Request for Information
U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Bioenergy Technologies Office

Advanced Biofuel Blends in Small Engines

DATE: June 23, 2015

SUBJECT: Request for Information (RFI)

DESCRIPTION: The U.S. Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy's (EERE) Bioenergy Technologies Office (BETO) seeks stakeholder input on (1) the potential to optimize and/or modify small engines to utilize ethanol blends greater than 10% (E10) and (2) the barriers limiting the expansion of overall biofuel consumption in the small engine industry. The small engines of interest for this RFI are spark-ignition, internal combustion engines such as those found in small tractors, chainsaws, hand-held line trimmers, off-road motorcycles, generator sets, personal water craft, small outboard motors, snowmobiles, and all-terrain vehicles.

BACKGROUND:

The Bioenergy Technologies Office (BETO) is one of ten technology development offices within DOE's Office of Energy Efficiency and Renewable Energy (EERE). BETO is a key component of EERE's efforts to expand the adoption of sustainable, domestically powered transportation alternatives and to stimulate the growth of a thriving domestic clean energy manufacturing industry. BETO's mission is to develop and transform renewable biomass resources into commercially viable, high-performance biofuels, bioproducts, and biopower through targeted research, development, and demonstration supported through public and private partnerships. BETO is working to enable sustainable, nationwide production of biofuels that (1) are compatible with today's transportation infrastructure, (2) reduce greenhouse gas emissions relative to petroleum-derived fuels, and (3) can displace a share of petroleum-derived fuels to reduce U.S. dependence on foreign oil.

As part of its objective to help develop the market for commercially viable biofuels, BETO is exploring how to overcome potential market barriers of using biofuels in small utility and recreational vehicle engines. The challenges of using fuel blends with higher than 10% ethanol in small engines are widely recognized, and include both technical and non-technical elements.[1]

[1] Knoll, K.; West, B.; Clark, W.; et al (2009), *Effects of Intermediate Ethanol Blends on Legacy Vehicles and Small Non-Road Engines, Report 1 – Updated,* National Renewable Energy Laboratory, NREL/TP-540-43543, Oak Ridge National Laboratory, ORNL/TM-2008/117.

With more than half a billion small engines in service across the United States,[2] these challenges present a significant hurdle for the higher-blend ethanol market. As such, BETO is interested in collecting technical and economic data that may undergird potential small engine design for use of ethanol blends greater than E10.

A 2009 study by the National Renewable Energy Laboratory and Oak Ridge National Laboratory identified compatibility issues in small non-road engines (SNREs) while operating on intermediate ethanol blends such as E15 and E20.[3] The complexities outlined in this report and other DOE-funded studies have resulted in obstacles limiting both the utilization of biofuel blends and the overall expansion of renewable transportation fuels into public markets. Scientists and engineers have responded to the challenge of using biofuels blends in SNREs by investigating methods to improve engine performance, such as increasing pressure in the cylinders, spark-less ignition, fuel injection systems, closed feedback loops, exhaust recovery systems, and other modifications.[4, 5]

In addition to technical challenges, there is confusion in the marketplace about the compatibility of using biofuel blends in SNREs, which is exacerbated by a proliferation of non-science-based information in wide circulation and a lack of science-based information available to the public. Expanding the use of ethanol blends in existing and potential small engine markets could increase public awareness of the viability of biofuel blends, provide the public with renewable fuel options, and contribute to the growth of U.S. capacity for production of sustainable domestic fuel sources.

PURPOSE: The purpose of this RFI is to solicit feedback from industry, academia, research laboratories, government agencies, and other stakeholders regarding biofuel consumption in the small, internal combustion engine market. BETO is specifically seeking information on the potential opportunities for increasing biofuel consumption in small engines; existing and/or potential obstacles to the expansion of biofuel use in small engines; stakeholder interest in optimizing engine efficiency, reducing emissions, and increasing longevity for small engines utilizing ethanol blends; and mechanisms for addressing biofuel expansion barriers.

This RFI will help BETO explore the potential impact and feasibility of efforts to address both technical and non-technical hurdles related to (1) the use of ethanol blends greater than E10 in small engines and (2) increased biofuels availability in related markets.

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[2] Westgard, R., (2010), "'Blend wall' decision on ethanol will have multiple side effects." MinnPost, Minneapolis, MN, http://www.minnpost.com/community-voices/2010/05/blend-wall-decision-ethanol-will-have-multiple-side-effects

[3] Knoll, K.; West, B.; Clark, W.; et al (2009), *Effects of Intermediate Ethanol Blends on Legacy Vehicles and Small Non-Road Engines, Report 1 – Updated,* National Renewable Energy Laboratory, NREL/TP-540-43543, Oak Ridge National Laboratory, ORNL/TM-2008/117.

[4] Moriarty, K.; Kass, M.; Theiss, T. (2014), *Increasing Biofuel Deployment and Utilization through Development of Renewable Super Premium: Infrastructure Assessment*, National Renewable Energy Laboratory, NREL/TP-5400-61684.

[5] Scania AB "*Green light for biofuels*," http://somnium.co.za/Silversands%20Ethanol/Scania%20on%20Alternative%20Fuels.pdf.

DISCLAIMER AND IMPORTANT NOTES: This RFI is not a Funding Opportunity Announcement (FOA); therefore, EERE is not accepting applications at this time. EERE may issue a FOA in the future based on or related to the content and responses to this RFI; however, EERE may also elect not to issue a FOA. There is no guarantee that a FOA will be issued as a result of this RFI. Responding to this RFI does not provide any advantage or disadvantage to potential applicants if EERE chooses to issue a FOA regarding the subject matter. Final details, including the anticipated award size, quantity, and timing of EERE-funded awards, will be subject to Congressional appropriations and direction.

Any information obtained as a result of this RFI is intended to be used by the Government on a non-attribution basis for planning and strategy development; this RFI does not constitute a formal solicitation for proposals or abstracts. Your response to this notice will be treated as information only. EERE will review and consider all responses in its formulation of program strategies for the identified materials of interest that are the subject of this request. EERE will not provide reimbursement for costs incurred in responding to this RFI. Respondents are advised that EERE is under no obligation to acknowledge receipt of the information received or provide feedback to respondents with respect to any information submitted under this RFI. Responses to this RFI do not bind EERE to any further actions related to this topic.

PROPRIETARY INFORMATION: Because information received in response to this RFI may be used to structure future programs and FOAs and/or otherwise be made available to the public, **respondents are strongly advised to NOT include any information in their responses that might be considered business sensitive, proprietary, or otherwise confidential.** If, however, a respondent chooses to submit business-sensitive, proprietary, or otherwise confidential information, it must be clearly and conspicuously marked as such in the response.

Responses containing confidential, proprietary, or privileged information must be conspicuously marked as described below. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the Freedom of Information Act or otherwise. The U.S. Federal Government is not liable for the disclosure or use of unmarked information, and may use or disclose such information for any purpose.

If your response contains confidential, proprietary, or privileged information, you must include a cover sheet marked as follows identifying the specific pages containing confidential, proprietary, or privileged information:

> **Notice of Restriction on Disclosure and Use of Data:**
> Pages [list applicable pages] of this response may contain confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for the purposes described in this RFI DE-FOA-0001373. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source.

In addition, (1) the header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: "Contains Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure" and (2) every line and paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting.

EVALUATION AND ADMINISTRATION BY FEDERAL AND NON-FEDERAL PERSONNEL: Federal employees are subject to the non-disclosure requirements of a criminal statute, the Trade Secrets Act, 18 USC 1905. The Government may seek the advice of qualified non-Federal personnel. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The respondents, by submitting their response, consent to EERE providing their response to non-Federal parties. Non-Federal parties given access to responses must be subject to an appropriate obligation of confidentiality prior to being given the access. Submissions may be reviewed by support contractors and private consultants.

REQUEST FOR INFORMATION CATEGORIES AND QUESTIONS:

CATEGORY 1: Input on Stakeholders' Perspectives and Interest in Biofuels for Small Engines

BETO is seeking information on perspectives and interest on increasing consumption of biofuels in the small, internal combustion engine market.

1. Due to the prevalence of E10 in the marketplace, please provide information regarding your interest in optimizing small engines to utilize ethanol blends. Are there additional factors (other than the prevalence of E10) that affect your interest in optimizing small engines to utilize ethanol blends? If so, please describe the additional factors.
2. Please provide information regarding your perspective on increasing the U.S. Environmental Protection Agency (EPA) certification fuel for marine, snowmobile, and motorcycle engines to E10.
3. Please provide information regarding your interest in reducing emissions from small engines.
4. Please provide information regarding your interest in having the option of using a drop-in fuel, such as renewable gasoline, in small engines.

CATEGORY 2: Input on Technical Hurdles

BETO is interested in information regarding the technical hurdles of designing, developing, and/or modifying small, internal combustion engines to improve compatibility when operated with high-octane biofuel blends.

1. What measures is the small engine manufacturing industry currently taking to optimize engine efficiency, reduce emissions, and increase longevity for small engines utilizing ethanol blends ranging from E10 to E25?
    a. Please comment on investigation of possible technical changes including, but not limited to, closed-loop systems, ignition modifications, fuel injection, or lubrication changes.

   b. If no measures are currently being taken, what factors have determined this course of action?
2. Please provide information regarding the current life expectancy of small engines.
   a. If designing or modifying small engines to use ethanol blends, what technical hurdles need to be overcome to optimize life expectancy?
   b. Does the public have a differing perception than industry in regards to the longevity of engines using ethanol blends?
3. Is there a specific class or size of small engines that have greater technical hurdles to utilizing ethanol blends? If so, explain.
4. What effect would increasing the EPA emissions certification fuel for marine, snowmobile, and motorcycle engines to E10 have on engine design?

CATEGORY 3: Input on Techno-Economic Analysis

BETO is seeking information regarding the market impact of increasing the consumption of biofuels in the small engine market.

1. Please provide information regarding the feasibility under realistic market constraints to optimize engine performance in small engines when operated with intermediate ethanol blends ranging from E15 to E25, in particular if the increased ethanol blending brings a higher octane number.
2. Please provide information on market feasibility under realistic market constraints of modifying existing small engines to utilize intermediate ethanol blends ranging from E15 to E25.
3. Please provide information regarding existing and/or potential non-technical obstacles limiting efforts by the small engine manufacturing industry to optimize engine efficiency, reduce emissions, and increase longevity for small engines utilizing ethanol blends of ranging from E10 to E25.
4. Starting in 2017, all Tier 3 light-duty and heavy-duty gasoline vehicles will be required to use E10 as the EPA emissions certification fuel.[6] What effect has this forthcoming transition and resulting reduced availability of E10 had on the small engine market?

CATEGORY 4: Exploring and Addressing Hurdles to Biofuels Expansion

BETO is interested in information regarding mechanisms for addressing the technical and non-technical hurdles of using biofuels in small, internal combustion engines. Three potential mechanisms have been identified:

- *Targeted research and development FOA* addressing specific technical and non-technical hurdles
- *Innovation prize* via a competitive research-focused platform, with a prize being awarded to the entity proposing the best solution to address a specified barrier
- *Collegiate competition* with emphasis on a combination of undergraduate technological and communications research.

[6] Federal Register, Vol. 79(81), Monday, April 28, 2014, Rules and Regulations (Tier 3 Emissions and Fuel Standards)

1. Please provide information on the potential strengths and weaknesses of using these mechanisms to explore and address these hurdles (specify which mechanism you are referring to in your response).
2. Are there other mechanisms that may better explore and address these hurdles?

REQUEST FOR INFORMATION RESPONSE GUIDELINES: Responses to this RFI must be submitted electronically to BETOSmallEnginesRFI@ee.doe.gov no later than 5:00 pm (EDT) on August 30, 2015. Responses must be provided as attachments to an email. It is recommended that attachments with file sizes exceeding 25MB be compressed (i.e., zipped) to ensure message delivery. **Responses must be provided as a Microsoft Word (.doc/.docx) or PDF attachment of no more than 5 pages in length, 12-point font, 1-inch margins, not to exceed 25MB in size.** Only electronic responses will be accepted.

Respondents are requested to provide the following information at the start of their response to this RFI:

- Company / institution name;
- Company / institution contact;
- Contact's address, phone number, and e-mail address;
- Stakeholder group(s) your response reflects (include all that apply from list below):
  - Small engine design/manufacturer
  - Small engine/fuels research
  - Small engine maintenance/repair
  - Small engine user
  - Fuel distribution/infrastructure
  - Government entity
  - Industry (please provide North American Industry Classification System [NAICS] code if possible)
  - Small business[7]
  - Academia
  - Research laboratory
  - Other (Please specify)

Please specify the category that you are responding to. Respondents may answer as many or as few questions as they wish. If you wish to provide input to more than one category of interest, you should submit a separate response for each category. Each response should not exceed 5 pages in length.

EERE will not respond to individual submissions or publish publicly a compendium of responses. A response to this RFI will not be viewed as a binding commitment to develop or pursue the project or ideas discussed.

[7] Small Business Qualifications: https://www.sba.gov/content/am-i-small-business-concern