HIGH-OCTANE LOW-CARBON CORN ETHANOL

Today's Fuel for Tomorrow's Future

Corn ethanol is uniquely positioned to play a larger role in future transportation fuels. Ethanol provides an affordable, abundant and renewable source of high octane, low carbon motor fuel. Society continues to ask for lower carbon products. In response, automakers are seeking affordable, higher octane motor fuels enabling them to unlock increased efficiency gains within future spark ignition engines. Corn ethanol is the only commercially available product capable of meeting and exceeding all these asks: Low-Carbon, High-Octane, Affordable, Abundant and Renewable!

Octane (Anti-Knock Index - AKI) is the number you see at the gas pump today. Octane is a measurement of fuel's ability to resist premature ignition. Consistent, controlled and predictable ignition of fuel is required for optimal engine performance. Premature ignition can lead to engine knocking resulting in: decreased performance, decreased efficiency, increased emissions and potential engine damage if left untreated. Today's engines are designed and optimized to operate within specific fuel octane ranges. However, future internal combustion engines (ICE) will require higher octane fuels to fully utilize new technology and deliver substantial gains in efficiency.

America's corn farmers maintain a vested interest in the future of liquid fuels. Today, nearly every gallon of gasoline in the U.S. is at least 10 percent ethanol derived from corn.

To understand ethanol's vital role as the world's leading octane additive, as well as it's increasing value as a low carbon solution, requires a full appreciation of both characteristics.

Corn is sustainable, abundant and affordable, making it the perfect feedstock for ethanol.

- In the 2018/19 market year, U.S. farmers produced 14.4 billion bushels of corn with carryout of 2.4 billion bushels.
- Corn farmers have experienced tremendous productivity gains since 2000:
  - Average yields have grown by nearly 40 bushels/acre (29 percent), and
  - U.S. total corn production is up 45 percent.
- Through the 2018 crop year, 5.4 billion bushels of U.S. corn produced 16 billion gallons of ethanol.
- Ethanol production also returned the equivalent of 1.24 billion bushels of corn for a protein-rich livestock feed in the form of distillers dried grains.
- Introducing a High-Octane Low-Carbon fuel in the marketplace could increase ethanol usage by 5 billion gallons or more. That equals 1.8 billion bushels of corn, roughly the same amount of corn carryout from 2018.

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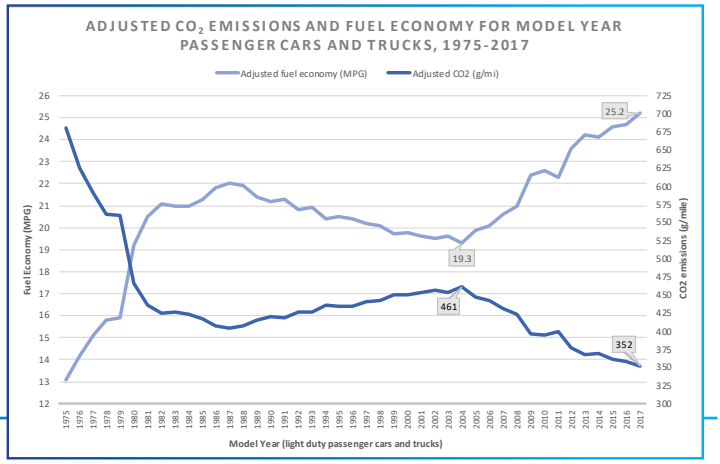
For current engine technology to advance, a higher quality, octane-enhanced fuel needs to be available.

- Between 2004 and 2017, average light duty vehicle (LDV) greenhouse gas (GHG) emissions decreased 22 percent while fuel economy improved 28 percent. But current fuel characteristics limits further engine improvements.[1]
- To further optimize engines for efficiency and emission reductions, automakers need a higher-octane fuel.[2]
- Higher-octane fuel allows for engines with higher compression ratio engines, improved turbocharging, optimized combustion, and other advanced technologies that significantly improve fuel efficiency and engine performance.[3] [4]



Ethanol is the most cost-effective, available and researched octane additive on the market.

- Ethanol reigns superior to other additives across three important fuel metrics: octane number, octane sensitivity, and heat of vaporization.[5] [6]
- Before the widespread use of ethanol, additives (such as lead and MTBE) were used to increase fuel octane. These have since been eliminated or reduced due to health and/or environmental concerns.[7]
- Ethanol is lower-cost compared to fossil fuel octane sources, making a high octane mid-level ethanol blend more affordable for consumers.[8] [9]

Ethanol is cleaner for the environment resulting in fewer GHG and tailpipe emissions than fossil fuel sources.

- A U.S. Department of Agriculture's 2019 analysis shows corn-based ethanol produces 39 to 43 percent less life cycle GHG emissions when compared to conventional gasoline.[10]
- Current technology curves for both conventional ethanol and corn production could result in emissions reductions of up to 70 percent compared to the gasoline it replaces.[11]
- The U.S. Department of Energy's leading energy model (GREET) places corn-based ethanol's carbon intensity – its environmental impact – at 41 percent below baseline gasoline.[12]

The adoption of higher blends of ethanol promotes better air quality and supports public health goals.

- Petroleum based aromatics have been shown to contribute to thousands of mortalities in the United States[13]. Ethanol provides a cleaner substitution.
- Increasing the volumes of ethanol to a midlevel blend (E20-E40) corresponds to a significant reduction in harmful particulates and carbon monoxide. [14]
- Ethanol improves urban visibility and moderates the formation of smog.[15]

To learn more about high-octane low-carbon corn-based fuel, go to: ncga.com/octane

Endnotes

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