growth energy™
America's Ethanol Supporters

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September 26, 2016

Re: EPA–HQ–OAR–2015–0827; NHTSA–2016–0068, Midterm Evaluation Draft Technical Assessment Report for Model Year 2022-2025 2017 Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards

Growth Energy, an association of the nation's leading ethanol manufacturers and other companies who serve America's need for alternative fuels, is pleased to submit these comments regarding the Midterm Evaluation Draft Technical Assessment Report ("Draft TAR") by the National Highway Traffic Safety Administration ("NHTSA"), U.S. Environmental Protection Agency ("EPA"), and the California Air Resources Board ("CARB"). The members of Growth Energy supply the renewable fuels that are a critical part of the nation's energy independence and greenhouse gas reduction efforts. Growth Energy and its members appreciate the efforts by NHTSA, EPA, and CARB (collectively, "the Agencies") to solicit data, analysis and views on the Draft TAR, and to respond to the public's comments. The Renewable Fuel Standards and the Agencies' greenhouse gas ("GHG") emissions and corporate average fuel economy ("CAFE") standards for model years ("MY") 2022-2025 taken together are essential, and synergistic, mechanisms for achieving emissions reductions and energy security and independence.

The Draft TAR is the first formal step in the Agencies' Midterm Evaluation process of the GHG emissions and corporate average fuel economy CAFE standards for model years MY 2022-2025 (the "2022-2025 Standards"), as set forth in EPA's regulations. 40 C.F.R. § 86.1818(h)(1). The EPA regulations require that the Draft TAR address "issues relevant to the standard for the 2022 through 2025 model years." *Id.* The regulations describe seven factors "relevant to setting [GHG] emissions standards," including "the availability and effectiveness of technology, and the appropriate lead time for introduction of technology;" "the cost on the producers or purchasers of new motor vehicles;" "the feasibility and practicability of the standards;" and "the impact of the standards on reduction of emissions, oil conservation, energy security, and fuel savings by consumers." 40 C.F.R. § 86.1818(h)(1)(i-iv).

Growth Energy offers the following comments in response to the Draft TAR's specific request for comment on "vehicle technologies . . . which could be in production in the 2022-2025 timeframe or are already in production today that may have been omitted from [the report]." *Id.* at 5-2. Growth Energy's primary concerns with the Draft TAR are two-fold. *First*, it fails to engage with the extensive existing technical literature regarding both the environmental benefits, availability, and effectiveness of usage of high octane, midlevel ethanol blends in conjunction with high compression engines as a means to attaining the current 2022-2025 Standards. As addressed more fully below, the Draft TAR inappropriately relegates these technologies and

potential benefits to beyond the 2025 timeframe. *See* Draft TAR at 5-42.[1] Growth Energy, the Alliance of Automobile Manufacturers (the "Alliance"), and other stakeholders have periodically, since 2012, presented EPA with technology and feasibility studies on these topics, and encouraged the EPA to explore the benefits of a high octane mid-level ethanol blend. *Second*, E85 and flex fuel vehicles ("FFVs") are currently commercially available fuels and vehicles that offer GHG emissions reductions beyond traditional fossil fuel-based transportation fuels; however, the Draft TAR passingly nods at this current technology's implications for the Midterm Evaluation without delving into any detailed analysis. Omission of these topics is particularly odd in light of the attention paid in the Draft TAR to technologies, such as hydrogen fuel cell vehicles and the related infrastructure that pose far greater challenges to implement on a large scale in the relevant timeframe.[2]

The Draft TAR's failure to incorporate analysis of mid- and higher-level ethanol blends and related engine technologies as a means to attaining the 2022-2025 Standards leads to the implication that, as a policy matter, the Agencies disfavor the use of ethanol as a vehicle GHG and MPG reduction strategy in comparison with electric, plug-in hybrid, and hydrogen fuel cell vehicles to which the Draft TAR devotes significant attention. However, EPA regulations require, and Growth Energy implores, that the Agencies not overlook the significant environmental benefits, the availability, and the effectiveness of these fuels and vehicle technologies. *See* 40 C.F.R. § 86.1818(h)(1).

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I. The Midterm Evaluation Must Include Analysis of High Octane, Midlevel Ethanol Blends with High Compression Ratio Engines.

[1] Chris Grundler (Director of EPA's Office of Transportation and Air Quality) reiterated this position at the August 2016 Management Briefing Seminars: "Fuel changes are not part of the [Draft] TAR," though regulation of higher octane levels may be considered after 2025 "as long as increasing octane levels do not increase greenhouse-gas emissions." *See* "GM, Honda execs agree: Higher octane gas needed to optimize ICE efficiency," SAE International (Aug. 3, 2016), http://articles.sae.org/14940/.

[2] Growth Energy is concerned that EPA have been misdirected by certain statements in the National Academy of Sciences 2015 study, on which the Draft TAR heavily relies. *See* Draft TAR at ES-3. The National Academy of Sciences Study, "Cost, Effectiveness and Deployment of Fuel Economy Technologies for Light-Duty Vehicles," July 2015 (the "NAS Study"), notes the potential benefits of high compression ratio engines with high octane fuels; however, the NAS Study concludes that "[d]ue to the relatively low energy content of ethanol, a vehicle tested on E30 would experience a loss of volumetric fuel economy." *See* NAS Study at 69. Although E30 is less energy dense than E10, as numerous studies by national laboratories and auto manufacturers have concluded, when E30 is paired with a properly optimized engine, there are not negative impacts for fuel economy; in fact, there are often benefits to volumetric fuel economy. *See infra* Section I. The NAS Study does not address the existing technical and techno-economic assessments of midlevel ethanol blends in high compression ratio engines.

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The science supporting the benefits of a high octane fuel, and specifically a midlevel ethanol blend in the E20 to E30 range, in conjunction with a high compression ratio engine is not new, and has been well-explored by a number of national laboratories including Oak Ridge National Laboratory, National Renewable Energy Laboratory, and Argonne National Laboratory as well as automobile manufacturers and other scientific institutions. Ethanol has a very high octane number relative to other gasoline hydrocarbons, has a lower carbon content than the gasoline components it generally replaces, and has many other benefits that assist in combustion to increase engine efficiency and reduce both tailpipe GHG and criteria pollutant emissions. The key studies that have been conducted over the past five years that highlight the efficiency improvements and environmental benefits associated with midlevel ethanol blends include:[3]

- Leone, T., Anderson, J., Stein R. et al., *Effects of Fuel Octane Rating and Ethanol Content on Knock, Fuel Economy, and CO_2 for a Turbocharged DI Engine*, SAE 2014-01-1228, April 1, 2014.

- Leone, T., Anderson, J. et al., *The Effect of Compression Ratio, Fuel Octane Rating, and Ethanol Content on Spark-Ignition Engine Efficiency*, Environmental Science and Technology, 2015, 49, 10778-10789.

- West B, McCormick, R., Wang M. et al., *Summary of High-Octane, Mid-Level Ethanol Blends Study*, ORNL/TM-2016/42, July 2016.

- Jung, H., Shelby, M., Stein, R. et al., *Effect of Ethanol on Part Load Thermal Efficiency and CO_2 Emissions of SI Engines*, SAE 2013-01-1634, April 8, 2013.

- Leone, T., Anderson, J. et al., *Fuel Economy and CO_2 Emissions of Ethanol-Gasoline Blends in a Turbocharged DI Engine*, SAE 2013-01-1321, April 8, 2013.

To briefly summarize, multiple studies have shown that a high RON, midlevel ethanol blend (*e.g.*, 96-RON E20 or 101-RON E30) when paired with various higher compression ratio engines (*e.g.*, 11.9:1, 13.0:1) yields tailpipe CO_2 emissions reductions of at least 5%, which, in most instances were also coupled with efficiency gains that offset the lower energy content of the high octane fuel. Some studies also showed significant volumetric miles per gallon savings associated with the higher efficiency engines and a high octane fuel. Growth Energy also refers the Agencies to the Air Improvement Resources, Inc. 2016 study, "Evaluation of Costs of EPA's 2022-2025 GHG Standards With High Octane Fuels and Optimized High Efficiency Engines," submitted with comments by the Minnesota Corn Growers Association (the "AIR Inc. Study"), for additional summaries of these studies and for further analysis of the cost benefits of high octane, midlevel ethanol blends.

a. Consensus Has Emerged Regarding the Efficiency and GHG Benefits of Midlevel Ethanol Blends.

[3] For copyright reasons, Growth Energy cannot provide copies of these studies with the comment letter.

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Not only are the benefits of midlevel ethanol blends well-understood by the scientific community, but the automobile industry has for years acknowledged the importance of affordable, high octane fuels coupled with high-compression ratio engines as important to attaining regulatory compliance and improving vehicle performance in the most economical manner possible. A snapshot at the consensus that has emerged on this topic is set forth below:

- The Alliance and the Association of Global Automakers (the "Association") submitted comments on EPA's Tier 3 rulemaking in July 2013 that highlighted high octane fuels and increased engine compression ratio as "[o]ne pathway to improved vehicle efficiency and lower GHG emissions." Alliance/Association Comments on Proposed Rulemaking to Control of Air Pollution from Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards at 52, EPA-HQ-OAR-2011-0135 (July 1, 2013). The Alliance and the Association directed EPA to various studies conducted by the Coordinating Research Council and Ford that found that E20 in higher compression ratio engines "provided a 5% reduction in CO_2 emissions compared to . . . E10 . . . and the fuel economy (MPG) was about the same, even though the energy content of the fuel was lower as the ethanol content increased." *Id.* The Alliance and the Association also highlighted that higher ethanol, high octane fuels "provide the desired high knock resistance" and "increase engine efficiency." *Id.*

- In 2013, Daimler (Mercedes-Benz) identified a worldwide strategy that incorporates E20 to E25 as the main grade gasoline fuel for the 2017-2020 period because "[i]ncreased octane with midblend ethanol fuels is [the] key enable to simultaneously achieve GHG compliance with high customer satisfaction." "Advanced Powertrain Technology Coupled with Octane & Ethanol – Benefits and Opportunities," at 19, William Woebkenberg, Mercedes-Benz Research and Development North America, 2013 SAE High Octane Fuels Symposium.

- Ford Motor Company, which has done extensive research into high octane fuels, highlighted the GHG emissions benefits of biofuels in its 2014/2015 Sustainability Report and referenced the efficiency gains of naturally high octane ethanol, with optimized engines. *See* Ford Sustainability Report 2014/15, available at https://corporate.ford.com/microsites/sustainability-report-2014-15/environment-products-plan-migration-biofuel.html#fn03.

- More recently, executives from GM, Ford, Fiat Chrysler Automobiles and Honda have publicly reiterated their opinions that high octane fuel is critical to attaining more stringent GHG and CAFE standards. *See e.g.,* "GM, Honda execs agree: Higher octane gas needed to optimize ICE efficiency," SAE International (Aug. 3, 2016), http://articles.sae.org/14940/; "Automakers Push for Higher Octane to Meet Fuel Economy Standards," Cars.com (Apr. 15, 2016), https://www.cars.com/articles/automakers-push-for-higher-octane-to-meet-fuel-economy-standards-1420684421731/#Z6Qq3UDdyw7KMaUG.99.

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- Indeed, EPA has chimed in acknowledging that "raising octane levels may allow higher compression engines, improving fuel efficiency and reducing GHG emissions." "EPA's Regulatory Authority to Address Octane," Paul Machiele, MSTRS Meeting (May 15, 2015), http://www.epa.gov/sites/production/files/2015-05/documents/050515mstrs_machiele.pdf. And although the Draft TAR briefly mentions high compression ratio engines, NHTSA committed "that all future engine model development [will be] performed with regular grade octane gasoline." Draft TAR at 5-512.

Given the well-established scientific understanding of the benefits of midlevel ethanol blends coupled with high compression ratio engines, and the fact that the automobile industry and certain regulators have reached consensus regarding those benefits, it is difficult to understand why the Agencies have sidelined discussion of these issues and implementation of solutions to beyond the 2025 timeframe. In other words, in light of the established technological feasibility, effectiveness, and the overall environmental benefits of these technologies, it is inappropriate for the Agencies to exclude a robust discussion of the benefits and costs from the Draft TAR.

b. Cost and Infrastructure Compatibility Do Not Preclude Midlevel Ethanol Blends As a Means to Attain the 2022-2025 Standards.

Growth Energy and other parties have previously shared studies with EPA that have found that an E30 high octane blend can be produced for less than the cost of current gasoline, and that the development of the infrastructure over time is very affordable. For example, one study Growth Energy shared with EPA during the Tier 3 Rulemaking comment period found that a 92 AKI E30 can be produced for between $11.7 billion and $30.8 billion per year less than the cost of current 88 AKI regular gasoline. *See* Growth Energy Tier 3 Comments (attached as Exhibit B). Another study concluded that the costs to develop infrastructure at terminals and gas stations across the country ranged from $0.0024 to $0.0056 per gallon on a 15-year amortized basis. *See id.*

Since Growth Energy shared these studies with EPA in early 2014, additional research has been conducted on the costs for the refining sector to produce E20 and E30 midlevel blends. For example, MathPro Inc, Ford, GM, and Chrysler partnered in 2014 on a techno-economic assessment that found that the refining sector could produce blendstocks for oxygenate blending yielding E20 and E30 gasolines for a minimal $.01/gallon for 95-RON E20 and 97-RON E30, and $.03-$.05 for 98-RON E20 or 100-RON E30. *See* Hirshfeld, D.S., et al., "Refining Economics of U.S. Gasoline: Octane Ratings and Ethanol Content," *Environ. Sci. Technol.* 11064-11071 (2014). The study found that "[p]roducing E20 and E30 gasoline pools would incur somewhat lower refining costs, petroleum use, and CO_2 emissions than using the corresponding volumes of ethanol in combination of E10 and E85" due to the octane benefits of the midlevel blend fuels. *See id*. at 11070. Additionally, the expense to redesign and manufacture higher compression ratio engines is not expected to be significant. *See e.g.*, the AIR Inc. Study.

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In a similar vein, Oak Ridge National Laboratories' recent "Summary of High-Octane, Mid-level Ethanol Blends Study" released in July 2016 concluded that "neither technical nor materials obstacles are likely to prohibit [High Octane Fuels]" and "blendstock costs are not a significant barrier to [High Octane Fuel] introduction." (http://info.ornl.gov/sites/publications/Files/Pub61169.pdf). Moreover, as of this year, both of the primary providers of fuel dispensers in the United States, Wayne Fueling Systems and Gilbarco Veeder Root, offer E25 compatible dispensers. *See, e.g.*, "Wayne makes all its North American fuel dispensers E25 compatible," Ethanol Producer Magazine (Aug. 30, 2016), http://ethanolproducer.com/articles/13664/wayne-makes-all-its-north-american-fuel-dispensers-e25-compatible; "Gilbarco Veeder-Root Announces E25 UL-Approved Retrofit Kits for All Encore Dispensers" (July 24, 2012) http://www.gilbarco.com/us/content/gilbarco-veeder-root-announces-e25-ul-approved-retrofit-kits-all-encore-dispensers.

Growth Energy acknowledges that although there are numerous existing studies and analyses on cost impacts and infrastructure compatibility, additional analyses of these topics may be warranted. EPA's regulations regarding the Midterm Evaluation clearly indicate that the time to dig into these questions is now; not in ten years when the 2022-2025 Standards are irrelevant. *See* 40 C.F.R. § 86.1818(h)(1)(i-vii) (The Midterm Evaluation requires EPA to consider, *inter alia*, the "availability and effectiveness of technology [and] costs[s] on the producers or purchasers of new motor vehicles."). Moreover, the preamble to the final 2017-2025 Rule committed the Agencies to considering in the course of the Midterm Evaluation Process the costs for alternative fuels; however, the Agencies failed to fulfill this commitment in the Draft TAR. *See* Draft TAR at 2-2.

c. EPA Should Correct the Current Disadvantages Associated With Certification of Higher Ethanol Blend Fuels.

Growth Energy is concerned that the R-Factor in the current fuel economy equation, which purports to account for a vehicle's ability to compensate for changes in fuel energy content and is set at 0.6 based on data from the 1980s, could also prevent automakers from using an E30 certification fuel option because of its impact on the 2022-2025 Standards. Since at least 2013 there has been sound analysis from the Department of Energy that supports updating the R-Factor from 0.6 to 1.0. *See, e.g.*, S. Sluder and B. H. West, (2013) Preliminary Examination of Ethanol Fuel Effects on EPA's R-factor for Vehicle Fuel Economy; http://info.ornl.gov/sites/publications/Files/Pub42819.pdf ("The current factor of 0.6 which is called out in CFR is clearly too low, and a proper factor for modern vehicles is closer to unity [i.e., 1.0], as might be expected from improved air/fuel ratio control common for more modern vehicles."). A higher R-factor would be more accurate and may encourage automakers to use an E30 test fuel. EPA acknowledged in the Tier 3 Rule in 2014 and stated again two years later in the Draft TAR that correction of the R-Factor is necessary, and the Draft TAR indicates the correction factor is "under regulatory development." Tier 3 Rule at 23,532; Draft TAR at 5-228. Growth Energy encourages to update the R-Factor as expeditiously as possible to correct the current disincentives for certification of a high octane, midlevel ethanol blend fuel.

II. The Draft TAR Overlooks Currently Commercially-Available E85 Use in Flex Fuel Vehicles.

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In addition to failing to regard midlevel blends in high compression ratio engines as a potential near-term solution, the Draft TAR omits any in-depth discussion of FFV's use of E85 as technologies that can contribute to compliance with the 2022-2025 Standards. FFVs typically have GHG tailpipe emissions on E85 that are approximately 5% below the GHG emissions on E0, but this can vary between 3-6%. *See* "Ethanol – the primary renewable liquid fuel", Datta, Maher, Jones, and Brinker, J. Chem Technol. Biotechnol. 2011; 86:473-480. And, there are substantial well-to-wheel emissions benefits of E85 beyond tailpipe-only reductions. The Draft TAR notes that "[t]here are already a large number of [FFVs], capable of refueling on either gasoline or ethanol (E85) in the marketplace" but summarily concludes that "gasoline vehicle technologies" and a limited number of plug-in electric hybrids will be capable of meeting the 2022-2025 Standards. Draft TAR at 9-41. Growth Energy encourages the Agencies to further analyze the environmental benefits--not only with respect to GHG emissions but with respect to criteria pollutants as well-- of FFV's use of E85 and its implications for the 2022-2025 Standards.

* * *

In conclusion, in order to comply with EPA regulations regarding the Midterm Evaluation and the Draft TAR process, the Agencies must consider the "availability and effectiveness" of midlevel ethanol blends in conjunction with a high compression ratio engine, and the "cost on the producers or purchasers of new motor vehicle" as they are issues "relevant to the standard for the 2022 through 2025 model years." *See* 40 C.F.R. § 86.1818(h)(1)(i-ii), (2)(i). There is already a wealth of research on this topic, on both the emissions benefits as well as cost and infrastructure considerations. Growth Energy encourages the Agencies to incorporate the existing literature on high octane, midlevel ethanol blends and high compression ratio engines, and, to the extent it deems necessary, conduct additional technical or feasibility analyses on these topics.

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