

Notice of Intent No. DE-FOA-0002416

Notice of Intent to Issue Funding Opportunity Announcement No. DE-FOA-0002396

The Office of Energy Efficiency and Renewable Energy (EERE) intends to issue, on behalf of the Bioenergy Technologies Office (BETO), a Funding Opportunity Announcement (FOA) entitled “FY21 Bioenergy Technologies Scale-up and Conversion FOA.”

Building a clean energy economy and addressing the climate crisis is a top priority of the Biden Administration. The Administration has laid out a bold plan to lead the world in building a clean energy economy, addressing climate change and achieving net-zero emissions no later than 2050 to the benefit of all Americans. The Department of Energy is committed to pushing the frontiers of science and engineering, catalyzing clean energy jobs through research, development, demonstration, and deployment (RDD&D), and ensuring environmental justice and inclusion of disadvantaged communities.

In support of these Administration priorities, BETO is focused on developing technologies that convert domestic biomass and other waste resources (e.g. municipal solid waste, biosolids) into low-carbon biofuels and bioproducts. These bioenergy technologies can enable a transition to a clean energy economy, create high-quality jobs, support rural economies, and spur innovation in renewable energy and chemicals production – the bioeconomy. The activities funded through this opportunity will mobilize public clean energy investment in the biofuels, chemical and agricultural industries, accelerate the deployment of bioenergy technologies, and support achieving economy-wide net-zero emissions by 2050.

This FOA may support high-impact technology RDD&D to accelerate the bioeconomy and, in particular, the production of low-carbon fuels for the aviation industry. BETO is focusing on applied RDD&D to improve the performance and reduce cost of biofuel production technologies and scale-up production systems in partnership with industry. By reducing cost and technical risk, BETO can help pave the way for industry to deploy commercial-scale integrated biorefineries and reduce greenhouse gas emissions from hard to decarbonize sectors, such as aviation. The Program is focused on developing and demonstrating technologies that are capable of producing low-carbon drop-in biofuels at \$2.50 per gallon gasoline equivalent (GGE) by 2030, as well as associated renewable chemical co-products to achieve this target. BETO is focused on biofuel production pathways that can deliver at least 70% lower lifecycle greenhouse gas emissions than petroleum.

It is anticipated that the FOA may include the following Topic Areas:

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Topic Area 1: Scale-up of Biotechnologies

Significant progress has been made on biofuels through both government and private sector RD&D over the last 10 years and some technologies are now ready for scaling-up to support their ultimate commercialization. BETO recognizes the availability of financing for first-of-a-kind process systems can be a barrier to commercializing advanced biofuels. Pilot and demonstration scale facilities are key to ensuring that ultimately commercial biorefineries are successful. BETO is looking for bioenergy companies that are ready to move their technologies from the laboratory to the pilot and demonstration stage and eventual commercialization.

Based on lessons learned from previous pilot, demonstration, and pioneer integrated biorefineries, BETO's scale-up strategy and FOA may:

- allow projects to be funded at either the pre-pilot, pilot or demonstration scale.
- require that projects have the data to show they completed the previous stage successfully. This can be done through a previous BETO funded deployment or can be through one the company has done on its own.
- provide a consistent approach each year to provide industry with less uncertainty on BETO scale-up work.

To support this approach, BETO anticipates its current and future Scale-up FOAs to have three (3) potential subtopic areas listed below:

Subtopic Area 1a: Scale-up: Pre-Pilot for Biofuels and Bioproducts

Many technologies developed at the bench scale, both externally and within the other BETO programs, require further development prior to full system scaling. This potential subtopic area will scale up key process steps from lab scale unit operations (TRL 3) to industrially relevant piece(s) of equipment (TRL 5).

Subtopic Area 1b: Scale-up: Pilot for Biofuels and Bioproducts

This potential subtopic area may seek applications proposing project definition, development, and execution plans for the scaling of pre-pilot biofuel and bioproduct technologies to pilot scale including for:

- The manufacture of sustainable aviation and marine fuels
- Carbon dioxide (CO₂) conversion, Waste-to-Energy¹ or novel carbon conversion technologies

¹ <https://www.energy.gov/eere/bioenergy/waste-energy>

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- Novel process technologies that leverage existing first generation biorefinery assets and infrastructure.

Subtopic Area 1c: Scale-up: Demonstration for Biofuels and Bioproducts

This potential subtopic area may seek applications proposing project definition, development, and execution plans for the scaling of pilot biofuel and bioproduct technologies to demonstration scale including for:

- The manufacture of sustainable aviation and marine fuels
- CO₂ conversion, Waste-to-Energy² or novel carbon conversion technologies
- Novel process technologies that leverage existing first generation biorefinery assets and infrastructure.

Topic Area 2: Affordable, Clean Cellulosic Sugars for High Yield Conversion

Biofuels produced from lignocellulosic biomass feedstocks can deliver significantly lower lifecycle greenhouse gas emissions than commercial starch-based sugars. However, it is much more challenging to produce an intermediate sugar from these feedstocks that is cheap enough and of sufficient quality to support a commercial conversion process. The potential topic area would aim to lower the price of cellulosic sugars and de-risk their use by downstream partners through increased availability and performance. It is designed to attract companies that produce and seek to sell cellulosic sugars. These technologies could include a variety of low severity pretreatment processes, detoxification/impurity removal technologies, amongst others. The topic area also may include funding for downstream partners that are critical to evaluating the quality and convertibility of these sugars. The potential topic area seeks a variety of downstream upgrading approaches (biological, chemical, and electrochemical catalysis) to gain a diverse understanding of the quality of these substrates.

Topic Area 3: Separations to Enable Biomass Conversion

Separations are energy-intensive and critical to the economics of a bioprocess, and can account for up to 50% of the cost of producing biomass-based chemicals and fuels. Due to the cost and energy intensity, separations can have a large impact on improving economic viability and the lifecycle greenhouse gas benefits for biofuel production. In a biorefinery, bioprocess separations isolate a specific component from a complex mixture and are a critical part of a bioprocess and are often overlooked during technology development. New bioprocesses introduce many variables that may prevent existing separations technologies from being readily deployed. Therefore, co-development of separations with up- and down-stream processes is

² <https://www.energy.gov/eere/bioenergy/waste-energy>

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key to the success of the overall bioprocess. The two (2) potential subtopic areas below aim to address the complexity and cost of bioprocess separations.

Subtopic Area 3a: Separations to Enable Biomass Conversion

This potential subtopic area seeks to develop efficient and cost-effective separations approaches to isolate and potentially upgrade organic acids and products of interest from digesters.

Subtopic Area 3b: Separations to Enable Biomass Conversion (Bioprocessing Separations Consortium)

This potential subtopic area seeks to improve availability of data that will support separations development, as well as to develop supporting technologies to improve bioprocessing separations. This potential subtopic area will provide funding for collaborative projects between an applicant and the Bioprocessing Separations Consortium to address critical bioprocess separations challenges. More information on the capabilities of the Bioprocessing Separations Consortium can be found at <https://www.bioesep.org/>.

Topic Area 4: Residential Wood Heaters

Wood is an abundant and renewable source of fuel for residential heat in the United States. Residential wood heaters are used in approximately 10% of U.S. households, with 2% using wood as a primary source of heat. Smoke emissions from residential wood heaters are a significant source of national air pollution and a health issue. These emissions contain fine particulate matter (PM) along with other pollutants including carbon monoxide (CO), volatile organic compounds (VOCs), toxic air pollutants (e.g., benzene and formaldehyde), and black carbon. Design and automation improvements of wood heaters can significantly reduce emissions and increase efficiency. This potential topic area will support the development and testing of low-emission, high efficiency residential wood heaters. Categories of residential wood heaters of interest include room heaters, hydronic central heaters, and forced air central heaters.

Topic Area 5: Renewable Natural Gas

Renewable natural gas (RNG) is rapidly emerging as a solution to simultaneously address local waste management problems and decarbonize energy sectors that rely on natural gas, such as residential heating or industrial applications. In the United States, several major utilities have committed to or have communicated renewable natural gas targets although several barriers

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around biogas upgrading and cleanup are still present. The two (2) potential subtopic areas below aim to aid the development of RNG technologies.

Subtopic Area 5a: Renewable Natural Gas (R&D)

This potential subtopic area is targeted at bench-scale research and development to produce RNG and specifically to develop new technologies for upgrading biogas and carbon dioxide/hydrogen to pipeline quality renewable natural gas.

Subtopic Area 5b: Renewable Natural Gas (Pilot Scale)

This potential subtopic seeks to advance the technology readiness of next generation biogas upgrading and RNG production technologies through piloting, integrated operations, and increased duration of continuous run-time.

EERE envisions awarding multiple financial assistance awards in the form of cooperative agreements. The estimated period of performance for each award will be approximately 12 - 60 months.

This Notice is issued so that interested parties are aware of EERE's intention to issue this FOA in the near term. All of the information contained in this Notice is subject to change. EERE will not respond to questions concerning this Notice. Once the FOA has been released, EERE will provide an avenue for potential Applicants to submit questions.

EERE plans to issue the FOA in Spring 2021 via the EERE Exchange website <https://eere-exchange.energy.gov/>. If Applicants wish to receive official notifications and information from EERE regarding this FOA, they should register in EERE Exchange. When the FOA is released, applications will be accepted only through EERE Exchange.

In anticipation of the FOA being released, Applicants are advised to complete the following steps, which are **required** for application submission:

- Register and create an account in EERE Exchange at <https://eere-exchange.energy.gov/>. This account will allow the user to register for any open EERE FOAs that are currently in EERE Exchange. It is recommended that each organization or business unit, whether acting as a team or a single entity, use only one account as the contact point for each submission.

Questions related to the registration process and use of the EERE Exchange website should be submitted to: EERE-ExchangeSupport@hq.doe.gov

- Obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number (including the plus 4 extension, if applicable) at <http://fedgov.dnb.com/webform>

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- Register with the System for Award Management (SAM) at <https://www.sam.gov>. Designating an Electronic Business Point of Contact (EBiz POC) and obtaining a special password called an MPIN are important steps in SAM registration. Please update your SAM registration annually.
- Register in FedConnect at <https://www.fedconnect.net/>. To create an organization account, your organization's SAM MPIN is required. For more information about the SAM MPIN or other registration requirements, review the FedConnect Ready, Set, Go! Guide at https://www.fedconnect.net/FedConnect/Marketing/Documents/FedConnect_Ready_Set_Go.pdf
- Register in Grants.gov to receive automatic updates when Amendments to a FOA are posted. However, please note that applications will not be accepted through Grants.gov. <http://www.grants.gov/>. All applications must be submitted through EERE Exchange.

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