environmental Benefits

Potential environmental benefits include:

•Significantly improved biodiesel production economics. Bio-based fuels reduce overall carbon dioxide emissions and reduce U.S. reliance on conventional petroleum fuels.

• Biodiesel by-product production is shifted from glycerol to propane. Propane represents a clean, high-value energy product which is in wide use today, has an existing distribution system, and can readily accommodate large additional volumes.

• Avoidance of potential environmental problems associated with disposition of large quantities of unwanted glycerol by-product.

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