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U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy
Submitted via email to OptimaRFI@ee.doe.gov

RE: Response to Request for Information (RFI) DE-FOA-0001460 **Category 1**

The Renewable Fuels Association (RFA) appreciates the opportunity to provide these comments in response to the Office of Energy Efficiency & Renewable Energy's (EERE) Request for Information on Co-Optimization of Fuels and Engines ("Optima"). [RFI DE-FOA-0001460]

RFA is the leading trade association for the nation's ethanol industry. Its mission is to advance the development, production, and use of fuel ethanol by strengthening America's renewable fuels industry and raising awareness about the benefits of biofuels. 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.

As an initial matter, RFA strongly supports the Optima initiative and encourages the Department of Energy (DOE) to continue applying appropriate resources and attention to this important program. We agree that co-optimization of future fuels and engines is an essential strategy for achieving national objectives related to energy conservation, carbon emissions reduction, and energy security. The Optima program is innovative and proactive, and the DOE should be applauded for undertaking such a bold and progressive initiative.

On behalf of the nation's ethanol producers, RFA is fully committed to collaborating with DOE to ensure the continued success of the Optima program. While a significant amount of research has already been completed to demonstrate the efficacy and efficiency of High Octane Fuels (HOF) in optimized spark ignition (SI) engines, much work remains to be done to establish a clear pathway to commercial introduction of these fuels and engines. RFA stands ready to assist the Optima program in any way possible to leverage the existing body of HOF research; identify and address knowledge gaps; and overcome technical, regulatory, and marketplace barriers to the introduction of co-optimized fuels and engines.

In this comment letter, we respond to EERE's Request for Information (RFI) on **"Category 1: Input on Stakeholders' Perspectives and Interest in the Optima Initiative."** We address the RFI for Category 2 in a separate response letter. Our comments are primarily focused on "Thrust I – Improvement of near-term conventional SI engine efficiency," as we see this component of Optima as most critical to the achievement of nearer-term goals to decrease transportation-related carbon emissions and reduce petroleum consumption.

1. **Activities Currently Under Way That May Support or Complement Optima Thrust I Work**

EERE asks for information regarding stakeholder efforts already under way that may complement Optima work related to co-optimized fuels and SI engines. RFA is engaged in the following activities that support the goals of Optima Thrust I (upon request, RFA will gladly provide its published reports, studies, etc. related to following activities):

- *Lifecycle energy and greenhouse gas (GHG) analysis of ethanol and HOFs (e.g., E25):* Using the DOE GREET model and other tools, RFA and its contractors regularly conduct lifecycle analysis of ethanol produced via various feedstock/conversion pathways to demonstrate the fuel's carbon benefits and energy intensity improvements. RFA also focuses on refining and refreshing key input data for ethanol lifecycle analysis, including conducting surveys of member producers to determine industry norms with regard to energy use, enzyme use, etc. We are increasingly focused on well-to-wheels lifecycle analysis of finished HOFs (e.g., E25) and improving the tools used to analyze emissions impacts from co-optimized fuel and engine systems.

- *Evaluation of ethanol and HOF criteria pollutant emissions (i.e., non-GHG emissions):* While there has been some focus on the potential lifecycle GHG emissions impacts of HOFs, little research has been done to estimate the lifecycle impacts of HOFs on emissions of other pollutants such as particulate matter (PM), nitrogen oxides (NOx), carbon monoxide (CO), and others. RFA believes HOFs can offer substantial reductions of these emissions when compared to today's marketplace fuels. RFA engaged Volpe and Wyle to evaluate the treatment of higher-octane mid-level ethanol blends (e.g., E15-E30) in EPA's MOVES2014 model (publication forthcoming). In general, the evaluation found that the MOVES model (and its underlying input data) needs substantial improvement before it can be reliably used to estimate emissions impacts from mid-level ethanol blends.

- *Compatibility analysis of current infrastructure and materials*: RFA continues to investigate the compatibility of existing wholesale and retail infrastructure with HOFs containing higher levels of ethanol (e.g., E15-E30). Most recently, RFA sponsored a study by DOE's National Renewable Energy Laboratory focused on the compatibility of underground storage tanks (USTs) with E15 and other ethanol blends.

- *Cost analysis of upgrading/modifying refueling infrastructure to accommodate HOFs*: RFA works with refueling equipment manufacturers, fuel marketers, and retail station owners to determine the cost and potential payback period of upgrading/retrofitting infrastructure to accommodate HOFs containing higher levels of ethanol (e.g., E15-E30).

- *Fuel retailer technical assistance and education:* RFA's market development team conducts regular educational seminars and webinars for retailers and marketers who may be interested in offering higher-octane mid-level ethanol blends. These sessions typically include discussions on potential costs, payback period, the value proposition for consumers, available incentive programs, pertinent policy and regulatory matters, and a variety of other topics. RFA also publishes technical and regulatory guidance documents for retailers (e.g., E15 Retailer's Handbook, Flex Fuel Blending Guide, the only EPA-approved E15 Misfueling Mitigation Plan, etc.).

- *Identification of regulatory barriers to HOF introduction*: While much technical work has been done to prove the efficacy of HOFs in advanced SI engines, a number of regulatory barriers remain in place that could potentially slow or prevent the commercial introduction of HOFs. RFA works with state and federal regulatory agencies to identify and address these barriers.

- *Development of specifications and standards*: Commercial introduction of new HOFs will require development of new fuel quality standards and specifications. RFA is an active participant in ASTM, NCWC, and other standards-developing organizations. We continue to support efforts in these forums to create new standards and specifications for HOFs.

2. Potential New Activities That Could Support or Complement Optima Thrust I Work

The RFI includes solicitation of comments on potential new activities complementary to Optima Thrust I that may be undertaken by stakeholders. RFA is planning or considering the following activities that support the goals of Optima Thrust I:

- *HOF emissions testing*: As described in the previous section, RFA has evaluated the EPA MOVES2014 model, a tool used to estimate tailpipe emissions from various fuel/engine systems. We believe the data underlying the MOVES2014 model fuel inventory is flawed with regard to ethanol blends, and this leads to the mischaracterization of emissions (e.g., PM, NOx, etc.) from HOFs containing higher levels of ethanol. As such, there is a critical need to gather *actual emissions data* from optimized SI engines using HOFs with higher ethanol content (e.g., E15-E30) in a controlled environment where HOF blending is performed in a realistic and transparent manner. RFA is interested in collaborating with other stakeholders on a program to determine actual emissions of PM, NOx, and other pollutants from HOFs created using the blendstocks and blending methods that are most likely to be used in the real world.

- *Refinery economics (LP modeling) and emissions analysis*: While some initial research has been done to estimate the petroleum refinery-level economic and stationary source emissions impacts of transitioning to HOFs, much more work is needed in this area. RFA believes HOFs can provide certain economic and emissions benefits to petroleum refiners. RFA is interested in sponsoring additional analysis of the potential economic and emissions impacts of HOFs on petroleum refiners under various scenarios.

- *Comprehensive HOF literature review*: As a result of the Optima program and other initiatives, DOE has already conducted a significant amount of research on HOFs. Other public and private stakeholders have also invested substantial resources in examining various aspects of HOFs. Currently, there is no comprehensive "library" of studies, reports, articles, presentations, etc. on the subject of HOFs. RFA is undertaking an extensive review of all the available literature on HOFs containing higher levels of ethanol. Gathering and summarizing all of the work conducted to date will help interested stakeholders (including DOE) better assess remaining knowledge gaps and research needs.

- *Cost analysis of mid-stream/terminal upgrades/modifications needed to accommodate HOFs*: A fair amount of work has been conducted to determine the likely costs and return-on-investment for installation of retail infrastructure that can accommodate HOFs with higher levels of ethanol. However, less work has been done to determine the likely costs of any necessary fuel storage and transportation infrastructure upgrades/modifications upstream from retail. RFA believes more detailed analysis may need to be conducted on these segments of the supply chain.

3. Additional Areas of Research in Which Universities and Other Stakeholders are Interested in Contributing or Collaborating

EERE's RFI asks respondents to identify other Optima-related research topics that may offer opportunities for collaboration. RFA believes the following subjects warrant further research and may be of interest to outside stakeholders as opportunities for cooperation.

- *Using flex-fuel vehicles (FFVs) as a "bridge" technology to co-optimized engines and HOFs:* Automakers have already produced and sold roughly 20 million flex-fuel vehicles (FFVs) capable of operating on fuel blends containing up to 85% fuel ethanol. Clearly, while not optimized for HOFs, these vehicles are already technically capable of consuming HOFs that contain higher levels of ethanol (e.g., E15-E40). ORNL has already demonstrated that HOFs made with ethanol can produce vehicle efficiency gains in FFVs, albeit not of the magnitude that may occur if the vehicle were fully optimized by the manufacturer to operate on a HOF with specific properties. Still, identifying simple methods for optimizing, to the extent possible, the existing fleet of FFVs to operate on HOFs could provide an opportunity for real-world proof of concept and could jumpstart

demand for such fuels at retail. While using HOFs in quasi-optimized FFVs admittedly would not capitalize on the same synergies that a truly co-optimized system would generate, an HOF/FFV demonstration program of this sort could help provide a bridge toward fully co-optimized engine platforms and HOFs. Such an effort would likely require tight coordination and collaboration amongst DOE and industry stakeholders involved in FFV production, as well as fuel blending and retailing.

- *HOF macroeconomic scenario analyses:* While DOE and others (e.g., Massachusetts Institute of Technology) have conducted some analysis on the potential macroeconomic effects of transitioning to HOFs, we believe more detailed and expansive analysis is needed. The potential economic impacts across multiple sectors (agriculture, energy, manufacturing, etc.) and net societal cost/benefit of several HOF adoption scenarios should be modeled in detail. We recognize that DOE's Oak Ridge National Laboratory (ORNL) possesses the expertise to conduct this type of analysis and may benefit from collaboration with certain universities that have similar expertise and experience.

- *Further characterizing the unique properties of potential octane sources and establishing reliable methods for determining "octane value"*: DOE has noted that different sources of octane can possess highly variable characteristics that may ultimately affect the substance's utility as a component of HOFs. For instance, DOE has shown that ethanol possesses unique Heat of Vaporization (HoV) properties that enhance the fuel's ability to resist engine knock. At the same time, it has been recognized that existing methods for measuring the octane value of certain fuels may not be fully reliable and may not capture additional factors that contribute to knock resistance. We believe further investigation of the unique properties of various octane sources is needed, along with examination of how those properties may affect engine performance and emissions. Further, more work may be needed to determine whether new or alternative methods of determining "octane value" or knock resistance are necessary. This work may be well-suited for collaboration with outside stakeholders, including universities or commercial laboratories.

4. Awareness of Other Research, Activities or Existing Work on Co-optimization of Fuels and Vehicle Engines

The RFI asks stakeholders to comment on any other ongoing research or activities related to co-optimization of engines and fuels of which DOE should be made aware. RFA believes DOE is very likely aware of any and all HOF work of which we have knowledge. Still, we recommend that DOE consider gathering (either virtually or in person) a broad cross section of stakeholders including automakers, petroleum refiners, biofuel producers, university researchers, and others to take inventory of existing, ongoing, or planned work on co-optimized engines and HOFs.