Diesel additives: Harnessing the "fuel" package

The commercial trucking industry is demanding more from diesel fuel given the complexities of today's heavy-duty vehicle systems. Many are recognizing that high quality diesel fuel is more than just a commodity driven by price and offers significant potential for optimizing modern diesel engine performance. This is an important focus area for fleet managers in Asia, whose role will require more product knowledge as the role shifts into a more strategic position.

Growing interest in "all-in-one" differentiated diesel fuels has brought additives to the forefront as managers look to harness the best formulation package for their unique fleet needs. However, finding the right mix can be tricky.

It is important to understand the makeup of the fuel you use to power your fleet. It is also important to understand what questions you should be asking.

Diesel fuel additive basics

Additives are blended into the fuel for vehicle performance, product quality, safety, and regulatory purposes. They enhance certain properties of a fuel without substantially altering the fuel's bulk physical makeup (such as density, energy content, etc.). Diesel additives therefore tend to be dosed in small amounts, usually below 1% w/w.

Fleet managers should be mindful of the additives which are already in their fuel before considering new ones:

Cetane improvers help when the crude selection or processing does not result in an on-spec cetane number on its own. A cetane number indicates the combustion speed of diesel fuel and compression needed for ignition. Higher cetane may benefit cold starts and reduce noise and smoke upon starting a vehicle.

Lubricity improvers are required because the natural lubricity-enhancing compounds in diesel fuel are reduced in ultra-low sulfur diesel fuel. Fuel lubricity protects the fuel pump and fuel injectors from wear. Lubricity improvers are not necessary if a minimum of 2% fatty acid methyl esters (FAME) are blended into the fuel.

Over time, corrosion can hurt the performance of diesel fuel systems. **Corrosion inhibitors** are typically added at refineries to help prevent the corrosion of steel and copper or its alloys (brass, bronze).

Conductivity improvers help protect against static discharge during fuel loading. They are added at refineries and sometimes again at the terminal, since their effectiveness can decrease over time and at cold temperatures.

Cold temperatures encourage wax to drop out of diesel fuel, which can lead to loss of flow from filter plugging or bulk gelling in the fuel tank. **Cold flow additives** are added at the refinery or the terminal to ensure the diesel fuel flows at the temperatures at which it will be exposed. Blending of cold flow additives depends on geography and season. (Note, however, that this additive is not typically used in Singapore given the country's tropical climate.)

High quality diesel fuels from reputable providers will contain the additives described above as necessary to meet local fuel specifications.

Since fuel undergoes changes throughout refining and the delivery process, fleet managers should inquire about providers' quality assurance procedures at three points: at the refinery, terminal and during transportation. ExxonMobil, for example, tests fuel at refineries, as it enters the pipeline or barge for delivery to the terminal and a third time at the terminal to ensure it meets or exceeds specifications.

Aftermarket additives: Leave it to the experts

There are many "aftermarket" additives sold that claim to meet specific customer needs. In contrast to the additives described above that are blended at the refineries and terminals, aftermarket additives are added by hand to fuel. However, fuel should meet the required specifications without customers needing to purchase additional additives. Fleet managers should always be cautious of adding additives to diesel fuel as it can cause more harm than good. For example, aftermarket cold flow additives can interact poorly with cold flow additives blended into the fuel at the refinery or the terminal, which can result in filter plugging and potentially worsen the fuel's cold flow properties. In addition, in cold temperatures, aftermarket additives become less soluble and may not dissolve correctly in the fuel.

The truth of the matter is that enhancing diesel fuel is a science best left to the experts.

Detergent-based additives can provide substantial benefits for diesel fuel products by removing injector deposits and preventing them from forming in the first place. In some cases, such as with Esso Diesel Efficient™ fuel,[1] pre-blending diesel with detergent-based additives has proven valuable for addressing demands for improved fuel economy, lower emissions and reduced downtime.

The bigger picture

According to ExxonMobil's 2019 Outlook for Energy: A Perspective to 2040, energy use by heavy-duty vehicles is expected to grow and become the largest portion by volume of the overall transportation sector.[2] Driving this growth will be an increase in economic activity and personal buying power, where, by 2040, Asia Pacific will lead in GDP per capita as well as size of the middle class.

In response, diesel engine technology will become even more sophisticated and versatile in the future. The growth and the diversity of the commercial trucking industry in Asia will continue to have a major impact on what the full diesel package needs to deliver down the road.

Above all, persistent research and innovation at the molecular level, combined with customer feedback, will be critical to engineering a fully formulated diesel fuel that meets the performance needs of commercial fleet managers, every time.

For more information, please visit Esso's expert insights page.

[1] Esso Diesel Efficient™ fuel claims are based on internal and third-party vehicle engine testing, laboratory testing, and/or industry or other scientific literature. Basis for comparison for all claims is versus Esso™ unadditised diesel. Vehicle type, engine type, driving behaviour, and other factors also impact fuel and vehicle performance, emissions, and fuel economy. Esso Diesel Efficient™ fuel may be used in all heavy-duty and light-duty vehicles, but results may vary.

[2] ExxonMobil. "2019 Outlook for Energy: A Perspective to 2040." Retrieved: https://corporate.exxonmobil.com/-/media/Global/Files/outlook-for-energy/2019-Outlook-for-Energy_v4.pdf