**VIA E-MAIL**

Avi Shultz
Director, Industrial Efficiency and Decarbonization Office
U.S. Department of Energy
1000 Independence Avenue SW
Washington, DC 20585
Email: Transforming-Industry@ee.doe.gov

**RE: Request for Information on Strategies to Decarbonize America's Industrial Sector**

Dear Mr. Shultz:

Thank you for the opportunity to respond to the most recent request for information (RFI) regarding strategies to decarbonize America's industrial sector. Growth Energy is expanding the bioeconomy and is the nation's largest association of biofuel producers, representing 97 U.S. plants that each year produce 9.5 billion gallons of low-carbon, renewable fuel; 120 businesses associated with the production process; and tens of thousands of biofuel supporters around the country. Our members make low-carbon fuels and high-protein animal feed and supply plant-based ingredients for everything from bioplastics to safer cleaning products.

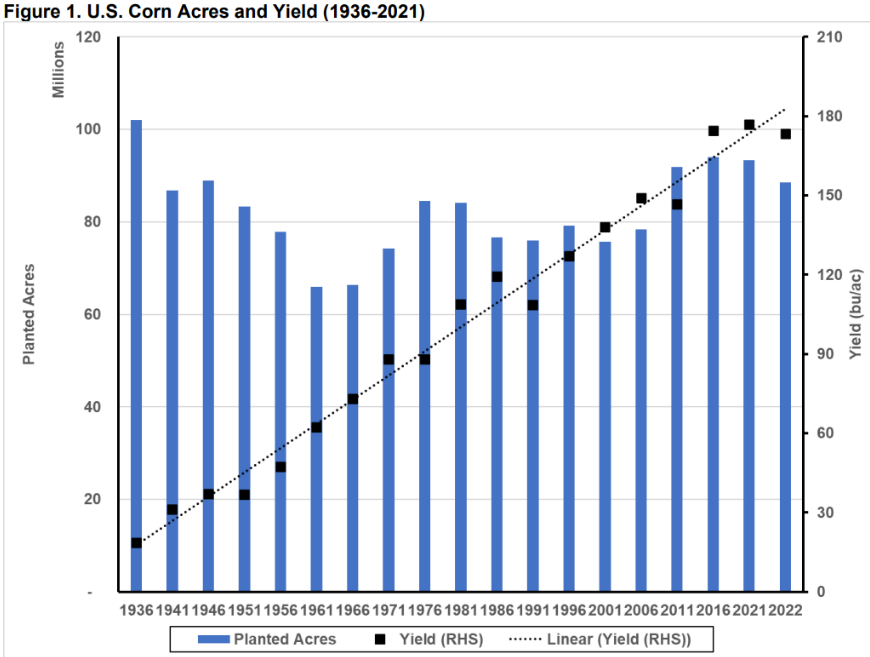
As we have noted in other venues, U.S. leadership in the global sustainable biofuels markets is vital to decarbonization and future economic competitiveness in the on-road, aviation, marine shipping, and off-road sectors, in addition to the industrial sector, and biofuels are the best tool available to do so. While our members are primarily focused on transportation fuels, we are exploring other opportunities throughout the bioeconomy that could provide an outlet for our low-carbon biofuels and other key coproducts to compete and help drive down greenhouse gas emissions. As such, we are happy to be a resource for the Department as it examines potential opportunities for further decarbonization in the industrial sector.

The industrial sector accounts for one third of greenhouse gas (GHG) emissions and requires a diverse and complex set of energy inputs, processes, and operations. While historically decarbonization has been more focused on the transportation sector, it is important to recognize biofuels and other bioproducts that would help reduce GHG emissions from the industrial sector as well. Importantly with any market for biofuels and bioproducts, the agency needs to think about scalability and reliable supply. The U.S. has the largest and most developed biofuels industry in the world.[1] Over the past 20 years,

[1] *See, e.g. International Biofuels Production,* U.S. Energy Information Administration, https://www.eia.gov/international/rankings/world?pa=28&u=2&f=A&v=none&y=01%2F01%2F2021&ev=false.

U.S. fuel ethanol production has grown from 2.1 billion gallons/year to 15.4 billion gallons/year.[2] During this time, there has been no observable increase in corn acres planted or related adverse impacts on food prices. Instead, increases in corn demand have consistently been met by increased yield as agricultural practices have become more efficient over time:[3]

**Figure 1. U.S. Corn Acres and Yield (1936-2021)**




***Source**: USDA, Stillwater analysis*

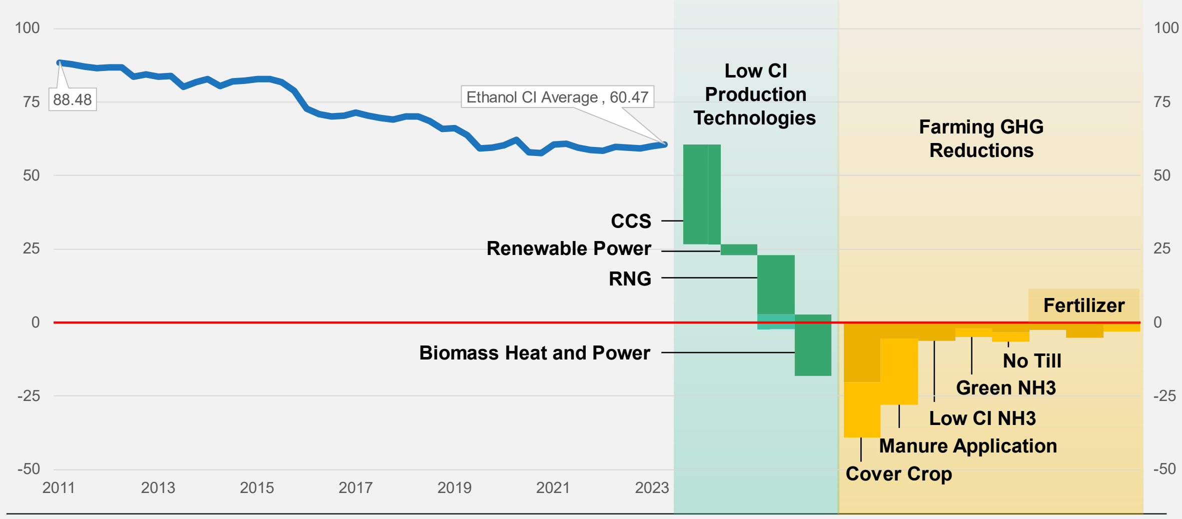
Our members produce bioethanol today primarily for on-road fuel, but it is also used in some chemical and other industrial settings. Today, all engines (both on-road and off-road) are approved for use with gasoline blended with 10 percent bioethanol while all 2001 and newer passenger vehicles are approved for gasoline blended with 15 percent bioethanol alongside flex-fuel vehicles that are approved for all bioethanol blends up to E85. Our industry can also provide bioethanol in the future as a feedstock for sustainable aviation fuel as well as for other biochemicals. Additionally, our members produce distillers corn oil (DCO) as a coproduct that is then used as a feedstock for both biodiesel and renewable diesel which can be used to power numerous industrial engines. And as our members broaden the use of carbon capture, utilization, and storage (CCUS) technology, some are exploring the potential for fuels and other products produced from a nearly pure stream of captured carbon dioxide.

[2] *Oxygenate Production,* U.S. Energy Information Administration, https://www.eia.gov/dnav/pet/pet_pnp_oxy_dc_nus_mbbl_a.htm; *U.S. Production, Consumption, and Trade of Ethanol*, U.S. DOE Alternative Fuels Data Center, https://afdc.energy.gov/data/10323.

[3] For detailed analysis showing the lack of any empirical link between ethanol production and land use change, s*ee, e.g.* Growth Energy Comments on EPA's Renewable Fuel Standard (RFS) Program: Standards for 2023–2025 and Other Changes, Exhibits 2-3, EPA-HQ-OAR-2021-0427-0796, (Feb 10, 2023); Growth Energy Comments on EPA's Workshop on Biofuel Greenhouse Gas Modeling, EPA-HQ-OAR-2021-0324-0580 (Apr. 1, 2022); Growth Energy Comments on EPA's Proposed Renewable Fuel Standard Program: RFS Annual Rules, Exhibits 1-3, EPA-HQ-OAR2021-0324-0521, (Feb. 4, 2022).

The U.S. biofuels industry continues to prove its ability to lower GHG emissions and deliver jobs and economic benefits to American workers and farmers. Extensive research from the Department's own Argonne National Laboratory through its Greenhouse Gases, Regulated Emissions, and Energy Use in Technologies (GREET) model has shown that today's bioethanol provides a nearly 50 percent reduction compared to gasoline in lifecycle GHG emissions and can get to net-zero emissions with the use of readily available technologies such as CCUS. The biofuels industry has also helped to create hundreds of thousands of jobs here in the United States and provides a stable market for American farmers while continuing to reduce prices at the fuel pump for the on-road fleet.

**Carbon Intensity of Ethanol Continues to Approach Net-zero**

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SOURCES: California Air Resources Board ; Environmental Health & Engineering, Inc. Carbon Intensity of Corn Starch Ethanol: State of the Science Assessment. David MacIntosh, Sc.D. (Chief Science Officer), Melissa Scully (Environmental Health Scientist), Tania Alarcon Falconi (Environmental Health Scientist), and Greg Norris (Life Cycle Analyst). Published March 10, 2021. https://iopscience.iop.org/article/10.1088/1748-9326/abde08 .

Lower-carbon fuels and bioproducts will require scalability, highlighting the need for and importance of a stable policy environment. The federal Renewable Fuel Standard (RFS) is foundational to the entire U.S. biofuels industry and its ability to provide a variety of fuels and feedstocks for use across transportation sectors. Any expanded use of biofuels for off-road use will require a strong and growing RFS.

Additionally, the U.S. Department of the Treasury is in the midst of implementing several key tax biofuel tax incentives including the Clean Fuel Production (45Z), Carbon Capture (45Q), and Sustainable Aviation Fuel (40B) credits. These provisions are critical to our industry's capital-intensive investments to reduce greenhouse gas emissions and ultimately to the achievement of the administration's broad climate goals, including the SAF Grand Challenge and the potential to get to net-zero by 2050. As we have articulated in multiple comments to Treasury (available here, here, here, and here), it is essential that the Argonne GREET model be used for any lifecycle emissions assessment as it is the best tool available for measuring biofuel lifecycle emissions. In fact, earlier this year, EPA highlighted that "the GREET model is well established, designed to adapt to evolving knowledge, and capable of including technological advances."[4] Also, implementation of these credits must allow for a wide range of carbon intensity reduction strategies including, but not limited to, CCUS technologies and projects, renewable power, and many emerging farm and agricultural practices. From our previous comments, below is a table of possible reductions of carbon intensity at our bioethanol plants. Any meaningful goals for the use of crop-based biofuels for the industrial or other hard to decarbonize sectors cannot be achieved without the use of the Argonne GREET model and recognition of a variety of carbon intensity reduction strategies.

**Table 1. Principal Options for GHG Reductions at Bioethanol Plants**

| Scenario | kg $CO_2$/MMBtu | Description | Assumption/ Calculation Basis[5] |
|---|---|---|---|
| Baseline | 55.5 | U.S. Average dry mill ethanol. | 22,480 Btu/gal, 0.61 kWh/gal, 2.86 gal/btu |

**<u>Low CI Production Technologies</u>**

| Scenario | CI Reduction[6] | Description | Assumption/ Calculation Basis |
|---|---|---|---|
| CCS | -33.8 | Store $CO_2$ underground | Capture 90% of fermentation $CO_2$ |
| Renewable Power | -3.8 | REC for electricity as well as on-site wind or solar power | 0 g $CO_2$e/kWh, per GREET |
| Biomass Heat and Power | -20 to -25 | Power and heat generated at corn ethanol plant. | Eliminates natural gas and electric power emissions. Calculate GHG emissions from biomass use in GREET. |
| RNG | -21 | 40% of natural gas from RNG | - 100 g $CO_2$/MJ diary, swine, or steer manure. Calculate GHG emissions based on RNG use and CI of RNG. |

[4] *New Source Performance Standards for Greenhouse Gas Emissions From New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units; Emission Guidelines for Greenhouse Gas Emissions From Existing Fossil Fuel-Fired Electric Generating Units; and Repeal of the Affordable Clean Energy Rule*, 88 Fed. Reg. 33,240, 33,328 (May 23, 2023).

[5] GHG reductions are available from standard values in the FD-CIC or from additional calculations as indicated.

[6] Reductions apply to baseline for typical dry mill ethanol plant; where multiple technologies or practices apply, reductions may be added together to calculate the fuel's emission rate.

**Farming GHG Reductions**

| Scenario | CI Reduction | Description | Assumption/ Calculation Basis |
|---|---|---|---|
| Green $NH_3$ | -6.1 | Green Ammonia for Fertilizer | FD-CIC Green Ammonia |
| Low CI $NH_3$ | -2 to -5 | Ammonia with $CO_2$ capture | Calculate GHG emissions based on ammonia production process. |
| No Till | -3.4 to -6.5 | Switch Reduced to No Till farming | FD-CIC Reduced Till to No Till depending upon region. |
| Fertilizer | -2.4<br>-5.2<br>-1 to -3 | Nitrogen efficiency<br>Precision application<br>Bio-based fertilizer | FD-CIC Enhanced Efficiency Fertilizer<br>FD-CIC (4R) Right time, place, form, rate<br>Calculate based on farming inputs |
| Manure Application | -5.5 to -28 | Mix of dairy, swine, cattle, poultry manure | FD-CIC Manure Application |
| Cover Crop | -20.4 to -39.1 | Grow winter cover crop | FD-CIC Cover Crop |

Thank you for your consideration and we are happy to be a resource as the Department further explores the potential for broader bioethanol use in the industrial sector.

Sincerely,

Chris Bliley
Senior Vice President of Regulatory Affairs
Growth Energy