Department of Energy (DOE)
Office of Energy Efficiency and Renewable Energy (EERE)

BioEnergy Engineering for Products Synthesis (BEEPS)

Funding Opportunity Announcement (FOA) Number: DE-FOA-0001916
FOA Type: Initial
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FOA Issue Date:	5/3/2018
Submission Deadline for Letter of Intent:	5/30/2018 5:00pm ET
Informational Webinar:	5/15/2018
Submission Deadline for Full Applications:	6/27/2018 5:00pm ET
Expected Submission Deadline for Replies to Reviewer Comments:	8/3/2018 5:00pm ET
Expected Date for EERE Selection Notifications:	August 2018
Expected Timeframe for Award Negotiations	September 2018

- Applicants must submit a Letter of Intent by 5:00pm ET the due date listed above to be eligible to submit a Full Application.

- To apply to this FOA, applicants must register with and submit application materials through EERE Exchange at https://eere-Exchange.energy.gov, EERE's online application portal.

- Applicants must designate primary and backup points-of-contact in EERE Exchange with whom EERE will communicate to conduct award negotiations. If an application is selected for award negotiations, it is not a commitment to issue an award. It is imperative that the applicant/selectee be responsive during award negotiations and meet negotiation deadlines. Failure to do so may result in cancelation of further award negotiations and rescission of the Selection.

- **Applicants must be registered in the System for Award Management (SAM) at https://www.sam.gov before submitting an application and must provide a valid Dun and Bradstreet Universal Numbering System (DUNS) number in the application. Failure to comply may result in a determination that the applicant is not qualified to receive a Federal award, and that determination could be used as a basis for making a Federal award to another applicant.**

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I. Funding Opportunity Description

A. Description/Background

The U.S. Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy (EERE) announces a notice of availability of funds for financial assistance addressing the development of technologies able to contribute to the production of price-competitive biofuels and bioproducts. These technologies will aid in the reduction of dependence on foreign oil, provide price-competitive fuels, spur domestic job growth, and lead to a thriving bioeconomy.

The mission of EERE's Bioenergy Technologies Office (BETO) is to research and develop the optimal transformation of biomass resources into high performance biofuels, bioproducts, and biopower supported through public and private partnerships. Under the statutory authority of the Energy Policy Act (EPAct) 2005, § 932(c), DOE is encouraged to partner with industry and institutions of higher education to conduct research and development (R&D) in advanced biotechnological processes capable of increasing energy production from domestic lignocellulosic feedstocks, with emphasis on reducing the dependence of industry on imported fossil fuels in U.S. manufacturing facilities, and other advanced processes that will enable the development of price-effective advanced biofuels and coproducts.

One of BETO's goals is to fund R&D for pathways capable of producing renewable hydrocarbon fuels at a modeled mature price of $3/gallon gasoline equivalent (GGE) from lignocellulosic biomass or other waste feedstocks by 2022. Various strategies have been identified to accomplish this goal as outlined in BETO's Multi-Year Program Plan (MYPP)[1]. BETO has identified gaps in current R&D which hinder development of these promising technologies. This FOA seeks to address some of these gaps including better utilizing waste streams (e.g. lignin, CO_2, and biosolids), improving organic and inorganic catalysts to increase conversion efficiency and decrease costs, and creating high-value performance-advantaged bioproducts to enable more economic biorefineries.

This funding opportunity contains six Topic Areas as follows:

- Topic Area 1: ChemCatBio Industrial Partnerships (CCB)
- Topic Area 2: Agile BioFoundry Industry Partnership Initiative (ABF)
- Topic Area 3: Performance Advantaged Bioproducts (PABP)
- Topic Area 4: Biofuels and Bioproducts from Wet Organic Waste Streams (WWTE)
- Topic Area 5: Rewiring Carbon Utilization (Rewiring)
- Topic Area 6: Lignin Valorization (Lignin)

[1] https://www.energy.gov/sites/prod/files/2016/07/f33/mypp_march2016.pdf

Each topic area contains different specific areas of interest, required descriptions, and metrics. Each also has different feedstock requirements which are outlined in Appendix D.

All work under EERE funding agreements must be performed in the United States. See Section IV.I.iii. and Appendix B.

B. Topic Areas/Technical Areas of Interest

Guidance Applicable to All Topic Areas:

Products of particular interest vary by topic area, but fuels with potential as jet or diesel replacements as well as fuels identified by DOE's Co-Optimization of Fuels and Engines (Co-Optima) consortium[2] are of particular interest. Co-Optima seeks to identify potentially transformative fuel and engine combinations which can improve energy efficiency, minimize environmental impact, and accelerate widespread adoption of innovative combustion strategies. A list of final products which are not allowable under this FOA can be found in Section I.C.

Applicants must provide a baseline discussion of sustainability, life cycle assessment (LCA) and techno-economic analyses (TEA) for the applicant's proposed research. Projects proposing systems that are not sustainable (excessive freshwater, unit operations, etc.) and/or are not economical when scaled for commercial operations will not be considered. Applicants must plan for performing ongoing TEA and LCA throughout the project in order to ensure that the most impactful areas for R&D in an applicant's pathway are addressed.

Applications submitted under any of the Topic Areas must present a strong and convincing technology development strategy, including a feasible pathway to transition the program results to the next logical stage of R&D and/or directly into commercial demonstration. Applications must meet this requirement by providing a baseline for their current state of technology by providing the information set forth in the applicable Technical and Economic Tables Template, found in Appendix E, as well as intermediate and final technical and economic target metrics to be met with the proposed Workplan. In addition, all projects will be subject to verification by a third party as described in Section I.D of the FOA.

All applications must utilize approved feedstocks for their topic area as outlined in Table 1. Definitions of each feedstock for the purposes of this FOA can be found in Appendix D.

[2] Farrell, John, John Holladay, and Robert Wagner. "Fuel Blendstocks with the Potential to Optimize Future Gasoline Engine Performance: Identification of Five Chemical Families for Detailed Evaluation." Technical Report. U.S. Department of Energy, Washington, DC. 2018. DOE/GO-102018-4970.

	Biomass Feedstocks or Biomass Intermediates	Biogas	Lignin	Carbon Dioxide/Flue Gas	Post-sorted MSW	Wet Waste
Topic Area 1: CCB	Allowed	Allowed	Allowed	Allowed	Allowed	Allowed
Topic Area 2: ABF	Allowed	Allowed	Allowed	Allowed	Allowed	
Topic Area 3: PABP	Allowed	Allowed	Allowed	Allowed	Allowed	Allowed
Topic Area 4: WWTE					Allowed	Allowed
Topic Area 5: Rewiring		Allowed		Allowed		
Topic Area 6: Lignin			Allowed			

Table 1: Allowable Feedstocks

i. Topic Area 1: ChemCatBio Industrial Partnerships

Virtually all technology pathways that convert biomass into a hydrocarbon fuel require a catalytic process. The high costs associated with these processes are one of several issues that plague the commercial viability of biofuels and bioproducts. Catalysts for bioenergy applications need to be inexpensive, robust, and not susceptible to poisoning by the multiple impurities found in biomass and intermediates, such as sulfur, nitrogen, alkali metals, etc. Catalysis solutions from conventional processes do not always translate to bioenergy applications due to the high oxygen and moisture content of biomass feedstocks. Other pervasive challenges in catalysis for bioenergy include: developing catalysts with longer lifetimes, minimizing biogenic carbon loss to coke and aqueous waste streams, increasing fuel and product yield, and controlling product selectivity and branching.

The Chemical Catalysis for Bioenergy (ChemCatBio) consortium is a DOE National Laboratory-led research and development consortium dedicated to identifying and overcoming catalysis challenges for biomass conversion processes. ChemCatBio features a network of capabilities in catalyst synthesis, characterization, and evaluation. More information can be found at ChemCatBio.org. A catalog of ChemCatBio capabilities can be found at https://www.chemcatbio.org/capabilities.html. The ChemCatBio consortium National Laboratories are: National Renewable Energy Laboratory, Pacific Northwest National Laboratory, Argonne National Laboratory, Oak Ridge National Laboratory, Sandia National Laboratory, Idaho National Laboratory, and Los Alamos National Laboratory. To find

appropriate ChemCatBio partners, visit the contact page https://www.chemcatbio.org/contacts.html.

Topic Area 1 will provide funding for collaborative projects between an applicant and ChemCatBio aimed at tackling fundamental challenges in catalysis for bioenergy. The preferred mechanism for collaboration with ChemCatBio is to utilize the ChemCatBio Cooperative Research and Development Agreement (CRADA) though other mechanisms authorized under the National Labs M&O contract are acceptable subject to DOE approval. For more information about the CRADA, please inquire using the contact page located at: https://www.chemcatbio.org/contacts.html. Applicants must have a National Laboratory partner that is currently part of ChemCatBio, and clearly articulate which ChemCatBio capabilities they propose to use. ChemCatBio National Laboratory partners can make up no more than 49% of the proposed work budget. DOE/NNSA Federally Funded Research and Development Centers (FFRDCs) are eligible to apply for funding as a Subrecipient, but are not eligible to apply as a Prime Recipient. This topic area will focus specifically on challenges which are precompetitive in nature and not reasonably addressed in the private sector.

Applications are invited that address early stage R&D challenges that are best addressed with the resources (equipment and personnel) based within the ChemCatBio consortium.

Specific areas of interest include, but are not limited to:

- Bioenergy catalyst characterization including catalyst post-mortem analysis;
- Catalyst development for biomass conversion processes;
- Identification and characterization of biomass-derived contaminants and catalyst poisons and development of catalysts that are tolerant of those contaminants;
- Development or improvement of catalytic processes for converting biomass to biofuels and bioproducts
- R&D for producing engineering-relevant/technical catalysts from vetted bench scale catalysts for bioenergy applications.

Topic Area specific requirements:

- Clearly uses an acceptable biomass feedstock (See Appendix D); the proposed work can focus on a catalytic transformation of a biomass-derived intermediate but the source of that intermediate must be clearly articulated;
- Utilizes the unique capabilities of the ChemCatBio consortium;
- Accelerates the catalyst and process development cycle;
- Develops a catalyst or catalytic process that is relevant to industry. Applicants must include justification for how the proposed project will increase the commercial relevance of an existing process, or allow the applicant to expand into a new area of interest;

- Results in a significant (≥ 15%) techno-economic improvement over the current state of the art.

Applications specifically not of interest are:

- Those identified in Section I.C of the FOA.
- Catalysts or catalytic processes that are only tangentially related to bioenergy (e.g. development of a new catalyst synthesis technique that does not specifically address challenges unique to bioenergy transformations would not be of interest);
- Processes that will not be economical when scaled to industrially relevant size;

Metric: Applicants must indicate how the proposed work will advance the state of technology in catalytic processes for producing biofuels and/or bioproducts. The applicant must show how the proposed work will result in improvements in catalyst activity, selectivity, lifetime and/or precursor material (e.g. a catalyst characterization study could be used to indicate that a platinum group metal can be replaced with a non-precious metal). As stated above, applicants must indicate how the proposed work will result in a significant (≥ 15%) techno-economic improvement over the current state-of-the-art.

ii. Topic Area 2: Agile BioFoundry Industrial Partnership Initiative

Using current biomanufacturing practices, bringing a new biologically-produced molecule to market can cost more than $150 million dollars and take more than ten years. Decreasing the development cost and time for new bioproducts will enhance the bioeconomy and enable the cost-competitive production of biofuels from lignocellulosic biomass. To decrease this time and cost, new biomanufacturing techniques and hosts are needed, that have improved industrial properties.

The Agile BioFoundry is focused on developing and uniting tools, technologies, software, and instrumentation across the DOE National Laboratory system for the robust and predictive engineering of biology for the production of biofuels and renewable chemicals from domestic, non-food lignocellulosic biomass. Central to this effort is developing robust host organisms and new microbiology techniques, in conjunction with databases and machine learning methods to enable better, automated design of bioprocesses with predictable performance and scaling, as well as significantly increased conversion efficiency. These efforts are incorporated into a Design-Build-Test-Learn (DBTL) methodology to enable faster, and more efficient bioproduct development cycles. More information on the Agile BioFoundry can be found at https://agilebiofoundry.org/. Development of an improved DBTL cycle including the development of superior hosts and techniques will enable a new biofuel and/or bioproduct to be brought to market in half the time and cost of traditional bioengineering while significantly increasing the conversion efficiency which will lead to economic viability.

Topic Area 2 will provide funding for collaborative projects between an applicant and the Agile BioFoundry to address critical biomanufacturing challenges. The applicant must clearly articulate which Agile BioFoundry National Laboratories partners they plan to work with and capabilities that they plan to use. More information on the capabilities of the Agile BioFoundry can be found at https://agilebiofoundry.org/home/about/capabilities/. The preferred mechanism for collaboration with the Agile BioFoundry is to use the Agile BioFoundry Cooperative Research and Development Agreement (CRADA) though other mechanisms authorized under the National Labs M&O contract are acceptable subject to DOE approval. For more information about the partnership agreements, please visit https://agilebiofoundry.org/work-with-us. The partner laboratories in the Agile BioFoundry consortium are: Lawrence Berkeley National Laboratory, National Renewable Energy Laboratory, Pacific Northwest National Laboratory, Sandia National Laboratory, Oak Ridge National Laboratory, Los Alamos National Laboratory, Argonne National Laboratory, and Idaho National Laboratory. The National Laboratory partners can make up no more than 49% of the proposed work budget. DOE/NNSA Federally Funded Research and Development Centers (FFRDCs) are eligible to apply for funding as a Subrecipient, but are not eligible to apply as a Prime Recipient. This Topic Area will focus specifically on challenges which are precompetitive in nature and not reasonably addressed in the private sector.

Applications are invited that address early stage R&D challenges that are best addressed with the resources (equipment and personnel) based within the Agile BioFoundry consortium.

Specific areas of interest include, but are not limited to:

- Development of non-model host organisms with industrially-relevant production advantages (low-pH, high flux to a metabolic node, utilization of a broad substrate scope, robustness, etc.) over *E. coli* and *S. cerevisiae* for a target molecule or class of molecules;
- De-bottlenecking of biosynthetic pathways to take a target molecule from mg/L to tens (10's) of g/L, increase productivity, and increase yield;
- Projects which produce data sets that will enable Agile BioFoundry's Learn methodologies, which seek to use machine learning and other approaches to improve subsequent rounds of design.

Topic Area specific requirements:

- Clearly uses an acceptable biomass feedstock (see Appendix D);
- Utilizes the unique capabilities of the Agile BioFoundry consortium;
- Accelerates the biomanufacturing cycle;

- Develops an industrially-relevant bioprocess (applicants must include justification for how the proposed project will increase the commercial relevance of an existing process, or allow the applicant to expand into a new area of interest);
- Performs verification and milestone testing in process relevant conditions (e.g. bioreactors versus shakeflasks).

Applications specifically not of interest are:

- Those identified in Section I.C of the FOA.
- Processes targeting small, niche, fine chemical markets, pharmaceutical markets, or nutraceutical markets;
- Processes that will not be economical when scaled to industrially relevant size;

Metric: By the end of the project period, all projects will be required to demonstrate titers exceeding 20 g/L of product using cellulosic sugars or other biomass derived intermediates as a feedstock.

iii. Topic Area 3: Performance Advantaged Bioproducts

The Bioenergy Technologies Office (BETO) at DOE invests in R&D for developing bio-derived products ("bioproducts") that have similar functions to petroleum-derived products, such as fuels and chemicals. Domestically produced bioproducts have several desirable qualities: they are made from American renewable, sustainable, resources while supporting the U.S. agricultural and bioprocessing industries; they can be manufactured in the U.S. to reduce imports and increase exports while stimulating U.S. economic growth; they can be synthesized with a reduced environmental impact; and they can be designed to be easily recyclable and non-toxic.

Due to the vast structural differences between petroleum-derived and bio-derived feedstocks, bioproducts also provide a platform to incorporate novel properties into existing materials, providing new opportunities across the supply chain. Many manufacturers have an interest in introducing renewable, safe, price-competitive compounds with highly desirable chemical properties to existing applications, and many end users are interested in chemicals that would provide improved or new performance attributes. While the search for existing petrochemical replacements that have enhanced functionality has yielded few new opportunities in recent years, novel bio-based alternatives remain largely unexplored.

The relationship between a bioproduct and a petroleum-derived product can be categorized one of three ways: bioproducts can be 1) *direct replacements* (i.e. the bio-derived product and the petroleum-derived product are chemically identical, also known as "drop-in"

replacements); 2) *functional replacements* (i.e. the bio-derived product and petroleum-derived product are different chemically, but they have similar functions/properties), or 3) *novel products* (i.e. the bio-derived product does not resemble an existing petroleum-derived product in structure or function.) Performance advantaged biobased products are bioproducts that do not resemble an existing commercial petroleum-derived product with functions that offer a performance advantage over existing products.

It is difficult to identify promising performance advantaged biobased products because of limited available data linking chemical structure to functionality and performance for many biobased compounds. As such, applications of interest must focus on: a) identifying structures of novel biobased compounds and testing for their performance, b) identifying performance attributes that could be addressed with biobased compounds, or c) addressing both issues simultaneously. Applications are invited for early stage applied R&D for identifying and producing performance advantaged biobased products.

Under this Topic Area, the DOE seeks applications in two **specific areas of interest:**

- Topic 3a: Performance Advantaged Bioproduct Identification (TRL 2): Areas of interest for bioproduct identification include, but are not limited to:
    - elucidating structure-function relationships for novel biobased compounds by using computational methods and/or high-throughput screening
    - identifying and publishing performance attributes unique to biobased compounds along with example compounds that display those attributes
- Topic 3b: Performance Advantaged Bioproduct Production (TRL 2-3): Areas of interest for bioproduct identification include but are not limited to:
    - producing and testing novel performance advantaged bioproducts

Topic Area specific requirements:

- Clearly uses an acceptable biomass feedstock (see Appendix D);
- Results in the identification or production of bioproducts fitting into one of the following categories: polymers, including biopolymers and polymers from novel monomers; small molecules like plasticizers, solvents, surfactants, preservatives; and other building block chemicals.

Applications specifically not of interest are:

- Those identified in Section I.C of the FOA;
- Processes targeting small, niche, fine chemical markets, pharmaceutical markets, or nutraceutical markets.

Metric:

- **Topic 3a. Performance Advantaged Bioproduct Identification:** If a proposal focuses on screening compounds, the applicant must commit to identifying at least 5 new

performance advantaged bioproducts. By the end of the project ≥ 5 novel bio-based compounds will be identified that improve performance metrics (e.g., thermal and mechanical properties, barrier properties, rheological and physiochemical properties, and composite manufacturability) over the incumbent product by >10%. Projects must include a justification for the potential market relevance of the products that are identified. A comparison of the metrics between the identified products and the incumbent products as well as any additional relevant characterization data must be made publically available.

- **Topic 3b. Performance Advantaged Bioproduct Production:** If a proposal focuses on producing a performance advantaged bioproduct, applicants must commit to substantially improving one or more performance metrics (e.g., thermal and mechanical properties, barrier properties, rheological and physiochemical properties, and composite manufacturability) over the incumbent product by >10%. Projects must include a justification for the potential market relevance of the products that are identified.

iv. Topic Area 4: Biofuels and Bioproducts from Wet Organic Waste Streams

Wet organic waste streams represent valuable potential feedstocks for the bioeconomy. They include, but are not limited to, municipal sludges and biosolids, industrial, commercial, and residential food wastes, manure slurries, fats, oils, and greases, byproducts from ethanol production, and other feedstocks not suitable for food or feed uses. These feedstocks often present a disposal problem for municipalities and similar responsible parties. Further, in many cases, they are already being collected, and in some cases separated, as part of existing waste management practices. While some of the available energy is currently being captured, a significant amount remains untapped[3,4]. These resources thus offer potential opportunity for conversion into biofuels, bioproducts, and biopower.

However, these feedstocks are not produced at the scale of traditional petroleum refineries. Further, given their high moisture content, long-distance transportation is rarely economically viable. This implies the need for conversion strategies that are techno-economically feasible at

[3] EPA. Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2012, 2013. Available at: http://www.epa.gov/waste/nonhaz/municipal/pubs/2012_msw_fs.pdf, Accessed on 11/26, 2014.

[4] Shen, Y, Linville, JL, Urgun-Demirtas, M, Mintz, MM and Snyder, SW. An overview of biogas production and utilization at full-scale wastewater treatment plants (WWTPs) in the United States: Challenges and opportunities towards energy-neutral WWTPs. Renewable & Sustainable Energy Reviews, 2015; 50:346-362.

scales that match the available feedstock volumes[5,6]. While traditional anaerobic digestion is a proven technology, the required capital expense presents challenges at scales smaller than 5 dry tons/day[7]. Thus, there is a practical need for novel alternatives to anaerobic digestion that have the potential to compete economically with feeds of one dry ton/day or less. Novel solutions must compete with existing practices[8,9], therefore, applications must illustrate awareness of their competitive position with respect to incumbent technologies and waste management practices.

Under this Topic Area, DOE seeks applications in two **specific areas of interest**:

- Anaerobic processes economically suitable for operation at scales at or below 1 dry ton of feedstocks per day, roughly equivalent to 1 million gallons/day of municipal wastewater. These volumes have not proven profitable for traditional forms of anaerobic digestion and this topic aims to enhance the viability of smaller-scale operations.
- Alternatives to traditional anaerobic digestion with potential for direct production of higher value products than biogas from wet waste feedstocks. Emphasis will be placed on processes that minimize the need for both drying and transportation of wet materials, have the potential to either reduce disposal costs or meet local organics diversion requirements, and are economically competitive with existing practices.

Topic Area specific requirements:

- Clearly uses an acceptable biomass feedstock (see Appendix D). Note, applicants to this topic area must use a waste stream as defined in Appendix D for the baseline, intermediate, and final verifications;
- Proposed systems must utilize wet organic waste streams (or blends thereof) as the primary feedstock (at least 90% dry weight) to produce fuels, or fuel and product mixtures. Proposed projects should employ actual (rather than model or synthetic) waste streams as feedstocks. Yellow grease to produce biodiesel is also excluded, as that is a commercial technology. Brown grease, however, is an acceptable feedstock;

[5] DOE. Biofuels and Bioproducts from Wet and Gaseous Waste Streams: Challenges and Opportunities. Washington, DC: DOE, 2017. 147 p.

[6] Jenks, C. Chemical Conversion via Modular Manufacturing: Distributed, Stranded, and Waste Feedstocks, 2015. Available at: https://www.ameslab.gov/workshops/chemical-conversion-modular-manufacturing, Accessed on April 25, 2016.

[7] WERF. Utilities of the Future Energy Findings, (Water Environment Research Foundation, Alexandria, VA, 2014), pp. 86.

[8] Smith, AL, Stadler, LB, Cao, L, Love, NG, Raskin, L and Skerlos, SJ. Navigating Wastewater Energy Recovery Strategies: A Life Cycle Comparison of Anaerobic Membrane Bioreactor and Conventional Treatment Systems with Anaerobic Digestion. Environmental Science & Technology, 2014; 48(10):5972-5981.

[9] Puyol, D, Batstone, D, Hulsen, T, Astals, S, Peces, M and Kromer, JO. Resource Recovery from Wastewater by Biological Technologies: Opportunities, Challenges, and Prospects. Frontiers in Microbiology, 2017; 7.

- Successful applications will propose to develop and run systems at a relevant scale (e.g., 5–50 L reactor volume).

Applications specifically not of interest are:

- Those identified in Section I.C of the FOA.

Metric: Applications must demonstrate the potential for a minimum 25% reduction in the net levelized cost of disposal resulting from the technology developed during the project using techno-economic analysis. For the purposes of this FOA, the levelized cost of disposal refers to the cost to dispose of, in units of $/wet ton, of any remaining waste material. *Please note that this is a discounted equation, akin to that of levelized costs of energy.* Net levelized cost of disposal (nLCOD) is defined with the equation below:

$$nLCOD = \frac{Total\ Life\ Cycle\ Costs}{Waste\ (Discounted)} = \frac{\sum_{t=1}^{N} \frac{Capex + Opex + Disposal\ Cost - CoProduct\ Revenue}{(1+i)^t}}{\sum_{t=1}^{N} \frac{Waste\ Generated}{(1+i)^t}} = \frac{\$}{wet\ ton}$$

- Applications must include baseline calculations for the *current* levelized cost of disposal for the proposed technological system.
  - Capex must include all capital costs (using straight line depreciation) with the proposed process including but not limited to any handling equipment, conversion operations, separations processes, and fuels, products, or combustion systems. Capex should not include existing infrastructure (e.g. the wastewater treatment system that is producing the waste)
  - Opex must include all operating costs including but not limited to utilities, chemicals, and disposal of byproducts.
  - Disposal cost must include the cost of disposing any remaining wet waste feedstocks including but not limited to short term storage, long term storage, drying, dewatering, , incineration, transportation, and any tipping fees that must be paid to dispose of the material. For example, if a process receives 5 tons of waste (per unit time), converts 4 tons of that waste, the disposal cost here should be for the remaining 1 ton of material that must be disposed.
  - CoProduct Revenue must include any coproduct credits resulting from the waste converted by the proposed technology. In the above example, the coproduct credit should be any revenues from the 4 tons of waste that was converted. Note that if the CoProduct Revenue is sufficiently large, the nLCOD may be negative.
  - Waste Generated must be the total amount of waste processed. In the above example, this would be 5 tons of waste per unit time.
  - In all of the above calculations, applicants must use the ultimate system design size for the estimations. The LCOD tab in the verification table includes a template for the above calculations. The assumptions used in the above calculation will be reviewed as part of the application review process and during the initial verification (see Appendix E).

v. Topic Area 5: Rewiring Carbon Utilization:

Carbon is the backbone of the United States economy as the major component of most fuels and materials in the market. During the process of converting or combusting carbon feedstocks, there are inefficiencies that generally represent themselves as carbon lost as carbon dioxide (CO_2). This waste carbon source resulted in around 5 gigatons of emissions in 2016 from the transportation, industrial, and electricity sector[10]. Though this represents a large supply of potential feedstock and commercial-scale carbon capture has enjoyed recent success, a major barrier to its utilization is the low energy content of CO_2, making it relatively difficult to convert to fuels and products. Even the most robust photosynthetic biological systems are relatively inefficient and slow at utilizing CO_2[11,12]; however, once reduced, biological systems can much more easily manipulate simple organic molecules to synthesize more valuable products.

On the other hand, various catalytic methods have been shown to reduce CO_2 to single-carbon intermediates with greater energy efficiency than photosynthesis[13]. The continued deployment of inexpensive energy sources could cause electricity to become more plentiful and inexpensive in the near future, thus enabling catalytic approaches to CO_2 reduction to make sense from a techno-economic and lifecycle assessment standpoint. However, the increasing energy requirements for generating multi-carbon compounds via catalysis makes this approach less appealing for forming more complex carbon products.

Topic Area 5 will provide funding for applications that combine the two approaches above and leverage non-biological carbon dioxide utilization technologies which efficiently generate reduced carbon intermediates and biological systems which can use that intermediate to generate a final product. This opportunity seeks to "rewire" carbon conversion by using electricity to transform waste CO_2 into intermediates and subsequently to biofuels and bioproducts through non-photosynthetic biological system engineering.

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[10] https://www.eia.gov/environment/emissions/ghg_report/ghg_carbon.php

[11] Blankenship, RE; Tiede, DM; Barber, J; Brudvig, GW, Fleming, G. et al. Comparing Photosynthetic and Photovoltaic Efficiencies and Recognizing the Potential for Improvement. *Science*. 2011. p. 805-809. DOI: 10.1126/science.1200165

[12] Zhu, X-G; Long, SP; Ort, DR. What is the maximum efficiency with which photosynthesis can convert solar energy into biomass? *Current Opinion in Biotechnology* Vol. 19 (2) April 2008. P. 153-159. DOI:10.1016/j.copbio.2008.02.004

[13] Bushuyev, OS; De Luna, P; Dinh, CT; Saur, G. et al. What Should We Make with CO2 and How Can We Make It? Joule *in press.* DOI: https://doi.org/10.1016/j.joule.2017.09.003

Specific areas of interest include:

- Cooperation between entities with previously proven experience in either innovative non-biological CO_2 reduction or biological upgrading of carbon intermediates is specifically encouraged;
- Applications targeting tractable carbon intermediates generated from CO_2 which may include (but are not limited to): formic acid, methanol, carbon monoxide and methane;
- Applications that will lead to an integrated system by the end of the project are encouraged.

Applications specifically not of interest are:

- Those identified in Section I.C of the FOA.
- Photosynthetic biological processes.

Topic Area specific requirements:

- Applications must explain the thermodynamic and carbon efficiency of any proposed process as well as the techno-economic and lifecycle assessment implications of the technology and the final product;
- Addresses issues of system scalability and robustness;
- CO_2 feedstock streams used for this work can be synthetically derived (i.e. not from point sources), but applications that propose to use real waste gases from a point emitter of CO_2 by the end of the project are encouraged. For more detail on acceptable feedstocks refer to Appendix D;
- Both the proposed CO_2 reduction technique (e.g. thermocatalytic, electrocatalytic etc.) used to generate an intermediate as well as the non-photosynthetic biological upgrading approach to generating the target biofuel or bioproducts;
- How the proposed technology would change the lifecycle assessment and techno-economic analysis of the target biofuel or bioproduct in comparison to the current commercial process. Recipients will be required to produce a detailed TEA and LCA by the end of the project.

Metric: BETO has a goal of meeting the 2022 modeled price target of $3/gallon gasoline equivalent (GGE) for the production of renewable hydrocarbon fuels from lignocellulosic biomass. To assist with that goal, applications must be able to achieve a 20% increase in the carbon efficiency of the 2014 *Dilute-Acid and Enzymatic Deconstruction of Biomass to Sugars and Biological Conversion of Sugars to Hydrocarbons Process Design Case*[14] through utilization of the fermentation CO_2 stream. Thus, applicants must indicate how, by the end of the project, the proposed CO_2 utilization process achieves a 37% conversion efficiency of an input CO_2 stream to fuel or product.

[14] https://www.nrel.gov/docs/fy14osti/60223.pdf

vi. Topic Area 6: Lignin Valorization

Lignin constitutes 15-40% of biomass carbon but it is currently considered a waste-stream in biorefineries, generally burned for heat and power. Techno-economic modeling suggests that for current biochemical routes to hydrocarbon fuels to be economically viable, lignin must be transformed into a higher-value co-product stream that is able to reduce effective fuel cost by $1 - $2 per gasoline gallon equivalent. Given BETO's focus on large commodity markets for co-products, NREL analysis suggests that 40-60% of the carbon in a lignin-rich stream will need to be converted into value-added products in a biochemical conversion process to achieve this reduction in fuel cost[15]. This implies a >50% lignin to product conversion as some carbon is lost to cell growth and respiration in the case of biological upgrading. Therefore, this Topic Area seeks new and innovative approaches to efficiently utilize lignin to address this R&D gap.

Specific areas of interest include, but are not limited to:

- Solubilization of lignin into tractable mixtures which can be biologically or catalytically upgraded;
- Deconstruction of polymeric lignin to defined sets of <10 monomers as the major products which can be separated or upgraded;
- Upgrading of deconstructed lignin to fuels and/or chemicals;
- Utilization of polymeric or partially deconstructed lignin for higher-value product applications.

Topic Area specific requirements:

- Clearly uses an acceptable biomass feedstock (see Appendix D);
- Improves on the status quo of burning lignin for heat and power;
- Develops an industrially-relevant bioprocess. Applicants must include justification for how the proposed project will increase the commercial relevance of an existing process, or allow the applicant to expand into a new area of interest.

Applications specifically not of interest are:

- Those identified in Section I.C of the FOA.

Metric: By the end of the project, processes to utilize >50% of the lignin carbon contained in a real deconstructed lignin stream must be developed.

[15] https://www.energy.gov/sites/prod/files/2017/05/f34/Biochemical%20Platform%20Analysis%20Project_0.pdf

C. Applications Specifically Not of Interest Under any Topic Area

In addition to applications identified as not of interest under each Topic Area, the following types of applications will be deemed nonresponsive and will not be reviewed or considered under any Topic Area (See Section III.D of the FOA):

- Technical:
  - Applications for proposed technologies that are not based on sound scientific principles (e.g., violates the laws of thermodynamics).
  - Applications that fall outside the technical parameters specified in Sections I.A and I.B of the FOA.
  - Applications that fail to include the appropriate data as outlined in the Technical and Economic Tables Template (Appendix E).
- Feedstock:
  - Applications that do not use an acceptable feedstock as defined in Appendix D.
  - Applications that propose the use food or feed carbohydrates, lipids, or proteins (e.g. maize or wheat dextrose, beet sucrose, sugar cane or grain sorghum syrup, soybean oil or meal), and/or derivatives (e.g. amino acids from maize dextrose, glycerol from the transesterification of soybean oil).
  - Applications that propose the production of biodiesel produced from transesterification or hydrotreating or hydrocracking of agronomic, natural plant oils (e.g., soybeans, palm, coconut, safflower, castor).
  - Applications that propose the use of pure sugar feeds and/or 'model' intermediate feeds such as avicel, cane and starch sugar or model lignin compounds and mixtures for their final process with the exception of Topic Area 4. Note that using model compounds in portions of the project is acceptable as long as acceptable feedstocks (as defined by Appendix D) are used to achieve project metrics and goals.
- Products:
  - Applications that propose hydrogen, ethanol, methane, biogas, syngas, dimethyl ether, and methanol as end products. Note, that while these are not acceptable as end products they are acceptable as intermediates, if the proposal is clear how the intermediates will be incorporated into processes to produce biofuels or bioproduct precursors by project completion.
- Algae:

- Applications that propose mixotrophic algae cultivation strategies that utilize food-based sugars (i.e., derived from food-based crops including but not limited to corn, beets, sorghum, and sugar cane).
- Applications that propose to develop technology for the artificial lighting-based cultivation of algae for energy products (other than as an enabling tool for high throughput laboratory-based screening).

D. Verification Requirements

Applications submitted under all of the Topic Areas for this FOA are required to participate in a verification process led by the National Renewable Energy Laboratory (NREL) and/or external third-party non-conflicted personnel performing the verifications (BETO's verification team). The scientists at NREL leading this effort are firewalled from the rest of the laboratory and the data provided will be protected under the applicable conflict of interest policies. This verification process provides technical assistance to both the funding agency and the project by providing an in-depth analysis of key technical and economic metrics to ensure transparency and increase the likelihood of project success.

The objectives of the verification effort are to:

- Verify the applicant's technical data/performance metrics/targets as described in the original application.
- Establish a framework to evaluate and track progress over time.
- Update the data in the Technical and Economic Tables Template (described below) to specifically match the project scope.
- Establish benchmark/baseline and associated target values.
- Identify potential major showstoppers.
- Align project goals with BETO's expectations.

There are typically three verification periods throughout the lifetime of the project; the "Initial Verification" conducted at the beginning of the project (months 0-3), the "Intermediate Verification," conducted in the middle of the project (~18 months), and the "Final Verification," conducted at the end of the project (within 3 months of closeout). The verification team will perform some or all of these verifications at the recipient's facility to verify the data included in the Technical and Financial tables attached to this FOA (Appendix E, described in more detail below). The specific objectives of these verifications are:

- The initial verification is to confirm the benchmark data and assumptions provided in the application, which will establish the baseline against which future performance and cost improvements will be evaluated. A go/no-go decision is made after this verification based on the data is verified.

- The intermediate verification will be conducted prior to a go/no-go or stage gate review of the project to assess progress relative to the intermediate performance and cost targets. A go/no-go decision is made after this verification based on the data is verified.
- A third (final) verification visit will be scheduled if a successful go or stage gate result was achieved after the intermediate verification. The objective of this final verification is to assess whether the final targets were achieved and document the challenges overcome as well as the technical or economic challenges that remain.

Technical and Financial tables:

The Technical and Economic Tables Template included with the FOA (Appendix E) was designed to guide applicants in providing information to assess the technical and financial status of the technology being developed within the selected project. The spreadsheet form is available on EERE Exchange at https://eere-Exchange.energy.gov/. Specific instructions on how to fill out these tables are provided in Appendix E. Examples regarding the adaptation of these parameters will be included with the tables. Applicants are required to submit the information in the tables at the time of application, as it will be reviewed during the merit review. **Applications submitted without the appropriate technical and economic data as defined in the template tables provided will be excluded from review under this FOA**. In addition, the data provided will be used as the basis for review and discussion during the initial verification and will be considered the project's baseline. As such, it is expected that the project will be able to reproduce this data when/if the verification team travels to the site to perform the verification. It is expected that the data will have been experimentally produced by the applicant in the applicant's facilities. However, if literature data needs to be used for parts of the process, those metrics that are based on literature data should be marked appropriately. Please refer to the excel template for more detailed instructions on how to fill out the table adequately.

Verification Timeline:

The initial verification period, including on-site observation of experiments (if applicable) and report creation, can take up to three months. Applicants must include this time in their schedule. Selected projects that receive a 'go' decision at the conclusion of the initial verification effort will be subject to both an intermediate and a final verification. The time required for the intermediate and final verifications will be considerably less than the initial verification. However, the applicant must also consider that time should be allocated to collect data for these verifications.

Verification Task:

All applicants must include the initial verification task within their scope as Task 1. It must be separated from the rest of the scope of work by a 'go/no-go' decision point, and applicants should estimate a three-month duration for the verification effort. This task, Task 1, will also be within a separate budget period, Budget Period 1 (BP1), from the remainder of the project. By way of example, the inclusion of the verification in the scope could include something like the following:

> 'Task 1. Initial Verification. At the beginning of the project, the baseline data and project targets provided in the Technical and Economic Tables will be experimentally verified. Process information and data will be provided to DOE (when applicable) to support the process claims within the original application. Technical metrics for project progress will be tailored to the project as needed. These metrics may include additional 'go/no-go' metrics that will be incorporated into the overall project and Statement of Project Objectives. Experiments will be conducted at the on-site verification visit to replicate the benchmark data provided in the application as described in the Technical and Economic Tables Template.
>
> There will be a 'go/no-go' associated with Task 1.1 as follows: Process information and data support the technology readiness level of the overall process, the unit operations within the process, and the original application. Technical metrics are based on preliminary data and represent a meaningful baseline and set of targets.
>
> Upon successful completion of the initial verification effort and 'go/no-go' decision point, the project will commence with work on the Priority Areas as discussed.'

Something similar can be included for the Intermediate Verification as a task that will occur mid-way through the project (~18 months) and the final Verification that will occur at the end of the projects (within 60 days of completion).

Verification Conflict of Interest/Proprietary Information:

All of the technical and economic information requested in the Technical and Economic Tables Template will be disclosed to non-conflicted DOE National Laboratory (National Renewable Energy Laboratory - NREL) personnel and/or external third-party non-conflicted validators performing the verifications (BETO's verification team) as well as non-conflicted third-party reviewers potentially participating in the go/no go review process and/or interim review meetings. It is expected that developments and advancements in technical performance made during the course of the project will be shared with the public via technical publications in journals or conference proceedings. It is also anticipated that the initial verification may, if

necessary, involve pre-existing intellectual property of which DOE will not require publication. Data access, deliverables and dissemination requirements will be negotiated and set forth in the Statement of Project Objectives and will be consistent with Section VIII.N. of this FOA. DOE and those working on DOE's behalf, such as support service contractors, National Laboratory personnel, validators, and reviewers, must be able to have sufficient access to these data, including but not limited to raw technical and financial data, to assess the baseline performance of the technology – subject to appropriate non-disclosure agreements or other protections.

Verification Process:

The verification effort generally includes three steps: pre-verification, on-site verification (when applicable), and post-verification. The verification effort will be adapted to be appropriate for the technology readiness level and funding available to the project. However, the details provided below establish the framework for the process.

All steps are performed in concert with BETO's verification team and the project management team. During the pre-verification step, the verification team will work closely with the project team to discuss the effort in detail, initiate the review of the data from the Technical and Economic Tables Template and metrics as provided in the original application, and set the date for the on-site meeting. This is an iterative process between the two teams and establishes the agenda for the on-site meeting. During the on-site verification meeting, the verification team will observe key experiments performed by the project team in order to replicate benchmark/baseline data provided in the application as described in the Technical and Economic Tables Template. In addition, the two teams will work together to discuss the goals and performance metrics, ideas for tracking project progress, and alignment with BETO's goals. At the conclusion of the on-site meeting, both teams will have the information needed to proceed forward – the project team will complete revisions to the Technical and Economic Tables Template previously submitted and resubmit it to DOE, and the verification team will prepare the report-out to the Technology Manager working with the teams. The post-verification step includes the verification team reporting to DOE and the DOE personnel working through the 'go/no-go' decision point.

At the conclusion of the verification effort and once a 'go/no-go' decision has been made, the DOE Technology Manager and Contracting Officer will send a formal document to the recipient regarding the go/no go decision and activities will proceed from there (based on the decision). If a 'go' decision is reached, the project team and DOE Technology Manager will proceed with the necessary steps to release the remaining scope and associated funding for the project. A 'no-go' decision may result in termination of the project or re-direction of scope.

Key Verification Requirements:

- During the initial verification effort, no additional experimental or project work, beyond that associated with the verification, may commence within the proposed scope. Only work associated with the verification – typically project management and data gathering activities – are allowed during the verification. The budget associated with the verification effort should correspond only to these types of activities and is typically minimal compared to the remaining project scope and budget.
- It is anticipated that the intermediate and final verifications will include the applicant (now recipient) presenting the project progress toward the targets established during the initial verification. Both the intermediate and final verifications must be noted and accounted for within the scope, schedule, and budget, so that if a project is selected and receives a 'go' decision at the conclusion of the initial verification effort, the schedule and budget will already account for the intermediate and final verifications.

All selected projects that receive awards will also be required to participate in DOE's Peer Review Process. Currently this is a bi-annual process that includes preparation of a presentation and participation/presentation at the Peer Review Meeting. This activity must be accounted for within each applicant's scope, schedule, and budget.

E. Authorizing Statutes

The programmatic authorizing statute is EPAct 2005, Title IX, Subtitle C Section 932.

Awards made under this announcement will fall under the purview of 2 CFR Part 200 as amended by 2 CFR Part 910.

II. Award Information

A. Award Overview

i. Estimated Funding

EERE expects to make approximately $28,000,000 of Federal funding available for new awards under this FOA, subject to the availability of appropriated funds. EERE anticipates making approximately 14-28 awards under this FOA. EERE may issue one, multiple, or no awards. Individual awards may vary between $1,000,000 and $2,500,000.

EERE may issue awards in one, multiple, or none of the following topic areas:

Topic Area 1: ChemCatBio Industry Partnerships. EERE may issue approximately 0-5 awards in this topic area, with a range of $1,000,000-$2,000,000 per award.

Topic Area 2: Agile BioFoundry Industry Partnership Initiative. EERE may issue approximately 0-5 awards in this topic area, with a range of $1,000,000-$2,000,000 per award.

Topic Area 3: Performance Advantaged Bioproducts. EERE may issue approximately 0-5 awards in this topic area, with a range of $1,000,000-$2,500,000 per award.

Topic Area 4: Biofuels, Bioproducts and Biopower from Wet Organic Wastes. EERE may issue approximately 0-5 awards in this topic area, with a range of $1,000,000-$2,500,000 per award.

Topic Area 5: Rewiring Carbon Utilization. EERE may issue approximately 0-3 awards in this topic area, with a range of $1,000,000-$1,500,000 per award.

Topic Area 6: Lignin Valorization. EERE may issue approximately 0-5 awards in this topic area, with a range of $1,000,000-$2,000,000 per award.

EERE may establish more than one budget period for each award and fund only the initial budget period(s). Funding for all budget periods, including the initial budget period, is not guaranteed.

ii. Period of Performance

EERE anticipates making awards that will run up to 36 months in length, comprised of one or more budget periods. Project continuation will be contingent upon satisfactory performance and go/no-go decision review. At the go/no-go decision points, EERE will evaluate project performance, project schedule adherence, meeting milestone objectives, compliance with reporting requirements, and overall contribution to the program goals and objectives. As a result of this evaluation, EERE will make a determination to continue the project, re-direct the project, or discontinue funding the project.

iii. New Applications Only

EERE will accept only new applications under this FOA. EERE will not consider applications for renewals of existing EERE-funded awards through this FOA.

B. EERE Funding Agreements

Through Cooperative Agreements and other similar agreements, EERE provides financial and other support to projects that have the potential to realize the FOA objectives. EERE does not use such agreements to acquire property or services for the direct benefit or use of the United States Government.

i. Cooperative Agreements

EERE generally uses Cooperative Agreements to provide financial and other support to Prime Recipients.

Through Cooperative Agreements, EERE provides financial or other support to accomplish a public purpose of support or stimulation authorized by Federal statute. Under Cooperative Agreements, the Government and Prime Recipients share responsibility for the direction of projects.

EERE has substantial involvement in all projects funded via Cooperative Agreement. See Section VI.B.ix. of the FOA for more information on what substantial involvement may involve.

ii. Funding Agreements with FFRDCs

In most cases, Federally Funded Research and Development Centers (FFRDC) are funded independently of the remainder of the Project Team. The FFRDC then executes an agreement with any non-FFRDC Project Team members to arrange work structure, project execution, and any other matters. Regardless of these arrangements, the entity that applied as the Prime Recipient for the project will remain the Prime Recipient for the project.

III. Eligibility Information

To be considered for substantive evaluation, an applicant's submission must meet the criteria set forth below. If the application does not meet these initial requirements, it will be considered non-responsive, removed from further evaluation, and ineligible for any award.

A. Eligible Applicants

i. Individuals

U.S. citizens and lawful permanent residents are eligible to apply for funding as a Prime Recipient or Subrecipient.

ii. Domestic Entities

For-profit entities, educational institutions, and nonprofits that are incorporated (or otherwise formed) under the laws of a particular State or territory of the United States are eligible to apply for funding as a Prime Recipient or Subrecipient. Nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995, are not eligible to apply for funding.

State, local, and tribal government entities are eligible to apply for funding as a Prime Recipient or Subrecipient.

DOE/NNSA Federally Funded Research and Development Centers (FFRDCs) are eligible to apply for funding as a Subrecipient, but are not eligible to apply as a Prime Recipient.

Non-DOE/NNSA FFRDCs are eligible to apply for funding as a Subrecipient, but are not eligible to apply as a Prime Recipient.

Federal agencies and instrumentalities (other than DOE) are eligible to apply for funding as a Subrecipient, but are not eligible to apply as a Prime Recipient.

iii. Foreign Entities

Foreign entities, whether for-profit or otherwise, are eligible to apply for funding under this FOA. Other than as provided in the "Individuals" or "Domestic Entities" sections above, all Prime Recipients receiving funding under this FOA must be incorporated (or otherwise formed) under the laws of a State or territory of the United States. If a foreign entity applies for funding as a Prime Recipient, it must designate in the Full Application a subsidiary or affiliate incorporated (or otherwise formed) under the laws of a State or territory of the United States to be the Prime Recipient. The Full Application must state the nature of the corporate relationship between the foreign entity and domestic subsidiary or affiliate.

Foreign entities may request a waiver of the requirement to designate a subsidiary in the United States as the Prime Recipient in the Full Application (i.e., a foreign entity may request that it remains the Prime Recipient on an award). To do so, the Applicant must submit an explicit written waiver

request in the Full Application. Appendix B lists the necessary information that must be included in a request to waive this requirement. The applicant does not have the right to appeal EERE's decision concerning a waiver request.

In the waiver request, the applicant must demonstrate to the satisfaction of EERE that it would further the purposes of this FOA and is otherwise in the economic interests of the United States to have a foreign entity serve as the Prime Recipient. EERE may require additional information before considering the waiver request.

A foreign entity may receive funding as a Subrecipient.

iv. Incorporated Consortia

Incorporated consortia, which may include domestic and/or foreign entities, are eligible to apply for funding as a Prime Recipient or Subrecipient. For consortia incorporated (or otherwise formed) under the laws of a State or territory of the United States, please refer to "Domestic Entities" above. For consortia incorporated in foreign countries, please refer to the requirements in "Foreign Entities" above.

Each incorporated consortium must have an internal governance structure and a written set of internal rules. Upon request, the consortium must provide a written description of its internal governance structure and its internal rules to the EERE Contracting Officer.

v. Unincorporated Consortia

Unincorporated Consortia, which may include domestic and foreign entities, must designate one member of the consortium to serve as the Prime Recipient/consortium representative. The Prime Recipient/consortium representative must be incorporated (or otherwise formed) under the laws of a State or territory of the United States. The eligibility of the consortium will be determined by the eligibility of the Prime Recipient/consortium representative under Section III.A of the FOA.

Upon request, unincorporated consortia must provide the EERE Contracting Officer with a collaboration agreement, commonly referred to as the articles of collaboration, which sets out the rights and responsibilities of each consortium member. This agreement binds the individual consortium's members together and should discuss, among other things, the consortium's:

- Management structure;
- Method of making payments to consortium members;
- Means of ensuring and overseeing members' efforts on the project;
- Provisions for members' cost sharing contributions; and
- Provisions for ownership and rights in intellectual property developed previously or under the agreement.

B. Cost Sharing

Cost Share 20%

The cost share must be at least 20% of the total allowable costs for research and development projects (i.e., the sum of the Government share, including FFRDC costs if applicable, and the recipient share of allowable costs equals the total allowable cost of the project) and must come from non-Federal sources unless otherwise allowed by law. (See 2 CFR 200.306 and 2 CFR 910.130 for the applicable cost sharing requirements.)

To assist applicants in calculating proper cost share amounts, EERE has included a cost share information sheet and sample cost share calculation as Appendix A to this FOA.

i. Legal Responsibility

Although the cost share requirement applies to the project as a whole, including work performed by members of the project team other than the Prime Recipient, the Prime Recipient is legally responsible for paying the entire cost share. The Prime Recipient's cost share obligation is expressed in the Assistance Agreement as a static amount in U.S. dollars (cost share amount) and as a percentage of the Total Project Cost (cost share percentage). If the funding agreement is terminated prior to the end of the project period, the Prime Recipient is required to contribute at least the cost share percentage of total expenditures incurred through the date of termination.

The Prime Recipient is solely responsible for managing cost share contributions by the Project Team and enforcing cost share obligation assumed by Project Team members in subawards or related agreements.

ii. Cost Share Allocation

Each Project Team is free to determine how best to allocate the cost share requirement among the team members. The amount contributed by

individual Project Team members may vary, as long as the cost share requirement for the project as a whole is met.

iii. Cost Share Types and Allowability

Every cost share contribution must be allowable under the applicable Federal cost principles, as described in Section IV.I.i. of the FOA. In addition, cost share must be verifiable upon submission of the Full Application.

Project Teams may provide cost share in the form of cash or in-kind contributions. Cost share may be provided by the Prime Recipient, Subrecipients, or third parties (entities that do not have a role in performing the scope of work). Vendors/Contractors may not provide cost share. Any partial donation of goods or services is considered a discount and is not allowable.

Cash contributions include, but are not limited to: personnel costs, fringe costs, supply and equipment costs, indirect costs and other direct costs.

In-kind contributions are those where a value of the contribution can be readily determined, verified and justified but where no actual cash is transacted in securing the good or service comprising the contribution. Allowable in-kind contributions include, but are not limited to: the donation of volunteer time or the donation of space or use of equipment.

Project teams may use funding or property received from state or local governments to meet the cost share requirement, so long as the funding was not provided to the state or local government by the Federal Government.

The Prime Recipient may not use the following sources to meet its cost share obligations including, but not limited to:

- Revenues or royalties from the prospective operation of an activity beyond the project period;
- Proceeds from the prospective sale of an asset of an activity;
- Federal funding or property (e.g., Federal grants, equipment owned by the Federal Government); or
- Expenditures that were reimbursed under a separate Federal Program.

Project Teams may not use the same cash or in-kind contributions to meet cost share requirements for more than one project or program.

Cost share contributions must be specified in the project budget, verifiable from the Prime Recipient's records, and necessary and reasonable for proper and efficient accomplishment of the project. As all sources of cost share are considered part of total project cost, the cost share dollars will be scrutinized under the same Federal regulations as Federal dollars to the project. Every cost share contribution must be reviewed and approved in advance by the Contracting Officer and incorporated into the project budget before the expenditures are incurred.

Applicants are encouraged to refer to 2 CFR 200.306 as amended by 2 CFR 910.130 & 10 CFR 603.525-555 for additional guidance on cost sharing.

iv. Cost Share Contributions by FFRDCs

Because FFRDCs are funded by the Federal Government, costs incurred by FFRDCs generally may not be used to meet the cost share requirement. FFRDCs may contribute cost share only if the contributions are paid directly from the contractor's Management Fee or another non-Federal source.

v. Cost Share Verification

Applicants are required to provide written assurance of their proposed cost share contributions in their Full Applications.

Upon selection for award negotiations, applicants are required to provide additional information and documentation regarding their cost share contributions. Please refer to Appendix A of the FOA.

vi. Cost Share Payment

EERE requires Prime Recipients to contribute the cost share amount incrementally over the life of the award. Specifically, the Prime Recipient's cost share for each billing period must always reflect the overall cost share ratio negotiated by the parties (i.e., the total amount of cost sharing on each invoice when considered cumulatively with previous invoices must reflect, at a minimum, the cost sharing percentage negotiated). As FFRDC funding will be provided directly to the FFRDC(s) by DOE, Prime Recipients will be required to provide project cost share at a percentage commensurate with the FFRDC costs, on a budget period basis, resulting in a higher interim invoicing cost share ratio than the total award ratio.

In limited circumstances, and where it is in the government's interest, the EERE Contracting Officer may approve a request by the Prime Recipient to

meet its cost share requirements on a less frequent basis, such as monthly or quarterly. Regardless of the interval requested, the Prime Recipient must be up-to-date on cost share at each interval. Such requests must be sent to the Contracting Officer during award negotiations and include the following information: (1) a detailed justification for the request; (2) a proposed schedule of payments, including amounts and dates; (3) a written commitment to meet that schedule; and (4) such evidence as necessary to demonstrate that the Prime Recipient has complied with its cost share obligations to date. The Contracting Officer must approve all such requests before they go into effect.

C. Compliance Criteria

Letters of Intent and Full Applications must meet all Compliance criteria listed below or they will be considered noncompliant. EERE will not review or consider noncompliant submissions, including Letters of Intent, Full Applications, and Replies to Reviewer Comments that were: submitted through means other than EERE Exchange; submitted after the applicable deadline; and/or submitted incomplete. EERE will not extend the submission deadline for applicants that fail to submit required information due to server/connection congestion.

i. Compliance Criteria

1. **Letters of Intent**
   Letters of Intent are deemed compliant if:

   - The applicant entered all required information and clicked the "Create Submission" button in EERE Exchange by the deadline stated in the FOA.

2. **Full Applications**
   Full Applications are deemed compliant if:

   - The applicant submitted a compliant Letter of Intent;
   - The Full Application complies with the content and form requirements in Section IV.C of the FOA; and
   - The applicant successfully uploaded all required documents and clicked the "Submit" button in EERE Exchange by the deadline stated in the FOA.

3. **Replies to Reviewer Comments**

Replies to Reviewer Comments are deemed compliant if:

- The Reply to Reviewer Comments complies with the content and form requirements in Section IV.D of the FOA; and
- The applicant successfully uploaded all required documents to EERE Exchange by the deadline stated in the FOA.

D. Responsiveness Criteria

All "Applications Specifically Not of Interest," as described in Section I.C of the FOA and as described within each Topic Area in Section I.B of the FOA, are deemed nonresponsive and are not reviewed or considered.

E. Other Eligibility Requirements

i. Requirements for DOE/NNSA and non-DOE/NNSA Federally Funded Research and Development Centers Included as a Subrecipient

DOE/NNSA and non-DOE/NNSA FFRDCs may be proposed as a Subrecipient on another entity's application subject to the following guidelines:

1. **Authorization for non-DOE/NNSA FFRDCs**
   The Federal agency sponsoring the FFRDC must authorize in writing the use of the FFRDC on the proposed project and this authorization must be submitted with the application. The use of a FFRDC must be consistent with its authority under its award.

2. **Authorization for DOE/NNSA FFRDCs**
   The cognizant Contracting Officer for the FFRDC must authorize in writing the use of the FFRDC on the proposed project and this authorization must be submitted with the application. The following wording is acceptable for this authorization:

   Authorization is granted for the [Enter Laboratory Name] Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complementary to the missions of the laboratory, and will not adversely impact execution of the DOE assigned programs at the laboratory.

3. **Value/Funding**

The value of and funding for the FFRDC portion of the work will not normally be included in the award to a successful applicant. Usually, DOE will fund a DOE/NNSA FFRDC contractor through the DOE field work proposal system and non-DOE/NNSA FFRDC through an interagency agreement with the sponsoring agency.

4. **Cost Share**
   Although the FFRDC portion of the work is usually excluded from the award to a successful applicant, the applicant's cost share requirement will be based on the total cost of the project, including the applicant's and the FFRDC's portions of the project.

5. **Responsibility**
   The Prime Recipient will be the responsible authority regarding the settlement and satisfaction of all contractual and administrative issues including, but not limited to disputes and claims arising out of any agreement between the Prime Recipient and the FFRDC contractor.

6. **Limit on FFRDC Effort**
   The scope of work to be performed by the FFRDC may not be more significant than the scope of work to be performed by the applicant.

F. Limitation on Number of Full Applications Eligible for Review

Applicants may submit more than one Full Application to this FOA, provided that each application describes a unique, scientifically distinct project.

G. Questions Regarding Eligibility

EERE will not make eligibility determinations for potential applicants prior to the date on which applications to this FOA must be submitted. The decision whether to submit an application in response to this FOA lies solely with the applicant.

IV. Application and Submission Information

A. Application Process

The application process will include two phases: a Letter of Intent phase and a Full Application phase. **Only applicants who have submitted an eligible Letter of Intent will be eligible to submit a Full Application**. At each phase, EERE performs

an initial eligibility review of the applicant submissions to determine whether they meet the eligibility requirements of Section III of the FOA. EERE will not review or consider submissions that do not meet the eligibility requirements of Section III. All submissions must conform to the following form and content requirements, including maximum page lengths (described below) and must be submitted via EERE Exchange at https://eere-exchange.energy.gov/, unless specifically stated otherwise. **EERE will not review or consider submissions submitted through means other than EERE Exchange, submissions submitted after the applicable deadline, and incomplete submissions**. EERE will not extend deadlines for applicants who fail to submit required information and documents due to server/connection congestion. A control number will be issued when an applicant begins the EERE Exchange application process. This control number must be included with all Application documents, as described below.

The Letter of Intent, Full Application, and Reply to Reviewer Comments must conform to the following requirements:

- Each must be submitted in Adobe PDF format unless stated otherwise.
- Each must be written in English.
- All pages must be formatted to fit on 8.5 x 11 inch paper with margins not less than one inch on every side. Use Times New Roman typeface, a black font color, and a font size of 12 point or larger (except in figures or tables, which may be 10 point font). A symbol font may be used to insert Greek letters or special characters, but the font size requirement still applies. References must be included as footnotes or endnotes in a font size of 10 or larger. Footnotes and endnotes are counted toward the maximum page requirement.
- The Control Number must be prominently displayed on the upper right corner of the header of every page. Page numbers must be included in the footer of every page.
- Each submission must not exceed the specified maximum page limit, including cover page, charts, graphs, maps, and photographs when printed using the formatting requirements set forth above and single spaced. If applicants exceed the maximum page lengths indicated below, EERE will review only the authorized number of pages and disregard any additional pages.

Applicants are responsible for meeting each submission deadline. **Applicants are strongly encouraged to submit their Letters of Intent and Full Applications at least 48 hours in advance of the submission deadline**. Under normal conditions (i.e., at least 48 hours in advance of the submission deadline), applicants should

allow at least 1 hour to submit a Letter of Intent, Full Application, or Reply to Reviewer Comments. Once the Letter of Intent, Full Application, or Reply to Reviewer Comments is submitted in EERE Exchange, applicants may revise or update that submission until the expiration of the applicable deadline. If changes are made, the applicant must resubmit the Letter of Intent, Full Application, or Reply to Reviewer Comments before the applicable deadline.

EERE urges applicants to carefully review their Letters of Intent and Full Applications and to allow sufficient time for the submission of required information and documents. All Full Applications that pass the initial eligibility review will undergo comprehensive technical merit review according to the criteria identified in Section V.A.i. of the FOA.

i. Additional Information on EERE Exchange

EERE Exchange is designed to enforce the deadlines specified in this FOA. The "Apply" and "Submit" buttons will automatically disable at the defined submission deadlines. Should applicants experience problems with EERE Exchange, the following information may be helpful.

Applicants that experience issues with submission PRIOR to the FOA deadline: In the event that an applicant experiences technical difficulties with a submission, the Application should contact the EERE Exchange helpdesk for assistance (EERE-ExchangeSupport@hq.doe.gov). The EERE Exchange helpdesk and/or the EERE Exchange system administrators will assist Applicants in resolving issues.

Applicants that experience issue with submissions that result in late submissions: In the event that an applicant experiences technical difficulties so severe that they are unable to submit their application by the deadline, the applicant should contact the EERE Exchange helpdesk for assistance (EERE-ExchangeSupport@hq.doe.gov). The EERE Exchange helpdesk and/or the EERE Exchange system administrators will assist the applicant in resolving all issues (including finalizing submission on behalf of and with the applicant's concurrence). PLEASE NOTE, however, those applicants who are unable to submit their application on time due to their waiting until the last minute when network traffic is at its heaviest to submit their materials will not be able to use this process.

B. Application Forms

The application forms and instructions are available on EERE Exchange. To access these materials, go to https://eere-Exchange.energy.gov and select the appropriate funding opportunity number.

Note: The maximum file size that can be uploaded to the EERE Exchange website is 10MB. Files in excess of 10MB cannot be uploaded, and hence cannot be submitted for review. If a file exceeds 10MB but is still within the maximum page limit specified in the FOA, it must be broken into parts and denoted to that effect. For example:
ControlNumber_LeadOrganization_Project_Part_1
ControlNumber_LeadOrganization_Project_Part_2, etc.

i. Content and Form of the Letter of Intent

To be eligible to submit a Full Application, applicants must submit a Letter of Intent by the specified due date and time. Letters of Intent will be used by EERE to plan for the merit review process. The letters should not contain any proprietary or sensitive business information. The letters will not be used for down-selection purposes, and do not commit an applicant to submit an application.

EERE will not review or consider ineligible Letters of Intent (see Section III of the FOA).

Each applicant must provide the following information as part of the Letter of Intent:

- Project Title;
- Lead Organization;
- Organization Type (Business < 500 Employees; Business > 1000 Employees; Business 500-1000 Employees; Federally Funded Research and Development Center (FFRDC); Government-Owned, Government Operated; Non-Profit; University);
- Whether the Application has been previously submitted to EERE;
- % of effort contributed by the Lead Organization;
- The Project Team, including:
  - The Principal Investigator for the Prime Recipient;
  - Team Members (i.e., Subrecipients); and
  - Key Participants (i.e., individuals who contribute in a substantive, measureable way to the execution of the proposed project);

- Technical Topic or Area; and
- Abstract – The abstract provided should be not more than 200 words in length, and should provide a truncated explanation of the proposed project.

C. Content and Form of the Full Application

Applicants must submit a Full Application by the specified due date and time to be considered for funding under this FOA. Applicants must complete the following application forms found on the EERE Exchange website at https://eere-Exchange.energy.gov/, in accordance with the instructions.

All Full Application documents must be marked with the Control Number issued to the applicant. Applicants will receive a control number upon submission of their Letter of Intent, and should include that control number in the file name of their Full Application submission (i.e., Control number_Applicant Name_Full Application)."

i. Full Application Content Requirements

EERE will not review or consider ineligible Full Applications (see Section III of the FOA).

Each Full Application shall be limited to a single concept or technology. Unrelated concepts and technologies shall not be consolidated in a single Full Application.

Full Applications must conform to the following requirements:

Submission	Components	File Name
Full Application (PDF, unless stated otherwise)	Technical Volume (See Chart in Section IV.C.ii.)	ControlNumber_LeadOrganization_TechnicalVolume
	Statement of Project Objectives (Microsoft Word format) (5 page limit)	ControlNumber_LeadOrganization_SOPO
	SF-424	ControlNumber_LeadOrganization_App424
	Budget Justification (EERE 335) (Microsoft Excel format. Applicants must use the template available in EERE Exchange)	ControlNumber_LeadOrganization_Budget_Justification
	Summary for Public Release (1 page limit)	ControlNumber_LeadOrganization_Summary

	Summary Slide (1 page limit, Microsoft PowerPoint format)	ControlNumber_LeadOrganization_Slide
	Subrecipient Budget Justification, if applicable (EERE 335) (Microsoft Excel format. Applicants must use the template available in EERE Exchange)	ControlNumber_LeadOrganization_Subrecipient_Budget_Justification
	Budget for FFRDC, if applicable	ControlNumber_LeadOrganization_FWP
	Authorization from cognizant Contracting Officer for FFRDC, if applicable	ControlNumber_LeadOrganization_FFRDCAuth
	SF-LLL Disclosure of Lobbying Activities	ControlNumber_LeadOrganization_SF-LLL
	Foreign Entity and Performance of Work in the United States waiver requests, if applicable	ControlNumber_LeadOrganization_Waiver
	U.S. Manufacturing Plans	ControlNumber_LeadOrganization_USMP
	Data Management Plan	ControlNumber_LeadOrganization_DMP
	Technical and Economic Tables	ControlNumber_LeadOrganization_Tables

Note: The maximum file size that can be uploaded to the EERE Exchange website is 10MB. Files in excess of 10MB cannot be uploaded, and hence cannot be submitted for review. If a file exceeds 10MB but is still within the maximum page limit specified in the FOA it must be broken into parts and denoted to that effect. For example:

ControlNumber_LeadOrganization_TechnicalVolume_Part_1
ControlNumber_LeadOrganization_TechnicalVolume_Part_2, etc.

EERE will not accept late submissions that resulted from technical difficulties due to uploading files that exceed 10MB.

EERE provides detailed guidance on the content and form of each component below.

ii. Technical Volume

The Technical Volume must be submitted in Adobe PDF format. The Technical Volume must conform to the following content and form requirements, including maximum page lengths. If applicants exceed the maximum page lengths indicated below, EERE will review only the authorized number of pages and disregard any additional pages. This volume must address the Merit Review Criteria as discussed in Section V.A.i. of the FOA.

Save the Technical Volume in a single PDF file using the following convention for the title: "ControlNumber_LeadOrganization_TechnicalVolume".

Applicants must provide sufficient citations and references to the primary research literature to justify the claims and approaches made in the Technical Volume. However, EERE and reviewers are under no obligation to review cited sources.

The Technical Volume to the Full Application may not be more than 25 pages, including the cover page, table of contents, and all citations, charts, graphs, maps, photos, or other graphics, and must include all of the information in the table below. The applicant should consider the weighting of each of the evaluation criteria (see Section V.A.i. of the FOA) when preparing the Technical Volume.

SECTION/PAGE LIMIT	DESCRIPTION
Cover Page	The cover page should include the project title, the specific FOA Topic Area being addressed (if applicable), both the technical and business points of contact, names of all team member organizations, and any statements regarding confidentiality.
Project Overview (This section should constitute approximately 10% of the Technical Volume)	The Project Overview should contain the following information: • Project Goal: The applicant should explicitly identify the targeted improvements to the baseline technology and the critical success factors in achieving that goal. • DOE Impact: The applicant should discuss the impact that DOE funding would have on the proposed project. Applicants should specifically explain how DOE funding, relative to prior, current, or anticipated funding from other public and private sources, is necessary to achieve the project objectives.

Technical Description, Innovation, and Impact (This section should constitute approximately 45% of the Technical Volume)	The Technical Description should contain the following information: <u>Technical Merit and Innovation</u> • Describe how the proposed technology or process is innovative; • Describe the current state of the technology and the proposed advancements, including a comparison of the proposed technology to relevant technologies and include appropriate citations; Describe specifically and convincingly demonstrate how the work proposed will move the state of the art to the proposed advancement; • Describe how the objectives and targets of the proposal build upon prior R&D and are substantiated with relevant data/experiments; and • Include sufficient technical detail in the application to allow reviewers to assess whether the proposed work is scientifically meritorious and revolutionary, including relevant data, calculations and discussion of prior work in the literature with analyses that support the viability of the proposed work. <u>Impact of Technology Advancement</u> • Describe the level of impact that DOE funding will have on the proposed project; • Define successful project outcomes; • Describe the potential impact of the project on advancing the state-of-the-art. • Describe the degree to which their success would impact the industry and other researchers; and • Justify assumptions made in describing the proposed LCA/environmental impact and include appropriate references; • Provide a compelling TEA or narrative explaining how the proposed route will enable the production of price-competitive biofuels and/or bioproducts (economic impact); and Ensure that assumptions in the TEA are based on verifiable and referenceable data <u>Topic Specific Requirements</u> • Convincingly demonstrate the ability to meet the required **metric** within the given topic area • Explain how the proposed technology matches to a "**specific area of interest**" identified in each topic area, or how it is related to a specific area of interest • Describe how the proposed work will achieve each element in the "**Topic area specific requirements:**" section for each topic area

Workplan and Market Transformation Plan (This section should constitute approximately 30% of the Technical Volume)	The Workplan should include a summary of the Project Objectives, Technical Scope, Work Breakdown Structure, Milestones, Go/No-Go Decision Points, and Project Schedule. A detailed Statement of Project Objectives (SOPO) is separately requested. The Workplan should contain the following information: • Project Objectives: The applicant should provide a clear and concise (high-level) statement of the goals and objectives of the project as well as the expected outcomes. • Technical Scope Summary: The applicant should provide a summary description of the overall work scope and approach to achieve the objective(s). The overall work scope is to be divided by performance periods that are separated by discrete, approximately annual decision points (see below for more information on go/no-go decision points). The applicant should describe the specific expected end result of each performance period. • Work Breakdown Structure (WBS) and Task Description Summary: The Workplan should describe the work to be accomplished and how the applicant will achieve the milestones, will accomplish the final project goal(s), and will produce all deliverables. The Workplan is to be structured with a hierarchy of performance period (approximately annual), task and subtasks, which is typical of a standard work breakdown structure (WBS) for any project. The Workplan shall contain a concise description of the specific activities to be conducted over the life of the project. The description shall be a full explanation and disclosure of the project being proposed (i.e., a statement such as "we will then complete a proprietary process" is unacceptable). It is the applicant's responsibility to prepare an adequately detailed task plan to describe the proposed project and the plan for addressing the objectives of this FOA. The summary provided should be consistent with the SOPO. The SOPO will contain a more detailed description of the WBS and tasks. • Milestone Summary: The applicant should provide a summary of appropriate milestones throughout the project to demonstrate success. A milestone may be either a progress measure (which can be activity based) or a SMART technical milestone. SMART milestones should be **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**imely, and must demonstrate a technical achievement rather than simply completing a task. Unless otherwise specified in the FOA, the minimum requirement is that each project must have at least one milestone per quarter for the duration of the project with at least one SMART technical milestone per year (depending on the project, more milestones may be necessary to comprehensively demonstrate progress). The applicant should also provide the means by which the milestone will be verified.

	The summary provided should be consistent with the Milestone Summary Table in the SOPO. • Go/No-Go Decision Points: The applicant should provide a summary of project-wide go/no-go decision points at appropriate points in the Workplan. A go/no-go decision point is a risk management tool and a project management best practice to ensure that, for the current phase or period of performance, technical success is definitively achieved and potential for success in future phases or periods of performance is evaluated, prior to actually beginning the execution of future phases. Unless otherwise specified in the FOA, the minimum requirement is that each project must have at least one project-wide go/no-go decision point for each budget period (12 to 18-month period) of the project. The Applicant should also provide the specific technical criteria to be used to make the go/no-go decision. The summary provided should be consistent with the SOPO. Go/no-go decision points are considered "SMART" and can fulfill the requirement for an annual SMART milestone. • End of Project Goal: The applicant should provide a summary of the end of project goal(s). Unless otherwise specified in the FOA, the minimum requirement is that each project must have one SMART end of project goal. The summary provided should be consistent with the SOPO. • Project Schedule (Gantt chart or similar): The applicant should provide a schedule for the entire project, including task and subtask durations, milestones, and go/no-go decision points. • Project Management: The applicant should discuss the team's proposed management plan, including the following: o The overall approach to and organization for managing the work o The roles of each Project Team member o Any critical handoffs/interdependencies among Project Team members o The technical and management aspects of the management plan, including systems and practices, such as financial and project management practices o The approach to project risk management o A description of how project changes will be handled o If applicable, the approach to Quality Assurance/Control o How communications will be maintained among Project Team members • Market Transformation Plan: The applicant should provide a market transformation plan, including the following: o Identification of target market, competitors, and distribution channels for proposed technology along with

	known or perceived barriers to market penetration, including a mitigation plan o Identification of a product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, U.S. manufacturing plan etc., and product distribution.
Technical Qualifications and Resources (Approximately 15% of the Technical Volume)	The Technical Qualifications and Resources should contain the following information: • Describe the Project Team's unique qualifications and expertise, including those of key Subrecipients. • Describe the Project Team's existing equipment and facilities that will facilitate the successful completion of the proposed project; include a justification of any new equipment or facilities requested as part of the project. • This section should also include relevant, previous work efforts, demonstrated innovations, and how these enable the applicant to achieve the project objectives. • Describe the time commitment of the key team members to support the project. • Attach one-page resumes for key participating team members as an appendix. Resumes do not count towards the page limit. Multi-page resumes are not allowed. • Describe the technical services to be provided by DOE/NNSA FFRDCs, if applicable. • Attach letters of commitment from all Subrecipient/third party cost share providers as an appendix. Letters of commitment do not count towards the page limit. • Attach any letters of commitment from partners/end users as an appendix (1 page maximum per letter). Letters of commitment do not count towards the page limit. • For multi-organizational or multi-investigator projects, describe succinctly: o The roles and the work to be performed by each PI and Key Participant; o Business agreements between the applicant and each PI and Key Participant; o How the various efforts will be integrated and managed;

	o Process for making decisions on scientific/technical direction; o Publication arrangements; o Intellectual Property issues; and o Communication plans

iii. Statement of Project Objectives

Applicants are required to complete a Statement of Project Objectives (SOPO). A SOPO template is available on EERE Exchange at https://eere-Exchange.energy.gov/. The SOPO, including the Milestone Table, must not exceed 5 pages when printed using standard 8.5 x 11 paper with 1" margins (top, bottom, left, and right) with font not smaller than 12 point. Save the SOPO in a single Microsoft Word file using the following convention for the title "ControlNumber_LeadOrganization_SOPO".

iv. SF-424: Application for Federal Assistance

Complete all required fields in accordance with the instructions on the form. The list of certifications and assurances in Field 21 can be found at http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms, under Certifications and Assurances. Note: The dates and dollar amounts on the SF-424 are for the complete project period and not just the first project year, first phase or other subset of the project period. Save the SF-424 in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_App424".

v. Budget Justification Workbook (EERE 335)

Applicants are required to complete the Budget Justification Workbook. This form is available on EERE Exchange at https://eere-Exchange.energy.gov/. Prime Recipients must complete each tab of the Budget Justification Workbook for the project as a whole, including all work to be performed by the Prime Recipient and its Subrecipients and Contractors, and provide all requested documentation (e.g., a Federally-approved rate agreement, vendor quotes). Applicants should include costs associated with required annual audits and incurred cost proposals in their proposed budget documents. The "Instructions and Summary" included with the Budget Justification Workbook will auto-populate as the applicant enters information into the Workbook. Applicants must carefully read the "Instructions and Summary" tab provided within the Budget Justification Workbook. Save the Budget Justification Workbook in a single Microsoft

Excel file using the following convention for the title "ControlNumber_LeadOrganization_Budget_Justification".

vi. Summary/Abstract for Public Release

Applicants are required to submit a one-page summary/abstract of their project. The project summary/abstract must contain a summary of the proposed activity suitable for dissemination to the public. It should be a self-contained document that identifies the name of the applicant, the project director/principal investigator(s), the project title, the objectives of the project, a description of the project, including methods to be employed, the potential impact of the project (e.g., benefits, outcomes), and major participants (for collaborative projects). This document must not include any proprietary or sensitive business information as DOE may make it available to the public after selections are made. The project summary must not exceed 1 page when printed using standard 8.5 x 11 paper with 1" margins (top, bottom, left, and right) with font not smaller than 12 point. Save the Summary for Public Release in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Summary".

vii. Summary Slide

Applicants are required to provide a single PowerPoint slide summarizing the proposed project. The slide must be submitted in Microsoft PowerPoint format. This slide is used during the evaluation process. Save the Summary Slide in a single file using the following convention for the title "ControlNumber_LeadOrganization_Slide".

The Summary Slide template requires the following information:

- A technology Summary;
- A description of the technology's impact;
- Proposed project goals;
- Any key graphics (illustrations, charts and/or tables);
- The project's key idea/takeaway;
- Project title, Prime Recipient, Principal Investigator, and Key Participant information; and
- Requested EERE funds and proposed applicant cost share.

viii. Subrecipient Budget Justification (EERE 335) (if applicable)

Applicants must provide a separate budget justification, EERE 335 (i.e., budget justification for each budget year and a cumulative budget) for each subrecipient that is expected to perform work estimated to be more than

$250,000 or 25 percent of the total work effort (whichever is less). The budget justification must include the same justification information described in the "Budget Justification" section above. Save each subrecipient budget justification in a Microsoft Excel file using the following convention for the title "ControlNumber_LeadOrganization_Subrecipient_Budget_Justification".

ix. Budget for DOE/NNSA FFRDC (if applicable)

If a DOE/NNSA FFRDC contractor is to perform a portion of the work, the applicant must provide a DOE Field Work Proposal (FWP) in accordance with the requirements in DOE Order 412.1, Work Authorization System. DOE Order 412.1 and DOE O 412.1 (Field Work Proposal form) area available at the following link, under "DOE Budget Forms": https://www.directives.doe.gov/directives-documents/400-series/0412.1-BOrder-a-admchg1/@@images/file. Save the FWP in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_FWP".

x. Authorization for non-DOE/NNSA or DOE/NNSA FFRDCs (if applicable)

The Federal agency sponsoring the FFRDC must authorize in writing the use of the FFRDC on the proposed project and this authorization must be submitted with the application. The use of a FFRDC must be consistent with the contractor's authority under its award. Save the Authorization in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_FFRDCAuth".

xi. SF-LLL: Disclosure of Lobbying Activities (required)

Prime Recipients and Subrecipients may not use any Federal funds to influence or attempt to influence, directly or indirectly, congressional action on any legislative or appropriation matters.

Prime Recipients and Subrecipients are required to complete and submit SF-LLL, "Disclosure of Lobbying Activities" (https://www.grants.gov/web/grants/forms/sf-424-individual-family.html) to ensure that non-Federal funds have not been paid and will not be paid to any person for influencing or attempting to influence any of the following in connection with your application:

- An officer or employee of any Federal agency;

- A Member of Congress;
- An officer or employee of Congress; or
- An employee of a Member of Congress.

Save the SF-LLL in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_SF-LLL".

xii. Waiver Requests: Foreign Entities and Performance of Work in the United States (if applicable)

1. **Foreign Entity Participation***:*
   As set forth in Section III.A.iii., all Prime Recipients receiving funding under this FOA must be incorporated (or otherwise formed) under the laws of a State or territory of the United States. To request a waiver of this requirement, the applicant must submit an explicit waiver request in the Full Application. Appendix B lists the necessary information that must be included in a request to waive this requirement.

2. **Performance of Work in the United States**
   As set forth in Section IV.I.iii., all work under EERE funding agreements must be performed in the United States. This requirement does not apply to the purchase of supplies and equipment, so a waiver is not required for foreign purchases of these items. However, the Prime Recipient should make every effort to purchase supplies and equipment within the United States. Appendix B lists the necessary information that must be included in a request to waive the Performance of Work in the United States requirement.

xiii. U.S. Manufacturing Commitments

As part of the application, applicants are required to submit a U.S. Manufacturing Plan. The U.S. Manufacturing Plan represents the applicant's measurable commitment to support U.S. manufacturing as a result of its award.

The weight given to the U.S. Manufacturing Plans during the review and selection process varies based on the particular FOA. Applicants should review Section V.A.i. of this FOA to determine the weight given to the U.S. Manufacturing Plans under this FOA.

A U.S. Manufacturing Plan should contain the following or similar preamble: "If selected for funding, the applicant agrees to the following commitments as a condition of that funding:" and, after the preamble, the plan should include one or more specific and measureable commitments. For example, an applicant may commit particular types of products to be manufactured in the U.S. In addition to or instead of making a commitment tied to a particular product, the applicant may make other types of commitments still beneficial to U.S. manufacturing. An applicant may commit to a particular investment in a new or existing U.S. manufacturing facility, keep certain activities based in the U.S. (i.e., final assembly) or support a certain number of jobs in the U.S. related to the technology and manufacturing. For an applicant which is likely to license the technology to others, especially universities for which licensing may be the exclusive means of commercialization the technology, the U.S. manufacturing plan may indicate the applicant's plan and commitment to use a licensing strategy that would likely support U.S. manufacturing.

When an applicant that is a domestic small business, domestic educational institution, or nonprofit organization is selected for an award, the U.S. Manufacturing Plan submitted by the applicant becomes part of the terms and conditions of the award. The applicant/recipient may request a waiver or modification of the U.S. Manufacturing Plan from DOE upon a showing that the original U.S. Manufacturing Plan is no longer economically feasible.

When an applicant that is a domestic large business is selected for an award, a class patent waiver applies as set forth in Section VIII. L. Under this class patent waiver, domestic large businesses may elect title to their subject inventions similar to the right provided to the domestic small businesses, educational institutions, and nonprofits by law. In order to avail itself of the class patent waiver, a domestic large business must agree that any products embodying or produced through the use of an invention conceived or first actually reduced to practice under the award will be substantially manufactured in the United States, unless DOE agrees that the commitments proposed in the U.S. Manufacturing Plan are sufficient.

For other entity types that are selected for award, please see Section VIII.L regarding U.S. manufacturing commitments.

xiv. Data Management Plan

Applicants are required to submit a Data Management Plan with their Full Application. The Data Management Plan is a document that outlines the proposed plan for data sharing or preservation. Submission of a Data Management Plan with the Full Application is required; failure to submit a complete Data Management Plan may result in a determination of non-compliance for your Full Application. Guidance for preparing a Data Management Plan is included in Appendix C of the FOA.

xv. Technical and Economic Data Tables.

The application must include the applicable data described in the Technical and Economic Tables Template provided in Appendix E of this FOA. Applicants may use the tables as presented or adapt them to fit the specific circumstances of their proposed process(es); however, applicants must use them in a manner consistent with the assessment purposes described in Section I.D above.

D. Content and Form of Replies to Reviewer Comments

EERE will provide applicants with reviewer comments following evaluation of all eligible Full Applications. Applicants will have a brief opportunity to review the comments and to prepare a short Reply to Reviewer Comments responding to comments however they desire or supplementing their Full Application. The Reply to Reviewer Comments is an optional submission; applicants are not required to submit a Reply to Reviewer Comments. EERE will post the Reviewer Comments in EERE Exchange. The expected submission deadline is on the cover page of the FOA; however, it is the applicant's responsibility to monitor EERE Exchange in the event that the expected date changes. The deadline will not be extended for applicants who are unable to timely submit their reply due to failure to check EERE Exchange or relying on the expected date alone. Applicants should anticipate having approximately three (3) business days to submit Replies to Reviewer Comments.

EERE will not review or consider ineligible Replies to Reviewer Comments (see Section III of the FOA). EERE will review and consider each eligible Full Application, even if no Reply is submitted or if the Reply is found to be ineligible.

Replies to Reviewer Comments must conform to the following content and form requirements, including maximum page lengths, described below. If a Reply to Reviewer Comments is more than three pages in length, EERE will review only the first three (3) pages and disregard any additional pages.

SECTION	PAGE LIMIT	DESCRIPTION
Text	2 pages max	Applicants may respond to one or more reviewer comments or supplement their Full Application.
Optional	1 page max	Applicants may use this page however they wish; text, graphs, charts, or other data to respond to reviewer comments or supplement their Full Application are acceptable.

E. Post-Award Information Requests

If selected for award, EERE reserves the right to request additional or clarifying information for any reason deemed necessary, including but not limited to:

- Indirect cost information
- Other budget information
- Commitment Letters from Third Parties Contributing to Cost Share, if applicable
- Name and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (See 10 CFR 1040.5)
- Representation of Limited Rights Data and Restricted Software, if applicable
- Environmental Questionnaire

F. Dun and Bradstreet Universal Numbering System Number and System for Award Management

Each applicant (unless the applicant is an individual or Federal awarding agency that is excepted from those requirements under 2 CFR §25.110(b) or (c), or has an exception approved by the Federal awarding agency under 2 CFR §25.110(d)) is required to: (1) Be registered in the System for Award Management (SAM) at https://www.sam.gov before submitting its application; (2) provide a valid Dun and Bradstreet Universal Numbering System (DUNS) number in its application; and (3) continue to maintain an active SAM registration with current information at all times during which it has an active Federal award or an application or plan under consideration by a Federal awarding agency. DOE may not make a Federal award to an applicant until the applicant has complied with all applicable DUNS and SAM requirements and, if an applicant has not fully complied with the requirements by the time DOE is ready to make a Federal award, the DOE may determine that the

applicant is not qualified to receive a Federal award and use that determination as a basis for making a Federal award to another applicant.

G. Submission Dates and Times

Letters of Intent, Full Applications, and Replies to Reviewer Comments must be submitted in EERE Exchange no later than 5:00 p.m. Eastern Time on the dates provided on the cover page of this FOA.

H. Intergovernmental Review

This FOA is not subject to Executive Order 12372 – Intergovernmental Review of Federal Programs.

I. Funding Restrictions

i. Allowable Costs

All expenditures must be allowable, allocable, and reasonable in accordance with the applicable Federal cost principles.

Refer to the following applicable Federal cost principles for more information:

- FAR Part 31 for For-Profit entities; and
- 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

ii. Pre-Award Costs

Selectees must request prior written approval to charge pre-award costs. Pre-award costs are those incurred prior to the effective date of the Federal award directly pursuant to the negotiation and in anticipation of the Federal award where such costs are necessary for efficient and timely performance of the scope of work. Such costs are allowable only to the extent that they would have been allowable if incurred after the date of the Federal award and **only** with the written approval of the Federal awarding agency, through the Contracting Officer assigned to the award.

Pre-award costs cannot be incurred prior to the Selection Official signing the Selection Statement and Analysis. Pre-award costs can only be incurred if

such costs would be reimbursable under the agreement if incurred after award.

Pre-Award expenditures are made at the Selectee's risk; EERE is not obligated to reimburse costs: (1) in the absence of appropriations; (2) if an award is not made; or (3) if an award is made for a lesser amount than the Selectee anticipated.

1. **Pre-Award Costs Related to National Environmental Policy Act (NEPA) Requirements**
   EERE's decision whether and how to distribute Federal funds under this FOA is subject to NEPA. Applicants should carefully consider and should seek legal counsel or other expert advice before taking any action related to the proposed project that would have an adverse effect on the environment or limit the choice of reasonable alternatives prior to EERE completing the NEPA review process.

   EERE does not guarantee or assume any obligation to reimburse costs where the Prime Recipient incurred the costs prior to receiving written authorization from the Contracting Officer. If the applicant elects to undertake activities that may have an adverse effect on the environment or limit the choice of reasonable alternatives prior to receiving such written authorization from the Contracting Officer, the applicant is doing so at risk of not receiving Federal funding and such costs may not be recognized as allowable cost share. Likewise, if a project is selected for negotiation of award, and the Prime Recipient elects to undertake activities that are not authorized for Federal funding by the Contracting Officer in advance of EERE completing a NEPA review, the Prime Recipient is doing so at risk of not receiving Federal Funding and such costs may not be recognized as allowable cost share. Nothing contained in the pre-award cost reimbursement regulations or any pre-award costs approval letter from the Contracting Officer override these NEPA requirements to obtain the written authorization from the Contracting Officer prior to taking any action that may have an adverse effect on the environment or limit the choice of reasonable alternatives.

iii. Performance of Work in the United States

1. **Requirement**
   All work performed under EERE Awards must be performed in the United States. This requirement does not apply to the purchase of supplies and

equipment; however, the Prime Recipient should make every effort to purchase supplies and equipment within the United States. The Prime Recipient must flow down this requirement to its Subrecipients.

2. **Failure to Comply**
   If the Prime Recipient fails to comply with the Performance of Work in the United States requirement, EERE may deny reimbursement for the work conducted outside the United States and such costs may not be recognized as allowable recipient cost share. The Prime Recipient is responsible should any work under this Award be performed outside the United States, absent a waiver, regardless of if the work is performed by the Prime Recipient, Subrecipients, contractors or other project partners.

3. **Waiver**
   There may be limited circumstances where it is in the interest of the project to perform a portion of the work outside the United States. To seek a waiver of the Performance of Work in the United States requirement, the applicant must submit a written waiver request to EERE. Appendix B lists the necessary information that must be included in a request to waive the Performance of Work in the United States requirement.

   The applicant must demonstrate to the satisfaction of EERE that a waiver would further the purposes of the FOA and is in the economic interests of the United States. EERE may require additional information before considering a waiver request. Save the waiver request(s) in a single PDF file titled "ControlNumber_PerformanceofWork_Waiver". The applicant does not have the right to appeal EERE's decision concerning a waiver request.

iv. Construction

Recipients are required to obtain written authorization from the Contracting Officer before incurring any major construction costs.

v. Foreign Travel

If international travel is proposed for your project, please note that your organization must comply with the International Air Transportation Fair Competitive Practices Act of 1974 (49 USC 40118), commonly referred to as the "Fly America Act," and implementing regulations at 41 CFR 301-10.131 through 301-10.143. The law and regulations require air transport of people or property to, from, between, or within a country other than the United

States, the cost of which is supported under this award, to be performed by or under a cost-sharing arrangement with a U.S. flag carrier, if service is available. Foreign travel costs are allowable only with the written prior approval of the Contracting Officer assigned to the award.

vi. Equipment and Supplies

To the greatest extent practicable, all equipment and products purchased with funds made available under this FOA should be American-made. This requirement does not apply to used or leased equipment.

Property disposition will be required at the end of a project if the current fair market value of property exceeds $5,000. The rules for property disposition are set forth in 2 CFR 200.310 – 200.316 as amended by 2 CFR 910.360.

vii. Lobbying

Recipients and Subrecipients may not use any Federal funds to influence or attempt to influence, directly or indirectly, congressional action on any legislative or appropriation matters.

Recipients and Subrecipients are required to complete and submit SF-LLL, "Disclosure of Lobbying Activities" (https://www.grants.gov/web/grants/forms/sf-424-individual-family.html) to ensure that non-Federal funds have not been paid and will not be paid to any person for influencing or attempting to influence any of the following in connection with your application:

- An officer or employee of any Federal agency;
- A Member of Congress;
- An officer or employee of Congress; or
- An employee of a Member of Congress.

viii. Risk Assessment

Prior to making a Federal award, the DOE is required by 31 U.S.C. 3321 and 41 U.S.C. 2313 to review information available through any OMB-designated repositories of government-wide eligibility qualification or financial integrity information, such as SAM Exclusions and "Do Not Pay."

In addition, DOE evaluates the risk(s) posed by applicants before they receive Federal awards. This evaluation may consider: results of the evaluation of the applicant's eligibility; the quality of the application; financial stability; quality

of management systems and ability to meet the management standards prescribed in this part; history of performance; reports and findings from audits; and the applicant's ability to effectively implement statutory, regulatory, or other requirements imposed on non-Federal entities.

In addition to this review, DOE must comply with the guidelines on government-wide suspension and debarment in 2 CFR 180, and must require non-Federal entities to comply with these provisions. These provisions restrict Federal awards, subawards and contracts with certain parties that are debarred, suspended or otherwise excluded from or ineligible for participation in Federal programs or activities.

ix. Invoice Review and Approval

DOE employs a risk-based approach to determine the level of supporting documentation required for approving invoice payments. Recipients may be required to provide some or all of the following items with their requests for reimbursement:

- Summary of costs by cost categories
- Timesheets or personnel hours report
- Invoices/receipts for all travel, equipment, supplies, contractual, and other costs
- UCC filing proof for equipment acquired with project funds by for-profit recipients and subrecipients
- Explanation of cost share for invoicing period
- Analogous information for some subrecipients
- Other items as required by DOE

V. Application Review Information

A. Technical Review Criteria

i. Full Applications

Applications will be evaluated against the merit review criteria shown below. All sub-criteria are of equal weight.

Criterion 1: Topic Specific Requirements, Technical Merit, Innovation, and Impact (55%)

Topic Specific Requirements

- Extent to which the proposed technology or process convincingly demonstrates the ability to meet the required **metric** within the given topic area;
- Extent to which the proposed technology matches a "**specific area of interest**" identified in each topic area;
- Degree to which applicants articulate how they plan to achieve each element in the "**Topic area specific requirements:**" section for each topic area.

Technical Merit and Innovation

- Extent to which the proposed technology or process is innovative;
- Degree to which the current state of the technology and the proposed advancement are clearly described, including a comparison of the applicant's technology to relevant technologies and the extent to which the applicant includes appropriate citations to defend his/her view of the state-of-the-art;
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state-of-the-art to the proposed advancement;
- Extent to which the objectives and targets of the proposal build upon prior R&D and are substantiated with relevant data/experiments; and
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and revolutionary, including relevant data, calculations and discussion of prior work in the literature with analyses that support the viability of the proposed work.

Impact of Technology Advancement

- Level of impact that DOE funding will have on the proposed project;
- Degree to which the applicant defined successful project outcomes;
- Potential impact of the project on advancing the state-of-the-art;
- If the applicant is successful, the degree to which their success would impact the industry and other researchers;
- Extent to which the applicant justifies assumptions made in describing the proposed LCA/environmental impact and appropriateness of the associated references;
- Extent to which the applicant provides a compelling TEA or narrative explaining how the proposed route will enable the production of cost-competitive biofuels (economic impact); and

- Degree to which the assumptions in the TEA are based on verifiable and referenceable data.

Criterion 2: Project Research and Market Transformation Plan (30%)

Research Approach, Workplan and SOPO

- Degree to which the approach and critical path have been clearly described and thoughtfully considered;
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed Workplan and SOPO will succeed in meeting the project goals;
- Level of clarity and reasonableness of the WBS;
- Level of clarity and reasonableness of the Gantt chart; and
- Reasonableness of schedule.

Identification of Technical Risks

- Discussion and demonstrated understanding of the key technical risk areas involved in the proposed work and the quality of the mitigation strategies to address them.

Baseline, Metrics, and Deliverables

- Level of clarity in the definition of the baseline, metrics, and milestones; and
- Relative to a clearly defined experimental baseline, the strength of the quantifiable metrics, milestones, and a mid-point deliverables defined in the application, such that meaningful interim progress will be made.

Market Transformation Plan

- Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including mitigation plan; and
- Comprehensiveness of Market Transformation Plan including but not limited to product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, Data Management Plan, U.S. Manufacturing Plan etc., and product distribution.

Criterion 3: Team and Resources (15%)

- Capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a high probability of success, including individual team members' qualifications, relevant expertise, and time commitment;
- Sufficiency of the facilities to support the work;
- Degree to which the proposed consortium/team demonstrates the ability to facilitate and expedite further development and commercial deployment of the proposed technologies;
- Level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan; and
- Reasonableness of the budget and spend plan for the proposed project and objectives.

ii. Criteria for Replies to Reviewer Comments

EERE has not established separate criteria to evaluate Replies to Reviewer Comments. Instead, Replies to Reviewer Comments are attached to the original applications and evaluated as an extension of the Full Application.

B. Standards for Application Evaluation

Applications that are determined to be eligible will be evaluated in accordance with this FOA, by the standards set forth in EERE's Notice of Objective Merit Review Procedure (76 Fed. Reg. 17846, March 31, 2011) and the guidance provided in the "Department of Energy Merit Review Guide for Financial Assistance," which is available at: https://energy.gov/management/downloads/merit-review-guide-financial-assistance-and-unsolicited-proposals-current.

C. Other Selection Factors

i. Program Policy Factors

In addition to the above criteria, the Selection Official may consider the following program policy factors in determining which Full Applications to select for award negotiations:

- The degree to which the proposed project exhibits technological diversity when compared to the existing BETO project portfolio and other projects selected from the subject FOA;

- The degree to which the proposed project, including proposed cost share, optimizes the use of available EERE funding to achieve programmatic objectives;
- The level of industry involvement and proven ability to overcome key market barriers;
- The degree to which the proposed project is likely to lead to increased employment and manufacturing in the United States;
- The degree to which the proposed project will accelerate transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty.

D. Evaluation and Selection Process

i. Overview

The evaluation process consists of multiple phases; each includes an initial eligibility review and a thorough technical review. Rigorous technical reviews of eligible submissions are conducted by reviewers that are experts in the subject matter of the FOA. Ultimately, the Selection Official considers the recommendations of the reviewers, along with other considerations such as program policy factors, in determining which applications to select.

ii. Pre-Selection Interviews

As part of the evaluation and selection process, EERE may invite one or more applicants to participate in Pre-Selection Interviews. Pre-Selection Interviews are distinct from and more formal than pre-selection clarifications (See Section V.D.iii. of the FOA). The invited applicant(s) will meet with EERE representatives to provide clarification on the contents of the Full Applications and to provide EERE an opportunity to ask questions regarding the proposed project. The information provided by applicants to EERE through Pre-Selection Interviews contributes to EERE's selection decisions.

EERE will arrange to meet with the invited applicants in person at EERE's offices or a mutually agreed upon location. EERE may also arrange site visits at certain applicants' facilities. In the alternative, EERE may invite certain applicants to participate in a one-on-one conference with EERE via webinar, videoconference, or conference call.

EERE will not reimburse applicants for travel and other expenses relating to the Pre-Selection Interviews, nor will these costs be eligible for reimbursement as pre-award costs.

EERE may obtain additional information through Pre-Selection Interviews that will be used to make a final selection determination. EERE may select applications for funding and make awards without Pre-Selection Interviews. Participation in Pre-Selection Interviews with EERE does not signify that applicants have been selected for award negotiations.

iii. Pre-Selection Clarification

EERE may determine that pre-selection clarifications are necessary from one or more applicants. Pre-selection clarifications are distinct from and less formal than pre-selection interviews. These pre-selection clarifications will solely be for the purposes of clarifying the application, and will be limited to information already provided in the application documentation. The pre-selection clarifications may occur before, during or after the merit review evaluation process. Information provided by an applicant that is not necessary to address the pre-selection clarification question will not be reviewed or considered. Typically, a pre-selection clarification will be carried out through either written responses to EERE's written clarification questions or video or conference calls with EERE representatives.

The information provided by applicants to EERE through pre-selection clarifications is incorporated in their applications and contributes to the merit review evaluation and EERE's selection decisions. If EERE contacts an applicant for pre-selection clarification purposes, it does not signify that the applicant has been selected for negotiation of award or that the applicant is among the top ranked applications.

EERE will not reimburse applicants for expenses relating to the pre-selection clarifications, nor will these costs be eligible for reimbursement as pre-award costs.

iv. Recipient Integrity and Performance Matters

DOE, prior to making a Federal award with a total amount of Federal share greater than the simplified acquisition threshold, is required to review and consider any information about the applicant that is in the designated integrity and performance system accessible through SAM (currently FAPIIS) (see 41 U.S.C. 2313).

The applicant, at its option, may review information in the designated integrity and performance systems accessible through SAM and comment on any information about itself that a Federal awarding agency previously entered and is currently in the designated integrity and performance system accessible through SAM.

DOE will consider any written comments by the applicant, in addition to the other information in the designated integrity and performance system, in making a judgment about the applicant's integrity, business ethics, and record of performance under Federal awards when completing the review of risk posed by applicants as described in 2 C.F.R. § 200.205.

v. Selection

The Selection Official may consider the technical merit, the Federal Consensus Board's recommendations, program policy factors, and the amount of funds available in arriving at selections for this FOA.

E. Anticipated Notice of Selection and Award Dates

EERE anticipates notifying applicants selected for negotiation of award by September 2018 and making awards by Fall 2018.

VI. Award Administration Information

A. Award Notices

i. Ineligible Submissions

Ineligible Full Applications will not be further reviewed or considered for award. The Contracting Officer will send a notification letter by email to the technical and administrative points of contact designated by the applicant in EERE Exchange. The notification letter will state the basis upon which the Full Application is ineligible and not considered for further review.

ii. Full Application Notifications

EERE will notify applicants of its determination via a notification letter by email to the technical and administrative points of contact designated by the applicant in EERE Exchange. The notification letter will inform the applicant whether or not its Full Application was selected for award negotiations. Alternatively, EERE may notify one or more applicants that a final selection determination on particular Full Applications will be made at a later date, subject to the availability of funds or other factors.

iii. Successful Applicants

Receipt of a notification letter selecting a Full Application for award negotiations does not authorize the applicant to commence performance of the project. If an application is selected for award negotiations, it is not a commitment by EERE to issue an award. Applicants do not receive an award until award negotiations are complete and the Contracting Officer executes the funding agreement, accessible by the Prime Recipient in FedConnect.

The award negotiation process will take approximately 60 days. Applicants must designate a primary and a backup point-of-contact in EERE Exchange with whom EERE will communicate to conduct award negotiations. The applicant must be responsive during award negotiations (i.e., provide requested documentation) and meet the negotiation deadlines. If the applicant fails to do so or if award negotiations are otherwise unsuccessful, EERE will cancel the award negotiations and rescind the Selection. EERE reserves the right to terminate award negotiations at any time for any reason.

Please refer to Section IV.I.ii. of the FOA for guidance on pre-award costs.

iv. Alternate Selection Determinations

In some instances, an applicant may receive a notification that its application was not selected for award and EERE designated the application to be an alternate. As an alternate, EERE may consider the Full Application for Federal funding in the future. A notification letter stating the Full Application is designated as an alternate does not authorize the applicant to commence performance of the project. EERE may ultimately determine to select or not select the Full Application for award negotiations.

v. Unsuccessful Applicants

EERE shall promptly notify in writing each applicant whose application has not been selected for award or whose application cannot be funded because of the unavailability of appropriated funds.

B. Administrative and National Policy Requirements

i. Registration Requirements

There are several one-time actions before submitting an application in response to this FOA, and it is vital that applicants address these items as soon as possible. Some may take several weeks, and failure to complete

them could interfere with an applicant's ability to apply to this FOA, or to meet the negotiation deadlines and receive an award if the application is selected. These requirements are as follows:

1. **EERE Exchange**
   Register and create an account on EERE Exchange at https://eere-Exchange.energy.gov.
   This account will then 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. Applicants should also designate backup points of contact so they may be easily contacted if deemed necessary. **This step is required to apply to this FOA.**

   The EERE Exchange registration does not have a delay; however, **the remaining registration requirements below could take several weeks to process and are necessary for a potential applicant to receive an award under this FOA**.

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

3. **System for Award Management**
   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.

4. **FedConnect**
   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.

5. **Grants.gov**

Register in Grants.gov (http://www.grants.gov) to receive automatic updates when Amendments to this FOA are posted. However, please note that Letters of Intent and Full Applications will not be accepted through Grants.gov.

6. **Electronic Authorization of Applications and Award Documents**
   Submission of an application and supplemental information under this FOA through electronic systems used by the Department of Energy, including EERE Exchange and FedConnect.net, constitutes the authorized representative's approval and electronic signature.

ii. Award Administrative Requirements

The administrative requirements for DOE grants and cooperative agreements are contained in 2 CFR Part 200 as amended by 2 CFR Part 910.

iii. Foreign National Access to DOE Sites

All applicants that ultimately enter into an award resulting from this FOA will be subject to the following requirement concerning foreign national involvement. Upon DOE's request, Prime Recipients must provide information to facilitate DOE's responsibilities associated with foreign national access to DOE sites, information, technologies, and equipment. A foreign national is defined as any person who was born outside the jurisdiction of the United States, is a citizen of a foreign government, and has not been naturalized under U.S. law. If the Prime Recipient or Subrecipients, contractors or vendors under the award, anticipate utilizing a foreign national person in the performance of an award, the Prime Recipient is responsible for providing to the Contracting Officer specific information of the foreign national(s) to satisfy compliance with all of the requirements for access approval.

iv. Subaward and Executive Reporting

Additional administrative requirements necessary for DOE grants and cooperative agreements to comply with the Federal Funding and Transparency Act of 2006 (FFATA) are contained in 2 CFR Part 170. Prime Recipients must register with the new FFATA Subaward Reporting System database and report the required data on their first tier Subrecipients. Prime Recipients must report the executive compensation for their own executives as part of their registration profile in SAM.

v. National Policy Requirements

The National Policy Assurances that are incorporated as a term and condition of award are located at: http://www.nsf.gov/awards/managing/rtc.jsp.

vi. Environmental Review in Accordance with National Environmental Policy Act (NEPA)

EERE's decision whether and how to distribute federal funds under this FOA is subject to the National Environmental Policy Act (42 USC 4321, *et seq.*). NEPA requires Federal agencies to integrate environmental values into their decision-making processes by considering the potential environmental impacts of their proposed actions. For additional background on NEPA, please see DOE's NEPA website, at http://nepa.energy.gov/.

While NEPA compliance is a Federal agency responsibility and the ultimate decisions remain with the Federal agency, all recipients selected for an award will be required to assist in the timely and effective completion of the NEPA process in the manner most pertinent to their proposed project. If DOE determines certain records must be prepared to complete the NEPA review process (e.g., biological evaluations or environmental assessments), the costs to prepare the necessary records may be included as part of the project costs.

vii. Applicant Representations and Certifications

1. **Lobbying Restrictions**
   By accepting funds under this award, the Prime Recipient agrees that none of the funds obligated on the award shall be expended, directly or indirectly, to influence Congressional action on any legislation or appropriation matters pending before Congress, other than to communicate to Members of Congress as described in 18 U.S.C. §1913. This restriction is in addition to those prescribed elsewhere in statute and regulation.

2. **Corporate Felony Conviction and Federal Tax Liability Representations**
   In submitting an application in response to this FOA, the applicant represents that:

   a. It is **not** a corporation that has been convicted of a felony criminal violation under any Federal law within the preceding 24 months, and

b. It is **not** a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

For purposes of these representations the following definitions apply:

A Corporation includes any entity that has filed articles of incorporation in any of the 50 states, the District of Columbia, or the various territories of the United States [but not foreign corporations]. It includes both for-profit and non-profit organizations.

3. Nondisclosure and Confidentiality Agreements Representations
In submitting an application in response to this FOA the applicant represents that:

a. It **does not and will not** require its employees or contractors to sign internal nondisclosure or confidentiality agreements or statements prohibiting or otherwise restricting its employees or contactors from lawfully reporting waste, fraud, or abuse to a designated investigative or law enforcement representative of a Federal department or agency authorized to receive such information.

b. It **does not and will not** use any Federal funds to implement or enforce any nondisclosure and/or confidentiality policy, form, or agreement it uses unless it contains the following provisions:

(1) *"These provisions are consistent with and do not supersede, conflict with, or otherwise alter the employee obligations, rights, or liabilities created by existing statute or Executive order relating to (1) classified information, (2) communications to Congress, (3) the reporting to an Inspector General of a violation of any law, rule, or regulation, or mismanagement, a gross waste of funds, an abuse of authority, or a substantial and specific danger to public health or safety, or (4) any other whistleblower protection. The definitions, requirements, obligations,*

rights, sanctions, and liabilities created by controlling Executive orders and statutory provisions are incorporated into this agreement and are controlling.''

(2) The limitation above shall not contravene requirements applicable to Standard Form 312, Form 4414, or any other form issued by a Federal department or agency governing the nondisclosure of classified information.

(3) Notwithstanding the provision listed in paragraph (a), a nondisclosure or confidentiality policy form or agreement that is to be executed by a person connected with the conduct of an intelligence or intelligence-related activity, other than an employee or officer of the United States Government, may contain provisions appropriate to the particular activity for which such document is to be used. Such form or agreement shall, at a minimum, require that the person will not disclose any classified information received in the course of such activity unless specifically authorized to do so by the United States Government. Such nondisclosure or confidentiality forms shall also make it clear that they do not bar disclosures to Congress, or to an authorized official of an executive agency or the Department of Justice, that are essential to reporting a substantial violation of law.

viii. Statement of Federal Stewardship

EERE will exercise normal Federal stewardship in overseeing the project activities performed under EERE Awards. Stewardship Activities include, but are not limited to, conducting site visits; reviewing performance and financial reports, providing assistance and/or temporary intervention in usual circumstances to correct deficiencies that develop during the project; assuring compliance with terms and conditions; and reviewing technical performance after project completion to ensure that the project objectives have been accomplished.

ix. Statement of Substantial Involvement

EERE has substantial involvement in work performed under Awards made as a result of this FOA. EERE does not limit its involvement to the administrative requirements of the Award. Instead, EERE has substantial involvement in the

direction and redirection of the technical aspects of the project as a whole. Substantial involvement includes, but is not limited to, the following:

1. EERE shares responsibility with the recipient for the management, control, direction, and performance of the Project.

2. EERE may intervene in the conduct or performance of work under this Award for programmatic reasons. Intervention includes the interruption or modification of the conduct or performance of project activities.

3. EERE may redirect or discontinue funding the Project based on the outcome of EERE's evaluation of the Project at that the Go/No Go decision point(s).

4. EERE participates in major project decision-making processes.

5. In order to adequately monitor project progress and provide technical direction and/or redirection to the Recipient, DOE must be provided an adequate level of insight into various Recipient activities. Government insight activities include but are not limited to access for DOE's consultants to perform independent evaluations of Recipient's plans and processes. (Consultants to DOE may not provide technical direction and/or redirection to the Recipient.)

6. DOE will be actively involved with the Recipient in verifying the current technology readiness level of the project (and specific unit operations) as well as establishing the project technology baseline and interim and concluding performance metrics. This includes working with the Recipient to generate the baseline technical and financial data sheet that will then be updated periodically throughout the project.

x. Subject Invention Utilization Reporting

In order to ensure that Prime Recipients and Subrecipients holding title to subject inventions are taking the appropriate steps to commercialize subject inventions, EERE may require that each Prime Recipient holding title to a subject invention submit annual reports for 10 years from the date the subject invention was disclosed to EERE on the utilization of the subject invention and efforts made by Prime Recipient or their licensees or assignees to stimulate such utilization. The reports must include information regarding the status of development, date of first commercial sale or use, gross royalties received by the Prime Recipient, and such other data and information as EERE may specify.

xi. Intellectual Property Provisions

The standard DOE financial assistance intellectual property provisions applicable to the various types of recipients are located at https://www.energy.gov/gc/standard-intellectual-property-ip-provisions-financial-assistance-awards.

xii. Reporting

Reporting requirements are identified on the Federal Assistance Reporting Checklist, attached to the award agreement. The checklist can be accessed at https://www.energy.gov/eere/funding/reporting-requirements-eere-funding-awards.

The information requested in the Technical and Economic Tables Template at the time of application as well as during the verification task for selected and awarded projects, must be updated during the intermediate and final verifications and at go/no go decision points throughout the project.

A Project Management Plan will be due for selected and awarded projects thirty days after award and must be updated annually at a minimum.

As a steward of taxpayer funds, BETO recognizes the importance of tracking, documenting and analyzing the outcomes of Federally funded awards. Investments in bioenergy applied R&D often do not immediately translate into impactful commercial products and processes. BETO is interested in evaluating both the short-term progress and the long-term impact of its investments. If a project is selected for award negotiations, a letter of commitment from selectees to reporting beyond the end of the period of performance for at least five years will be required. Receipt of the required information during award negotiations enables BETO to improve future funding opportunities to achieve better outcomes for the high-risk, high-reward technologies it seeks to support.

Therefore, Prime Recipients must agree to provide annual updates (consisting of no more than 600 words) for at least five years following the conclusion of the award, describing technical and economic updates to the technology developed under the BETO award. This may include but is not limited to the following: how the results from the project have been leveraged and have led to commercialization efforts; creation of jobs; subsequent awards; formation of new partnerships; building of new facilities; testing at increased scales; patents and licenses awarded; purchase of

technologies and/or companies; and if the recipient sells technologies or the company itself.

xiii. Go/No-Go Review

Each project selected under this FOA will be subject to a periodic project evaluation referred to as a Go/No-Go Review. Federal funding beyond the Go/No Go decision point (continuation funding), is contingent on: (1) the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority; (2) meeting the objectives, milestones, deliverables, and decision point criteria of recipient's approved project and obtaining approval from EERE to continue work on the project; and (3) the submittal of required reports in accordance with the Statement of Project Objectives.

As a result of the Go/No Go Review, DOE may, at its discretion, authorize the following actions: (1) continue to fund the project, contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority; (2) recommend redirection of work under the project; (3) place a hold on federal funding for the project, pending further supporting data or funding; or (4) discontinue funding the project because of insufficient progress, change in strategic direction, or lack of funding.

The Go/No-Go decision is distinct from a non-compliance determination. In the event a recipient fails to comply with the requirements of an award, EERE may take appropriate action, including but not limited to, redirecting, suspending or terminating the award.

xiv. Conference Spending

The recipient shall not expend any funds on a conference not directly and programmatically related to the purpose for which the grant or cooperative agreement was awarded that would defray the cost to the United States Government of a conference held by any Executive branch department, agency, board, commission, or office for which the cost to the United States Government would otherwise exceed $20,000, thereby circumventing the required notification by the head of any such Executive Branch department, agency, board, commission, or office to the Inspector General (or senior ethics official for any entity without an Inspector General), of the date, location, and number of employees attending such conference.

xv. UCC Financing Statements

Per 2 CFR 910.360 (Real Property and Equipment) when a piece of equipment is purchased by a for-profit recipient or subrecipient with Federal Funds, and when the Federal share of the financial assistance agreement is more than $1,000,000, the recipient or subrecipient must:

Properly record, and consent to the Department's ability to properly record if the recipient fails to do so, UCC financing statement(s) for all equipment in excess of $5,000 purchased with project funds. These financing statement(s) must be approved in writing by the contracting officer prior to the recording, and they shall provide notice that the Recipient's title to all equipment (not real property) purchased with Federal funds under the financial assistance agreement is conditional pursuant to the terms of this section, and that the Government retains an undivided reversionary interest in the equipment. The UCC financing statement(s) must be filed before the Contracting Officer may reimburse the recipient for the Federal share of the equipment unless otherwise provided for in the relevant financial assistance agreement. The recipient shall further make any amendments to the financing statements or additional recordings, including appropriate continuation statements, as necessary or as the contracting officer may direct.

VII. Questions/Agency Contacts

Upon the issuance of a FOA, EERE personnel are prohibited from communicating (in writing or otherwise) with applicants regarding the FOA except through the established question and answer process as described below. Specifically, questions regarding the content of this FOA must be submitted to: BETOBEEPSFOA@EE.DOE.GOV. Questions must be submitted not later than 3 business days prior to the application due date and time.

All questions and answers related to this FOA will be posted on EERE Exchange at: https://eere-exchange.energy.gov. **Please note that you must first select this specific FOA Number in order to view the questions and answers specific to this FOA**. EERE will attempt to respond to a question within 3 business days, unless a similar question and answer has already been posted on the website.

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

VIII. Other Information

A. FOA Modifications

Amendments to this FOA will be posted on the EERE Exchange website and the Grants.gov system. However, you will only receive an email when an amendment or a FOA is posted on these sites if you register for email notifications for this FOA in Grants.gov. EERE recommends that you register as soon after the release of the FOA as possible to ensure you receive timely notice of any amendments or other FOAs.

B. Informational Webinar

EERE will conduct one informational webinar during the FOA process. It will be held after the initial FOA release.

Attendance is not mandatory and will not positively or negatively impact the overall review of any applicant submissions. As the webinar will be open to all applicants who wish to participate, applicants should refrain from asking questions or communicating information that would reveal confidential and/or proprietary information specific to their project. Specific dates can be found on the cover page of the FOA.

C. Government Right to Reject or Negotiate

EERE reserves the right, without qualification, to reject any or all applications received in response to this FOA and to select any application, in whole or in part, as a basis for negotiation and/or award.

D. Commitment of Public Funds

The Contracting Officer is the only individual who can make awards or commit the Government to the expenditure of public funds. A commitment by anyone other than the Contracting Officer, either express or implied, is invalid.

E. Treatment of Application Information

In general, EERE will only use data and other information contained in applications for evaluation purposes, unless such information is generally available to the public or is already the property of the Government.

Applicants should not include trade secrets or commercial or financial information that is privileged or confidential in their application unless such information is necessary to convey an understanding of the proposed project or to comply with a requirement in the FOA.

The use of protective markings such as "Do Not Publicly Release – Trade Secret" or "Do Not Publicly Release – Confidential Business Information" is encouraged. However, applicants should be aware that the use of protective markings is not dispositive as to whether information will be publicly released pursuant to the Freedom of Information Act, 5 U.S.C. §552, et. seq., as amended by the OPEN Government Act of 2007, Pub. L. No. 110-175. (See Section I of this document, "Notice of Potential Disclosure Under the Freedom of Information Act (FOIA)" for additional information regarding the public release of information under the Freedom of Information Act.

Applicants are encouraged to employ protective markings in the following manner:

The cover sheet of the application must be marked as follows and identify the specific pages containing trade secrets or commercial or financial information that is privileged or confidential:

> Notice of Restriction on Disclosure and Use of Data:
> Pages [list applicable pages] of this document may contain trade secrets or commercial or financial information that is privileged or confidential, and is exempt from public disclosure. Such information shall be used or disclosed only for evaluation purposes or in accordance with a financial assistance or loan agreement between the submitter and the Government. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source.
> [End of Notice]

The header and footer of every page that contains trade secrets or commercial or financial information that is privileged must be marked as follows: "May contain trade secrets or commercial or financial information that is privileged or confidential and exempt from public disclosure."

In addition, each line or paragraph containing trade secrets or commercial or financial information that is privileged or confidential must be enclosed in brackets.

F. Evaluation and Administration by Non-Federal Personnel

In conducting the merit review evaluation, the Go/No-Go Review and Peer Review, the Government may seek the advice of qualified non Federal personnel as reviewers. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The applicant, by submitting its application, consents to the use of non-Federal reviewers/administrators. Non-Federal reviewers must sign conflict of interest and non-disclosure agreements prior to reviewing an application. Non-Federal personnel conducting administrative activities must sign a non-disclosure agreement.

G. Notice Regarding Eligible/Ineligible Activities

Eligible activities under this FOA include those which describe and promote the understanding of scientific and technical aspects of specific energy technologies, but not those which encourage or support political activities such as the collection and dissemination of information related to potential, planned or pending legislation.

H. Notice of Right to Conduct a Review of Financial Capability

EERE reserves the right to conduct an independent third party review of financial capability for applicants that are selected for negotiation of award (including personal credit information of principal(s) of a small business if there is insufficient information to determine financial capability of the organization).

I. Notice of Potential Disclosure Under Freedom of Information Act (FOIA)

Under the Freedom of Information Act, (FOIA), 5 U.S.C. §552, et. seq., as amended by the OPEN Government Act of 2007, Pub. L. No. 110-175, any information received from the Applicant is considered to be an agency record, and as such, subject to public release under FOIA. The purpose of the FOIA is to afford the public the right to request and receive agency records unless those agency records are protected from disclosure under one or more of the nine FOIA exemptions. Decisions to disclose or withhold information received from the Applicant are based upon the applicability of one or more of the nine FOIA exemptions, not on the existence or nonexistence of protective markings or designations. Only the agency's designated FOIA Officer may determine if information received from the Applicant may be withheld pursuant to one of the nine FOIA exemptions. All FOIA requests received by DOE are processed in accordance with 10 C.F.R. Part 1004.

J. Requirement for Full and Complete Disclosure

Applicants are required to make a full and complete disclosure of all information requested. Any failure to make a full and complete disclosure of the requested information may result in:

- The termination of award negotiations;
- The modification, suspension, and/or termination of a funding agreement;
- The initiation of debarment proceedings, debarment, and/or a declaration of ineligibility for receipt of Federal contracts, subcontracts, and financial assistance and benefits; and
- Civil and/or criminal penalties.

K. Retention of Submissions

EERE expects to retain copies of all Letters of Intent, Full Applications, Replies to Reviewer Comments, and other submissions. No submissions will be returned. By applying to EERE for funding, applicants consent to EERE's retention of their submissions.

L. Title to Subject Inventions

Ownership of subject inventions is governed pursuant to the authorities listed below.

- Domestic Small Businesses, Educational Institutions, and Nonprofits: Under the Bayh-Dole Act (35 U.S.C. § 200 et seq.), domestic small businesses, educational institutions, and nonprofits may elect to retain title to their subject inventions.
- All other parties: The Federal Non-Nuclear Energy Act of 1974, 42. U.S.C. 5908, provides that the Government obtains title to new inventions unless a waiver is granted (see below).
- Class Patent Waiver: DOE has issued a class waiver that applies to this FOA. Under this class waiver, domestic large businesses may elect title to their subject inventions similar to the right provided to the domestic small businesses, educational institutions, and nonprofits by law. In order to avail itself of the class waiver, a domestic large business must agree that any products embodying or produced through the use of a subject invention first created or reduced to practice under this program will be substantially

manufactured in the United States, unless DOE agrees that the commitments proposed in the U.S. Manufacturing Plan are sufficient.

- Advance and Identified Waivers: Applicants may request a patent waiver that will cover subject inventions that may be invented under the award, in advance of or within 30 days after the effective date of the award. Even if an advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver for identified inventions, i.e., individual subject inventions that are disclosed to EERE within the timeframes set forth in the award's intellectual property terms and conditions. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784.
- Determination of Exceptional Circumstances (DEC): Each applicant is required to submit a U.S. Manufacturing Plan as part of its application. If selected, the U.S. Manufacturing Plan shall be incorporated into the award terms and conditions for domestic small businesses and nonprofit organizations. DOE has determined that exceptional circumstances exist that warrants the modification of the standard patent rights clause for small businesses and non-profit recipients under Bayh-Dole to the extent necessary to implement and enforce the U.S. Manufacturing Plan. For example, the commitments and enforcement of a U.S. Manufacturing Plan may be tied to subject inventions. Any Bayh-Dole entity (domestic small business or nonprofit organization) affected by this DEC has the right to appeal it.

M. Government Rights in Subject Inventions

Where Prime Recipients and Subrecipients retain title to subject inventions, the U.S. Government retains certain rights.

i. Government Use License

The U.S. Government retains a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States any subject invention throughout the world. This license extends to contractors doing work on behalf of the Government.

ii. March-In Rights

The U.S. Government retains march-in rights with respect to all subject inventions. Through "march-in rights," the Government may require a Prime Recipient or Subrecipient who has elected to retain title to a subject invention (or their assignees or exclusive licensees), to grant a license for use of the invention to a third party. In addition, the Government may grant

licenses for use of the subject invention when a Prime Recipient, Subrecipient, or their assignees and exclusive licensees refuse to do so.

DOE may exercise its march-in rights only if it determines that such action is necessary under any of the four following conditions:

- The owner or licensee has not taken or is not expected to take effective steps to achieve practical application of the invention within a reasonable time;
- The owner or licensee has not taken action to alleviate health or safety needs in a reasonably satisfied manner;
- The owner has not met public use requirements specified by Federal statutes in a reasonably satisfied manner; or
- The U.S. Manufacturing requirement has not been met.

Any determination that march-in rights are warranted must follow a fact-finding process in which the recipient has certain rights to present evidence and witnesses, confront witnesses and appear with counsel and appeal any adverse decision. To date, DOE has never exercised its march-in rights to any subject inventions.

N. Rights in Technical Data

Data rights differ based on whether data is first produced under an award or instead was developed at private expense outside the award.

"Limited Rights Data": The U.S. Government will not normally require delivery of confidential or trade secret-type technical data developed solely at private expense prior to issuance of an award, except as necessary to monitor technical progress and evaluate the potential of proposed technologies to reach specific technical and cost metrics.

Government rights in Technical Data Produced Under Awards: The U.S. Government normally retains unlimited rights in technical data produced under Government financial assistance awards, including the right to distribute to the public. However, pursuant to special statutory authority, certain categories of data generated under EERE awards may be protected from public disclosure for up to five years after the data is generated ("Protected Data"). For awards permitting Protected Data, the protected data must be marked as set forth in the awards intellectual property terms and conditions and a listing of unlimited rights data (i.e., non-protected data) must be inserted into the data clause in the award. In

addition, invention disclosures may be protected from public disclosure for a reasonable time in order to allow for filing a patent application.

O. Copyright

The Prime Recipient and Subrecipients may assert copyright in copyrightable works, such as software, first produced under the award without EERE approval. When copyright is asserted, the Government retains a paid-up nonexclusive, irrevocable worldwide license to reproduce, prepare derivative works, distribute copies to the public, and to perform publicly and display publicly the copyrighted work. This license extends to contractors and others doing work on behalf of the Government.

P. Personally Identifiable Information (PII)

All information provided by the Applicant must to the greatest extent possible exclude Personally Identifiable Information (PII). The term "personally identifiable information" refers to information which can be used to distinguish or trace an individual's identity, such as their name, social security number, biometric records, etc. alone, or when combined with other personal or identifying information which is linked or linkable to a specific individual, such as date and place of birth, mother's maiden name, etc. (See OMB Memorandum M-07-16 dated May 22, 2007, found at: https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2007/m07-16.pdf

By way of example, Applicants must screen resumes to ensure that they do not contain PII such as personal addresses, phone/cell numbers, personal emails and/or SSNs. In short, if the PII is not essential to the application, it should not be in the application.

Q. Annual Independent Audits

If a for-profit entity is a Prime Recipient and has expended $750,000 or more of DOE awards during the entity's fiscal year, an annual Compliance Audit performed by an independent auditor is required. For additional information, please refer to 2 C.F.R. § 910.501 and Subpart F.

If an educational institution, non-profit organization, or state/local government is a Prime Recipient or Subrecipient and has expended $750,000 or more of Federal awards during the non-Federal entity's fiscal year, then a Single or Program-

Specific Audit is required. For additional information, please refer to 2 C.F.R. § 200.501 and Subpart F.

Applicants and sub-recipients (if applicable) should propose sufficient costs in the project budget to cover the costs associated with the audit. EERE will share in the cost of the audit at its applicable cost share ratio.

Appendix A – Cost Share Information

Cost Sharing or Cost Matching

The terms "cost sharing" and "cost matching" are often used synonymously. Even the DOE Financial Assistance Regulations, 2 CFR 200.306, use both of the terms in the titles specific to regulations applicable to cost sharing. EERE almost always uses the term "cost sharing," as it conveys the concept that non-federal share is calculated as a percentage of the Total Project Cost. An exception is the State Energy Program Regulation, 10 CFR 420.12, and State Matching Contribution. Here "cost matching" for the non-federal share is calculated as a percentage of the Federal funds only, rather than the Total Project Cost.

How Cost Sharing Is Calculated

As stated above, cost sharing is calculated as a percentage of the Total Project Cost. FFRDC costs must be included in Total Project Costs. Following is an example of how to calculate cost sharing amounts for a project with $1,000,000 in federal funds with a minimum 20% non-federal cost sharing requirement:

- Formula: Federal share ($) divided by Federal share (%) = Total Project Cost
  Example: $1,000,000 divided by 80% = $1,250,000

- Formula: Total Project Cost ($) minus Federal share ($) = Non-federal share ($)
  Example: $1,250,000 minus $1,000,000 = $250,000

- Formula: Non-federal share ($) divided by Total Project Cost ($) = Non-federal share (%)
  Example: $250,000 divided by $1,250,000 = 20%

What Qualifies For Cost Sharing

While it is not possible to explain what specifically qualifies for cost sharing in one or even a couple of sentences, in general, if a cost is allowable under the cost principles applicable to the organization incurring the cost and is eligible for reimbursement under an EERE grant or cooperative agreement, then it is allowable as cost share. Conversely, if the cost is not allowable under the cost principles and not eligible for reimbursement, then it is not allowable as cost share. In addition, costs may not be counted as cost share if they are paid by the Federal Government under another award unless authorized by Federal statute to be used for cost sharing.

The rules associated with what is allowable as cost share are specific to the type of organization that is receiving funds under the grant or cooperative agreement, though are generally the same for all types of entities. The specific rules applicable to:

- FAR Part 31 for For-Profit entities, (48 CFR Part 31); and
- 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

In addition to the regulations referenced above, other factors may also come into play such as timing of donations and length of the project period. For example, the value of ten years of donated maintenance on a project that has a project period of five years would not be fully allowable as cost share. Only the value for the five years of donated maintenance that corresponds to the project period is allowable and may be counted as cost share.

Additionally, EERE generally does not allow pre-award costs for either cost share or reimbursement when these costs precede the signing of the appropriation bill that funds the award. In the case of a competitive award, EERE generally does not allow pre-award costs prior to the signing of the Selection Statement by the EERE Selection Official.

General Cost Sharing Rules on a DOE award

1. Cash Cost Share - encompasses all contributions to the project made by the recipient or subrecipient(s), for costs incurred and paid for during the project. This includes when an organization pays for personnel, supplies, equipment, etc. for their own company with organizational resources. If the item or service is reimbursed for, it is cash cost share. All cost share items must be necessary to the performance of the project.

2. In Kind Cost Share - encompasses all contributions to the project made by the recipient or subrecipient(s) that do not involve a payment or reimbursement and represent donated items or services. In Kind cost share items include volunteer personnel hours, donated existing equipment, donated existing supplies, etc. The cash value and calculations thereof for all In Kind cost share items must be justified and explained in the Cost Share section of the project Budget Justification (EERE 335). All cost share items must be necessary to the performance of the project. If questions exist, consult your DOE contact before filling out the In Kind cost share section of the Budget Justification (EERE 335).

3. Funds from other Federal sources MAY NOT be counted as cost share. This prohibition includes FFRDC sub-recipients. Non-Federal sources include any source not originally derived from Federal funds. Cost sharing commitment letters from subrecipients must be provided with the original application.

4. Fee or profit, including foregone fee or profit, are not allowable as project costs (including cost share) under any resulting award. The project may only incur those costs that are allowable and allocable to the project (including cost share) as determined in accordance with the applicable cost principles prescribed in FAR Part 31 for For-Profit entities and 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

DOE Financial Assistance Rules 2 CFR Part 200 as amended by 2 CFR Part 910

As stated above, the rules associated with what is allowable cost share are generally the same for all types of organizations. Following are the rules found to be common, but again, the specifics are contained in the regulations and cost principles specific to the type of entity:

(A) Acceptable contributions. All contributions, including cash contributions and third party in-kind contributions, must be accepted as part of the Prime Recipient's cost sharing if such contributions meet all of the following criteria:

(1) They are verifiable from the recipient's records.

(2) They are not included as contributions for any other federally-assisted project or program.

(3) They are necessary and reasonable for the proper and efficient accomplishment of project or program objectives.

(4) They are allowable under the cost principles applicable to the type of entity incurring the cost as follows:

a. For-profit organizations. Allowability of costs incurred by for-profit organizations and those nonprofit organizations listed in Attachment C to OMB Circular A–122 is determined in accordance with the for-profit cost principles in 48 CFR Part 31 in the Federal Acquisition Regulation, except that patent prosecution costs are not allowable unless specifically authorized in the award document. (v) Commercial Organizations. FAR Subpart 31.2—Contracts with Commercial Organizations

b. Other types of organizations. For all other non-federal entities, allowability of costs is determined in accordance with 2 CFR Part 200 Subpart E.

(5) They are not paid by the Federal Government under another award unless authorized by Federal statute to be used for cost sharing or matching.

(6) They are provided for in the approved budget.

(B) Valuing and documenting contributions

(1) Valuing recipient's property or services of recipient's employees. Values are established in accordance with the applicable cost principles, which mean that amounts chargeable to the project are determined on the basis of costs incurred. For real property or equipment used on the project, the cost principles authorize depreciation or use charges. The full value of the item may be applied when the item will be consumed in the performance of the award or fully depreciated by the end of the award. In cases where the full value of a donated capital asset is to be applied as cost sharing or matching, that full value must be the lesser or the following:

a. The certified value of the remaining life of the property recorded in the recipient's accounting records at the time of donation; or
b. The current fair market value. If there is sufficient justification, the Contracting Officer may approve the use of the current fair market value of the donated property, even if it exceeds the certified value at the time of donation to the project. The Contracting Officer may accept the use of any reasonable basis for determining the fair market value of the property.

(2) Valuing services of others' employees. If an employer other than the recipient furnishes the services of an employee, those services are valued at the employee's regular rate of pay, provided these services are for the same skill level for which the employee is normally paid.

(3) Valuing volunteer services. Volunteer services furnished by professional and technical personnel, consultants, and other skilled and unskilled labor may be counted as cost sharing or matching if the service is an integral and necessary part of an approved project or program. Rates for volunteer services must be consistent with those paid for similar work in the recipient's organization. In those markets in which the required skills are not found in the recipient organization, rates must be consistent with those paid for similar work in the labor market in which the recipient competes for the kind of services involved. In either case, paid fringe benefits that are reasonable, allowable, and allocable may be included in the valuation.

(4) Valuing property donated by third parties.

a. Donated supplies may include such items as office supplies or laboratory supplies. Value assessed to donated supplies included in the cost sharing or matching share must be reasonable and must not exceed the fair market value of the property at the time of the donation.

b. Normally only depreciation or use charges for equipment and buildings may be applied. However, the fair rental charges for land and the full value of equipment or other capital assets may be allowed, when they will be consumed in the performance of the award or fully depreciated by the end of the award, provided that the Contracting Officer has approved the charges. When use charges are applied, values must be determined in accordance with the usual accounting policies of the recipient, with the following qualifications:

    i. The value of donated space must not exceed the fair rental value of comparable space as established by an independent appraisal of comparable space and facilities in a privately-owned building in the same locality.
    ii. The value of loaned equipment must not exceed its fair rental value.

(5) Documentation. The following requirements pertain to the recipient's supporting records for in-kind contributions from third parties:

a. Volunteer services must be documented and, to the extent feasible, supported by the same methods used by the recipient for its own employees.

b. The basis for determining the valuation for personal services and property must be documented.

Appendix B – Waiver Requests: Foreign Entity Participation as the Prime Recipient and Performance of Work in the United States

1. *Waiver for Foreign Entity Participation as the Prime Recipient*

As set forth in Section III.A.iii., all Prime Recipients receiving funding under this FOA must be incorporated (or otherwise formed) under the laws of a State or territory of the United States. To request a waiver of this requirement, an applicant must submit an explicit waiver request in the Full Application.

Overall, the applicant must demonstrate to the satisfaction of EERE that it would further the purposes of this FOA and is otherwise in the economic interests of the United States to have a foreign entity serve as the Prime Recipient. A request to waive the *Foreign Entity Participation as the Prime Recipient* requirement must include the following:

- Entity name;
- The rationale for proposing a foreign entity to serve as the Prime Recipient;
- Country of incorporation;
- A description of the project's anticipated contributions to the US economy;
    - How the project will benefit U.S. research, development and manufacturing, including contributions to employment in the U.S. and growth in new markets and jobs in the U.S.;
    - How the project will promote domestic American manufacturing of products and/or services;
- A description of how the foreign entity's participation as the Prime Recipient is essential to the project;
- A description of the likelihood of Intellectual Property (IP) being created from the work and the treatment of any such IP;
- Countries where the work will be performed (Note: if any work is proposed to be conducted outside the U.S., the applicant must also complete a separate request for waiver of the Performance of Work in the United States requirement).

EERE may require additional information before considering the waiver request.

The applicant does not have the right to appeal EERE's decision concerning a waiver request.

2. *Waiver for Performance of Work in the United States*

As set forth in Section IV.I.iii., all work under EERE funding agreements must be performed in the United States. This requirement does not apply to the purchase of supplies and equipment,

so a waiver is not required for foreign purchases of these items. However, the Prime Recipient should make every effort to purchase supplies and equipment within the United States. There may be limited circumstances where it is in the interest of the project to perform a portion of the work outside the United States. To seek a waiver of the Performance of Work in the United States requirement, the applicant must submit an explicit waiver request in the Full Application. A separate waiver request must be submitted for each entity proposing performance of work outside of the United States.

Overall, a waiver request must demonstrate to the satisfaction of EERE that it would further the purposes of this FOA and is otherwise in the economic interests of the United States to perform work outside of the United States. A request to waive the *Performance of Work in the United States* requirement must include the following:

- The rationale for performing the work outside the U.S. ("foreign work");
- A description of the work proposed to be performed outside the U.S.;
- An explanation as to how the foreign work is essential to the project;
- A description of the anticipated benefits to be realized by the proposed foreign work and the anticipated contributions to the US economy;
    - The associated benefits to be realized and the contribution to the project from the foreign work;
    - How the foreign work will benefit U.S. research, development and manufacturing, including contributions to employment in the U.S. and growth in new markets and jobs in the U.S.;
    - How the foreign work will promote domestic American manufacturing of products and/or services;
- A description of the likelihood of Intellectual Property (IP) being created from the foreign work and the treatment of any such IP;
- The total estimated cost (DOE and Recipient cost share) of the proposed foreign work;
- The countries in which the foreign work is proposed to be performed; and
- The name of the entity that would perform the foreign work.

EERE may require additional information before considering the waiver request.

The applicant does not have the right to appeal EERE's decision concerning a waiver request.

Appendix C - Data Management Plan

A data management plan ("DMP") explains how data generated in the course of the work performed under an EERE award will be shared and preserved or, when justified, explains why data sharing or preservation is not possible or scientifically appropriate.

DMP Requirements

In order for a DMP to be considered acceptable, the DMP must address the following:

At a minimum, the DMP must describe how data sharing and preservation will enable validation of the results from the proposed work, or how results could be validated if data are not shared or preserved.

The DMP must provide a plan for making all research data displayed in publications resulting from the proposed work digitally accessible at the time of publication. This includes data that are displayed in charts, figures, images, etc. In addition, the underlying digital research data used to generate the displayed data should be made as accessible as possible in accordance with the principles stated above. This requirement could be met by including the data as supplementary information to the published article, or through other means. The published article should indicate how these data can be accessed.

The DMP should consult and reference available information about data management resources to be used in the course of the proposed work. In particular, a DMP that explicitly or implicitly commits data management resources at a facility beyond what is conventionally made available to approved users should be accompanied by written approval from that facility. In determining the resources available for data management at DOE User Facilities, researchers should consult the published description of data management resources and practices at that facility and reference it in the DMP. Information about other DOE facilities can be found in the additional guidance from the sponsoring program.

The DMP must protect confidentiality, personal privacy, Personally Identifiable Information, and U.S. national, homeland, and economic security; recognize proprietary interests, business confidential information, and intellectual property rights; avoid significant negative impact on innovation, and U.S. competitiveness; and otherwise be consistent with all laws (i.e., export control laws), and DOE regulations, orders, and policies.

Data Determination for a DMP

The Principal Investigator should determine which data should be the subject of the DMP and, in the DMP, propose which data should be shared and/or preserved in accordance with the DMP Requirements noted above.

For data that will be generated through the course of the proposed work, the Principal Investigator should indicate what types of data should be protected from immediate public disclosure by DOE (referred to as "protected data") and what types of data that DOE should be able to release immediately. Similarly, for data developed outside of the proposed work at private expense that will be used in the course of the proposed work, the Principal Investigator should indicate whether that type of data will be subject to public release or kept confidential (referred to as "limited rights data"). Any use of limited rights data or labeling of data as "protected data" must be consistent with the DMP Requirements noted above.

Suggested Elements for a DMP

The following list of elements for a DMP provides suggestions regarding the data management planning process and the structure of the DMP:

Data Types and Sources: A brief, high-level description of the data to be generated or used through the course of the proposed work and which of these are considered digital research data necessary to validate the research findings or results.

Content and Format: A statement of plans for data and metadata content and format including, where applicable, a description of documentation plans, annotation of relevant software, and the rationale for the selection of appropriate standards. Existing, accepted community standards should be used where possible. Where community standards are missing or inadequate, the DMP could propose alternate strategies for facilitating sharing, and should advise the sponsoring program of any need to develop or generalize standards.

Sharing and Preservation: A description of the plans for data sharing and preservation. This should include, when appropriate: the anticipated means for sharing and the rationale for any restrictions on who may access the data and under what conditions; a timeline for sharing and preservation that addresses both the minimum length of time the data will be available and any anticipated delay to data access after research findings are published; any special requirements for data sharing, for example, proprietary software needed to access or interpret data, applicable policies, provisions, and licenses for re-use and re-distribution, and for the production of derivatives, including guidance for how data and data products should be cited; any resources and capabilities (equipment, connections,

systems, software, expertise, etc.) requested in the research proposal that are needed to meet the stated goals for sharing and preservation (this could reference the relevant section of the associated research proposal and budget request); and whether/where the data will be preserved after direct project funding ends and any plans for the transfer of responsibilities for sharing and preservation.

Protection: A statement of plans, where appropriate and necessary, to protect confidentiality, personal privacy, Personally Identifiable Information, and U.S. national, homeland, and economic security; recognize proprietary interests, business confidential information, and intellectual property rights; and avoid significant negative impact on innovation, and U.S. competitiveness.

Rationale: A discussion of the rationale or justification for the proposed data management plan including, for example, the potential impact of the data within the immediate field and in other fields, and any broader societal impact.

Additional Guidance

In determining which data should be shared and preserved, researchers must consider the data needed to validate research findings as described in the Requirements, and are encouraged to consider the potential benefits of their data to their own fields of research, fields other than their own, and society at large.

DMPs should reflect relevant standards and community best practices and make use of community accepted repositories whenever practicable.

Costs associated with the scope of work and resources articulated in a DMP may be included in the proposed research budget as permitted by the applicable cost principles.

To improve the discoverability of and attribution for datasets created and used in the course of research, EERE encourages the citation of publicly available datasets within the reference section of publications, and the identification of datasets with persistent identifiers such as Digital Object Identifiers (DOIs). In most cases, EERE can provide DOIs free of charge for data resulting from DOE-funded research through its Office of Scientific and Technical Information (OSTI) Data ID Service.

EERE's Digital Data Management principles can be found at: EERE Digital Data Management | Department of Energy

Definitions

Data Preservation: Data preservation means providing for the usability of data beyond the lifetime of the research activity that generated them.

Data Sharing: Data sharing means making data available to people other than those who have generated them. Examples of data sharing range from bilateral communications with colleagues, to providing free, unrestricted access to anyone through, for example, a web-based platform.

Digital Research Data: The term digital data encompasses a wide variety of information stored in digital form including: experimental, observational, and simulation data; codes, software and algorithms; text; numeric information; images; video; audio; and associated metadata. It also encompasses information in a variety of different forms including raw, processed, and analyzed data, published and archived data.

Research Data: The recorded factual material commonly accepted in the scientific community as necessary to validate research findings, but not any of the following: preliminary analyses, drafts of scientific papers, plans for future research, peer reviews, or communications with colleagues. This 'recorded' material excludes physical objects (e.g., laboratory samples). Research data also do not include:

> (A) Trade secrets, commercial information, materials necessary to be held confidential by a researcher until they are published, or similar information which is protected under law; and
>
> (B) Personnel and medical information and similar information the disclosure of which would constitute a clearly unwarranted invasion of personal privacy, such as information that could be used to identify a particular person in a research study."

Validate: In the context of DMPs, validate means to support, corroborate, verify, or otherwise determine the legitimacy of the research findings. Validation of research findings could be accomplished by reproducing the original experiment or analyses; comparing and contrasting the results against those of a new experiment or analyses; or by some other means.

APPENDIX D – DEFINITIONS AND ACCEPTABLE BIOMASS FEEDSTOCKS

Table 2 outlines which feedstocks may be used for each FOA topic area. Definitions of each feedstock for the purposes of this FOA are below.

	Biomass Feedstocks or Biomass Intermediates	Biogas	Lignin	Carbon Dioxide/Flue Gas	Post-sorted MSW	Wet Waste
Topic Area 1: CCB	Allowed	Allowed	Allowed	Allowed	Allowed	Allowed
Topic Area 2: ABF	Allowed	Allowed	Allowed	Allowed	Allowed	
Topic Area 3: PABP	Allowed	Allowed	Allowed	Allowed	Allowed	Allowed
Topic Area 4: WWTE					Allowed	Allowed
Topic Area 5: Rewiring		Allowed		Allowed		
Topic Area 6: Lignin			Allowed			

Table 2. Acceptable Feedstocks

"Advanced biofuels" for purposes of this FOA, the term 'advanced biofuels' means renewable fuel, other than sugar, starch and lignocellulosic based ethanol, that has lifecycle greenhouse gas emissions that are at least 50 percent less than baseline lifecycle greenhouse gas emissions. "Biodiesel" or other diesel-equivalent fuel derived from trans-esterification of renewable biomass, including vegetable oil and animal fat, is specifically excluded.

"**Biomass intermediates**" for the purposes of this FOA, 'biomass intermediates' are biologically derived materials such as mixed, dilute sugars, oligomeric sugars, acids, alcohols, biogases, biosolids, and lignin (additional information provided below). Further conversion of these intermediates leads to liquid transportation fuels or other bioproducts.

"Biomass feedstocks"
Both lignocellulosic and algal feedstocks are of interest. Applicants must identify their target, high-impact feedstock, which is defined as a feedstock that could be sustainably produced at a rate of at least 50 million dry tons of biomass per year. Alternatively, the proposed technology must be shown to have the ability to convert a variety of biomass feedstocks that together

represent a total sustainable potential of at least 50 million dry tons of biomass per year. The lignocellulosic biomass sources include agricultural residues such as corn stover, other grain straws, bagasse, soybean matter and wood residues as defined in EPAct 2005 Section 932(a)(1)&(2) and cited below. No plant based material that is generally intended for use as food may be used as a feedstock under this FOA. Hence, sugars derived from sugarcane, sweet sorghum, or beets and oils derived from soy, canola, sunflower, peanut, and other such food sources normally recovered using conventional food processing methods are not eligible as feedstocks under this FOA. Model compounds may not be used to meet technical milestones; real biomass-derived feedstocks are required. To be clear, applications proposing to process fiber from wet and dry-grind corn refineries, distillers dried grains and solubles, or other food related biomass will be considered non-responsive and will NOT be considered for funding under this FOA.
Algal biomass includes micro- and macro-algae, as well as cyanobacteria. Algal biofuel and bioproduct intermediates include extracted lipids, products derived from sugars or proteins (alcohol or hydrocarbon fuels), secreted metabolites (alcohols or others), or bio-crude resulting from hydrothermal liquefaction. If experimental plans rely on genetically modified organism (GMO) technology, a discussion of the U.S. regulatory landscape – e.g., Toxic Substance Control Act (TSCA), the Animal and Plant Health Inspection Service (APHIS) – and the impacts of regulations on the project objectives, scope, and schedule are required. Biology and cultivation experimental plans must consider scaling explicitly in experimental design and objectives as shown by but not limited to: primary use of robust production organisms (instead of model organisms, e.g. Chlamydomonas reinhardtii); diurnal cycles, solar-strength irradiance, and fluctuating temperatures for growth experiments; and outdoor culture performance verification.

"**Biogas**" (including landfill gas and sewage waste treatment gas) for the purposes of this FOA, is produced through the conversion of organic matter from renewable biomass. This DOES NOT include syngas from the gasification of biomass. Pure methane and mixtures of gases resembling biogas are specifically excluded.

"Carbon dioxide/flue gas" for the purpose of this FOA, refers to any waste carbon dioxide (CO_2) produced as a byproduct from fermentation or the combustion of biomass or other biopower processes. Applicants can propose to use synthetic gas mixtures that reasonably mimic actual waste CO_2 streams during their work.

"Lignin" for the purpose of this FOA, refers to a lignin-containing stream resulting from the deconstruction of lignocellulosic biomass. Model compounds may not be used to meet milestones or metrics. To meet the metric of >50% conversion of lignin, only carbon actually derived from the lignin polymer will be accepted. Therefore, appropriate methods must be in place to determine the extent of lignin conversion and to characterize lignin deconstruction products.

"Post-sorted MSW" for the purposes of this FOA, biomass as defined in EPAct 2005 (Public Law 109-58) Section 932(a)(1-2) that is segregated from the MSW as a separate stream, could be employed as a feedstock with appropriate considerations for the costs of such segregation, collection, processing, and transportation. Hence, post-sorted MSW, where all recyclables and non-biomass components have been removed, would qualify, but only the remaining organic material that meets the above requirements would qualify as a feedstock for purposes of this FOA. Unsorted MSW is specifically excluded.

"Wet waste" for the purpose of this FOA, "wet waste" refers to the following: Primary, secondary, tertiary, and post-anaerobic digestion sludge (i.e., biosolids) from municipal wastewater treatment systems; food wastes from industrial, commercial, and residential sources; Organic-rich wastewaters from industrial and commercial operations; Manure slurries from animal husbandry operations

Sec. 932. BIOENERGY PROGRAM.

(a) DEFINITIONS:—In this section:

(1) BIOMASS.—The term "biomass" means—

(A) any organic material grown for the purpose of being converted to energy;

(B) any organic byproduct of agriculture (including wastes from food production and processing) that can be converted into energy; or

(C) any waste material that can be converted to energy, is segregated from other waste materials, and is derived from—

(i) any of the following forest-related resources: mill residues, precommercial thinnings, slash, brush, or otherwise non-merchantable material; or

(ii) wood waste materials, including waste pallets, crates, dunnage, manufacturing and construction wood wastes (other than pressure-treated, chemically-treated, or painted wood wastes), and landscape or right-of-way tree trimmings, but not including municipal solid waste, gas derived from the biodegradation of municipal solid waste or paper that is commonly recycled.

(2) LIGNOCELLULOSIC FEEDSTOCK.—The term "lignocellulosic feedstock" means any portion of a plant or coproduct from conversion, including crops, trees, forest residues, and agricultural residues *not specifically grown for food*, [emphasis added] including from barley grain, grape seed, rice bran, rice hulls, rice straw, soybean matter, and sugarcane bagasse.

(b) PROGRAM.—The Secretary shall conduct a program of research, development, demonstration, and commercial application for bioenergy, including—

(1) biopower energy systems;

(2) biofuels;

(3) bioproducts;
(4) integrated biorefineries that may produce biopower, biofuels, and bioproducts;
(5) cross-cutting research and development in feedstocks; and
(6) economic analysis

(c) BIOFUELS AND BIOPRODUCTS.—The goals of the biofuels and bioproducts programs shall be to develop, in partnership with industry and institutions of higher education—

(1) advanced biochemical and thermochemical conversion technologies capable of making fuels from lignocellulosic feedstocks that are price-competitive with gasoline or diesel in either internal combustion engines or fuel cell-powered vehicles;
(2) advanced biotechnology processes capable of making biofuels and bioproducts with emphasis on development of biorefinery technologies using enzyme-based processing systems;
(3) advanced biotechnology processes capable of increasing energy production from lignocellulosic feedstocks, with emphasis on reducing the dependence of industry on fossil fuels in manufacturing facilities; and
(4) other advanced processes that will enable the development of cost-effective bioproducts, including biofuels.

APPENDIX E – TECHNICAL AND ECONOMIC TABLES TEMPLATE

The Technical and Economic Tables Template is available in an Excel format as an attachment to the FOA. This form is available on EERE Exchange at https://eere-Exchange.energy.gov/. The tables in the template are intended to be utilized to demonstrate performance target metrics as well as the estimated production cost impacts of the proposed project. **Applications submitted without the appropriate technical and economic data as defined in the template tables provided will be excluded from review under this FOA.** Complete these or similar tables as they apply to the proposed project. It is expected that all relevant data will be provided where possible and appropriate. If the applicant chooses to use the format provided in the Excel spreadsheet, please use the following instructions. If the applicant chooses to represent this data in a different format, please use the Technical and Economic Tables Template as a guide to the types of data that must be included in the application.

Tab Definitions and Instructions

BFD (Block Flow Diagram) - The BFD should be completed by applicants for Topic Areas 1, 2, 4, 5, and 6) – On the "BFD" tab, the applicant is expected to insert a block flow diagram (BFD) of their process. It is understood that the proposed project may be in the very early stages of research and the BFD may change throughout the project as the applicant better understands how the project would fit into a commercial biofuels plant. The BFD is intended to be high-level but should include the ***entire process from feedstock to all products including fuel***. It should represent the conceptual design and show the relationship between the major unit operations. It should not include any minor equipment, piping materials of construction, or piping sizes. The applicant should ***clearly highlight which portion of this process is being explored in the application***. For each unit operation that is highlighted in the BFD (and is the focus of the application), a set of three columns (Benchmark, Intermediate, and Final) must be completed on the "Verification Table" tab.

Verification Table – The Verification table should be completed by applicants for all Topic Areas) – This tab contains the majority of the key technical performance metrics that should be completed by applicant to represent the current benchmark, as well as intermediate and final targets (described below). **Please note that Topic Area 3a applicants do not need to provide baseline data; only intermediate and final targets are required**. **All other Topic Areas are required to provide data for benchmark, intermediate and final targets.** The intent of the Verification Table is to capture the data that is critical for measuring the current state of technology as well provide a template to measure the success of a project. There are three main sections to this tab:

- **General Information**: This part of the table is intended to capture the general aspects of your project (feedstock, technology readiness level, products, scale and basis for benchmark data provided). This information is critical; however, if there are other parameters that the applicant believes are necessary for understanding the project, they are free to add or subtract rows.
- **Key Performance Parameters relevant to the proposed scope of work:** Please go to **cell B18** and select (from the drop-down menu), one of the Topic Areas. Selecting the appropriate Topic Area will auto-populate a select number of metrics that are likely to be relevant to your project. Please populate the metrics that are applicable to your project/process for the benchmark, intermediate, and final verification targets. If there are metrics that are not applicable to your project or process, please leave them blank.
- **Insert Other Key Performance Parameters:** This section provides the applicant with additional rows to include metrics that are specific to their project. It is expected that each application will add additional Key Performance Parameters tailored to the application. When adding Key Performance Parameters (KPP) it is important to include benchmark, intermediate, and final target data to evaluate the current state-of-technology and establish the framework to evaluate progress throughout the project. The "KPP example" tab (described below) provides some suggestions for metrics (by Topic Area) that are representative of the types of metrics expected to show up in this section - these are only suggestions/examples and the applicant can add any relevant KPP. **Please note that this is a very important section to complete.**

LCOD – The levelized Cost of Disposal tab should only be completed by applicants for Topic Area 4. Cells that are highlighted in green should be filled out with project-relevant data. All other cells should auto-calculate and be locked.

Techno-economics - The Techno-economics tab should be completed by applicants for relevant projects within Topic Areas 1, 2, 4, 5, and 6. If applicants within Topic Area 1 and 2 can make a convincing case that a techno-economic analysis is premature and will not help guide the research and development efforts, then the Techno-economics tab may be left blank. However, it is possible that during the verification it may be deemed necessary and informative by DOE, in which case the project team would need to populate the tab at that time." – On this tab, the applicant is expected to fill out the appropriate line items ***for an envisioned commercial-scale project that includes their technology(s)*** to the best of their ability. Values entered into the "Techno-Economics" tab should reflect the unit operations included in the applicant's BFD. While it is understood that these projects may have lower technology readiness levels (TRLs), there are a number of Techno-Economic Analysis (TEA) inputs that each applicant should know before moving forward with research and development. At a minimum the applicant should understand the margin between the value of the products and the cost of the feedstock and other process inputs. ***The "Techno-Economics" table is designed to evaluate***

the economic improvements to a commercial process that would be realized if the technical targets established in the project's scope were achieved. The "Techno-Economics" table is not designed to capture improvements to economics resulting from economies of scale or process improvements outside the scope of work for the project. Therefore, economic parameters (i.e. capital costs, operating expenses) for unit operations outside the scope of work for the project should remain the same across the Benchmark, Intermediate, and Final Target columns.
The "Techno-Economics" tab should be filled out at an appropriate level for the project's TRL. For example, some of the potential capital and operating expenses should be understood and reported, however, BETO recognizes these are lower TRL projects and there is a large number of unknowns. A detailed economic analysis may not be feasible or appropriate at this stage. If the application is selected for award negotiations, the initial verification will include populating the rest of the table and walking through the table to understand the assumptions that went into completing it.
There are a number of design cases that can be leveraged to fill in portions of the table that are not being addressed by the application. Those design cases can be found here:

Process Design and Economics for the Conversion of Lignocellulosic Biomass to Hydrocarbons: Dilute-Acid and Enzymatic Deconstruction of Biomass to Sugars and Biological Conversion of Sugars to Hydrocarbons
https://www.nrel.gov/docs/fy14osti/60223.pdf

Process Design and Economics for the Conversion of Lignocellulosic Biomass to Hydrocarbons: Dilute-Acid and Enzymatic Deconstruction of Biomass to Sugars and Catalytic Conversion of Sugars to Hydrocarbons
http://www.nrel.gov/docs/fy15osti/62498.pdf

Process Design and Economics for the Conversion of Lignocellulosic Biomass to Hydrocarbon Fuels: Fast Pyrolysis and Hydrotreating Bio-oil Pathway
http://www.nrel.gov/docs/fy14osti/61178.pdf

Process Design and Economics for the Conversion of Algal Biomass to Biofuels: Algal Biomass Fractionation to Lipid- and Carbohydrate-Derived Fuel Products
http://www.nrel.gov/docs/fy14osti/62368.pdf

KPP Examples – This tab is not to be filled out by the applicant. This tab is intended to provide examples of Key Performance Parameters for each Topic Area that can be used to populate the "Verification Table" to help define the performance of each unit operation in the proposed process. It is important to note that these metrics or parameters should only show up in the Verification table if they are applicable to your process. If there are parameters that are not included in this tab, but relevant to your process, please fill them out in the Verification table as appropriate. These are only to be used as a reference for the Verification Table.

Column Definitions

Please note that Topic Area 3a applicants do not need to provide baseline data; only intermediate and final targets are required. **All other Topic Areas are required to provide data for benchmark, intermediate and final targets.**

Benchmark/Current Process: The benchmark data provided should reflect the most representative, current status of the process being proposed under the application. Should the application be selected for negotiation of an award, **the benchmark data must be reproducible** and will be verified during the initial project verification. There are some key points to be aware of when completing the benchmark column:

- Please provide the most representative data available, even if that means your baseline is zero.
- If your project is developing a new technology and no baseline data is available for that particular technology, an option is to use literature values as the current state-of-the-art and make it clear where literature/experimental values are used (please include relevant citations).

Intermediate Targets: These targets should reflect the technical achievements that are being proposed within the first 2/3rds of the project. The achievement of these targets will be verified during the second or stage gate verification and will be utilized during a stage gate review upon completion of the verification.

Final Targets: These targets are to reflect the overall technical achievements being proposed within the application. The achievement of these targets will be verified during the final verification at the completion of the project.