HIGH OCTANE FUELS

POWERING THE FUTURE

Meeting aggressive new corporate average fuel economy (CAFE) requirements and tailpipe GHG emissions standards will require revolutionary changes in fuel and vehicle technologies. Accordingly, automakers are exploring a broad portfolio of technologies that can simultaneously improve vehicle efficiency and reduce emissions impacts. As stated by Sergio Marchionne, CEO of Fiat Chrysler Automobiles, "Everything is on the table."

As automakers have assessed various technology pathways toward complying with new CAFE/GHG standards, one very promising strategy has risen to the top: using high octane fuels in advanced internal combustion engines. When paired with downsized, high-compression, turbo-charged engines, high octane fuels can deliver the same—or better—fuel economy as regular gasoline, but with less energy and far fewer emissions. As EPA has recognized, high octane fuels "...could help manufacturers who wish to raise compressions ratios to improve vehicle efficiency as a step toward complying with the 2017 and later GHG and CAFE standards."

A growing body of research by automakers, government laboratories, and universities demonstrates that gasoline blends containing 20-40% ethanol can deliver the octane needed to maximize efficiency in advanced internal combustion engines. In addition to possessing an extremely high octane rating, ethanol is less expensive and cleaner than other potential octane sources.

In recent years, a broad coalition of stakeholders has rallied to help advance ethanol as the "key ingredient" in the high octane fuels of tomorrow. Ethanol producers, automakers, government researchers, fuel retailers, agricultural groups, and others continue to collaboratively chart the course to a high octane future that finally recognizes ethanol's full potential.

"Our analysis suggests that transitioning the fleet to higher-octane gasoline would result in significant economic and environmental benefits through reduced gasoline consumption."

– *Massachusetts Institute of Technology (Speth et al., 2014)*

A recent study by the Massachusetts Institute of Technology (MIT) found that use of high octane fuels in appropriately tuned vehicles by 2040 could:

- Reduce annual gasoline consumption in the U.S. by 3.0 - 4.4%;
- Provide additional CO2 emission reductions of 19–35 metric tons/year;
- Generate an annual direct economic benefit of $0.4–6.4 billion; and
- Offer a net societal benefit (including the social cost of carbon) of $1.7–8.8 billion annually.

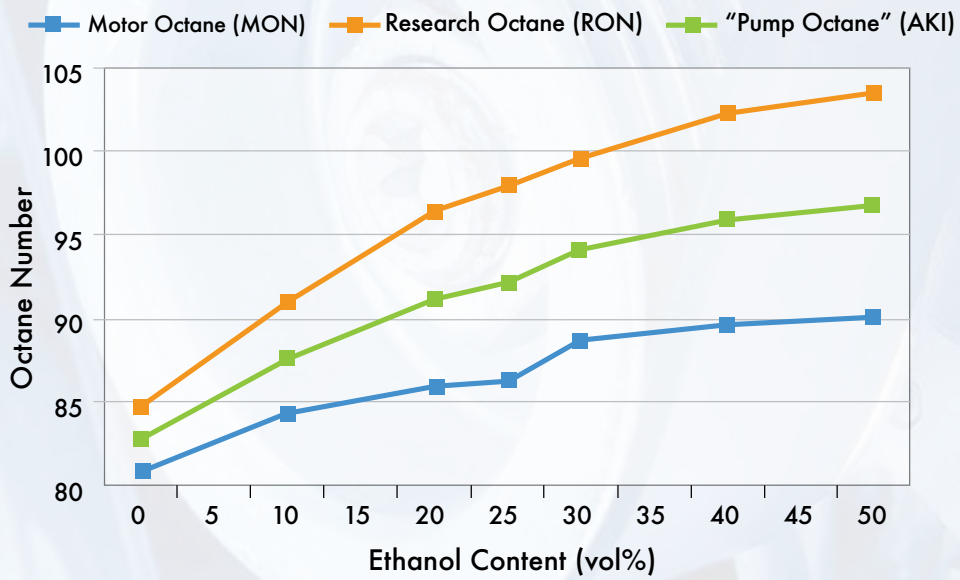
"Ethanol can be a major enabler in producing High Octane Fuel with significant vehicle efficiency gains and a large reduction in well-to-wheels greenhouse gas emissions."

– Argonne National Laboratory

"Higher ethanol content is one available option for increasing the octane ratings of gasoline and would provide additional engine efficiency benefits..."

– Ford, General Motors, Fiat Chrysler (Leone et al., 2015)

Octane Effect of Adding Ethanol to CA Gasoline Blendstock (CARBOB)



Source: RON, MON from Chupka et al. (2015); AKI based on R+M/2