NATIONAL CORN GROWERS ASSOCIATION

October 26, 2021

The Honorable Steven Cliff, Acting Administrator
National Highway Transportation Safety Administration
1200 New Jersey Ave. SE
Washington, DC 20590

RE: Docket No. NHTSA-2021-0053-0012

Dear Acting Administrator Cliff:

On behalf of more than 40,000 dues-paying corn farmers nationwide and more than 300,000 corn growers who contribute to corn checkoff programs in their states, the National Corn Growers Association (NCGA) appreciates the opportunity to comment on the proposal to revise 2024 and later model year vehicle fuel economy standards.

As the producers of low carbon feedstock for low carbon ethanol, corn farmers are part of the solution to improve fuel economy and cut transportation emissions. Just as in our comments to the Environmental Protection Agency's (EPA) proposed revised vehicle greenhouse gas (GHG) emission standards, we also encourage NHTSA to focus on outcomes and opening pathways for all low carbon fuels and technologies that enable stricter standards, taking advantage of not only the low carbon benefits of higher ethanol blends, but also the greater fuel efficiency, consumer cost savings and cuts in toxic emissions that come with more renewables.

For automakers to use new technologies and enhanced engines to meet more stringent fuel economy standards, they need updated fuel that enables new vehicles and fuels to work as a system to enhance fuel efficiency and GHG reductions. Higher ethanol blends used with advanced engines optimized for higher octane would provide a much-needed pathway for low carbon fuels and fuel economy gains. Higher octane fuel is an essential tool for automakers to meet revised standards, but higher octane must also be clean octane to meet emission reduction goals. Clean octane from today's ethanol is 50 percent lower in GHG emissions than gasoline and replaces the most harmful hydrocarbon aromatics to improve air quality and prevent adverse health impacts.

Although issued separately from EPA's GHG proposal, we are concerned both agencies missed opportunities to broaden the solutions that reduce transportation emissions and improve fuel economy by beginning a transition to low carbon, high octane fuels to advance climate, air quality and environmental justice goals with these and future standards. Furthermore, alternative fuel vehicles such as flex-fuel vehicles, which have the potential to reach net-zero emissions, should also be equitably incentivized through vehicle standards rules.

In addition to improving this proposal, NCGA urges NHTSA to work with EPA to ensure the rulemaking for MY 2027 and later opens pathways to achieve greater fuel economy and emissions reductions from sustainable, affordable low carbon ethanol through a clean, high octane standard, removing barriers to higher ethanol blends and equitably incentivizing all alternative fuels and vehicles on track to reach net-zero emissions. Our full comments follow.

Sincerely,

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OVERVIEW

The proposed revised fuel economy standards would increase in stringency from 2023 levels by eight percent per year for passenger cars and light trucks from model years (MY) 2024-2026, requiring an industry fleet-wide average of 48 miles per gallon in MY 2026. NHTSA's proposal concludes that the proposed revised standards are the maximum feasible, based on the need to conserve energy, reduce climate impacts and be economically practicable.

As NHTSA explains in the proposal, the difference between the stringency of the SAFE rule and the revised vehicle standards proposal is due to greater priority put on energy conservation and consideration of environmental implications.[1] NHTSA estimates the proposal would save about 50 billion gallons of gasoline and increase electricity consumption by about 275 TWh. Accounting for emissions from both vehicles and upstream energy, including electricity generation, NHTSA estimates the proposal would reduce carbon emissions by 465 million metric tons.

NHTSA states the agency and EPA worked together to draft proposals that would allow automakers to build a single fleet of vehicles to meet both proposals. In EPA's proposal to revise vehicle GHG emission standards, EPA estimates that "the vast majority of vehicles produced in the time frame of the proposed standards," will be powered by liquid fuels.[2] In fact, EPA projects that just eight percent of the vehicle market share by MY 2026 will be plug-in hybrid electric vehicles (PHEVs) or all-electric vehicles (EVs), meaning the vehicles in the remaining 92 percent of the market share will require liquid fuel. The proposed standards do not rely on "dramatically increased penetration of electric vehicles into the fleet during the 2023-2026 model years."[3] Instead, EPA's assessment of the technology feasibility of the proposal relies on advances in engine and transmission technologies that have entered the fleet in the past 10 years and expanded use of those already in place in today's vehicles.

Describing use of these new technologies, EPA notes that as of MY 2020, more than half of light-duty gasoline spark ignition engines now use direct injection (GDI) engines and more than a third are turbocharged.[4] However, further advancements from these and additional engine technologies such as higher compression ratios and greater downsizing are limited by current fuel formulations in the marketplace.

Improving the fuel will enable greater efficiency gains and GHG emissions reductions from the advanced engine technologies the agencies are relying on to make these proposed standards feasible. Recognizing vehicles and fuels as a complete system, increasing the octane rating of the nation's fuel supply through a clean, high octane standard would deliver greater fuel economy benefits and GHG emission reductions in the 92 percent of the vehicle market share EPA projects will be powered by liquid fuel in MY 2026 and during the 15 to 20 years those vehicles remain on the road after introduction.

NHTSA and EPA leave significant fuel economy gains and GHG emission reductions on the table if the agencies fail to take steps in this proposal, or in a parallel action, to also improve fuel along with vehicles. If the agencies are truly putting higher priority on energy security and improving health and welfare, they missed a significant opportunity to advance complementary fuel improvements that would enable greater fuel efficiency, greater GHG reductions and more substantial air quality improvements from further reduction of non-GHG emissions than the proposals offer.

A CLEAN HIGH OCTANE STANDARD

NCGA supports establishing a pathway to a higher minimum clean octane standard for fuel of at least 98 RON that enables mid-level ethanol blends to immediately and cost-effectively support fuel economy gains, while also reducing both GHG and tailpipe emissions and bringing lower carbon and lower cost fuels to the market.

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[1] 86 Federal Register 49621
[2] 86 Federal Register 43737
[3] 86 Federal Register 43776
[4] 86 Federal Register 43776

Even with advancements in engine technology, manufacturers are nearing a point where further improvements in fuel economy will be difficult without a higher-octane fuel. This is because advanced downsized, down sped engines, and their associated technologies, make an engine more susceptible to knock. Because of its knock-limiting properties, a higher-octane fuel, such as a midlevel ethanol blend, enables engine designs featuring higher compression ratios, turbocharging, and down speeding and increases overall engine performance and efficiency.[5]

A variety of properties determine a fuel's efficacy and efficiency in an engine. Much of the efficiency benefit realized from today's engines is a direct result of mitigating knock at high load – these engines work because they don't knock.[6] The efficiency improvement that comes from increasing engine compression ratio is achievable only when the fuel's anti-knock properties (its octane rating and sensitivity) are also improved. Moving toward higher-octane fuel featuring higher blends of ethanol works to increase engine performance and improve fuel efficiency in future model year vehicles, meeting goals of regulators, automakers, and consumers.

According to Department of Energy (DOE) researchers at Oak Ridge National Laboratory, "the opportunity for further downsizing and down speeding of engines to improve fuel economy is limited by the available octane rating of fuels…[which] allow higher efficiency designs of naturally aspirated and turbocharged engines dedicated to use the high octane fuel."[7] Since 2016, DOE has completed extensive research through its Co-Optimization of Fuels and Engines initiative (Co-Optima) on innovating fuels and engines together and understanding the types of fuels that can improve engine performance and efficiency to reduce emissions, with alcohol fuels like ethanol identified as top contenders.[8]

Numerous engine testing experiments—on different engines and vehicles, under varying test conditions, and using a spectrum of ethanol blends—have produced what's now quite a large body of evidence demonstrating ethanol's ability to increase engine efficiency and efficacy while lowering emissions.[9,10,11] In 2016, DOE researchers reviewed other recent engine testing efforts to quantify the potential of E25 to E40 fuel in their *Summary of High-Octane Mid-Level Ethanol Blends Study*. In summarizing the studies on octane, midlevel ethanol blends used in dedicated high-octane vehicles achieved efficiency gains of 5 to 10 percent, more than overcoming any energy density differences with E10. [12]

As DOE explained in its GHG analysis of high octane fuel, determining GHG impacts of high octane fuel relative to current gasoline requires accounting for vehicle efficiency gains, refinery operation changes and GHG emissions changes from ethanol blending. DOE's results show the largest impacts on wells to wheels (WTW) emissions from high octane fuel come from efficiency gains and the level of ethanol blending.

- DOE's modeling compared 100 RON E25 and E40 fuels to baseline E10. When used in HOF vehicles, the E25 reduced WTW GHG emissions by a total of 8 to 9 percent (or 36-40 g CO_2e/mile driven) compared to baseline E10. The vehicle efficiency gains from HOF reduced GHG emissions by 4 percentage points of that total, and the additional 4 percentage points of GHG reductions with the E25 fuel were realized from ethanol offsetting petroleum. For the E40 HOF, the ethanol content provides a 9 percent reduction in WTW GHG emissions.[13]

Current fuels with higher octane, such as E10 blends marketed as premium grades, are not cost-effective for consumers, fall short of enabling the efficiency and emissions technology changes automakers need and fail to advance transportation

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[5] Leone, T., Olin, E., Anderson, J., Jung, H. et al. 2014. "Effects of Fuel Octane Rating and Ethanol Content on Knock, Fuel Economy, and CO2 for a Turbocharged DI Engine," SAE Int. J. Fuels Lubr. 7(1):9-28, 2014, doi:10.4271/2014-01-1228.

[6] Farrell, John, John Holladay, and Robert Wagner. 2018. Fuel Blendstocks with the Potential to Optimize Future Gasoline Engine Performance: Identification of Five Chemical Families for Detailed Evaluation. Technical Report. U.S. Department of Energy, Washington, DC. 2018. DOE/GO-102018-4970.

[7] Theiss, T., T. Alleman, A. Brooker, A. Elgowainy, G. Fioroni, J. Han, S. Huff, C. Johnson, M. Kass, P. Leiby, R. U. Martinez, R. McCormick, K. Moriarty, E. Newes, G. Oladosu, J. Szybist, J. Thomas, M. Wang, B. West. 2016. Summary of High-Octane Mid-Level Ethanol Blends Study. Oak Ridge National Laboratory, National Renewable Energy Laboratory, and Argonne National Laboratory. Available at: http://info.ornl.gov/sites/publications/files/pub61169.pdf

[8] U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, "Co-Optimization of Fuels & Engines," https://www.energy.gov/eere/bioenergy/co-optimization-fuels-engines

[9] Leone et al., 2014.

[10] Splitter, D.A., and Szybist, J.P., 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, 28(2): 1418-1431, doi:10.1021/ef401574p

[11] Jung, H., Leone, T., Shelby, M., Anderson, J. et al., "Fuel Economy and CO_2Emissions of Ethanol-Gasoline Blends in a Turbocharged DI Engine," *SAE Int. J. Engines* 6(1):422-434, 2013, doi:10.4271/2013-01-1321.

[12] Theiss et al., 2016.

[13] Theiss et al., 2016.

decarbonization. Because ethanol results in nearly half the emissions of unblended gasoline and is on a pathway to future net-zero emissions, producing higher-octane fuel with a midlevel ethanol blend would do more to improve fuel efficiency and reduce GHG emissions, supporting the increased stringency goals of both NHTSA's and EPA's proposed rules. Optimized vehicles powered by low carbon, high octane fuel made from a midlevel ethanol blend after model year 2024 would have much lower GHG emissions than vehicles running on either current E10 blends or premium E10 blends.

A clean, low carbon, high octane fuel standard avoids increasing the use of fossil-based octane sources, which produce more carbon emissions, erasing the GHG reduction benefits from gains in engine efficiencies while releasing more toxic emissions from harmful hydrocarbon aromatics, degrading air quality and respiratory health. Due to ethanol's high octane rating, a low carbon, high octane ethanol blend results in both additional fuel efficiency *and* significant GHG reductions. Higher ethanol content, reached by removing regulatory barriers to higher blends, would boost GHG reductions and replace harmful aromatics, providing a cost-effective low carbon fuel solution for consumers, including low income consumers, and the environment.

TRANSPORTATION COSTS

In addition to failing to decarbonize liquid fuel and enabling fewer fuel economy gains, simply transitioning current premium fuel to the new "regular fuel" as a higher octane E10 blend, such as a 95 RON E10, would be significantly more expensive to consumers than current regular E10 fuel.

However, a higher RON level met through increased ethanol blending, would reduce fuel costs compared to higher RON fuels with less ethanol content. Incremental refining costs to produce a 98 RON E20 or E30 fuel could be between $0.02-$0.05 per gallon, respectively, based on one analysis. Incremental refining costs are estimated to be nearly $0.20 per gallon to produce a 98 RON fuel using 10 percent ethanol.[14] Because of the availability and effectiveness of ethanol as an octane enhancer, a midlevel blend 98 RON fuel is cleaner and more cost-effective.

Analysis presented to Ag-Auto-Ethanol Work Group by the Defour Group compares the economics of a 95 RON E10 fuel and a 98 RON E25 fuel.[15] This analysis builds on Hirshfeld, et al.'s use of a linear programming model to estimate the refining economics of increasing fuel octane ratings and ethanol content. This additional analysis shows that the presence of a 98 RON high-octane midlevel blend in the market, along with a 95 RON E10 fuel, would change the economics of high-octane fuel and fuel pricing.

When additional ethanol is blended to reach 98 RON, it allows for a lower-octane base gasoline blendstock, which costs less to produce at the refinery and avoids refinery GHG emissions. Coupled with the low cost of ethanol added to raise octane, the finished high-octane midlevel blend is less expensive. This updated analysis concludes that a 98 RON E25 fuel would be cost comparative with the current regular fuel, accounting for a transition with both 95 RON and 98 RON fuels in the market.

Using more ethanol enables a larger increase in fuel octane, allowing for greater efficiency improvements, at a lower cost. When more refining is needed to increase fuel octane, as with current premium E10 blends, the cost will be greater. An E25 blend would support additional octane at a lower price than current premium fuel. Drivers of future model year vehicles optimized to use a higher RON fuel would not pay more for fuel over the lifetime of the vehicle with low carbon, high octane midlevel ethanol blend fuel.

If automakers continue to design vehicles around the current lower octane fuels on the market, higher vehicle technology costs for automakers to meet standards with those fuels would lead to increased vehicle costs.[16] Automakers would pass

[14] Hirshfeld, D. & Kolb, J. & Anderson, J. & Studzinski, W. & Frusti, J. 2014. Refining Economics of U.S. Gasoline: Octane Ratings and Ethanol Content, Environmental Science and Technology. *48* (19), 11064-11071. DOI: 10.1021/es5021668

[15] Drake, Dean et. al., "Comparing the Cost of Two Different Grades of Hight Octane Motor Fuel in Future High Efficiency Vehicles (2017) (not published but available if requested).

[16] USCAR March 15, 2018 presentation, "Wells-To-Wheels Analysis of High-Octane Fuels: Cost and CO_2 Emissions

those higher costs on to consumers. When automakers have the option of clean, higher-octane fuel, the vehicle cost to consumers is less than without higher octane fuel.

ACTIONS NEEDED

In coordination with NHTSA, NCGA believes EPA should take the following actions to support the production and use of low carbon, high octane fuel in conjunction with setting vehicle standards:

Implement a pathway to a minimum fuel octane level of 98 RON, phasing out lower octane fuels as new optimized vehicles enter the market.
NCGA believes EPA has ample authority to regulate fuel octane because of the impact higher fuel octane would have on reducing GHG emissions from the vehicle fleet. EPA has previously acknowledged the agency has authority to regulate fuel octane under Section 211(c).

Higher octane fuel, with ethanol as a clean octane source, would result in a cost-effective fuel that offers automakers an additional technologically and economically feasible means to meet more stringent fuel economy and emissions standards. Additionally, high-octane fuel would enable vehicle technologies that result in more GHG emissions reductions and enable greater reductions from this proposal from the new vehicles NHTSA and EPA expect to be sold in coming years. When automakers have the option of higher-octane fuel, the total vehicle ownership cost to consumers is less than without higher octane fuel.

A higher RON level, met through greater ethanol blending, would reduce fuel costs. As discussed previously in our comments, the higher ethanol content of the midlevel blend 98 -100 RON fuel makes it much more cost effective than current E10 premium fuel. A cleaner, high-octane midlevel blend would be cost-competitive with current regular fuel.

Finally, a higher RON level met through greater ethanol blending would reduce GHG emissions. At the refinery level, production of a 98 RON E20 fuel reduces refinery CO_2 emissions by nearly 5 percent, and a 98 RON E30 blend would reduce refinery emissions by more than 10 percent. Conversely, even a 95 RON E10 would result in a small increase in refinery emissions.[17] On a WTW basis, based on the previously discussed DOE analysis, the greater vehicle efficiency enabled by a higher RON fuel accounts for about half of the GHG emissions reductions with a 5 percent efficiency gain, and the percentage of the ethanol blend determines the additional GHG reduction from the high octane fuel.[18]

Approve a high-octane, midlevel ethanol blend vehicle certification fuel (98-100 RON, E25-E30).
EPA's timely approval of a high-octane, midlevel ethanol blend vehicle certification fuel would enable automakers to expedite design and testing of optimized vehicles for use with this new low carbon fuel. We believe NHTSA and EPA should propose or invite automakers to propose submission of this certification fuel in conjunction with this or future rulemakings.

Correct the fuel economy formula by updating the R-Factor to 1.0 to reflect documented operation of modern engine technology.
Correcting the R-Factor in the fuel economy formula would support automakers developing high efficiency engines that require higher octane ratings and a higher ethanol content. Agencies have acknowledged that the current EPA-mandated R-Factor of 0.6, originally established in the 1980s, is outdated and fails to achieve the statutory purpose of making fuel economy testing on today's fuel equivalent to fuel economy testing in 1975.

An update to 1 from 0.6 would reflect results of analysis by the Department of Energy and EPA using modern engines and fulfill previous observations and commitments from EPA to address this issue. Published studies have shown that R for modern vehicles should be around 0.93 to 0.96.[19]

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[17] Hirshfeld, et al. 2014
[18] Thiess, et al. 2016
[19] Sluder, C., West, B., Butler, A., Mitcham, A. et al. 2014. Determination of the R Factor for Fuel Economy Calculations Using Ethanol-Blended Fuels over Two Test Cycles. SAE Int. J. Fuels Lubr. 7(2):2014, doi:10.4271/2014-01-1572.

As NCGA explained in 2020 comments on EPA's proposed rule on vehicle test procedure adjustments in Docket EPA–HQ–OAR–2020-0104, an R-factor of 1.0 in the fuel economy formula would support a lower-carbon fuel policy, providing automakers with greater options for choice and innovation in meeting more stringent GHG standards through vehicle technologies and lower carbon fuels. Without this overdue correction, use of lower carbon fuels will continue to be unjustifiably penalized in the fuel economy formula.

Setting the R-factor to 1.0 sets fuel economy results on an energy basis. In application, the R factor equation is a "fuel response factor," adjusting for more than just energy density. An R of 1.0 essentially converts fuel economy to mile per gallon gasoline equivalent (MPGge), which is how other alternative fuels such as propane, natural gas, and electricity have been compared to their gasoline counterparts for decades. Setting R to 1.0 provides equitable treatment to renewable ethanol that other alternative fuels already receive. This change could help speed the transition to certification with Tier 3 fuel as well as encourage vehicle manufacturers to seek certification for even higher ethanol blends, such as E15 or the high octane E30 EPA suggested in its Tier 3 proposal several years ago. Manufacturers are not incentivized to build dedicated high-octane vehicles that reduce GHG emissions and improve fuel economy when those low carbon benefits are penalized by a low R factor.

Lower summer vapor pressure to 9 psi or less for all fuel or provide parity in Reid Vapor Pressure (RVP) treatment for all ethanol blends with E10.

Higher ethanol blends such as E15 offer an immediate decarbonization opportunity and support a transition to low carbon, high octane fuel. However, outdated RVP rules and the oil industry's refusal to produce lower volatility blendstock prevents E15 – which is lower in evaporative, tailpipe and GHG emissions – from reaching the market on the same terms as standard E10 fuel. Addressing these outdated rules would allow lower-volatility and lower-emissions E15 full market access and support EPA's efforts to reduce emissions across the board, and it is unfortunate the oil industry took EPA to court to block the agency's 2019 action aimed at updating unnecessary fuel restrictions in order to keep cleaner E15 out of the marketplace and limit consumer choice.

By using existing authority in the Clean Air Act to require lower volatility conventional gasoline blendstock during the summer months to reduce emissions of volatile organic compounds and decrease the potential for ozone formation, EPA would simultaneously open the market to E15 year-round. NCGA urges EPA to take this action to improve air quality while simultaneously eliminating outdated barriers to cleaner, low carbon higher ethanol blends like E15 and future high octane fuel.

Use Tier 3 certification fuel, and any future certification fuel, without test procedure adjustments for CO_2.

As NCGA recommended to EPA in 2020 comments on Docket EPA–HQ–OAR–2016-0604, actual tailpipe carbon emissions, regardless of the test fuel, must continue to be the only measure of vehicle emissions performance in vehicle testing. CO_2 test adjustments would needlessly complicate vehicle test procedures. Relying solely on test results eliminates uncertainty, averaging and potential for inaccuracies in procedures to adjust emission test results for the fuel.

Lower GHG emissions from vehicles benefit consumers, our environment, and our energy security. Just as updating the test fuel from E0 to E10 reduced GHG emissions by blending cleaner, renewable ethanol with gasoline, E15 and future clean, high octane fuels that blend more ethanol will further reduce emissions and improve fuel economy when used with optimized engines. Vehicle test procedures for Tier 3 fuel, or any future certification fuel, must not create impediments to low carbon fuels such as E15 and higher blends and the vehicle technologies that help reach our mutual goal of lower GHG emissions. Stringency of the standards is best maintained through the Administrator's authority to adjust the standards, as NHTSA and EPA are using in these proposals, not by adjusting emission test results.

FLEX FUEL VEHICLES and CREDITING

NHTSA requested comment on retaining current compliance flexibilities in the final rule, including the 0.15 factor that supports manufacturing of flex-fuel vehicles (FFV).[20] NCGA supports NHTSA continuing to incorporate the .15 factor to respect the statutory intent, promote energy security and environmental goals, and help ensure the success of the fuel economy program. Furthermore, since the proposal does not discuss or take comment on removing this .15 factor, nor provide any analytical basis for removing it, any other NHTSA action on this .15 factor for FFVs other than simply retaining it would be inappropriate.

FFVs and the .15 factor can help ensure the success of the fuel economy program. FFVs provide automakers an important compliance flexibility and are a proven, cost-effective technology to reduce oil use and improve environmental outcomes. FFVs utilizing higher blends of low carbon ethanol, such as E85, can provide immediate emissions reductions without tangibly altering the price of the vehicle and reducing fuel costs. In fact, E85 is typically sold at a lower price than gasoline, translating to monetary savings in addition to the significant air pollution savings.

Compared to gasoline, E85 leads to significant reductions in NOx and GHG emissions. E85 avoids use of toxic hydrocarbon aromatics in gasoline that are precursors to secondary organic aerosols that result in harmful fine particulate matter emissions that cause serious respiratory, cardiovascular, and other health harm, including premature death, according to the American Lung Association.

Incentivized to reduce emissions through the state's Low Carbon Fuel Standard (LCFS), in California some FFVs are even powered by a blend of 15 percent renewable naphtha with 85 percent ethanol. These vehicles use zero fossil fuels, have improved air emissions profiles, and have an extremely low carbon intensity. As such, NCGA has recently advocated to CARB to go a step further to decrease emissions in its most recent Advanced Clean Cars and Scoping Plan proposals by requiring that all PHEVs MY 2026 and later be a FFV.

Just as we recommended to CARB, NHTSA and EPA should not constrain their vision of a zero-emission vehicle and a zero-emissions future based on today's vehicle limitations, but rather remain focused on setting technology and feedstock neutral standards and allowing markets to innovate and respond. California's LCFS has resulted in a reduction in ethanol CI in the state, as well as increased demand for low carbon fuel like E85 and FFVs, as low carbon ethanol has helped the state meet ambitious GHG emission reduction goals.

Despite the GHG and criteria pollution reduction benefits of FFVs, as well as the low cost to purchase and fuel these vehicles, automakers are offering fewer choices to consumers. Well-structured vehicle credit programs remain an impactful, cost-effective means for the government to encourage the introduction and adoption of new products and technologies. NCGA has also EPA to take steps to update the F-factor in the fuel economy formula to a forward looking F-factor of at least 0.2, as we outlined in 2020 comments in response to Docket EPA–HQ–OAR–2020-0104

FFVs promote key CAFE goals regarding energy security, reduced emissions, and environmental justice. NTSA has not proposed modifying the .15 factor for FFVs, and, therefore, NCGA believes this .15 factor for FFVs must be left in place as-is, without modification.

LOW CARBON ETHANOL: MOVING TO NET ZERO

NHTSA estimates the proposal would reduce carbon emission by 465 million metric tons. Compared to the proposal, the Renewable Fuel Standard (RFS) has already resulted in nearly 1 billion metric tons of cumulative GHG savings from 2008-2020, exceeding projections largely due to the reduced carbon intensity of corn ethanol.[21] Using biofuels like ethanol will enhance the GHG emissions reductions from transportation with the right policies.

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[20] 86 Federal Register 49609-49610

[21] Unnasch, S. & Parida, D., "GHG Emissions Reductions due to the RFS2: A 2020 Update," February 2021; https://ethanolrfa.org/wp-content/uploads/2021/02/GHG-Emissions- Reductions-Due-to-the-RFS2-2020-Update.pdf

The most recent assessment from the Department of Energy's Argonne National Laboratory concludes corn ethanol's carbon intensity decreased 23 percent from 2005 to 2019 due to increased corn yield, reduced fertilizer intensity and improved ethanol production efficiency, with corn ethanol now between 44 and 52 percent lower in carbon intensity (CI) than the gasoline it replaces.[22] Argonne's conclusions are similar to analysis from Environmental Health and Engineering finding ethanol now results in 46 percent fewer GHG emissions compared to gasoline, due to improved corn production, ethanol production efficiencies and land productivity.[23]

Corn-based ethanol can reach net zero emissions with continued on-farm improvements and soil carbon sequestration, along with carbon capture technology and new efficiencies in ethanol production. Corn farmers are proud of our leadership in adopting conservation and best management practices. NCGA's recently released Corn Sustainability Report details corn farmers' history of improvements and our commitment to further sustainability achievements by 2030

Sustainable production means corn farmers today are producing more corn using less land and fewer resources. For example, planted corn acres in 2020, at 90.8 million acres, were less than planted acres in 2007, the year the RFS was expanded, at 93.5 million acres. USDA data also shows the area planted to principal crops in the United States is not expanding overall. Corn production has increased primarily because crop yields have increased from an average of 150 bushels per acre in 2007 to 172 bushels in 2020. With the average yield in 1980 at just 91 bushels per acre, productivity growth is a long-term trend.

Using the expertise of Argonne's scientists and the U.S. Department of Agriculture's data, we believe Argonne's Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model is the federal government's most accurate tool for evaluating biofuel and energy lifecycle emissions. Because GREET is regularly updated, this model captures GHG emissions reductions from farmers' improved production practices and will incorporate the ongoing, voluntary climate-smart improvements in agriculture production this Administration supports, ensuring further carbon intensity reductions are accounted for in the LCA.

Corn production has improved across all measures of resource efficiency, including higher crop yields per acre, resulting in greater corn production using less land and fewer inputs, further fortifying ethanol as a sustainable, low-carbon renewable fuel. This progress is reflected in Argonne's most recent analysis, which builds on and is consistent with other recent reviews.

For example, a 2018 USDA study shows that ethanol then resulted in 39 to 43 percent fewer GHG emissions than gasoline.[24] Building on this progress, additional improvements on farms and in ethanol production supported by expanding markets for low carbon fuels could result in ethanol with up to 70 percent fewer GHG emissions than gasoline, according to USDA's analysis. Furthermore, according to California Air Resources Board (CARB) data, the CI of ethanol under the state's Low Carbon Fuel Standard (LCFS) is more than 35 percent lower today than it was in 2011 and more than 40 percent lower than the CI of gasoline.[25]

These increasing benefits have occurred without accounting for corn's ability to sequester carbon in the soil. Corn as a crop can serve as a carbon sink. As a photo-synthetically superior C4 plant, corn has an extraordinary ability to sequester carbon and move fertilizer nutrients back to the surface for plant growth rather than polluting ground water. Corn's extensive, deep root system makes it one of the few plants with this important capability to make crop production sustainable.

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[22] Lee, Uisung & et al. ANL, "Retrospective Analysis of the U.S. Corn Ethanol Industry for 2005–2019: Implications for Greenhouse Gas Emission Reductions," (2021). https://onlinelibrary.wiley.com/doi/10.1002/bbb.2225

[23]Scully, Melissa J., et al, "Carbon intensity of corn ethanol in the United States: state of the science," (2021) Environmental Research Letters 16 043001. https://iopscience.iop.org/article/10.1088/1748-9326/abde08

[24] Lewandrowski, Jan, and et. al, "The Greenhouse Gas Benefits of Corn Ethanol - Assessing Recent Evidence," (202) Biofuels, 11:3, 361-375. https://www.tandfonline.com/doi/full/10.1080/17597269.2018.1546488

[25] California Air Resources Board, Low Carbon Fuel Standard Reporting Tool Quarterly Summaries, based on data through Q3 2020 at https://ww3.arb.ca.gov/fuels/lcfs/lrtqsummaries.htm

High-yield corn—combined with the steady adoption of best practices such as reductions in tillage intensity—is sequestering carbon from the atmosphere into the soil. This sequestration is increasing soil carbon levels and reducing atmospheric CO_2. According to the Journal of Soil and Water Conservation, the potential to sequester atmospheric carbon in soil is greatest on lands currently used for annual crops; most remarkably, there is potential to sequester carbon in the soil at an annual growth rate of 0.4 percent each year.[26] The results of tracking soil organic carbon (SOC) advancements on select USDA-specified agricultural land areas is estimated to have sequestered an estimated 309 metric tons of CO_2-equivalent in less than a decade.[27]

Although GHG lifecycle models do not currently account for this direct GHG reduction from corn production, NCGA believes the effect of corn crops on soil carbon sequestration, among other considerations, should be incorporated into current lifecycle analysis. This increase in soil carbon from corn production, when included, could result in a 20 gram/MJ carbon credit for corn-based ethanol.[28] Fully accounting for corn's carbon sequestration would further demonstrate significant low-carbon advantages of a high-octane midlevel ethanol blend.

CRITERIA POLLUTANTS AND AIR TOXICS

Bringing high octane fuel to market in the form of midlevel ethanol blends will be significantly less capital-intensive than attempting to increase blendstock octane with hydrocarbon components at refineries. It will also be incredibly cleaner. The avoided production cost and offset emissions lower end-costs to consumers, reducing both economic costs and social costs related to health and environment, key considerations in advancing environmental justice and avoiding adverse impacts from oil refineries on communities that have historically borne them.

Increased volumes of ethanol in fuel displace the most harmful compounds from gasoline.[29] These aromatic hydrocarbon additives (i.e. benzene, toluene, ethylbenzene, xylene – or BTEX) have high cancer-causing potential. Increasing the ethanol volume in fuel to a midlevel blend has a positive impact on tailpipe emissions of toxins, including significant reductions in particulates and carbon monoxide. These same aromatic hydrocarbons are also precursors to the formation of secondary organic aerosols (SOA), which in turn are a major contributor to particulate matter emissions (PM 2.5).

According to EPA's review for the 2020 Anti-backsliding Study, ethanol does not form SOA directly or affect SOA formation. However, as EPA states, toluene is a large contributor to SOA. Ethanol's high octane value "greatly reduces the need for other high-octane components including aromatics such as toluene."[30]

As explained in EPA's Fuel Trends Report: Gasoline 2006-2016, "Ethanol's high octane value has also allowed refiners to significantly reduce the aromatic content of the gasoline, a trend borne out in the data." EPA's data shows that aromatics' share of gasoline volume dropped from nearly 25 percent to 19.3 percent, and benzene volume dropped from 0.99 percent to 0.58 percent between 2000 and 2016, the same time as ethanol blending increased from 1 percent to at least 10 percent.

EPA's data demonstrates the air quality and human health benefits of increased ethanol blending in gasoline by replacing harmful aromatics with clean octane from ethanol. Limiting the aromatics content of gasoline and using higher ethanol blends in high octane fuel would further reduce risks from SOA formation and exposure to PM 2.5, which causes serious respiratory, cardiovascular, and other health harm, including premature death, according to the American Lung Association. The same GDI engine advancements that help lower GHG emissions have the unfortunate side effect of increasing particulate emissions, which could be reduced by use of midlevel ethanol blends.

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[26] Chambers, A. & Lal, R. & Paustian, K. 2016. Soil carbon sequestration potential of US croplands and grasslands: Implementing the 4 per Thousand Initiative. Journal of Soil and Water Conservation. doi:10.2489/jswc.71.3.68A

[27] *ibid*

[28] American Coalition for Ethanol, The Case for Properly Valuing the Low Carbon Benefits of Corn Ethanol, 2018

[29] Environmental and Energy Study Institute. Ethanol and Air Quality – Separating Fact from Fiction. October 12, 2018. https://www.eesi.org/articles/view/ethanol-and-air-quality-separating-fact-from-fiction

[30] U.S. Environmental Protection Agency, Clean Air Act Section 211 (v)(1) Anti-backsliding Study, (2020) Appendix A, Page 61.

Petroleum-based aerosol particles represent a significant source of pollution, especially in population-dense urban areas. Health issues related to PM and other emission-based pollutants can be reduced by lowering the volume of petroleum in the domestic gasoline pool, which can be accomplished by increasing octane with higher ethanol blends and replacing more hydrocarbon aromatics with ethanol.

NHTSA and EPA could greatly increase the air quality, health, and environmental justice benefits of their proposals by cleaning up the fuel going into the 92 percent vehicles by MY 2026 expected to use liquid fuels. We urge NHTSA and EPA to take immediate steps toward setting a clean, high octane fuel standard that blends more ethanol to replace aromatics to expand the health and environmental justice benefits of this proposal, as well as set caps or limits on air toxics in future rulemakings.