RENEWABLE DIESEL FUELS: STATUS OF TECHNOLOGY AND R&D NEEDS

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Renewable diesel fuel development has begun to focus on a portfolio of fuels because no single fuel option offers adequate petroleum displacement benefits on its own. In the near term, these options include biodiesel and ethanol-diesel blends. Medium- and longer term options include biomass-derived Fischer-Tropsch (FT) diesel, esters of levulinic acid (produced from cellulosic biomass), and certain other oxygenates. This presentation will review the technical status of these renewable diesel options and their position in the fuels development pathway.

Biodiesel consists of the methyl esters of fatty acids and can be produced from a variety of vegetable oil, animal fat, and waste grease resources. The potential production of biodiesel is from 2 to 6 billion gallons per year in the United States. Biodiesel is a fully commercial fuel based on the development of the ASTM D6751 quality standard and completion of EPA 211b testing requirements. Most engine and fuel injection equipment (FIE) manufacturers believe that use of up to 5-percent blends of biodiesel in petroleum diesel will have no adverse effects and can result in a significant improvement in fuel lubricity. There is little significant change in pollutant emissions at this level. The biodiesel industry supports the use of 20-percent blends, which produces a significant lowering of PM emissions (15-20 percent) relative to conventional diesel. However, there are several technical barriers to the use of 20-percent and higher blend levels. These include the potential for poor oxidative stability, incompatibility with fuel system elastomers and other materials, low-temperature flow properties, and increased NO_x emissions.

Ethanol-diesel blends, or e-diesel, are mixtures of up to 15-percent ethanol in conventional diesel fuel with cosolvent or microemulsifier additives at levels of 0.5-2 percent. E-diesel is an experimental fuel, and most engine and FIE manufacturers are opposed to its use because it exhibits a low flashpoint (13°C), and fuel tank vapor is flammable under most conditions. However, if these safety issues can be overcome, e-diesel offers the potential for significant PM emissions reductions and petroleum displacement. Current U.S. production of fuel ethanol is about 2 billion gallons, and some projections suggest more than 20 billion gallons could be produced at some point in the future.

Longer term, the potential exists to produce on the order of 10 billion gallons of FT diesel via biomass gasification. Biomass FT diesel will be very similar to natural gas- or coal-derived FT diesel. The main technical barrier to this fuel is high cost. A second longer term option is esters of levulinic acid, which is produced via acid hydrolysis of cellulose. Some analyses suggest that levulinic acid could be produced for $0.04-$0.10/lb. The ethyl and methyl esters of this acid exhibit high flashpoint and lubricity. Blends of up to 10 percent in conventional diesel appear to be stable. This potential

renewable blending component is in the initial stages of the fuel development pathway. Potential production capacity is on the order of billions of gallons. Several other oxygenates with potential as fuel-blending components can also be produced from renewable resources and will be briefly discussed.