RENEWABLE FUELS ASSOCIATION

December 30, 2016

Attention: Docket ID No. EPA-HQ-OAR-2015-0827

U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

RE: Proposed Determination on the Appropriateness of the Model Year 2022-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards under the Midterm Evaluation (Docket ID No. EPA-HQ-OAR-2015-0827)

Dear Administrator McCarthy:

The Renewable Fuels Association (RFA) appreciates the opportunity to comment on the above referenced Proposed Determination.

RFA is the leading trade association for America's ethanol industry. Its mission is to advance the development, production and use of fuel ethanol by strengthening America's ethanol industry and raising awareness about the benefits of renewable fuels. Founded in 1981, RFA serves as the premier meeting ground for industry leaders and supporters. RFA's 300-plus members are working to help America become cleaner, safer, more energy secure, and economically vibrant.

In short, we were surprised and disappointed that the Proposed Determination was issued so quickly after the close of the comment period on the Draft Technical Assessment Report (TAR). We are troubled by the fact that the Proposed Determination fails to take into account many of the comments and recommendations submitted by affected stakeholders in response to the Draft TAR. More specifically, we are greatly concerned that, to date, the Midterm Evaluation (MTE) process has focused exclusively on vehicle and engine technologies in the 2022-2025 timeframe and has largely ignored the influence of fuel parameters (like octane rating) on fuel economy and GHG emissions.

RFA and many other stakeholders provided detailed technical comments in response to the Draft TAR's evaluation of the appropriateness of the Model Year 2022-2025 standards. We are concerned that our comments and recommendations likely were not reviewed as intensively as is warranted for a ruling that will have important consequences for the transportation and fuels industries over the coming years. Attached to this letter, we are again enclosing our comments responding to the Draft TAR; we encourage EPA to give our comments (and the submissions of other stakeholders) careful consideration before issuing a Final Determination. Furthermore, we recommend that EPA and NHTSA retain the original schedule for release of the Final Determination (i.e., April 2018); this would ensure adequate time for the agencies to fully review and incorporate the feedback received from stakeholders in response to the Draft TAR and Proposed Determination.

Our concerns with the Draft TAR are extensive, and these issues were left unaddressed in the Proposed Determination. As outlined more fully in the attached comments, our most critical concerns with the MTE process to date include the following:

- Many of the advanced internal combustion (IC) engine technologies examined in the TAR and Proposed Determination Technical Support Document (TSD) implicitly call for liquid fuels with higher octane than is offered by today's regular gasoline.
- While the TAR and TSD examine various advanced IC engine technologies, they fail to simultaneously examine the fuels that *enable* those engine technologies. In general, the TAR and TSD fail to treat IC engines and liquid fuels as integrated systems, even though fuel properties can have significant effects on fuel economy and emissions.
- The TAR and TSD ignore the influence on fuels of other public policies, like the Renewable Fuel Standard (RFS), aimed at reducing petroleum consumption and GHG emissions.
- Pairing the advanced IC engine technologies examined in the TAR and TSD with high octane low carbon (HOLC) fuels with 98-100 RON octane would result in greater fuel economy and emissions benefits than considered by EPA and NHTSA.
- Use of an ethanol-based HOLC in optimized IC engines would be the lowest cost means of achieving compliance with CAFE and GHG standards for MY2022-2025 and beyond.

As underscored in the attached comments, consensus is building around the need for HOLC fuels to enable greater engine efficiency and reduce emissions. Published research has clearly demonstrated that HOLC fuels would enable high compression ratio engines and other advanced IC technologies, which would in turn improve engine efficiency and reduce emissions.

The EPA clearly has authority to regulate fuel parameters that effect emissions, and thus the Agency should use the MTE process to introduce regulations that specify minimum octane ratings that will reduce emissions of CO2 and other pollutants and simultaneously facilitate greater fuel efficiency. RFA believes that adoption of new regulations governing octane levels could be done fairly quickly, and that the MTE should include the regulatory roadmap that the agencies, automakers and other stakeholders can follow to assure that gasoline in 2025 and beyond has the minimum octane rating required to enable proliferation of advanced IC engine technologies that improve fuel efficiency and slash automotive emissions.

Thank you again for the opportunity to comment and we look forward to interacting further with EPA throughout the MTE process.

Sincerely,

Bob Dinneen
President & CEO

Attachment: *Comments of the Renewable Fuels Association (RFA) in response to Notice of Availability of Midterm Evaluation Draft Technical Assessment Report for Model Year 2022–2025 Light Duty Vehicle GHG Emissions and CAFE Standards (81 Fed. Reg. 49,217; July 27, 2016)*

RENEWABLE FUELS ASSOCIATION

September 26, 2016

Attention: Docket ID No. EPA–HQ–OAR–2015–0827
Docket ID No. NHTSA–2016–0068

U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

National Highway Traffic Safety Administration
1200 New Jersey Avenue SE
Washington, DC 20590

RE: *Comments of the Renewable Fuels Association (RFA) in response to Notice of Availability of Midterm Evaluation Draft Technical Assessment Report for Model Year 2022–2025 Light Duty Vehicle GHG Emissions and CAFE Standards (81 Fed. Reg. 49,217; July 27, 2016)*

The Renewable Fuels Association (RFA) appreciates the opportunity to comment on the Draft Technical Assessment Report (TAR) published by the U.S. Environmental Protection Agency (EPA) and National Highway Traffic Safety Administration (NHTSA) in July 2016.

RFA is the leading trade association for America's ethanol industry. Its mission is to advance the development, production, and use of fuel ethanol by strengthening America's ethanol industry and raising awareness about the benefits of renewable fuels. Founded in 1981, RFA serves as the premier meeting ground for industry leaders and supporters. RFA's 300-plus members are working to help America become cleaner, safer, more energy secure, and economically vibrant.

I. Executive Summary

In 2012, EPA and NHTSA promulgated final regulations establishing corporate average fuel economy (CAFE) and greenhouse gas (GHG) emissions standards for model year (MY) 2017-2025 light-duty vehicles (LDVs). Included in the 2012 final rule was a regulatory requirement for the agencies to conduct a Midterm Evaluation (MTE) of the standards established for MY2022-2025. Through the MTE, the agencies must determine whether the MY2022-2025 standards established in 2012 are still appropriate in light of the latest available data and information.

The first step in the MTE process was the July 2016 release of a Draft Technical Assessment Report (TAR) for public comment. The TAR examines a wide range of technical issues relevant to the GHG emission and augural CAFE standards for MY2022-2025, including assessments of technology effectiveness and cost, as well as modeling of various compliance scenarios. EPA and NHTSA state that the information in the TAR and the comments received in response to the document "will inform the agencies' subsequent determination and rulemaking actions."[1] Further, they commit to "fully consider public comments on this Draft TAR as they continue to update and refine the analyses for further steps in the MTE process."[2] RFA has reviewed the TAR and has also commissioned a technical analysis of the TAR by Ricardo, Inc. (Attachment A), an engineering and technical consultancy with expertise in automotive technologies. Our examination of the TAR, along with Ricardo's analysis, leads to the following main conclusions:

[1] EPA, NHTSA, CARB. July 2016. Draft TAR, at ES-2.
[2] *Id*., at ES-2.

- Many of the advanced internal combustion (IC) engine technologies examined in the TAR implicitly call for liquid fuels with higher octane than is offered by today's regular gasoline.
- While the TAR examines various advanced IC engine technologies, it fails to simultaneously examine the fuels that *enable* those engine technologies. In general, the TAR fails to treat IC engines and liquid fuels as integrated systems, even though fuel properties can have significant effects on fuel economy and emissions.
- The TAR ignores the influence on fuels of other public policies, like the Renewable Fuel Standard (RFS), aimed at reducing petroleum consumption and GHG emissions.
- Pairing the advanced IC engine technologies examined in the TAR with high octane low carbon (HOLC) fuels with 98-100 RON octane would result in greater fuel economy and emissions benefits than considered by EPA and NHTSA.
- Use of an ethanol-based HOLC in optimized IC engines would be the lowest cost means of achieving compliance with CAFE and GHG standards for MY2022-2025 and beyond.

At the conclusion of these comments, RFA offers a number of recommendations for EPA and NHTSA's forthcoming "Proposed Determination" and the remainder of the MTE process. Chief among them are suggestions that EPA and NHTSA treat engines and fuels as integrated systems during the MTE process, and that the agencies "heed the call" from automakers, government scientists, expert panels, and academia to establish a regulatory roadmap for the broad commercial introduction of HOLC fuels to enable advanced IC engines no later than 2025.

These comments and recommendations are discussed more fully below.

II. Internal combustion engines will continue to serve as the predominant propulsion technology for light duty vehicles through 2025 and beyond

Much like the 2012 final rule, the TAR concludes that internal combustion (IC) engines powered by liquid fuels will continue to serve as the most prevalent propulsion technology for LDVs, stating that only "modest levels" of strong hybridization and "very low levels" of full electrification (plug-in vehicles) are expected by 2025.[3]

Further, the agencies determine that the efficiency of modern IC engines can be significantly improved through increased adoption of incremental technologies that exist today or are near commercialization.[4] These technologies, and their likely impacts on efficiency and CO_2 emissions, are discussed in great detail in Chapter 5 of the TAR. Several of these newer IC engine technologies (including "higher compression ratio, naturally aspirated gasoline engines") were not originally considered by the agencies for the 2012 final rule.[5] According to EPA and NHTSA, these modest IC engine improvements can enable compliance with MY2022-2025 fuel economy and GHG emissions standards: "The agencies' analyses each project that the MY2022-2025 standards can be met largely through improvements in gasoline

[3] *Id*., at ES-2.

[4] *Id*., at 5-12 ("[i]nternal combustion engine improvements continue to be a major focus in improving the overall efficiency of light-duty vehicles." and "Vehicle manufacturers have more choices of technology for internal combustion engines than at any previous time in automotive history and more control over engine operation and combustion.")

[5] *Id*., at ES-4 ("Beyond the technologies the agencies considered in the 2012 final rule, manufacturers are now employing several technologies, such as higher compression ratio, naturally aspirated gasoline engines, and greater penetration of continuously variable transmissions (CVTs); other new technologies are under active development and are expected to be in the fleet well before MY2025.")

vehicle technologies, such as improvements in engines…."[6] Indeed, the agencies project market penetration rates of just 2-3% or less will be necessary for full hybrids, plug-in hybrid electric vehicles, and battery electric vehicles to meet the MY2025 standards, while penetration rates of 33-54% are expected for certain advanced IC engine technologies.[7]

The agencies' views that IC engines will continue as the predominant powertrain technology through at least 2025, and that significant gains in IC engine efficiency are likely, are consistent with the positions of leading experts in the automotive engineering field. Moreover, the agencies' analysis showing that the costs of key advanced IC technologies are lower than costs for other powertrain options is also generally aligned with stakeholder positions. According to Paul Whitaker, powertrain and technical director for AVL Power Train Engineering, "We see big efficiency improvements with (IC) engines today and see the potential for lots more in the future, and they are very inexpensive relative to the other options."[8] Additionally, the U.S. Department of Energy (DOE) states that "…vehicles with internal combustion engines will continue to comprise a significant portion of the nation's vehicle fleet for the next several decades."[9] Further, the National Research Council (NRC) states, "…spark-ignition engines are expected to be dominant beyond 2025."[10]

RFA agrees with the TAR's overarching conclusions that IC engines will continue to be the predominant LDV propulsion technology through 2025 and beyond, that further improvements in IC engine efficiency are imminent, and that such improvements are relatively low cost in comparison to other options.

III. Many of the advanced IC engine technologies examined in the TAR implicitly call for fuels with higher octane ratings than today's regular grade gasoline

The TAR examines in detail a number of advanced IC engine technologies that are expected to facilitate compliance with MY2022-2025 CAFE and GHG standards. However, as discussed in subsequent sections of these comments, the TAR's examination of these engine technologies does not generally include analysis of the effects of fuel properties—such as octane rating—on fuel efficiency and emissions.

a. EPA and NHTSA examine various advanced IC engine technologies, but fail to simultaneously examine the fuels that enable those engine technologies

Ricardo's analysis of the TAR (Attachment A) shows that many of the advanced IC engine technologies examined by EPA and NHTSA would experience increased fuel efficiency and generate fewer emissions if operating on fuels with higher octane ratings than today's regular 87 AKI gasoline. According to the Ricardo report, "…the TAR does examine in detail a number of advanced spark-ignition engine technologies that would clearly produce greater fuel economy and emissions benefits when using higher octane mid-level ethanol blends than regular gasoline." Ricardo cites gasoline direct injection (GDI), turbocharging, downsizing, cylinder deactivation and higher compression ratio, naturally aspirated (HCR NA) engines as technologies examined in the TAR that would "benefit further from high octane fuels."

In examining the TAR's discussion on GDI, turbocharging, downsizing and cylinder deactivation, Ricardo concluded, "These technologies are used to increase the average load on the engine, and therefore

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[6] *Id*., at ES-9.
[7] *Id*., Table ES-3 at ES-10
[8] Detroit Public Television. Aug. 21, 2016. *Autoline with John McElroy*. Episode #2026 ("Deep Freeze for the ICE?")
[9] U.S. Department of Energy. *Co-Optimization of Fuels & Engines for Tomorrow's Energy-Efficient Vehicles.* Available at: http://www.nrel.gov/docs/fy16osti/66146.pdf
[10] National Research Council, Committee on the Assessment of Technologies for Improving Fuel Economy of Light-Duty Vehicles. June 2015. *Cost, Effectiveness and Deployment of Fuel Economy Technologies for Light-Duty Vehicles,* at S-4.

make it more prone to knocking. Because the engine tends to run more often at or near a knock-limited condition, it can take advantage of a high octane fuel." As Ricardo explains, GDI and turbocharging are "…often employed together in a downsized engine package because the in-cylinder charge cooling effect from GDI helps to mitigate the knocking tendency." The TAR shows that market penetration rates for GDI and turbocharging have expanded rapidly in recent years, with GDI growing from 2% of the market to 45% between MY2008 in MY2015 and turbocharging growing from 3% to 18% in the same timeframe. EPA and NHTSA expect more than 90% of IC engines to employ GDI and turbocharging by MY2025.[11]

The TAR also discusses emerging Atkinson cycle and Miller cycle engine technologies, both of which would also operate more efficiently on high octane fuels, according to the Ricardo report. And while it may not seem immediately obvious, Ricardo reports that even advanced technologies like variable compression ratio, certain transmission technologies, and even hybrid electric vehicles (when operating on engine power) would benefit from the use of a higher octane fuel.

The technology discussed in the TAR that is most reliant on higher octane is HCR NA engines. EPA projects that HCR NA engines will need to penetrate 44% of the light duty vehicle market by 2025 to facilitate compliance with CAFE and GHG standards.[12] However, according to Ricardo, "…compression ratios *cannot be increased with existing engine technologies using our current standard gasoline octane ratings* and even more so with engine technologies that are expected to be increasingly utilized in the future, such as downsizing and boosting." Similarly, the NRC cites "currently available octane levels" as the key "limitation on [increasing] compression ratio."[13] Thus, it is somewhat puzzling that EPA would include such heavy reliance on HCR NA engines in the TAR without any accompanying discussion of the fuels and octane ratings necessary to enable this technology.

Collectively, these current and emerging engine technologies point to the need for a higher octane rating for regular gasoline. Indeed, the effectiveness of future advanced IC engines in improving fuel economy and reducing emissions will in part be determined by the octane rating of the liquid fuels they use. The use of high octane fuels in these engines would ensure they produce the maximum possible fuel economy and emissions reductions.

b. Increased use of certain advanced IC engine technologies has *already* resulted in greater demand for higher octane fuels

Growth in turbocharging has already resulted in increased demand for higher-octane fuels, according to recent analysis by the Energy Information Administration (EIA).[14] The EIA analysis suggests that more stringent CAFE and GHG standards caused automakers to increase the market penetration of turbocharging from 3.3% in MY2009 to 17.6% in MY2014. The surge in turbocharging was accompanied by an increase in the demand for high octane premium gasoline, according to EIA. In fact, premium gasoline sales rose from 7.8% of total gasoline sales in June 2008 to 11.3% of total gasoline sales by September 2015.

According to the EIA analysis, "As automakers produce more vehicles with turbocharged engines, it is likely they will recommend or require more LDVs to use higher-octane gasoline. Premium gasoline sales as a percent of total gasoline sales are likely to increase as more car models either recommend or require premium gasoline. This increase is expected to continue as automakers increase the use of turbocharging as one strategy to comply with increasingly stringent fuel economy standards."

[11] EPA, NHTSA, CARB. July 2016. Draft TAR, Figure 3.10 and 3.11 at 3-12
[12] *Id*., Table ES-3 at ES-10.
[13] NRC. June 2015 at S-4.
[14] EIA. April 6, 2016. *Engine design trends lead to increased demand for higher-octane gasoline.*

The EIA report is corroborated by analysis performed by MathPro, Inc., a consulting firm that specializes in petroleum refining economics.[15] MathPro's analysis shows that the average pool-wide octane rating for gasoline increased from approximately 88.2 AKI in 2009 to 88.5 in 2015, largely as a result of increased sales of vehicles requiring or recommending the use of premium gasoline. In examining the TAR's projections of future advanced IC engine technology deployment, MathPro concluded that greater use of higher compression ratio and turbocharging will "substantially increase the call for octane."

Based on projected growth in turbocharging alone, MathPro calculated that premium gasoline could account for 17-22% of total gasoline sales by 2025, depending on varying levels of consumer adherence to the auto manufacturers' fueling recommendations. According to MathPro, "By itself, increasing the use of turbocharging could increase the required average octane of the gasoline pool by 0.3-0.6 numbers (AKI), depending on consumer response to fueling recommendations." Notably, this MathPro analysis does not account for the impact of HCR, which would further intensify the call for octane. EPA projects HCR NA engine technology will need to penetrate 44% of the market by MY2025 (compared to 3% or less today) to facilitate compliance with the standards.

It is important to note, however, that retail prices for premium grade gasoline have annually averaged 7-16% more than regular grade gasoline prices since 2010 ($0.24-0.40/gallon).[16] This cost increase likely has deterred some owners of GDI, turbocharged vehicles from purchasing premium, even though the manufacturer recommends or requires premium. The cost discrepancy between regular and premium grade gasoline also highlights the need to leverage lower-cost sources of octane, such as ethanol.

IV. The TAR fails to treat IC engines and liquid fuels as integrated systems, even though fuel properties can have significant effects on fuel economy and emissions

By itself, the IC engine does nothing to propel a light duty vehicle or generate GHG emissions. It is only when a liquid fuel is introduced into the engine that the technology works to deliver the service of mobility. In this way, IC engines and liquid fuels combine to form a highly integrated system in which one component is useless without the other. Indeed, the IC engine's efficiency and emissions can be greatly affected by the characteristics of the liquid fuel used in the engine. Unfortunately, in assessing the technologies potentially used to meet MY2022-2025 CAFE and GHG standards, the TAR focuses almost exclusively on the engine component of this system and gives no consideration to the effect of various fuel properties on fuel economy and emissions. This is a significant shortcoming of the TAR.

a. EPA and NHTSA should follow the example of DOE, whose Co-Optima program appropriately recognizes the symbiotic relationship between fuels and engines

Recognizing that fuels and engines must be developed in concert to maximize efficiency and emissions reductions, the U.S. Department of Energy has launched an initiative to focus on "Co-optimization of Fuels and Engines for Tomorrow's Energy Efficient Vehicles." The initiative, known simply as "Co-optima," endeavors to "…simultaneously tackle fuel and engine innovation to co-optimize performance of both elements and provide dramatic and rapid cuts in fuel use and emissions."[17] Co-optima has two major research tracks, the first of which is "…improving near-term efficiency of spark-ignition engines through the identification of fuel properties and design parameters of existing base engines that

[15] MathPro, Inc. Sep. 8, 2016. *Capturing Ethanol's Octane Value in Gasoline Blending*. Webinar presentation to RFA members. (Available upon request)

[16] EIA. *Retail Gasoline Prices*. https://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_nus_w.htm Accessed Sep. 12, 2016.

[17] U.S. Department of Energy. *Co-Optimization of Fuels & Engines for Tomorrow's Energy-Efficient Vehicles.* Available at: http://www.nrel.gov/docs/fy16osti/66146.pdf

maximize performance."[18] Importantly, this track includes identifying "candidate fuels" for use in co-optimized engines to achieve peak performance, energy efficiency and emissions reductions. The "market introduction target" for co-optimized fuels and IC engines under this research track is 2025.

A recent summary of DOE research conducted as part of the Co-optima program (Attachment B) demonstrates that significant additional improvement in fuel economy and GHG emissions reduction can occur when advanced IC engines are paired with high octane low carbon (HOLC) fuels.[19] Automakers have also advocated for a coordinated approach to the development and regulation of engines and fuels. According to Dan Nicholson, vice president of global propulsion systems at GM, "Fuels and engines must be designed as a total system. It makes absolutely no sense to have fuel out of the mix."[20]

EPA and NHTSA tangentially acknowledge the importance of the Co-optima initiative in the TAR, stating that the agencies "…will continue to closely follow the Co-Optima program and provide input to DOE, including through EPA's technical representative on the Co-Optima External Advisory Board, as this program has the potential to provide meaningful data and ideas for GHG and fuel consumption reductions in the light-duty vehicle fleet for 2026 and beyond." However, this statement is the closest the TAR gets to examining future engine technologies and fuels in a holistic, systems-based manner.

b. The TAR's assumptions regarding future liquid fuels are often unclear and inconsistent

In general, the TAR does not discuss liquid fuel properties in the context of their potential effects on fuel economy and emissions. However, as part of the agencies' analysis of technology cost, effectiveness, and lead time, the TAR necessarily makes some assumptions about the liquid fuels used in advanced IC engines. Unfortunately, these fuel property assumptions—particularly with respect to octane—are often unclear, misaligned, or inconsistent with the properties of today's market fuels and, more importantly, those expected in the future. The fuel properties assumed for the TAR's engine testing, engine mapping, demonstrations of compliance, and assessments of technology effectiveness and cost often vary widely, leading to apples-to-oranges results and conclusions. Ultimately, however, the key pieces of the EPA and NHTSA analyses (e.g., demonstrations of compliance) generally assume the status quo for fuels (i.e., predominantly 87 AKI gasoline) will continue through 2025.

The TAR contains a number of examples of misaligned assumptions and testing results related to fuels generally, and octane rating specifically. EPA testing of the 2.0L and 2.5L variants of the Mazda SKYACTIV-G engine apparently used 88 AKI (91 RON) fuel with 10% ethanol (E10) and 92 AKI (96 RON) fuel without ethanol.[21] Meanwhile, testing of the Ricardo 3.2L V6 Turbocharged, GDI "EBDI" used 91 RON (87 AKI E10), but all fuel consumption results developed in this study "assumed use of U.S. Certification Gasoline (95 RON, E0)."[22] Further, the TAR states that engine mapping conducted by IAV for NHTSA "…used gasoline with LHV = 41.3 MJ/kg for the mapping but the naturally aspirated engines were calibrated with 87 (R+M)/2 rating fuel and the turbocharged engines used 93 octane fuel."[23] Despite the likelihood that manufacturers of turbocharged engines likely would require or recommend the use of 91-93 AKI retail fuels (premium grade), the NHTSA vehicle fuel economy results for turbocharged engines were adjusted to represent certification fuel by using the ratio of the lower heating values of

[18] *Id*.
[19] Oak Ridge National Laboratory. July 2016. *Summary of High-Octane, Mid-Level Ethanol Blends Study*. ORNL/TM-2016/42
[20] Society of Automotive Engineers. Aug. 3, 2016. *GM, Honda execs agree: Higher octane gas needed to optimize ICE efficiency.* http://articles.sae.org/14940/
[21] EPA, NHTSA, CARB. July 2016. Draft TAR, at 5-42.
[22] *Id*., at 5-281.
[23] *Id*., at 5-504.

the test and certification fuels. Apparently, this was done because "NHTSA understands that using such fuel (i.e., 93 AKI) might lead to overestimating the effectiveness of the technology, especially for high BMEP engines."[24] Thus, despite being justified in its choice to use 93 AKI fuel for turbocharged engines, NHTSA says it "…will ensure that all future engine model development is performed with regular grade octane gasoline."[25]

For the demonstration of compliance with light-duty vehicle GHG and CAFE standards, EPA chose a 93 RON (roughly 89 AKI) gasoline with no ethanol.[26] Further, the TAR states that "EPA's analysis of effectiveness with gasoline fueled engines did not include analysis of effectiveness using Tier 3 certification gasoline (E10, 87 AKI) although protection for operation in-use on 87 AKI E10 gasoline was included in the analysis of engine technologies considered both within the original FRM and within the Draft TAR."[27] Finally, EPA's OMEGA modeling used "petroleum gasoline" without ethanol to determine the quantity of fuel savings, with EPA explaining that "petroleum gasoline…is different than retail fuel, which is typically blended with ethanol…"[28]

c. The TAR ignores the influence on fuels of other public policies aimed at reducing petroleum consumption and GHG emissions

EPA administers a number of other regulatory programs focused on fuels and GHG emissions, the most notable of which is the Renewable Fuel Standard (RFS). The RFS is responsible for rapid growth in the use of ethanol and other biofuels since 2005, and today ethanol represents 10% of U.S. gasoline consumption. Further increases in renewable fuel production and use in the future are required under the RFS, meaning larger volumes of ethanol will be available through the 2025 timeframe. Given that ethanol represents a large and growing portion of the U.S. gasoline pool, it is unfathomable that EPA and NHTSA would use gasoline with no ethanol to model compliance scenarios for the MY2022-2025 CAFE and GHG standards. In reality, the RFS will continue to drive investment and innovation in renewable fuel technologies, and high-octane ethanol will represent an increasing share of the gasoline pool through 2025 and beyond. The impacts of the RFS and other regulations on the composition and mix of the U.S. gasoline pool should be considered by EPA and NHTSA throughout the MTE process.

The TAR also ignores the potential impacts of EPA's Tier 3 fuel regulations, which include a provision allowing automakers to potentially certify new vehicles to HOLC fuels. Indeed, the Tier 3 regulation cites E30 as a potential HOLC that could improve engine efficiency: "…we allow vehicle manufacturers to request approval for an alternative certification fuel such as a high-octane 30 percent ethanol by volume blend (E30) for vehicles that may be optimized for such fuel. …This could help manufacturers who wish to raise compression ratios to improve vehicle efficiency as a step toward complying with the 2017 and later light-duty greenhouse gas and CAFE standards."[29]

Finally, by failing to consider the fuels that will enable these new technologies, the agencies miss an opportunity to address another critically important public policy priority – reducing global climate change. This Administration has made reducing GHG emissions a priority, as evidenced by its leadership at last year's Paris Climate Change Conference (COP21). But it is clear now that we can't address climate change by attacking coal and power generation alone, as the Administration's plan submitted to the UN

[24] *Id*., at 5-509.
[25] *Id*., at 5-512.
[26] *Id*., Table 5.33 at 5-227.
[27] *Id*. at 5-228.
[28] *Id*., at 12-60.
[29] 79 FR 23,424 and 23,528.

appears to do. Transportation is now the single largest source of U.S. GHG emissions.[30] Promoting fuels that reduce GHG emissions, such as ethanol, must be a part of any successful climate change policy.

In summary, the TAR generally omits discussion on the potential effects of various liquid fuel properties, such as octane rating, on engine efficiency or emissions. However, certain elements of the TAR (e.g. engine tests, engine mapping, etc.) required EPA and NHTSA to make assumptions about the fuels used in future IC engines; in these instances, assumptions about fuel properties were often found to be unclear, inconsistent, or not representative of current and future expectations regarding marketplace fuels. Further, the agencies ignore the significant influence of other regulatory programs, like the RFS, on the current and future composition and mix of U.S. fuels.

Because liquid fuels and IC engines act as integrated systems, the EPA and NHTSA should ensure any other analyses conducted for the MTE properly consider both the impacts of the fuel and the engine on fuel efficiency and emissions. Further, EPA and NHTSA should, to the extent possible, use consistent assumptions about future fuel properties when conducting engine testing and mapping, compliance demonstrations, cost modeling, and other analyses for the MTE.

V. Pairing the advanced IC engine technologies examined in the TAR with high octane low carbon (HOLC) fuels would result in greater fuel economy and emissions benefits than considered by EPA and NHTSA.

As underscored elsewhere in these comments, the TAR examines only the potential fuel economy and emissions improvements expected to result from adoption of various advanced IC engine technologies. The TAR does not consider the ability of high octane low carbon (HOLC) fuels to multiply these fuel economy and emissions improvements. In essence, the TAR assumes the status quo for liquid fuels, meaning significant additional fuel economy improvements and emissions reductions are overlooked.

According to the attached Ricardo report, "…many of the technologies that are discussed in the Draft TAR, including the ones with the highest expected penetration rates, could produce *greater* GHG and fuel economy benefits if paired with fuels offering higher octane ratings than contemplated by EPA and NHTSA for the agencies' modeling exercises."

Numerous studies by the automotive industry, DOE, and academia have examined the efficiency gains and emissions reductions that can be achieved when HOLC fuels is used in an IC engine with HCR, turbocharging, and other advanced technologies discussed in the TAR. These studies have repeatedly shown that a high octane fuels (98-100 RON) used in HCR engines improves efficiency and reduces emissions by 4-10%, depending on drive cycle and other factors. Studies using a high octane mid-level ethanol blend also demonstrate that fuel economy and vehicle range using HOLC blends like E25 and E30 is equivalent or superior to performance using E10, even though the E25 and E30 blends have lower energy density. Many of these studies are discussed in detail in Attachments A, B, and C.

a. Ethanol's unique properties make it an attractive candidate for boosting octane in future HOLC fuel blends

Certain chemical properties, such as "sensitivity" and heat of vaporization, make some octane boosters more attractive than others. As researchers have examined different methods of boosting gasoline octane ratings, one option—increased levels of ethanol—has stood out as the most efficient and economical pathway.

Not only does ethanol offer extremely high octane (109 RON, 91 MON), it also features high sensitivity and high heat of vaporization. These are attractive properties that, when considered along with

[30] EIA, *Monthly Energy Review*, July 2016, p. 176.

ethanol's lower "lifecycle" carbon intensity and lower cost relative to other octane options, make ethanol the clear choice for future HOLC fuels. The importance of octane sensitivity and heat of vaporization are discussed in great detail in the Ricardo report (Attachment A). Ricardo states that these benefits are important considerations for "…DI engines especially, both NA and turbocharged, which are expected to comprise the majority of future engines for both conventional and hybrid vehicles."

In addition to the tailpipe CO_2 reductions observed in several of the studies cited in these comments, ethanol-based HOLC fuels also offer important lifecycle GHG emissions benefits. That is, the total "well-to-wheels" (WTW) emissions associated with producing and using ethanol are significantly lower per unit of energy delivered than the emissions resulting from petroleum production and use. The latest analysis conducted by DOE's Argonne National Laboratory found that today's corn ethanol reduces GHG emissions by an average of 34-44% compared to petroleum, while emerging cellulosic ethanol technologies offer GHG reductions of 88-108%.[31] These benefits are compounded when the ethanol is used in a HOLC fuel that achieves greater fuel economy and vehicle range (i.e., more miles with less energy) than today's marketplace fuels.

In a recent study, Argonne National Laboratory examined the WTW GHG emissions impacts of HOLC fuels (100 RON) containing 25% and 40% ethanol.[32] The analysis found that the inherent efficiencies resulting from using a high octane fuel in a HCR engine alone resulted in a 4-8% reduction in GHG emissions per mile compared to baseline E10 gasoline vehicles. Additional GHG reductions of 4-9% were realized as a result of corn ethanol's lower lifecycle emissions upstream, meaning total GHG emissions per mile were 8% and 17% lower for E25 and E40, respectively, compared to baseline E10. Meanwhile, E25 and E40 HOLC blends made with cellulosic ethanol were shown to reduce total WTW GHG emissions by 16-31% per mile compared to E10. While high octane fuels using petroleum-derived octane sources may provide similar tailpipe CO_2 reductions as ethanol-based HOLC fuels, they clearly do not offer the additional GHG reductions associated with ethanol's full WTW lifecycle.

Additional studies show that using ethanol as the source of octane in future high octane fuels has the potential to significantly decrease petroleum refinery GHG emissions by reducing the energy intensity of the refining process.[33]

b. Use of an ethanol-based HOLC in optimized IC engines would be the lowest cost means of achieving compliance with CAFE and GHG standards for MY2022-2025 and beyond

A central objective of the TAR is to estimate the potential costs associated with various technology pathways for achieving the MY2022-2025 CAFE and GHG standards. Again, however, the TAR tends to examine only the expected costs associated with various engine and vehicle technologies, with little or no consideration given to the associated fuel costs over the vehicle's life.

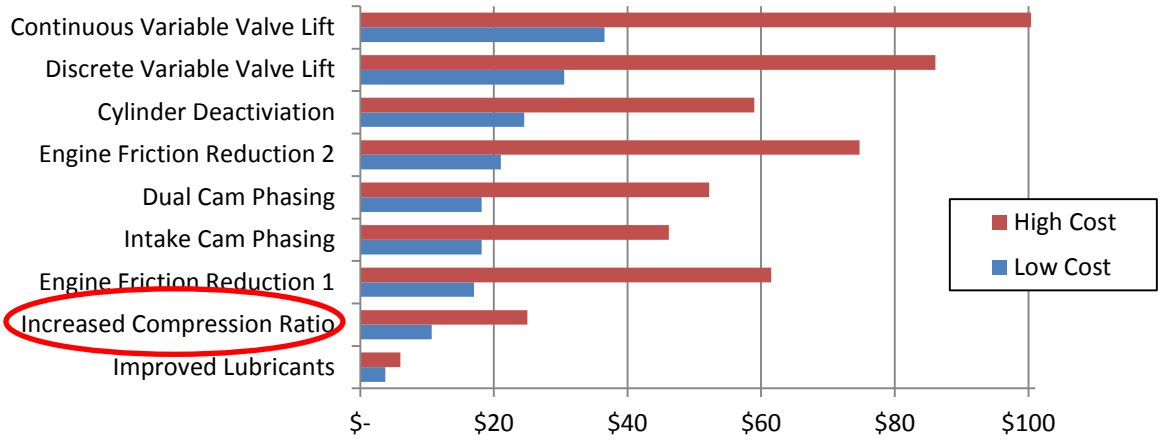
[31] Wang, M.; Han, J.; Dunn, J. B.; Cai, H.; Elgowainy, A. Well-to-wheels energy use and greenhouse gas emissions of ethanol from corn, sugarcane and cellulosic biomass for US use. Environ. Res. Lett. 2012, 7, 1−13, DOI: 10.1088/1748-9326/7/4/045905

[32] Oak Ridge National Laboratory. July 2016. *Summary of High-Octane, Mid-Level Ethanol Blends Study*. ORNL/TM-2016/42

[33] See "Refining Economics of U.S. Gasoline: Octane Ratings and Ethanol Content", DS Hirshfeld, JA Kolb, JE Anderson, W Studzinski, and J Frusti. (2014) dx.doi.org/10.1021/es5021668 | Environ. Sci. Technol. 2014, 48, 11064-11071; and "Petroleum refinery greenhouse gas emission variation related to higher ethanol blends at different gasoline octane rating and pool volume levels", V Kwasniewski, J Blieszner, and R Nelson, DOI: 10.1002/bbb.1612; Biofuels, Bioprod. Bioref (2015)

When only the costs of various engine technologies are considered, HCR stands out as one of the most cost-effective means available for increasing engine efficiency (Figure 1).

Figure 1. Cost per Percentage Point Increase in Engine Efficiency



Based on NRC (June 2015); Draft TAR (July 2016); AIR, Inc. (Sep. 2016)

The National Research Council estimates that the cost to the automaker to introduce higher compression ratio for use with "higher octane regular fuel" is likely $75-150 per vehicle.[34] However, analysis by Air Improvement Resource, Inc. (Attachment C) suggests "…costs of increased compression ratio would be near zero, especially if it were accomplished during normal engine re-design cycles." Similarly, Ricardo (Attachment A) notes that "Since the costs to an OEM for increasing compression ratio are minimal for a new engine design, it is clear that implementing a high octane mid-level ethanol fuel standard would be the lowest cost technology and have even greater benefits in real world driving."

Still, the engine technology cost is only one-half of the equation when total vehicle purchase and operation costs are considered; fuel costs must also be considered. To examine the total cost of high compression ratio engines using a HOLC fuel (98 RON E25) as a technology pathway for compliance with 2022-2025 CAFE and GHG standards, Air Improvement Resource, Inc. (AIR) conducted a study (Attachment C) using the same OMEGA model used by EPA and NHTSA for the TAR. The AIR study found that this pathway can substantially reduce the cost of compliance with the standards, concluding that "With higher compression ratio engines included, total costs of the 2025 model year standards are reduced from $23.4 billion to $16.8 billion. …This analysis has shown that if a high octane mid-level blend ethanol fuel such as 98-RON E25 were an option for model year 2022-2025 vehicles meeting EPA's GHG standards, overall program costs would be significantly reduced."

c. Increasing octane should not come at the expense of air quality, carbon emissions, or human health

The potential for significant environmental, economic, and public health benefits from introducing higher octane fuels is obvious. However, the transition to higher octane fuels must be accompanied by requirements that octane sources improve air quality, reduce carbon emissions, and protect public health. Without such protections, there is the potential that increasing gasoline octane could result in unnecessary backsliding on criteria air pollutants, air toxics, and other harmful emissions linked to certain high-octane hydrocarbons. When it comes to air quality and human health, not all octane sources are created equal. Ethanol reduces criteria pollutants, and is the only source of octane that is truly renewable and results in a significant reduction in carbon. But much of the octane contribution in

[34] NRC. June 2015. TABLE S.2 NRC Committee's Estimated 2025 MY Direct Manufacturing Costs of Technologies

today's gasoline comes from petroleum-derived aromatic hydrocarbons such as benzene, toluene, and the C8 aromatics like xylene. Those sources of octane are far from benign.

The health impacts of aromatic hydrocarbons are well known. A 2015 study published in the *American Journal of Epidemiology* linked benzene found in traffic emissions to childhood leukemia. A 2012 study published by the University of California ties the risk of autism to toxics found in traffic pollution. And a 2015 study published in the *Journal of Environmental Health Perspectives* links microscopic toxic particles in car exhaust to heart disease. Aromatic hydrocarbons compose 20-50% of the non-methane hydrocarbons in urban air and are considered to be one of the major precursors to urban secondary organic aerosols (SOA). SOA is a form of fine particulate matter pollution (PM2.5), which is widely viewed as the most lethal air pollutant in the U.S. today. Moreover, new evidence is confirming that particulate matter from gasoline exhaust is a major source of black carbon, which is thought to be a significant contributor to climate change.

To date, EPA has been relatively quiet on the growing health and environmental threat posed by increased aromatics in gasoline. Because increasingly stringent fuel economy and GHG standards will likely result in increased use of higher octane fuels, the EPA must take into consideration the ancillary health and climate impacts of the various octane sources, and assure that no backsliding can occur.

VI. Automotive engineers and executives, Department of Energy researchers, the National Research Council, and academia all are calling for HOLC fuels to increase fuel economy and decrease GHG emissions

Over the past several years, a growing chorus of automotive engineers and executives, government scientists, expert panels, and university researchers has called for the introduction of HOLC fuels. These experts have clearly demonstrated that HOLC fuels would enable HCR engines and other advanced IC engine technologies, which in turn would improve engine efficiency and reduce emissions. Below is a partial list of statements from these experts regarding the need for HOLC fuels.

- "Higher octane is necessary for better engine efficiency. It is a proven low-cost enabler to lower CO2; 100 RON fuel is the right fuel for the 2020-2025 timeframe."*—Dan Nicholson, vice president of global propulsion systems, GM*[35]
- "100 RON has been on the table for a long time. The only way we will ever get there is to continue to push and work in a collaborative way." *– Tony Ockelford, director of product and business strategy for powertrain operations, Ford Motor Company*[36]
- "We need to find a new equilibrium. Whether it is 98 or 100 (RON) octane, we need something at that level*."— Bob Lee, head of powertrain coordination, Fiat Chrysler*[37]
- "…it appears that substantial societal benefits may be associated with capitalizing on the inherent high octane rating of ethanol in future higher octane number ethanol-gasoline blends." *– Ford Motor Company*[38]

[35] Truett, Richard. Automotive News. April 13, 2016. *Powertrain executives press for higher octane gasoline to help meet mpg, CO2 rules.*
[36] *Id*.
[37] *Id.*
[38] J.E. Anderson et al. July 2012. *High octane number ethanol–gasoline blends: Quantifying the potential benefits in the United States*. Fuel, Volume 97: Pages 585–594.

- "…a mid-level ethanol-gasoline blend (greater than E20 and less than E40) appears to be attractive as a long-term future fuel for automotive engines in the U.S." – *AVL Powertrain Engineering and Ford Motor Company*[39]

- "There has been a big push in the industry for higher octane ratings…and it is proven that you can gain several percentage points in improvement of fuel economy if you have higher octane rating fuel available." – *Dean Tomazic, executive vice president and chief technology officer, FEV North America*[40]

- "One of the advantages without costing more on the vehicle side is to look at upping the minimum octane rating on the fuel and allowing OEMs to optimize compression ratio in engines, which would give us an efficiency benefit without actually adding cost to the whole system. …the addition of ethanol blends would be a good improvement to actually drive efficiency." – *David McShane, vice president of business development, Ricardo, Inc.*[41]

- "If we could optimize engines only to operate on premium fuel, then life would be a lot easier for us and we'd be able to see much more of a benefit in terms of efficiency. …if ethanol was widely available then our life as developers of gasoline engines would become easier." – *Paul Whitaker, powertrain & technical director, AVL Powertrain Engineering*[42]

- "(High octane fuels), specifically mid-level ethanol blends (E25-E40), could offer significant benefits for the United States. These benefits include an improvement in vehicle fuel efficiency in vehicles designed and dedicated to use the increased octane." – *Oak Ridge National Laboratory, Argonne National Laboratory, and National Renewable Energy Laboratory*[43]

- "Improvements to engine efficiency made possible with ethanol fuels may be a synergistic approach to simultaneous compliance with CAFE and RFS II. This presents a unique and infrequent opportunity to dramatically alter internal combustion engine operation by improving fuel properties." – *Oak Ridge National Laboratory*[44]

- "Several technologies beyond those considered by EPA and NHTSA might provide additional fuel consumption reductions for spark ignition engines or provide alternative approaches at possibly lower costs for achieving reductions in fuel consumption by 2025. These technologies include…higher compression ratio with higher octane regular grade gasoline…" – *National Research Council*[45]

- "[T]ransitioning the fleet to higher-octane gasoline would result in significant economic and environmental benefits through reduced gasoline consumption." – *Massachusetts Institute of Technology*[46]

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[39] Stein, R., Anderson, J., and Wallington, T., "An Overview of the Effects of Ethanol-Gasoline Blends on SI Engine Performance, Fuel Efficiency, and Emissions," *SAE Int. J. Engines* 6(1):470-487, 2013, doi:10.4271/2013-01-1635.
[40] Detroit Public Television. Aug. 21, 2016. *Autoline with John McElroy*. Episode #2026 ("Deep Freeze for the ICE?")
[41] *Id*.
[42] *Id*.
[43] Oak Ridge National Laboratory. July 2016. *Summary of High-Octane, Mid-Level Ethanol Blends Study*. ORNL/TM-2016/42.
[44] Derek A. Splitter and James P. Szybist (2014) "Experimental Investigation of Spark-Ignited Combustion with High-Octane Biofuels and EGR. 2. Fuel and EGR Effects on Knock-Limited Load and Speed" *Energy & Fuels*.
[45] NRC. June 2015, at 2-84.
[46] R.L. Speth et al. Economic and environmental benefits of higher-octane gasoline. *Environ Sci Technol.* 2014 Jun 17;48(12):6561-8. doi: 10.1021/es405557p

VII. Recommendations for EPA and NHTSA's "Proposed Determination" and remainder of MTE process

EPA and NHTSA state that feedback received in response to the Draft TAR will inform the agencies' "Proposed Determination" of whether the 2022-2025 standards are appropriate. Based on the forgoing comments in this document and the overwhelming preponderance of evidence supporting introduction of HOLC fuels as a means of increasing engine efficiency and reducing emissions, we offer the following recommendations for the agencies' consideration:

a. EPA and NHTSA should treat engines and fuels as integrated systems during the MTE process and beyond

Liquid fuels and IC engines combine to form highly integrated systems. One component of this system is ineffectual without the other. Thus, any effort to examine the potential impacts of new and emerging advanced IC engine technologies on fuel economy and emissions must also take into account the effects of the fuels being used by the engines. Unfortunately, fuels are little more than an afterthought in the TAR, and where fuel-related assumptions were unavoidable, the TAR is unclear, inconsistent, conflicts with current and future expectations about in-use liquid fuels, and ignores the influence of other policies—like the RFS—on the composition and mix of motor fuels.

RFA strongly recommends that EPA and NHTSA follow the lead of DOE's Co-Optima program by treating engines and fuels as a system in the Proposed Determination and any further analysis supporting the MTE process. Specifically, the agencies should give consideration to the liquid fuel properties—such as octane—that can best enable near term, low-cost advances in IC engine technologies.

b. As a sensitivity case to the central compliance demonstrations, the agencies should assess the fuel economy and emissions impacts associated with using HOLC fuels in advanced IC engines with high compression ratios

Numerous independent studies have documented the fuel economy and emissions benefits resulting from the use of HOLC fuels in HCR and other advanced IC engine technologies. These analyses consistently show HOLC fuels (98-100 RON) in HCR engines produce efficiency gains and CO_2 reductions in the range of 4-10% compared to the use of regular grade 87 AKI gasoline in today's IC engines, depending on drive cycle and other factors. Additional upstream GHG emissions reductions mean ethanol-based HOLC fuels can reduce WTW emissions by 8-17% per mile if using today's corn ethanol, and 16-31% per mile if using emerging cellulosic ethanol.

EPA and NHTSA should examine a compliance demonstration scenario in which a significant portion of the LDV fleet uses 98-100 RON fuel in HCR engines. The agencies should further analyze the impact of various octane streams on the results of this scenario (i.e., compare a 98-100 RON mid-level ethanol blend to a 98-100 RON ethanol-free gasoline). Such analysis would greatly contribute to the understanding of the potential of HOLC fuels to multiply the efficiency and emissions benefits of advanced IC engine technologies.

c. A comprehensive cost-benefit analysis of various CAFE/GHG compliance pathways including both engine *and fuel technologies* should be conducted. Such analysis should include a pathway for HOLC fuels in advanced IC engines

The TAR provides the technical underpinnings for EPA and NHTSA's Proposed Determination of whether the 2022-2025 CAFE and GHG standards are appropriate. The implementation of these standards will have significant ramifications for the nation's economy and environment. The automotive sector will deploy billions of dollars in capital to develop and manufacture the technologies that ultimately will facilitate achievement of future fuel economy and GHG reduction standards. Consumers will feel the

impacts of these regulations as well, as automakers attempt to recoup some of their increased costs through higher retail prices for new automobiles. As discussed in these comments, the standards will also have impacts on fuel producers.

Given the economic and environmental significance of the 2022-2025 fuel economy and emissions standards, we believe EPA, NHTSA and the White House Office of Management and Budget should undertake a comprehensive cost-benefit analysis of various technology pathways for meeting the 2022-2025 standards. Critically, this analysis should include not just the engine and vehicle costs to manufacturers and consumers, but also the expected fuel costs over the life of the engine. Such analysis should be conducted for all of the various engine/vehicle technologies examined in the TAR and the corresponding fuels they use. Such an analysis also bears relevance to EPA's administrative authority to regulate octane, as EPA has stated it "…would have to show how the benefits of raising gasoline octane would justify the cost" in order to promulgate regulations requiring higher minimum octane.[47]

d. EPA and NHTSA should ensure the Proposed Determination fully accounts for the Co-Optima initiative's recommendations for "candidate fuels" that best enable advanced IC engine technologies and maximize their efficiency

A major near-term objective of the DOE's Co-Optima initiative is to identify and characterize the behavior of new "candidate fuels" that can enable greater energy efficiency and reduced emissions in optimized engines. Upon identifying and characterizing the fuels that offer the greatest potential, DOE will examine the impact of the candidate fuels' properties on engine design and the effects on performance, energy efficiency and emissions. Much of this work is already underway at DOE, and a recent report summarizing research efforts to date demonstrates that mid-level ethanol HOLC fuel blends offer great potential to improve efficiency and cut emissions in the near-term (Attachment B). However, DOE has not yet officially specified and characterized the candidate fuels that merit further research and testing. Once available, the MTE process should fully account for information from DOE pertaining to the candidate fuels best suited for use in new and emerging IC engine technologies.

e. The agencies should "heed the call" for HOLC fuels. EPA and NHTSA should use the MTE process to establish the roadmap to broad commercial introduction of HOLC fuels in advanced IC engines beginning in 2025

Consensus is building around the need for HOLC fuels to enable greater engine efficiency and reduced emissions. Automotive engineers and executives, government scientists, expert panels, and university researchers have called for a higher minimum octane rating for future fuels. These experts have clearly demonstrated that HOLC fuels would enable HCR engines and other advanced IC engine technologies, which in turn would improve engine efficiency and reduce emissions.

However, without regulatory intervention or guidance, there is no guarantee that HOLC fuels will indeed be broadly available in the marketplace to enable advanced IC engine technologies to proliferate. Many of the stakeholders calling for the introduction of HOLC fuels have also called upon EPA to use its regulatory authority to establish a minimum octane rating for future gasoline. The Alliance of Automobile Manufacturers made such a request during the Tier 3 rulemaking. Meanwhile, the NRC recommended that "EPA and NHTSA should investigate the overall well-to-wheels CAFE and GHG effectiveness of increasing the minimum octane level and, if it is effective, ***determine how to implement an increase in the minimum octane level*** so that manufacturers would broadly offer engines with

[47] P. Machiele, EPA. May 5, 2015. "EPA's Regulatory Authority to Address Octane." Presentation to EPA Mobile Sources Technical Review Subcommittee.

significantly increased compression ratios for further reductions in fuel consumption."[48] Similarly, the attached Ricardo report states, "It is clear that implementing a high octane fuel standard would provide opportunity for increased engine efficiency and hence reduced greenhouse gases."

EPA clearly has the authority to regulate gasoline octane ratings, as octane has direct implications for emissions of CO_2 and other pollutants. EPA has acknowledged this authority, stating that "CAA 211(c) provides EPA with broad and general authority to regulate fuels and fuel additives; this authority could be used to…'control'…the octane level of gasoline."[49] While EPA has acknowledged it has the authority to regulate octane levels, the agency has suggested that the "time frame to complete all the steps [to implement octane regulations] could be ~10 years" and that "[e]ven if the rule were initiated now it would likely be a number of years before it could be implemented."[50] Chris Grundler, director of EPA's office of transportation and air quality, recently confirmed that EPA is not likely to consider regulating gasoline octane levels before 2025.[51]

Although RFA believes adoption of new regulations governing octane levels could be done relatively quickly (certainly more quickly than 10 years), EPA maintains that an extremely long lead time is required. Similarly, automakers would require a long planning horizon to adjust engineering and design activities in response to impending changes to fuel composition. Given the long lead time involved in effectuating changes to EPA regulations and automaker engineering and design plans, the agencies should indicate ***now*** the future direction of potential octane regulation and HOLC fuel introduction. That is, EPA and NHTSA should use the MTE process as an opportunity to respond to stakeholder outcry for HOLC fuels. The Proposed and Final Determinations should include the regulatory roadmap that the agencies, automakers and other stakeholders can follow to guarantee gasoline in 2025 and beyond has the necessary minimum octane rating to enable proliferation of advanced IC engine technologies that improve fuel efficiency and slash GHG emissions.

Attachments:

A: ***The Draft Technical Assessment Report: Implications for High Octane, Mid-Level Ethanol Blends*. Ricardo, Inc. September 20, 2016. Project Number C013713**

B: ***Summary of High-Octane, Mid-Level Ethanol Blends Study*. Oak Ridge National Laboratory. July 2016. ORNL/TM-2016/42**

C: ***Evaluation of Costs of EPA's 2022-2025 GHG Standards With High Octane Fuels and Optimized High Efficiency Engines*. AIR, Inc. September 16, 2016**

[48] NRC. June 2015, at 2-86.
[49] P. Machiele, EPA. May 5, 2015. "EPA's Regulatory Authority to Address Octane." Presentation to EPA Mobile Sources Technical Review Subcommittee.
[50] *Id*.
[51] Society of Automotive Engineers. Aug. 3, 2016. *GM, Honda execs agree: Higher octane gas needed to optimize ICE efficiency.* http://articles.sae.org/14940/