FTA RESEARCH

REPORT SUMMARY

Zero-Sulfur Diesel Fuel from Non-Petroleum Resources: The Key to Reducing U.S. Oil Imports

Background

Zero-sulfur diesel fuel of the highest quality—the fuel used in this project—can be made by Fischer-Tropsch (FT) synthesis from many non-petroleum resources, including natural gas, which is increasingly abundant in the United States. Zero-sulfur FT diesel fuel can upgrade and more-than-proportionally increase the supply of conventional Ultra-Low-Sulfur Diesel (ULSD) fuel by targeted blending and could eventually even replace conventional ULSD, which has become the most valuable and profitable bulk-fuel product (supplanting gasoline's former dominance) of petroleum refineries for about the past seven years. Production of zero-sulfur FT diesel fuel at the margin would not add incrementally more to the global surpluses of gasoline and other products with low or negative profit potential that inevitably result from refining crude oil.

Objectives

This project is one of a series of related projects, the goal of which has been to evaluate the operating performance benefits and develop market acceptance of synthetic FT diesel fuel by understanding and resolving, within the transit-bus context, the issues that make FT fuel different or unique in comparison to conventional diesel fuel. The projects have all been conducted by successfully running neat (i.e., unblended) sulfur-free, FT diesel fuel in diesel engines, but over a broad spectrum of operating environments and climates and in a range of diesel engines, produced by different manufacturers, and used in different types of service.

Findings and Conclusions

Sulfur-free FT diesel fuel produced from U.S. domestic resources can offer extraordinary leverage in reducing crude oil imports and enhancing security.

This project consisted primarily of running an Air Force bus with a Caterpillar C-7 engine on neat S-2 FT diesel fuel for three years. This was a direct follow-on to two previous/contemporaneous projects using the same neat S-2 FT fuel: running a new Tulsa Transit bus in revenue service in Tulsa, OK, for three years and running an Air Force Bus at Edwards Air Force Base in the California desert for three years. One of the most striking things that occurred over the combined period of these directly-related projects from 2005 to 2011 was the extreme volatility of the prices of both crude oil and petroleum products, and the effects that this price-volatility has had on both the U.S. and global economies.

The original objective of the project, to assess the potential for problems to occur with neat FT diesel fuel, is a usage strategy that is exactly opposite the most effective strategy, namely blending of FT with conventional diesel, for using whatever quantity of FT fuel could be produced over at least the next several decades. Furthermore, blending of FT with conventional diesel virtually eliminates the potential problems, such as fuel-injector nozzle-fouling, that could be caused by zero-aromatic neat FT fuel. If implemented on a large-enough scale (100,000s barrels per day), FT fuels produced from resources other than petroleum also have the capability of actually moderating the market prices of both ULSD and gasoline over the long term.

The FT diesel fuel in this project was used "neat" or unblended because this represents a "worst-case scenario" with respect to the possibility of fuel-injector nozzle-fouling in the Caterpillar C-7 engine by potential chemical and physical mechanisms related to the virtual absence of aromatics from neat FT diesel fuel. However, even under this worst-case condition, no nozzle-fouling was observed during this evaluation. Furthermore, it has now been fully appreciated that the greatest value by far of FT diesel fuel, to both the U.S. and world economies, will be as a sulfur-free component in blends with conventional petroleum-derived diesel fuel. If the FT diesel fuel is used as a blendstock with conventional diesel, rather than neat as in this worst-case evaluation, the possibility of nozzle fouling would be virtually eliminated by the continued presence of aromatics in the conventional diesel portion of the blend.

Demand for ULSD is greater than the refining capacity available to produce ULSD from customary and readily-available high-sulfur crude oils. This has caused, through market-driven increases in the prices of low-sulfur crude oils and the follow-on increases in high-sulfur crude oil prices by the OPEC cartel (which would be illegal under U.S. law), the prices of all petroleum-derived fuels to more than double (and to triple during price-spikes) since the middle of the last decade. Since the demand for ULSD, not the demand for gasoline, determines the amount of foreign crude oil imported into the U.S., any effort focused solely on "conserving" gasoline will have no impact on reducing U.S. imports of crude oil. This project expanded its focus from merely evaluating FT diesel fuel in a particular transit-bus engine to considering the broader aspects and opportunities for sulfur-free FT diesel fuel to enhance US energy and economic security.

Benefits

Each barrel of FT can reduce crude-oil imports in a leveraged 3:1 ratio from unfriendly areas of the world, all without producing more global-surplus gasoline. Furthermore, with targeted blending, FT can enable refiners to get more conventional ULSD out of each barrel of crude oil they refine.

Project Information

FTA Report No. 0029

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