Octane standardization

A global fuel standardization effort is an imperative for unlocking transport decarbonization through the widespread adoption of high-octane ethanol blends

Transport has emerged as the primary source of greenhouse gas (GHG) emissions in many parts of the developing world, presenting a significant challenge with no straightforward solutions. However, high-octane fuels, particularly those leveraging ethanol's unique properties, offer a powerful and immediate pathway to substantial decarbonization. Despite this potential, a critical barrier remains: the lack of coordinated global standardization for ethanol blends.

The Octane Advantage: Ethanol's Role in Efficient Decarbonization

Ethanol stands out as the most cost-effective and lowest-carbon source of octane available today. Its high Research Octane Number (RON) of 109, and Anti-Knock Index (AKI) of 99 provide an octane boost when blended with gasoline. This superior octane quality is crucial. To truly tap into the engine efficiency improvement potential of ethanol, **octane levels in gasoline must increase in line with increased ethanol blending**. Higher octane allows for the design of more efficient, higher-compression engines that can operate with advanced ignition timing, leading directly to improved fuel economy and reduced CO2 emissions.

Furthermore, ethanol not only provides a significant octane boost but does so at a lower cost than fossil-derived octane enhancers. In the U.S. market, ethanol is typically the lowest-cost source of octane available. The cost of refinery octane is 4.5 times higher than the cost of ethanol octane (6.3 v 1.4 USD¢/AKI-gal) which implies a large economic incentive to increase the ethanol content of gasoline. This economic advantage reinforces its appeal as a practical and scalable decarbonization tool.

Higher ethanol blends, such as E20 (20% ethanol, 80% gasoline) and E30, can deliver significant GHG savings. These blends are compatible with current vehicle technology and existing fueling infrastructure, negating the need for entirely new vehicle purchases or extensive charging network buildouts. Beyond carbon reduction, ethanol also contributes to improved air quality by reducing harmful aromatics and particulate matter in gasoline. With advanced feedstocks and carbon capture and storage (CCS) technologies, ethanol offers clear pathways to achieve net-zero, and even net-negative, emissions.

CLIMATE ETHANOL ALLIANCE

ADDRESS H-1051 BUDAPEST, ZRÍNYI UTCA 16. III/8. EMAIL ZOLTAN.SZABO@CLIMATEETHANOLALLIANCE.COM
WEB CLIMATEETHANOLALLIANCE.COM

Building Momentum: Global Progress in Ethanol Uptake

While high-octane fuels could contribute substantially to decarbonization efforts, there is currently no global standardization process coordination. Despite this, ethanol is gaining significant traction globally, demonstrating its practical viability and environmental impact:

- **United States:** The U.S. is moving ahead with year-round E15 availability, expanding access to a lower-carbon fuel option for American drivers.
- **India:** Showing remarkable leadership, India has doubled its ethanol consumption in just two years. India has successfully achieved 20% ethanol blending in petrol in 2025, five years ahead of its original 2030 target. The transition was achieved with no adverse effect on global commodity markets, demonstrating the feasibility of rapid, large-scale adoption.
- **European Union:** The EU is in the process of revising its modeling framework (PRIMES) to better reflect the current and future climate performance of ethanol. This critical update acknowledges the scientific accuracy of industry data, validating ethanol's substantial GHG reduction potential that has been consistently demonstrated over the past 15 years. The revised modeling now confirms that ethanol has clear pathways to exceed 100% GHG savings (net negativity) as early as the end of this decade.
- **Brazil:** Following successful government testing showing consistent performance and real environmental benefits, Brazil approved raising the ethanol content in gasoline from 27% to 30%.

The Urgency of Global Coordination for Standardization

While these regional advancements are commendable, the full decarbonization potential of high-octane ethanol fuels can only be realized through globally coordinated standardization efforts. Such coordination would create significant momentum, fostering innovation, reducing market fragmentation, and accelerating the adoption of these vital climate solutions worldwide.

By establishing common standards for high-octane ethanol blends and fuel properties, countries can unlock greater investment in biofuel technologies, optimize engine designs for higher efficiency, and provide regulatory certainty for both producers and consumers. This strategic alignment is essential to leverage ethanol's validated climate benefits and its ability to rapidly decarbonize the transport sector using existing infrastructure and vehicle fleets. As the world seeks effective and immediate climate action, a globally coordinated approach to ethanol blend standardization, with a focus on increasing octane levels in line with ethanol blending, is not merely beneficial—it is a strategic imperative.

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ADDRESS H-1051 BUDAPEST, ZRÍNYI UTCA 16. III/8. EMAIL ZOLTAN.SZABO@CLIMATEETHANOLALLIANCE.COM
WEB CLIMATEETHANOLALLIANCE.COM