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

FY22 Bioenergy Technologies Office (BETO)
Waste Feedstocks and Conversion R&D FOA

Funding Opportunity Announcement (FOA) Number: DE-FOA-0002636
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FOA Issue Date:	03/22/2022
Informational Webinar:	03/31/2022
Submission Deadline for Concept Papers:	04/18/2022 5:00pm ET
Submission Deadline for Full Applications:	06/07/2022 5:00pm ET
Expected Submission Deadline for Replies to Reviewer Comments:	07/14/2022 5:00pm ET
Expected Date for EERE Selection Notifications:	08/24/2022
Expected Timeframe for Award Negotiations:	Aug 2022 – Sep 2022

- Applicants must submit a Concept Paper by 5:00pm ET on 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.

MODIFICATIONS

All modifications to the Funding Opportunity Announcement are highlighted in yellow in the table below.

<table>
<tr><th>Mod. No.</th><th>Date</th><th>Description of Modifications</th></tr>
<tr><td>000001</td><td>3/30/2022</td><td>

APPENDIX G - ACCEPTABLE FEEDSTOCKS:

The original topic area text is correct, however Appendix G contained an error. Appendix G has been modified to allow the following feedstocks for Topic Area 3: Syngas (derived from other allowable feedstocks).

<table>
<tr><th rowspan="2">Topic Area</th><th rowspan="2">Biomass (general definition, see next page)</th><th colspan="4">Biomass Breakdown per Topic Area</th><th colspan="5">Other Feedstocks</th></tr>
<tr><th>Ligno-cellulosic Feedstocks</th><th>Algae</th><th>Organic Wet Waste</th><th>Sorted Municipal Solid Waste</th><th>Biogas</th><th>Waste Carbon Dioxide</th><th>Syngas (derived from other allowable feedstocks)</th><th>Grain Starch</th><th>Oilseed Crops</th></tr>
<tr><td>1: MSW Feedstock Technologies</td><td>Yes</td><td>Yes, only if for blending with MSW at up to 50%</td><td>Yes, only if for blending with MSW at up to 50%</td><td>Yes</td><td>Yes</td><td>No</td><td>No</td><td>No</td><td>Yes, only if for blending with MSW at up to 50%</td><td>Yes, only if for blending with MSW at up to 50%</td></tr>
<tr><td>2a/2b: Robust Microbial Cells</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>No</td></tr>
<tr><td>3: Robust Catalytic Processes</td><td>Yes</td><td>Cellulosic sugars only</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td><td>No</td><td>Yes</td><td>No</td><td>No</td></tr>
<tr><td>4a/4b: Community Organic Waste</td><td>No</td><td>No</td><td>No</td><td>Yes</td><td>Yes</td><td>Yes</td><td>No</td><td>No</td><td>No</td><td>No</td></tr>
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<tr>
<td>000002</td>
<td>4/4/2022</td>
<td>

FOA SECTION I B) II, (PAGE 21) SUBTOPIC AREA 2B

The purpose of this amendment is to modify Subtopic Area 2B Metrics to replace “reduction in variability” with “extension of performance”. And under the third bullet in Subtopic Area 2b Specific Requirements, replace “variability” with “duration”.

<table>
<tr><th>Metric</th><th>Minimum Targets</th></tr>
<tr><td>Understanding longevity</td><td>Work focused on gaining mechanistic understanding of microbial production should characterize production limitations in at least one industrially relevant system and should be designed for actionability to enable prolonged production in future work.</td></tr>
<tr><td>Increasing longevity</td><td>Work focused on prolonging production should increase the duration of productivity by >50% by the end of the project and the ~~reduction in variability~~ extension of performance should improve titer, rate, or yield metrics by >50% by the end of the project period.</td></tr>
</table>

Subtopic Area 2b Specific Requirements:

• Projects focused on characterizing production ~~variability~~ duration must characterize longevity of microbial production and identify factors that contribute to extending the duration of production

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</table>

Table of Contents

I. Funding Opportunity Description

a. Background and Context

i. Background and Purpose

Building a clean and equitable energy economy and addressing the climate crisis are top priorities of the Biden Administration. This FOA will advance the Biden Administration's goals to "deliver an equitable, clean energy future, and put the United States on a path to achieve net-zero emissions, economy-wide, by no later than 2050"[1] to the benefit of all Americans. The Department of Energy (DOE) is committed to pushing the frontiers of science and engineering, catalyzing clean energy jobs through research, development, demonstration, and deployment (RDD&D), and ensuring environmental justice and inclusion of underserved communities. Additionally, this FOA will support the Biden Administration's new action items to produce 3 billion gallons of Sustainable Aviation Fuels (SAFs) per year and reduce aviation emissions by 20% by 2030, both of which will unlock the potential for a fully zero-carbon aviation sector by 2050.

In support of these Administration priorities, DOE's Bioenergy Technologies Office (BETO) focuses on developing technologies that convert domestic lignocellulosic biomass (e.g., agricultural residues, forestry residues, dedicated energy crops) and waste resources (e.g. municipal solid wastes, animal manure, biosolids) into affordable low-carbon (minimum of 70% decrease in Greenhouse Gases (GHGs)) biofuels and bioproducts that significantly reduce carbon emissions on a life-cycle basis as compared to equivalent petroleum-based products. These bioenergy technologies can enable a transition to a clean energy economy, create high-quality jobs, and support rural economies. The research and development (R&D) activities to be funded under this FOA will support the government-wide approach to the climate crisis by driving the innovation that can accelerate the deployment of clean energy technologies, which are critical for climate protection. These activities will also mobilize public clean energy investment in the biofuels, chemical and agricultural sectors and support achieving economy-wide net-zero emissions by 2050.

This FOA supports development of high-impact technology R&D to accelerate the growth of the bioeconomy by requesting applications across BETO's mission space in Feedstock Technologies and Conversion R&D. In particular, BETO seeks applications to enable waste feedstocks utilization and more robust conversion

[1] Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad" (Jan. 20, 2021).

processes to produce low-carbon (minimum of 70% decrease in GHGs) aviation fuels. By reducing economic and technical risk, BETO can help pave the way for industry to deploy commercial-scale integrated biorefineries and reduce greenhouse gas emissions from hard to decarbonize sectors, such as aviation. BETO is focused on developing and demonstrating technologies that are capable of producing low-carbon and affordable drop-in biofuels, as well as associated renewable chemical co-products to achieve this target.[2] BETO has interest in biofuel production processes that are capable of producing sustainable aviation fuel and meeting the White House's goal of reducing aviation emissions by 20% by 2030.

Specifically, this FOA supports two high-impact technology areas in the BETO program R&D portfolio: waste feedstock strategies to improve bioenergy and resource recovery from diverse waste streams; and improved organisms and inorganic catalysts to address conversion process robustness and improve the economics of sustainable biofuels production. These activities support the Biden Administration's goals of building a clean and equitable energy economy, addressing the climate crisis, and ensuring environmental justice and inclusion of underserved communities. These activities will ultimately improve the sustainable fuel production to meet the low-carbon (minimum of 70% decrease in GHGs) and affordable drop-in biofuels and aviation emission reduction goals.

ii. Technology Space and Strategic Goals

This FOA supports two priority areas in the BETO R&D portfolio. The first of these priorities addresses new strategies for energy and resource recovery from waste streams. Waste streams including municipal solid waste, animal manure, wastewater residuals and other organic wastes have been identified as a key feedstock source for the production of biofuels and bioproducts. These wastes represent significant environmental liabilities in the forms of fugitive methane emissions, air and water quality impacts, and odors, amongst others. These wastes are also disproportionately located in disadvantaged communities leading to a multitude of health impacts on the surrounding populations. There are also significant costs associated with the management of these waste streams including treatment, hauling, and disposal or tipping fees. These economic factors make these waste streams an economic liability to the communities managing them but also a cost-advantaged feedstock for the production of biofuels and bioproducts.

The second priority area addressed by this FOA will be development of improved organisms and inorganic catalysts. BETO's Conversion R&D Program has

[2] U.S. Department of Energy (2020), Bioenergy Technologies Office 2019 R&D State of Technology, DOE/EE-2082, https://www.energy.gov/sites/prod/files/2020/07/f76/beto-2019-state-of-technology-july-2020-r1.pdf

identified process robustness as a key challenge that must be addressed prior to scale-up. This includes the development of more robust organisms and catalytic processes for the conversion of sustainable feedstocks and intermediates into biofuels and bioproducts.

Biofuels and bioproducts are produced via a variety of technology configurations that can be referred to as technology pathways. Each technology pathway includes a specific feedstock or feedstocks supply and conversion technology combination to produce a product slate of biofuels and/or bioproducts. One objective of this FOA is to overcome key technology barriers that affect technology pathways and the ability to economically scale-up these pathways to industrially-relevant volumes.

Significant R&D is required to reach the ultimate goal of affordable, low-carbon transportation fuels and products. The Topic Areas in this FOA seek to address the following R&D needs:

- R&D on feedstock technologies and co-product development for energy and resource recovery from waste streams, and reduction of environmental and health impacts.

- R&D on conversion technologies to address process robustness and improve the economic viability of sustainable biofuels production.

Municipal Solid Waste (MSW) represents a source of low-cost feedstocks for biofuels, bioproducts, and biopower. Heterogeneity and variability in MSW fractions are significant barriers for MSW use as a bioenergy and bioproducts feedstock, and advanced preprocessing technologies are required to produce feedstock streams suitable for conversion. Additionally, for a conversion facility to be economically viable, it is necessary to ensure that feedstock components that cannot be used for biofuel production could be used to make valuable co-products. This FOA will address challenges in pre-processing MSW and generating co-products from MSW streams.

Biological conversion represents one of BETO's primary pathways for conversion of a feedstock into a biofuel or bioproduct. Many barriers have limited the commercialization and large scale deployment of engineered microorganisms. Correspondingly, BETO has historically invested in a range of approaches to improve microorganism engineering for enhanced production. This FOA will address some of the key challenges that face many engineered microorganisms and places an emphasis on approaches that uncover some of the fundamental limitations facing the deployment of engineered microorganisms at scale.

BETO also explores catalytic and thermochemical conversion methods for conversion of feedstocks and intermediates into biofuels or bioproducts. Catalytic approaches have been developed over decades and borrow learnings from other commercial sectors but there are unique challenges to catalytic processing of biomass that remain. This FOA will address key barriers with regards to catalytic processes to prepare these conversion technologies for scale-up.

In addition, BETO invests in novel approaches to achieve resource and energy recovery from waste streams. This includes providing communities with technical assistance and decision-making support. Many communities are facing immediate and significant environmental, social, and economic challenges with the organic waste streams that are generated and disposed of within. Often, these waste streams are managed by municipal entities or organizations contracted by municipal entities and advanced solutions requires significant effort in regard to strategic planning and coordinating.

iii. Diversity, Equity, and Inclusion

It is the policy of the Biden Administration that:

> [T]he Federal Government should pursue a comprehensive approach to advancing equity[3] for all, including people of color and others who have been historically underserved, marginalized, and adversely affected by persistent poverty and inequality. Affirmatively advancing equity, civil rights, racial justice, and equal opportunity is the responsibility of the whole of our Government. Because advancing equity requires a systematic approach to embedding fairness in decision-making processes, executive departments and agencies (agencies) must recognize and work to redress inequities in their policies and programs that serve as barriers to equal opportunity.

[3] The term "equity" means the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment, such as Black, Latino, and Indigenous and Native American persons, Asian Americans and Pacific Islanders and other persons of color; members of religious minorities; lesbian, gay, bisexual, transgender, and queer (LGBTQ+) persons; persons with disabilities; persons who live in rural areas; and persons otherwise adversely affected by persistent poverty or inequality.

> By advancing equity across the Federal Government, we can create opportunities for the improvement of communities that have been historically underserved, which benefits everyone.[4]

As part of this whole of government approach, this FOA seeks to encourage the participation of underserved communities[5] and underrepresented groups. Applicants are highly encouraged to include individuals from groups historically underrepresented[6,7] in STEM on their project teams. As part of the application, applicants are required to describe how diversity, equity, and inclusion objectives will be incorporated in the project. Specifically, applicants are required to submit a Diversity, Equity, and Inclusion Plan that describes the actions the applicant will take to foster a welcoming and inclusive environment, support people from underrepresented groups in STEM, advance equity, and encourage the inclusion of individuals from these groups in the project; and the extent the project activities will be located in or benefit underserved communities. (See Section IV.D.xv.). The plan should include at least one SMART (Specific, Measurable, Assignable, Realistic and Time-Related) milestone per

[4] Executive Order 13985, "Advancing Racial Equity and Support for Underserved Communities Through the Federal Government" (Jan. 20, 2021).

[5] The term "underserved communities" refers to populations sharing a particular characteristic, as well as geographic communities, that have been systematically denied a full opportunity to participate in aspects of economic, social, and civic life, as exemplified by the list of in the definition of "equity." E.O. 13985. For purposes of this FOA, as applicable to geographic communities, applicants can refer to economically distressed communities identified by the Internal Revenue Service as Qualified Opportunity Zones; communities identified as disadvantaged or underserved communities by their respective States; communities identified on the Index of Deep Disadvantage referenced at https://news.umich.edu/new-index-ranks-americas-100-most-disadvantaged-communities/, and communities that otherwise meet the definition of "underserved communities" stated above.

[6] According to the National Science Foundation's 2019 report titled, "Women, Minorities and Persons with Disabilities in Science and Engineering", women, persons with disabilities, and underrepresented minority groups—blacks or African Americans, Hispanics or Latinos, and American Indians or Alaska Natives—are vastly underrepresented in the STEM (science, technology, engineering and math) fields that drive the energy sector. That is, their representation in STEM education and STEM employment is smaller than their representation in the U.S. population. https://ncses.nsf.gov/pubs/nsf19304/digest/about-this-report For example, in the U.S., Hispanics, African Americans and American Indians or Alaska Natives make up 24 percent of the overall workforce, yet only account for 9 percent of the country's science and engineering workforce. DOE seeks to inspire underrepresented Americans to pursue careers in energy and support their advancement into leadership positions. https://www.energy.gov/articles/introducing-minorities-energy-initiative

[7] See also. Note that Congress recognized in section 305 of the American Innovation and Competitiveness Act of 2017, Public Law 114-329:

> (1) [I]t is critical to our Nation's economic leadership and global competitiveness that the United States educate, train, and retain more scientists, engineers, and computer scientists; (2) there is currently a disconnect between the availability of and growing demand for STEM-skilled workers; (3) historically, underrepresented populations are the largest untapped STEM talent pools in the United States; and (4) given the shifting demographic landscape, the United States should encourage full participation of individuals from underrepresented populations in STEM fields.

budget period supported by metrics to measure the success of the proposed actions. This plan will be evaluated as part of the technical review process and incorporated into the award if selected.

Further, Minority Serving Institutions[8], Minority Business Enterprises, Minority Owned Businesses, Woman Owned Businesses, Veteran Owned Businesses, or entities located in an underserved community that meet the eligibility requirements (See Section III.) are encouraged to apply as the prime applicant or participate on an application as a proposed partner to the prime applicant. The Selection Official may consider the inclusion of these types of entities as part of the selection decision (See Section V.C.i.).

b. Topic Areas

Topic Area	Topic Area Title
1	MSW Feedstock Technologies 1a: Advanced MSW Preprocessing for Conversion-ready Feedstocks 1b: High Value Co-product Development from MSW
2	Robust Microbial Cells 2a: Overcoming and understanding batch-to-batch and cell-to-cell variability 2b: Improving the longevity of microbial production
3	Robust Catalytic Processes
4	Community Scale Resource and Energy Recovery from Organic Wastes 4a: Feasibility Development 4b: Feasibility Development and Technology Testing

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

i. Topic Area 1: MSW Feedstock Technologies

Municipal Solid Waste (MSW) represents a source of low-cost feedstocks for biofuels, bioproducts, and biopower. Heterogeneity and variability in MSW fractions are significant barriers for MSW use as a bioenergy and bioproducts feedstock, and advanced preprocessing technologies are required to produce

[8] Minority Serving Institutions (MSIs), including Historically Black Colleges and Universities/Other Minority Institutions as educational entities recognized by the Office of Civil Rights (OCR), U.S. Department of Education, and identified on the OCR's Department of Education U.S. accredited postsecondary minorities' institution list. See https://www2.ed.gov/about/offices/list/ocr/edlite-minorityinst.html.

feedstock streams suitable for conversion. Additionally, for a conversion facility to be economically viable, it is necessary to ensure that feedstock components that cannot be used for biofuel production could be used to make valuable co-products. Topic Area 1 seeks technologies in two Subtopic areas: 1a) advanced MSW preprocessing for conversion-ready feedstocks, and 1b) high value co-product development from MSW.

Subtopic Area 1a seeks advanced physical, chemical, and biological preprocessing technologies to reduce MSW variability, remove harmful contaminants, and improve the quality for logistics, transportation, handling, and efficient downstream conversion into sustainable aviation fuels.

Subtopic Area 1b seeks technologies to produce valuable, non-fuel coproducts from low quality MSW fractions (e.g., material not meeting the quality specification for biofuel production) at bench scale to improve the economic viability of SAF pathways.

For purposes of Topic Area 1, BETO seeks applications targeting non-recycled MSW which is sorted and discharged from Material Recovery Facilities (MRFs) and going to a landfill but not considered or used for recycling. Specifically, the focus is the organic portions of MSW that can be converted to biofuels/ bioproducts, including non-recycled paper, plastic, rubber and leather, textiles, wood, food waste, and yard trimming constituents of the MSW stream, and the relevant contaminants that could affect conversion of the feedstock to a fuel or product.

The focus on MSW in Topic Area 1 is to contribute to BETO's goal of affordable, low-carbon (minimum of 70% decrease in GHGs) fuels, and products via the introduction of low cost feedstocks such as MSW. Topic Area 1 also supports the Biden Administration's new action items to produce 3 billion gallons of SAF per year by 2030.

Subtopic Area 1a: Advanced MSW Preprocessing for Conversion-ready Feedstocks

Subtopic Area 1a addresses advanced physical, chemical, and biological preprocessing technologies to reduce MSW variability, remove harmful contaminants, and improve the quality for logistics, transportation, handling, and efficient downstream conversion.

Applicants must propose to develop at least one advanced preprocessing technology and demonstrate quality improvement of the feedstock resulting from the proposed preprocessing over a baseline (e.g., using non-recyclable

MSW streams discharged from MRF without preprocessing). Feedstock quality improvement is defined as the improvement of MSW chemical, physical, and biological characteristics to meet conversion specifications. The critical quality characteristics of interest for the baseline metric include but are not limited to: moisture content, particle size/shape metrics, purity, density, inorganic content/speciation, proximate/ultimate analysis, biological reactivity, tissue and structure characteristics, molecular/chemical composition, rheology, and contamination sources.

Applicants must propose to perform techno-economic analysis (TEA) and life cycle assessment (LCA) for the process step(s) of interest. Applications may use citable data from the literature and governmental agencies in addition to their own data. TEA and LCA must be performed to evaluate the process economics and GHG reduction performance. Technologies that are not able to demonstrate economic feasibility will not be considered.

Specific MSW preprocessing technologies of interest to improve the critical characteristics needed to produce conversion-ready feedstocks include, but are not limited to:

- Advanced decontamination and/or stabilization technologies to reduce contamination and stabilize quality over time.
- Blending, formulation, and/or homogenization technologies to improve quality and reduce variability.
- Storage and preservation of MSW quality for year-round feedstock supply and improved critical quality characteristics.
- Novel physical, chemical, and biological preprocessing to improve critical quality characteristics.

Subtopic Area 1a Specific Requirements:

The following requirements must be addressed in the application and the strength of the applicant's discussion will be evaluated by the independent technical review panel for scientific merit (see evaluation criteria in Section V.A.ii.):

- The applicant must propose to work on sorted MSW following acceptable feedstock requirements (Appendix G). Other biomass types, such as lignocellulosic, algae, starch, oil-seed crops, are allowable only if used for blending with MSW at up to 50% by weight.

- The applications must describe the technologies and define the applicable feedstock specifications.

- The applications must provide a baseline for determining the MSW quality improvement achieved by their proposed preprocessing technology. In the context of Subtopic Area 1a, a baseline refers to published data in literature, and/or experiments performed, and data gathered directly by members of the project team. The baseline could use post-sorted MSW discharged from MRF without preprocessing, and/or the MSW streams going to the landfill for feedstock quality, and/or carbon intensity evaluations. The baseline must show proficiency in the MSW preprocessing including, but not limited to, the analytical standard operating procedures, their target MSW feedstock quality attributes (e.g., moisture content, particle size/shape metrics, purity, density, inorganic content/speciation, proximate/ultimate analysis, biological reactivity, tissue and structure characteristics, molecular/chemical composition, rheology, and contamination sources.) for improvement, and/or prior experience in handling of the lignocellulosic biomass and/or MSW at the location proposed.

- Applications must tie quality improvement achieved by the proposed preprocessing technology to a biofuel conversion pathway, preferably one that leads to SAF, and the importance of target quality characteristics must be clearly explained. The characteristic(s) to be resolved must be critical to the specifications of feedstock entering the reactor throat for a technology to produce a biofuel or a biofuel intermediate. If necessary, limited conversion testing is allowed to demonstrate the improvement of the MSW critical quality characteristics by the proposed preprocessing technology.

- TEA and LCA are required at the outset and completion of the project to assess improvements. Applications must provide feedstock carbon intensity evaluation by defining the system boundary and parameters for their proposed technology. An example of carbon intensity evaluation is provided in the Argonne GREET Publication[9].

- Applicants must provide signed letters of commitment from each facility that will supply MSW.

- Successful applications will propose to develop and run systems at a relevant scale appropriate for the technology. The proposed scale will be subject to DOE's verification procedures as described in Section I.D.

[9] Argonne GREET Publication: Feedstock Carbon Intensity Calculator (FD-CIC) - Users' Manual and Technical Documentation (anl.gov). Carbon intensity: amount of carbon or CO_2 equivalent or full GHG emission per unit of energy consumed.

- Successful applications must define and justify a clear R&D path toward achieving the required metrics as shown below. Both baseline claims and milestone objectives will be subject to DOE's verification procedures as described in Section I.D.

Subtopic Area 1a Metrics:

The application must propose to meet the minimum end of project target as outlined in the table below:

Metric	Minimum Targets
MSW Quality Improvement	Targets will be project-specific. Project must propose to significantly improve the quality of the MSW stream to enable conversion into a biofuel. Applications must specify at least three quality characteristics and a relevant percent quality improvement over baseline for each characteristic to meet the desired conversion specifications.

Subtopic Area 1b: High Value Co-product Development from MSW

Co-product development is a strategy to increase feedstock value and advance the viability of biofuels from these waste resources. Feedstock is typically the most costly component of a conversion facility's operational cost. Finding uses for all portions of the feedstock coming into a facility is key to economic success.

Applications are sought that produce high value, non-fuel co-products from low quality MSW fractions (e.g., fractions separated prior to the conversion reactor throat that do not meet the quality specifications for biofuels production) at bench scale to improve the economic viability of preferable SAF pathways. The application must include methods to define the co-product market and perform a market analysis.

To improve the feedstock value, applicants must demonstrate how they will recover the cost of low quality MSW streams that do not meet specifications for biofuels conversion. Examples of low quality MSW streams include, but are not limited to: (1) high ash fractions or (2) high moisture fractions of MSW that do not meet specifications for biofuels, but can be used to develop co-products and recover costs.

Co-product opportunities of interest include, but are not limited to: cellulosic fiber composites, nanomaterials, high surface area carbon materials to use as

water absorbents, macronutrients, soil amendments, biocomposites, plastics resin, medical composites, packaging, green hydrogen, and building materials. Applications are encouraged to explore and utilize available data from the scientific literature and governmental agencies.

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

- Mechanical, thermal, chemical, electrochemical, or biological processes to transform the low-quality MSW fractions and enhance their formulation to produce a final proof-of-concept co-product.
- Screening techniques to separate low-quality fractions or slipstreams from the MSW biofuel feedstock that enable high quality co-product development.
- Decontamination/preprocessing technologies to improve and achieve feedstock specifications that enable high quality co-product development.

Subtopic Area 1b Specific Requirements:

- The applicant must propose to work on sorted MSW following acceptable feedstock requirements (Appendix G).
- Applications must include full product life cycles within the process boundary of their TEA and LCA analyses, including any prior separation processes assumed in the delivery of end use co-product to their process boundaries. Applicant must propose to do a TEA early in the project and complete a TEA and LCA based on the results of the proposed work at the end of the project.
- The applicant must provide a market analysis of proposed co-product(s) in its application and discuss the market size, market value, and/or market landscape.
- If multiple co-products (co-product opportunities of interest are described above under Subtopic Area 1b description) are proposed, a down selection methodology should be included to focus the project on no more than three co-products.

Subtopic Area 1b Metrics:

The application must propose to meet or exceed the minimum target in the table below by the end of the project:

Metric	Minimum Targets
MSW Feedstock Value	Project must demonstrate the proposed co-product development technologies can significantly increase the total value of MSW streams relative to the cost of original MSW streams through TEA and market analysis.

Topic Area 1 Special Deliverables (both Subtopic Areas):

In addition to the deliverables required in the Federal Assistance Reporting Checklist, the following deliverables are required for awards made under Topic Area 1:

- Applications submitted under this Topic Area are required to participate in a Verification as described in Section I.D.
- Projects must deliver representative replicate (at least two) MSW fraction samples gathered from each MSW resource and MSW preprocessing steps, to be archived and characterized in the Bioenergy Feedstock Library (https://bioenergylibrary.inl.gov/Home/Home.aspx) located at the Idaho National Laboratory. Additionally, all data resulting from characterization of raw physical MSW samples and processed MSW samples will be catalogued in the Bioenergy Feedstock Library. Inclusion of these samples in the Bioenergy Feedstock Library will help researchers and industry understand and overcome challenges posed by the variability of the physical, chemical, and biological properties of MSW streams and evaluation of preprocessing technologies for quality improvement, while providing all stakeholders with accessible data of a wide variety of feedstock materials.
- Projects must upload publications and data stemming from funded projects to the Bioenergy Knowledge Discovery Framework (https://www.bioenergykdf.net/) administered at Oak Ridge National Laboratory, or other relevant public databases, to facilitate dissemination to other researchers and industry.

ii. Topic Area 2: Robust Microbial Cells

Topic Area 2 seeks to improve the productivity and robustness of microorganisms. For the purpose of Topic Area 2, the term "robustness" will be used to describe a microorganism in a bioprocess that can avoid cell-to-cell production variability, maintain stable production over an extended period of time, and/or perform reproducibly between batches. Projects funded under Topic Area 2 will work to improve the understanding of microbial performance and leverage this information to overcome production variability or a loss of viability during cultivation, thereby increasing the robustness of the microorganisms.

Topic Area 2 is interested in providing R&D funds to help industry and academia solve real-world challenges relating to bioprocesses that rely on microorganisms. It includes two separate Subtopic Areas (2a and 2b), described more fully below. In both Subtopic Areas, the microbial systems must be relevant to the BETO mission space for biofuels and bioproducts, as well as to industry for technology

deployment. The two Subtopic Areas are intended to fund projects that will ultimately improve the performance of bioprocesses.

- Subtopic Area 2a seeks to overcome batch-to-batch and cell-to-cell variability. Successful projects will explore why microbial performance varies, how organisms or processes can be engineered for improved performance, and/or identify why batches may unexplainably fail.
- Subtopic Area 2b seeks to improve the longevity of microbial production. Successful projects will explore why organisms lose viability or productivity over time during a cultivation and develop approaches to prolong microbial production.

Many research groups have observed microbial cell-to-cell heterogeneity in a bioprocess, in which on a single cell basis, each cell may produce different quantity of the desired product. There may also be a subset of "cheaters," or cells that avoid producing the product altogether. As most analysis currently quantifies the product quantity produced by the population as a whole, this type of variability may often go unnoticed, even though it may reduce the overall performance of a bioprocess.

Batch-to-batch variability is another phenomenon that may impact the robustness of a bioprocess. Batch-to-batch variability may be observed as an unexplained "failed" experiment, when a previously characterized production strain performs much more poorly than in previous experiments, or when a strain unexplainably starts to perform increasingly worse between runs. In addition, duration of viability and productivity can dramatically impact the performance of a bioprocess. Topic Area 2 seeks to provide resources to the community to understand why some processes end prematurely and develop tools to extend the duration of performance.

Microbial heterogeneity is well studied as a mechanism for microbial community resilience in nature. This phenomenon increases the overall robustness of monoclonal communities and multi-species consortia by introducing phenotypic diversity so that the population as a whole may respond more readily to external stimuli and stresses (Shade et al. 2012)[10]. While this feature of microbial communities carries distinct advantages in nature, the same microbial heterogeneity is not desirable in a controlled bioprocess. Several research groups have worked to understand the impact of microbial heterogeneity and develop solutions to reduce the negative impact of heterogeneity on microbial production of chemical targets.

[10] Front. Microbiol. Dec 19 2012 | https://doi.org/10.3389/fmicb.2012.00417

While the processes that underly microbial heterogeneity originate at the smallest levels of molecular interactions as stochasticity and noise (the result of randomness in molecular interactions), the impacts of heterogeneity are amplified in terms of how they manifest in a bioprocess. In a bioprocess, heterogeneity may result in lower bulk productivity, shorter duration of productivity, and variability between batches. While heterogeneity may contribute to production variability, it is certainly far from the only explanatory cause.

Microorganisms have undergone millennia of evolution to optimize their own metabolism and have not undergone comparable evolution to maximize performance of human-engineered pathways or human-designed systems. As such, engineered pathways or bioprocesses may introduce metabolic imbalance, metabolic burden, and other evolutionary pressures that incentivize the microorganisms to evolve away from prioritizing the human-engineered goals.

Evolutionary pressure and microbial heterogeneity may represent two mechanisms that contribute to reduced robustness. Other mechanisms may also contribute to the same outcome. Open discussion of when production variability occurs will provide an opportunity to explore explanatory mechanisms and engineering solutions to improve overall production durability.

Topic Area 2 seeks projects that will determine the origins of variability in a bioprocess, report the impacts of variability, and develop approaches to increase the robustness of microorganisms in a controlled bioprocess. Additionally, projects funded under Topic Area 2 will assist in understanding limits to the viability of microorganisms in a bioprocess and develop solutions to prolong the period of viability and productivity. Projects funded from Topic Area 2 will enable cultivations to be more productive and run longer, ultimately enhancing the economics of biologically produced chemicals and fuels.

Subtopic Area 2a: Overcoming and Understanding Batch-to-Batch and Cell-to-Cell Variability

Subtopic Area 2a specifically explores variability in microbial production, at both the single cell and batch level. The bioprocessing industry relies heavily on microbial conversion of a feedstock into a product reproducibly, consistently, and over extended periods of time. However, performance of microorganisms used in these bioprocesses has been shown to suffer from variability on a single cell basis (cell-to-cell variability) and between batches (batch-to-batch variability). Subtopic Area 2a seeks to build understandings of how and why microbial performance varies, and how organisms can be engineered for

reduced variability and improved performance. Specific emphasis will be placed on microbial systems demonstrated at pre-pilot and pilot scale.

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

- Projects that aim to understand batch-to-batch variability or why batches may unexplainably fail
- Work cataloging and characterizing cell-to-cell and batch-to-batch variability and measuring the impact of variability on titer/rate/yield (TRY) metrics
- Engineering of pathways designed to reduce variability in production
- Process engineering efforts to reduce variability
- Reduction of metabolic burden to decrease variability
- Design of genetic circuits to reduce variability
- Biosensor or reporter development to track single cell performance
- Implementation of evolutionary pressure to favor expression of heterologous pathways

Subtopic Area 2a Specific Requirements:

- Applications must use an acceptable feedstock (Appendix G)
- Applications must propose to develop an industrially-relevant microorganism/product pair within the DOE BETO mission space
- Applications must characterize and/or reduce cell-to-cell or batch-to-batch variability
- Recipients will be required to contribute major project results and findings for inclusion in a Case Study Report to be coordinated and published by BETO on its website and other publicly available locations. The Case Study Report will document recipients' technology advancements and obstacles, lessons learned, and best practices on bioprocess variability and instability.
- Final demonstration strains at the end of the project must express heterologous pathways genomically or in stable vector systems that do not require exogenous molecules for maintenance

Subtopic Area 2a Applications Specifically Not of Interest:

The following types of applications will be deemed nonresponsive and will not be reviewed or considered (See Section III.D. of the FOA):

- Those identified in I.C of the FOA
- Processes targeting small, niche, fine chemical markets, pharmaceutical markets, or neutraceutical markets
- Processes that do not improve the robustness and productivity of the chosen system through measurable increases in titer, rate, or yield
- Processes that become more costly after reduction of variability

Subtopic Area 2a Metrics:

Metric	Minimum Targets
Understanding variability	Work focusing on gaining mechanistic understanding of variability must characterize variability in at least one industrially relevant system. Results from mechanistic work must be designed for actionability to enable reduction of variability in future work.
Reducing variability	Work focused on reducing variability must quantify the starting variability and achieve a reduction in either cell-to-cell or batch-to-batch variability of >50% by the end of the project. Reduction in variability must improve titer, rate, or yield metrics by >50% by the end of the project period.

Subtopic Area 2b: Improving the Longevity of Microbial Production:

Subtopic Area 2b seeks to uncover why organisms lose viability or productivity during a cultivation and develop approaches to prolong microbial production. Prolonged batch or continuous microbial production provides many advantages to operating expenses (OPEX) in a biorefinery but is difficult to achieve in many instances. Subtopic Area 2b seeks to understand factors intrinsic to microbial hosts that prevent production over long periods of time, as well as engineering approaches that can be employed to prolong microbial production. In both cases, an emphasis will be placed on understanding the mechanism that limits extended microbial production so that this knowledge may inform the design of related systems.

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

- Projects that aim to extend the duration of productivity, or aim to understand why production may unexplainably end prematurely
- Work cataloging and characterizing loss of productivity over time
- Engineering of pathways designed to prolong duration of production
- Process engineering efforts to prolong production
- Biosensor or reporter development to track single cell performance
- Reduction of metabolic burden to prolong production
- Design of genetic circuits to prolong production
- Implementation of evolutionary pressure to favor expression of heterologous pathways over extended periods of time

Subtopic Area 2b Specific Requirements:

- Applications must use an acceptable feedstock (Appendix G).
- Applications must develop an industrially-relevant microorganism/product pair within the DOE BETO mission space
- Projects focused on characterizing production duration must characterize longevity of microbial production and identify factors that contribute to extending the duration of production
- Projects that develop engineering solutions must improve longevity of production and work to understand why the approach may increase longevity
- Recipients will be required to contribute major project results and findings for inclusion in a Case Study Report to be coordinated and published by BETO on its website and other publicly available locations. The Case Study Report will document recipients' technology advancements and obstacles, lessons learned, and best practices on bioprocess variability and instability.
- Final demonstration strains at the end of the project must express heterologous pathways genomically or in stable vector systems that do not require exogenous molecules for maintenance

Subtopic Area 2b Metrics:

Metric	Minimum Targets
Understanding longevity	Work focused on gaining mechanistic understanding of microbial production should characterize production limitations in at least one industrially relevant system and should be designed for actionability to enable prolonged production in future work.
Increasing longevity	Work focused on prolonging production should increase the duration of productivity by >50% by the end of the project and the extension of performance should improve titer, rate, or yield metrics by >50% by the end of the project period.

Topic Area 2 Special Deliverables (both Subtopic Areas):

In addition to the deliverables required in the Federal Assistance Reporting Checklist, the following deliverables are required for awards made under this Topic Area:

- Applications submitted under this Topic Area are required to participate in a Verification as described in Section I.D.

- Applications submitted under this Topic Area are required to make the results of their research public
- BETO will coordinate the publication of a Case Study Report to describe the findings of all projects funded under this Topic Area. All recipients must contribute to the Case Study Report, particularly with regard to negative data.

iii. Topic Area 3: Robust Catalytic Processes

Catalytic processes are central in the conversion of biomass into biofuels including renewable diesel, sustainable aviation fuel, and marine fuel. Most pathways that transform biomass into fuels or other valuable chemicals involve a catalytic process, and often a heterogeneous catalytic process. Improvement of catalyst durability, stability, and overall robustness are of high importance – particularly in the presence of the impurities typically found in common bio-derived streams.

Topic Area 3 focuses on developing catalysts for the conversion of biomass and waste resources to sustainable aviation fuel, renewable diesel, and marine fuel. Relevant processes can use a variety of biomass feedstocks. The catalytic processes of interest for Topic Area 3 can include syngas to fuel, ethanol to fuel, catalytic upgrading of biochemical intermediates to fuel, and other similar biomass to fuel catalytic processes.

The subject of Topic Area 3 is the improvement of catalyst robustness under model and real bio-derived streams and the mitigation of the negative impacts of impurities present in bio-derived streams on catalyst performance. Additionally, it focuses on the development and testing of catalysts in an engineered catalyst form relevant to industrial applications. Other forms may be used to establish a baseline for catalyst screening. However, engineered catalyst forms such as pelletized or extruded forms should be used for important milestones. The impact of impurities that make it downstream to the catalyst should be investigated on the engineered catalyst.

Topic Area 3 encourages mechanistic studies on the deactivation of catalysts by means of varied in situ or ex situ characterization techniques. A dual approach combining experimental and computational work to predict the fate of the catalysts under real bio-derived streams is of particular interest. The enhanced understanding acquired via such a dual approach will be helpful in improving the catalyst performance and robustness. Additionally, it will inform the techno-economic analysis (TEA) and life cycle analysis (LCA) of the proposed pathway and the full biomass-to-fuel pathway.

Collaboration with DOE's National Laboratories and particularly members of the Chemical Catalysis for Bioenergy Consortium (ChemCatBio consortium) is also encouraged. Information on the work ChemCatBio consortium performs can be found online at: http://chemcatbio.org.

BETO's goals of producing affordable, low-carbon (minimum of 70% decrease in GHGs) fuels should be considered for this Topic Area.

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

- Catalyst development for biomass and waste resources conversion processes such as, but not limited to, syngas to fuel, ethanol to fuel, and catalytic upgrading of thermochemical or biochemical intermediates to sustainable aviation fuel, renewable diesel, and marine fuel.
- Deactivation mechanisms using experiment combined with modeling to predict catalyst fate under real and model bio-derived streams.
- Develop catalysts that are tolerant of contaminants present in biomass.

Topic Area 3 Specific Requirements

- The applicant must demonstrate that their process generates the selected fuel i.e., sustainable aviation fuel, renewable diesel, or marine fuel.
- Engineered catalyst forms (such as pelletized or extruded catalyst) relevant to the industrial application must be used to validate performance metrics for key milestones including verifications (see Section I.D) and Go/No-Go decision points (see Section I.D).
- Projects must use real biomass or biomass intermediate streams for key milestones including verifications (see Section I.D) and Go/No-Go decision points (see Section I.D). Mock or synthetic feeds will not be accepted for these verifications and Go/No-Go decision points. Mock or synthetic biomass or biomass intermediates will be permitted for other R&D activities.
- The application must identify one project partner with whom catalyst development will happen throughout the duration of the project. This project partner must provide a letter of support describing their contribution in the project.
- Applications must include preliminary TEA and LCA for the proposed pathway.
- Additional TEA and LCA should be included in the intermediate and final verifications.

Topic Area 3 Metrics

Metric	Minimum Targets
Catalyst robustness	Catalysts must be tested for at least 500 continuous hours in a real bio-derived stream by the end of the project, with no more than 2 on-stream regenerations. The catalyst should not undergo more than 15% conversion loss after 500 hours time-on-stream.
Catalyst performance	By the end of the project, the applicant must develop a catalyst with a conversion of at least 80 % and a selectivity to the desired compound of at least 80 %.

Topic Area 3 Specific Areas Not of Interest:
The following types of applications will be deemed nonresponsive and will not be reviewed or considered (See Section III.D. of the FOA):

- Applications that propose lignin valorization to products or fuels.
- Applications that propose processes that cannot be scaled up or processes that will not be economically viable when scaled up.
- Applications that utilize mock or synthetic feed streams exclusively.
- Applications that do not contain plans to develop engineered catalyst forms and utilize them in experiments.

iv. Topic Area 4: Community Scale Resource and Energy Recovery from Organic Wastes

For many communities, organic waste streams present a variety of economic, environmental, and social sustainability challenges. These waste streams include food waste, municipal wastewater sludges, animal manure, and fats, oils, and greases. There are significant costs associated with management of organic waste, including treatment, stabilization, hauling, and disposal costs or tipping fees. These waste streams also represent major sources of greenhouse gas emissions and contribute to other environmental issues including air and water quality degradation. Increasingly, state and local statutes are requiring that organic waste streams be diverted from landfills which demands implementing new processing strategies and developing novel business models to meet these requirements.

Waste treatment, storage, and management infrastructure also has a history of inequitable siting: these facilities are disproportionately sited in disadvantaged and low-income communities. Thus, the air, water, and health impacts from

these facilities disproportionately impact these same disadvantaged and low-income communities. Publicly available tools such as the Environmental Protection Agency's EJScreen or California Office of Environmental Health Hazard Assessment's CalEnviroScreen can be useful (in addition to other state and local systems and tools) to identify and quantify these impacts, especially as it relates to proximity to solid waste facilities and water discharge locations.

The objectives and targeted outcomes of Topic Area 4 are to support the development of community-centered solutions and business plans for resource and energy recovery from these organic waste streams. As such, it seeks community leadership in project design, feasibility, and ultimately execution of their projects to improve resource and energy recovery from waste. Because of this focus and to ensure community ownership of the project, BETO is seeking only community-related prime recipients for its Topic Area 4 awards. As noted in the **Topic Area 4 Eligible Applicants** section below, therefore:

> Applications to Topic Area 4 will be accepted *only* from the following eligible prime applicants: States (including the District of Columbia, Puerto Rico, Virgin Islands, American Samoa, and Northern Mariana Islands), local, Tribal, intrastate government agencies and instrumentalities, and non-profit organizations that are not 501I(4) organizations engaged in lobbying activities.
>
> Other types of entities, including but not limited to Individuals, Institutes of Higher Education, FFRDCS, and for-profit organizations, are eligible to apply for funding as a subrecipient but are not eligible to apply as a prime recipient.

Most commonly, municipal governments are the organizations that are responsible for developing community waste management infrastructure. Applications, however, are encouraged to include partnerships from a variety of community-related organizations and organization types who may not necessarily be eligible as prime recipients. Such partners and subrecipients may include entities who are eligible as prime recipients, but may also include (but are not limited to) entities such as educational institutions, public water systems, waste authorities, non-profit organizations, waste producers, project development teams.

In addition, Topic Area 4 is targeted at decision makers in rural communities that have identified specific organic waste management problems. Applicants from rural communities are of particular interest, but ex-urban, suburban, and urban communities are also eligible to apply for funding. It further seeks to support constructive stakeholder partnerships among waste producers, management

entities, and end-users of the energy and resources that can be recovered from these streams. Applicants are encouraged, but not required, to include letters of interest or commitment with the application, especially from partnerships or collaborations that already exist.

Support for feasibility development, engineering design, equitable siting, and technology validation has been clearly communicated as a need in order to achieve these solutions for organic waste challenges. By providing support for project feasibility and business plan development, Topic Area 4 seeks to aid communities in identifying, developing, and eventually implementing the best solutions for their community based on the unique waste challenges that they are facing. A key requirement of this Topic Area is community ownership, engagement, and involvement to ensure equitable siting for potential projects and sustainability into the future. For communities that may be further along in implementing resource or energy recovery strategies from waste, applicants may request additional funds to perform technology testing/validation activities. By providing two different Subtopic Areas, Topic Area 4 seeks to support a diverse range of community priorities and solutions.

Applicants are strongly encouraged to refer to Section V.A.ii. to review the Technical Review Criteria that are being used to evaluate the project applications. Note that Topic Area 4 will be using different Technical Review Criteria than the other Topic Areas of this FOA.

As noted, Topic Area 4 has two Subtopic Areas:

Subtopic Area 4a: Feasibility Development

Subtopic Area 4a seeks to develop partnerships and business models between rural communities facing waste challenges, researchers/communities that may have solutions to solve them, and/or engineering firms who can help with design work.

Applications to Subtopic Area 4a must propose Feasibility Development projects that consider, address and/or include (as appropriate or required) the elements described in the (a) Feasibility Development Objectives and Outcomes and (b) Sustainability Objectives and Outcomes sections below. Funding of up to $500K per project will be available for Feasibility Development activities under Subtopic Area 4a.

Subtopic Area 4b: Feasibility Development and Technology Testing

Subtopic Area 4b seeks projects including the same types of Feasibility Development activities, partnerships and business models described in Subtopic Area 4a above; in addition, it includes funding for Technology Testing to verify that the proposed project systems and processes can achieve local goals regarding resource and energy recovery from waste. Technology Testing activities may take place in parallel with Feasibility Development activities under this Subtopic Area.

Applications to Subtopic Area 4b must propose projects that include ***both*** Feasibility Development and Technology Testing and that consider, address, and/or include (as appropriate or required) the elements described in the (a) Feasibility Development Objectives and Outcomes, (b) Feasibility Development and Technology Testing Objectives and Outcomes, and (c) Sustainability Objectives and Outcomes sections below. Funding of up to $500K per project will be available for Feasibility Development activities, and applicants may request up to an additional $1M per project to cover Technology Testing activities, for a total Subtopic Area 4b request of up to $1.5M.

Feasibility Development Objectives and Outcomes (Required of All Topic Area 4 Applicants)

Applicants may propose projects involving any stage of waste management planning. Eligible project scope activities, as part of Feasibility Development, could include, but are not limited to:

- Detailed characterization of waste streams and waste resource availability
- Establishing sustainability indicator baselines (e.g., quantifying methane generation or nitrate runoff)
- Performing community engagement or education efforts (e.g., creating roundtable discussions between community members and sustainability professionals)
- Creating implementation plans based on existing sustainability or climate-action plans relating to organic waste
- Evaluating regulatory considerations and permitting requirements
- Completing economic and environmental feasibility analyses for technologies or processes
- Developing and issuing request-for-proposals to project design/engineering firms

For purposes of providing information regarding Feasibility Development Outcomes, the term “outcome” means the result, effect, or consequence that will occur from carrying out the envisioned organic waste management approach. Outcomes may be quantitative and/or qualitative, and environmental,

behavioral, health-related, or programmatic in nature. Applications must include a description of anticipated project outcomes resulting from the project outputs, even if the outcome to be achieved is beyond the project funding period. Include the quantitative target associated with the outcome, as appropriate.

By the end of the project, all applications must achieve the following objectives and outcomes as part of the Feasibility Development activities:

- Identification of the most important community sustainability indicators and considerations.
- Quantification of the business-as-usual (baseline) environmental and economic sustainability indicators from the current practices.
- Completion of a feasibility study and/or engineering design for a system/process that can quantify the impacts in increasing resource and energy recovery from waste and its impacts on these economic and environmental sustainability indicators.
- Documentation of the process for stakeholder engagement, partnering, business model development, sustainability indicator prioritization, etc.
- Demonstration of solutions and/or approaches that can be replicated by other communities, governments, or other entities.
- Development of means of communicating and socializing resource and energy recovery solutions and/or approaches via public or open-source means.
- Inclusion of a complete siting analysis that includes diversity, equity, and inclusion considerations.

Feasibility Development and Technology Testing Objectives and Outcomes (Required of Subtopic 4b applicants only)

Applicants may propose projects involving any stage of waste management planning. Eligible project activities as part of Feasibility Development could include but are not limited to those described above in the "Feasibility Development Objectives and Outcomes" section. In addition, applicants to Subtopic Area 4b may request up to an additional $1M for Technology Testing activities.

Eligible project scope activities, as part of Technology Testing, could include, but are not limited to:

- On-site or remote testing of the process or system to handle the waste streams
- Comparing technologies to evaluate performance
- Optimization of the process to accept blends of localized waste streams

- Modeling to estimate air and water quality impacts of process implementation (for example, to support an air quality permit application)
- Training or demonstrations with community members
- Experimental testing of resulting energy products or resource streams to ensure they are of sufficient quality (e.g., toxicity testing of nutrients recovered, combustion analysis of resulting biogas/renewable natural gas streams)

All activities under the Technology Testing component of the project must use real waste streams from the community in order to demonstrate that the processes and technologies are sufficiently mature and robust to be utilized in the community. Model or mock-feedstocks are not permitted in these activities.

In addition to achieving the outcomes described above in Subtopic 4a, by the end of the project, applicants to Subtopic Area 4b must also achieve the following outcomes as part of the Technology Testing activities:

- Experimental demonstration of a system or process that can increase the degree of resource and energy recovery from waste by at least 10% compared to the current practices in the community as a whole (as measured by total energy yield/ton of waste and/or total mass of resources recovered/ton of waste); and
- Experimental demonstration of a system or process that can improve upon all required environmental and economic sustainability indicators (see Sustainability Objectives and Outcomes section below) using real wastes from the community compared to the current practices in the community as a whole.

Sustainability Objectives and Outcomes (Required of All Topic Area 4 Applicants)

All Topic Area 4 applicants must describe, in their applications, how they will communicate how the proposed project could make positive advancements towards economic, environmental, and social sustainability goals in their community. Applicants may want to consider the use of publicly available tools such as EJScreen or CalEnviroScreen to help address these and other sustainability indicators.

At a minimum, applicants must describe how the proposed project solution or process addresses the following sustainability indicators. Applicants are not required to have baseline levels for each of these required indicators at the time of the application, but the Feasibility Development components of the projects

must include the following required indicators during the duration of the projects, if awarded. Applications should include baseline values for as many of these sustainability indicators as possible at the time of application.

Required Economic Indicators:

- Total energy recovered from wastes (e.g., MJ/ton of waste recovered)
- Total nutrients or other resources recovered from wastes (nitrogen, phosphorus, potassium as examples)
- Total costs of waste management for the community

Required Environmental Indicators:

- Greenhouse gas emissions (carbon dioxide and methane at a minimum)
- Tonnage of waste sent to landfill
- Malodorous compounds (sulfur species and ammonia at a minimum)
- Compliance with current or pending disposal regulations (if applicable)
- Water quality

Required Social Indicators:

- Project siting (especially proximity of infrastructure to communities)
- Degree of community ownership/engagement in the project
- Localized health impacts (respiratory impacts as an example)

In addition to these required sustainability indicators, applicants may self-select other appropriate economic, environmental, and social indicators that are relevant to their community. Examples include but are not limited to those listed below:

Economic Indicators: Impacts on total costs of waste management, impacts on relevant rates for municipal services charged to communities.

Environmental Indicators: Localized water quality or runoff (nitrate/nitrite or phosphorus as examples), localized air quality (volatile organic compounds as examples), soil contamination, impact on fluorinated species, particulate emissions, heavy duty traffic, accidental waste discharges.

Social Indicators: Localized energy and economic resilience, local workforce impacts, community-wide recycling rates, community aesthetics, local property values.

Summary Table of Application Requirements

Required Metric and Criteria	Subtopic 4a: Feasibility Development	Subtopic 4b: Feasibility Development and Technology Testing
Feasibility Development Objectives and Outcomes	Yes	Yes
Sustainability Objectives and Outcomes	Yes	Yes
Technology Testing Objectives and Outcomes	No	Yes
Maximum Federal Award Size	$500,000	$1,500,000
Required Cost Share	20% of Total Project Cost	20% for Feasibility Development Track Activities and 20% for Technology Testing Track Activities
Anticipated Project Length	18-24 months	Up to 3 years

Topic Area 4 Eligible Applicants

Applications to Topic Area 4 will be accepted *only* from the following eligible prime applicants: States (including the District of Columbia, Puerto Rico, Virgin Islands, American Samoa, and Northern Mariana Islands), local, Tribal, intrastate government agencies and instrumentalities, and non-profit organizations that are not 501(c)(4) organizations engaged in lobbying activities.

Other types of entities, including but not limited to Individuals, Institutes of Higher Education, FFRDCS, and for-profit organizations, are eligible to apply for funding as a subrecipient but are not eligible to apply as a prime recipient.

Topic Area 4 seeks community leadership in project design, feasibility, and ultimately execution of their projects to improve resource and energy recovery from waste. Because of this focus and to ensure community ownership of the project, BETO is seeking only community-related prime recipients for its Topic Area 4 awards, as specifically set forth above.

Most commonly, municipal governments are the organizations that are responsible for developing community waste management infrastructure. Applications, however, are encouraged to include partnerships from a variety of community-related organizations and organization types who may not necessarily be eligible as prime recipients. Such partners and subrecipients may include entities who are eligible as prime recipients, but may also include (but are not limited to) entities such as educational institutions, public water

systems, waste authorities, non-profit organizations, waste producers, project development teams.

Topic Area 4 Eligibility Summary Table (see Section III for full details and descriptions)

Type Of Applicant	Allowed As A Prime Applicant?	Allowed As Subrecipients/Partners?
Individuals	No	Yes
Domestic Entities:		
Local, State, Tribal, and Intrastate Government Entities	Yes	Yes
Nonprofit Organizations*	Yes	Yes
For-profit Organizations	No	Yes
Institutes of Higher Education	No	Yes
DOE and Non-DOE FFRDCs	No	Yes
Federal Agencies	No	Yes
Foreign Entities:	No	Yes
Incorporated Consortia	No	Yes
Unincorporated Consortia	No	Yes

* As stated in Section III.A.ii., 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.

Topic Area 4 Applications Specifically Not of Interest:
The following types of applications will be deemed nonresponsive and will not be reviewed or considered (See Section III.D. of the FOA):

- Applications that do not have community partners.
- Applications that do not include the required economic, environmental, and social sustainability indicators.
- Applications that include only technology validation/testing. Applications must include the feasibility and sustainability outcomes.
- Applications to Subtopic 4b that propose to use mock or model waste streams only.
- Applications to Subtopic 4b that propose to test commercially marketed technologies or processes.

c. Applications Specifically Not of Interest

The following types of applications will be deemed nonresponsive and will not be reviewed or considered (See Section III.D. of the FOA):

- Applications that fall outside the technical parameters specified in Section I.A. and I.B. of the FOA.
- Applications for proposed technologies that are not based on sound scientific principles (e.g., violates the laws of thermodynamics).
- Applications identified in each Topic Area or Subtopic Area as "Applications Specifically Not of Interest" for that Topic Area or Subtopic Area.

d. Verification

All applications from Topic Areas 1, 2, and 3 selected for award negotiations under this FOA are required to participate in a verification process led by DOE's identified external third-party non-conflicted verification team. Applications from Topic Areas 4 selected for award negotiations will not be subject to the verification process. This team may be led by the National Renewable Energy Laboratory's Systems Integration team, DOE BETO's independent engineering contractor, or another non-conflicted BETO contractor. Personnel involved in verifications sign project specific Non-Disclosure Agreements and conflict of interest statements. This verification process provides technical assistance to both the DOE BETO 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 so that the milestones and Go/No-Go decision points separating budget periods may be tracked and evaluated.
- Establish benchmark, baseline, and associated target values.
- Identify potential major showstoppers and discuss risk mitigation strategies.
- Align project goals with BETO's expectations.

There are three types of verification periods throughout the lifetime of the project: the "Initial Verification," conducted at the beginning of the project (months 0-3); the "Intermediate Verification(s)," conducted as a part of Go/No-Go decisions separating budget periods; 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 initially verify the data included in the application or Technical datasheet and subsequently in conjunction with site visits to monitor progress.

The specific objectives of these verifications are set forth below:

- The initial verification is to confirm the benchmark data and assumptions provided in the application, which will establish the project baseline against which future performance and cost improvements will be evaluated. During the initial verification, the verification team will work closely with the project team to discuss the project effort in detail; initiate the review of application data, metrics, and procedures 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 (or virtual) meeting. The project baseline will be set in this period, either through revision of the application data or by submission of additional/new data. The verification results are used by DOE at its sole discretion, among other factors, in making the Go/No-Go decision to proceed with Budget Period 2 (BP2). See Section II.A.ii. for information on period of performance and Go/No-Go decisions.
- An intermediate verification will be conducted toward the end of BP2. The intermediate verification assesses progress towards the project's BP2 Go/No-Go decision point and any targets established in the application, the initial verification, the achievement of the Statement of Project Objectives (SOPO) milestones in support of the Go/No-Go decision point, and any other factors contributing to progress toward the project objectives. The verification results are used by DOE at its sole discretion, among other factors, in making the Go/No-Go decision to proceed with BP3. In projects with more than 3 budget periods, additional interim verifications may be conducted.
- The final verification will be held prior to the end of the project. The objective of this final verification is to assess whether the final targets were achieved, document the challenges overcome, and record the technical or economic challenges that remain.

Technical Datasheets:

Projects selected from this FOA will be required to complete a Technical Datasheet which will be used throughout the verification process. The data and claims provided in the Full Application 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 the project will be able to reproduce this data when/if the verification team travels to the site to perform the verification. It is also expected 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 based on literature data should be marked appropriately.

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 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 decision points that will be incorporated into the overall project and Statement of Project Objectives (SOPO). Experiments will be conducted at the on-site verification visit to replicate the benchmark data provided in the application as described in the Technical Datasheet.
>
> There will be a Go/No-Go associated with Task 1 as follows: Process information and data supporting 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.

Similar provisions must 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 project (within 3 months of completion).

Verification Conflict of Interest/Proprietary Information:

All of the technical and economic information requested will be disclosed to non-conflicted DOE National Renewable Energy Laboratory Systems Integration (NREL-SI) 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 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.M. of this FOA. DOE and those working on DOE's behalf, such as support service contractors, NREL personnel, Independent Engineers, 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 Datasheet 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 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 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 (i.e., BP1), 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 – is 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 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.

e. Authorizing Statutes

The programmatic authorizing statute is the Energy Policy Act of 2005 (EPAct 2005), § 931 as codified at 42 U.S.C. § 16231; and EPAct 2005 § 932, as codified at 42 U.S.C. § 16232.

Awards made under this announcement will fall under the purview of 2 Code of Federal Regulation (CFR) Part 200 as amended by 2 CFR Part 910.

II. Award Information

a. Award Overview

i. Estimated Funding

EERE expects to make a total of approximately $34,500,000 of federal funding available for new awards under this FOA, subject to the availability of appropriated funds. EERE anticipates making approximately 15-27 awards under this FOA. EERE may issue one, multiple, or no awards. Individual awards may vary between $500,000 and $2,500,000.

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

Topic Area Number	Topic Area Title	Anticipated Number of Awards	Anticipated Minimum Award Size for Any One Individual Award (Fed Share)	Anticipated Maximum Award Size for Any One Individual Award (Fed Share)	Approximate Total Federal Funding Available for All Awards	Anticipated Period of Performance (months)
1	MSW Feedstock Technologies	6-10	$1,250,000	$2,250,000	$13,000,000	24-36
2	Robust Microbial Cells	2-6	$1,000,000	$2,500,000	$9,500,000	36
3	Robust Catalytic Processes	2-3	$1,250,000	$2,500,000	$7,000,000	36
4	Community Scale Resource and Energy Recovery from Organic Wastes	5-8	$500,000	$1,500,000	$5,000,000	18-36

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. Before the expiration of the initial budget period(s), EERE may perform a down-select among different recipients and provide additional funding only to a subset of recipients.

ii. Period of Performance

EERE anticipates making awards that will run from 18 months up to 36 months in length, comprised of one or more budget periods. Project continuation will be contingent upon several elements, including satisfactory performance and Go/No-Go decision review. For a complete list, see Section VI.B.xiv. At the

Go/No-Go decision points, EERE will evaluate project performance, project schedule adherence, the extent milestone objectives are met, compliance with reporting requirements, and overall contribution to the program goals and objectives. As a result of this evaluation, EERE 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.

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 Federally Funded Research and Development Center (FFRDCs)

In most cases, FFRDCs 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 eligibility requirements, it will be considered ineligible and removed from further evaluation.

For All Topic Areas: DOE/NNSA and non-DOE/NNSA Federally Funded Research and Development Centers (FFRDCs) are restricted from applying for funding as a Prime Recipient but are eligible to participate as a Subrecipient. Each FFRDC is permitted to participate as a Subrecipient with effort equivalent to up to 50% of the total estimated cost of the project; however, in aggregate, total FFRDC effort shall not exceed 50% of the total estimated cost of the project.

For Topic Areas 1, 2, and 3: Please see the applicant eligibility requirements set forth below in Subsection III.A., "Eligible Applicants. "

For Topic Area 4 (including both Subtopic Areas):
Applications will be accepted *only* from the following eligible prime applicants: States (including the District of Columbia, Puerto Rico, Virgin Islands, American Samoa, and Northern Mariana Islands), local, Tribal, intrastate government agencies and instrumentalities, and non-profit organizations that are not 501(c)(4) organizations engaged in lobbying activities. Other types of entities, including but not limited to Individuals, Institutes of Higher Education, FFRDCS, and for-profit organizations, are eligible to apply for funding as a subrecipient but are not eligible to apply as a prime recipient.

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 and have a physical location for business operations in 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 FFRDCs are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient.

BETO provides significant funding through non-competitive Annual Operating Plans (AOPs) to support research and development (R&D) efforts at the National Laboratories. There is a significant potential for private industry to advance R&D efforts in the bioenergy space, and this FOA will provide the opportunity for these private companies to compete for federal funds while allowing the Labs to receive funding as sub-recipients.

In addition, National Laboratories will not be permitted as prime recipients under Topic Area 4 because, as described more fully in the Determination of Restricted Eligibility (DRE) for this FOA, community ownership and leadership are sought on applications submitted under that Topic Area. National Laboratories will, however, be permitted to receive funding as sub-recipients to support those communities in their resource and energy recovery from waste objectives. 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 and have a physical location for business operations in 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 C 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 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

For all Topic Areas, 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 Appendices A and B 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. 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.J.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 for additional cost sharing requirements.

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

Concept Papers, Full Applications, and Replies to Reviewer Comments must meet all compliance criteria listed below or they will be considered

noncompliant. EERE will not review or consider noncompliant submissions, including Concept Papers, 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 by the applicable deadline due to server/connection congestion.

i. Compliance Criteria

1. *Concept Papers*
   Concept Papers are deemed compliant if:
   - The Concept Paper complies with the content and form requirements in Section IV.C.i. of the FOA; and
   - The applicant successfully uploaded all required documents and clicked the "Submit" button in EERE Exchange by the deadline stated in this FOA.

2. *Full Applications*
   Full Applications are deemed compliant if:
   - The applicant submitted a compliant Concept Paper;
   - The Full Application complies with the content and form requirements in Section IV.D. 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.E. 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, 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 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 (WP) 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, the subrecipient'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 FFRDC effort, in aggregate, shall not exceed 50% of the total estimated cost of the project, including the applicant's and the FFRDC's portions of the effort.

f. Limitation on Number of Concept Papers and Full Applications Eligible for Review

An entity may submit more than one Concept Paper and Full Application to this FOA, provided that each application describes a unique, scientifically distinct project and provided that an eligible Concept Paper was submitted for each Full Application.

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 Concept Paper phase, and a Full Application phase. **Only applicants who have submitted an eligible Concept Paper 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, or 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 Concept Paper, 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 Calibri 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; and
- 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 Concept Papers, Full Applications, and Replies to Reviewer Comments 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 Concept Paper, Full Application, or Reply to Reviewer Comments. Once the Concept Paper, 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 to any of these documents, the applicant must resubmit the Concept Paper, Full Application, or Reply to Reviewer Comments before the applicable deadline.

EERE urges applicants to carefully review their Concept Papers, Full Applications, and Replies to Reviewer Comments 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.ii. 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 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 applicants in resolving issues.

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:
TechnicalVolume_Part_1
TechnicalVolume_Part_2

c. Content and Form of the Concept Paper

To be eligible to submit a Full Application, applicants must submit a Concept Paper by the specified due date and time.

i. Concept Paper Content Requirements

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

Each Concept Paper must be limited to a single concept or technology. Unrelated concepts and technologies should not be consolidated into a single Concept Paper.

The Concept Paper must conform to the following content requirements:

Section	Page Limit	Description
Cover Page	1 page maximum	The cover page should include the project title, the specific announcement 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.

Technology Description	2 pages maximum	Applicants are required to describe succinctly: • The proposed technology, including its basic operating principles and how it is unique and innovative; • The proposed technology's target level of performance (applicants should provide technical data or other support to show how the proposed target could be met); • The current state-of-the-art in the relevant field and application, including key shortcomings, limitations, and challenges; • How the proposed technology will overcome the shortcomings, limitations, and challenges in the relevant field and application; • The potential impact that the proposed project would have on the relevant field and application; • The key technical risks/issues associated with the proposed technology development plan; and • The impact that EERE funding would have on the proposed project.
Addendum	1 page maximum	Applicants are required to describe succinctly the qualifications, experience, and capabilities of the proposed Project Team, including: • Whether the Principal Investigator (PI) and Project Team have the skill and expertise needed to successfully execute the project plan; • Whether the applicant has prior experience which demonstrates an ability to perform tasks of similar risk and complexity; • Whether the applicant has worked together with its teaming partners on prior projects or programs; and • Whether the applicant has adequate access to equipment and facilities necessary to accomplish the effort and/or clearly explain how it intends to obtain access to the necessary equipment and facilities. • Applicants may provide graphs, charts, or other data to supplement their Technology Description.

EERE makes an independent assessment of each Concept Paper based on the criteria in Section V.A.i. of the FOA. EERE will encourage a subset of applicants to submit Full Applications. Other applicants will be discouraged from submitting a Full Application. An applicant who receives a "discouraged" notification may still submit a Full Application. EERE will review all eligible Full Applications. However, by discouraging the submission of a Full Application, EERE intends to convey its lack of programmatic interest in the proposed project in an effort to save the applicant the time and expense of preparing an application that is unlikely to be selected for award negotiations.

EERE may include general comments provided from reviewers on an applicant's Concept Paper in the encourage/discourage notification posted on EERE Exchange at the close of that phase.

d. 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.

Applicants will have approximately 30 days from receipt of the Concept Paper Encourage/Discourage notification on EERE Exchange to prepare and submit a Full Application. Regardless of the date the applicant receives the Encourage/Discourage notification, the submission deadline for the Full Application remains the date and time stated on the FOA cover page.

All Full Application documents must be marked with the Control Number issued to the applicant. Applicants will receive a control number upon clicking the "Create Concept Paper" button in EERE Exchange, 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:

Component	File Format	Page Limit	File Name
Technical Volume	PDF	25	ControlNumber_LeadOrganization_TechnicalVolume
Resumes	PDF	2 pages each	ControlNumber_LeadOrganization_Resumes
Letters of Commitment	PDF	1 page each	ControlNumber_LeadOrganization_LOCs
Statement of Project Objectives	MS Word	15	ControlNumber_LeadOrganization_SOPO
SF-424	PDF	n/a	ControlNumber_LeadOrganization_App424

Budget Justification Workbook	MS Excel	n/a	ControlNumber_LeadOrganization_Budget_Justification
Summary/Abstract for Public Release	PDF	1	ControlNumber_LeadOrganization_Summary
Summary Slide	MS PowerPoint	1	ControlNumber_LeadOrganization_Slide
Subrecipient Budget Justification	MS Excel	n/a	ControlNumber_LeadOrganization_Subrecipient_Budget_Justification
DOE Work Proposal for FFRDC, if applicable (see DOE O 412.1A, Attachment 3)	PDF	n/a	ControlNumber_LeadOrganization_WP
Authorization from cognizant Contracting Officer for FFRDC	PDF	n/a	ControlNumber_LeadOrganization_FFRDCAuth
SF-LLL Disclosure of Lobbying Activities	PDF	n/a	ControlNumber_LeadOrganization_SF-LLL
Foreign Entity and Foreign Work Waivers	PDF	n/a	ControlNumber_LeadOrganization_Waiver
Diversity Equity and Inclusion Plan	PDF	5	ControlNumber_LeadOrganization_DEIP
Current and Pending Support	PDF	n/a	ControlNumber_LeadOrganization_Topic_CPS

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:
TechnicalVolume_Part_1
TechnicalVolume_Part_2

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 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.ii. 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.ii. of the FOA) when preparing the Technical Volume.

The Technical Volume should clearly describe and expand upon information provided in the Concept Paper. The Technical Volume must conform to the following content requirements:

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, names of the senior/key personnel and their organizations, and any statements regarding confidentiality.
Project Overview (Approximately 10% of the Technical Volume)	The Project Overview should contain the following information: • Background: The applicant should discuss the background of their organization, including the history, successes, and current research and development status (i.e., the technical baseline) relevant to the technical topic being addressed in the Full Application. • 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 (Approximately 30% of the Technical Volume)	The Technical Description should contain the following information: • Relevance and Outcomes: The applicant should provide a detailed description of the technology, including the scientific and other principles and objectives that will be pursued during the project. This section should describe the relevance of the proposed project to the goals and objectives of the FOA, including the potential to meet specific DOE technical targets or other relevant performance targets. The applicant should clearly specify the expected outcomes of the project. • Feasibility: The applicant should demonstrate the technical feasibility of the proposed technology and capability of achieving the anticipated performance targets, including a description of previous work done and prior results. • Innovation and Impacts: The applicant should describe the current state-of-the-art in the applicable field, the specific innovation of the proposed technology, the advantages of proposed technology over current and emerging technologies, and the overall impact on advancing the state-of-the-art/technical baseline if the project is successful.

Section/Page Limit	Description
Workplan and Market Transformation Plan (Approximately 40% of the Technical Volume)	The Workplan should include a summary of the Project Objectives, Technical Scope, Work Breakdown Structure (WBS), Milestones, Go/No-Go Decision Points, and Project Schedule. A detailed 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. • 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 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 Specific, Measurable, Achievable, Relevant, and Timely, 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.

Section/Page Limit	Description

	• 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. At a minimum, 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. See Section VI.B.xiv. The applicant should also provide the specific technical criteria to be used to evaluate the project at the Go/No-Go decision point. 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). At a minimum, 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:
	  ○ The overall approach to and organization for managing the work
	  ○ The roles of each project team member
	  ○ Any critical handoffs/interdependencies among project team members
	  ○ The technical and management aspects of the management plan, including systems and practices, such as financial and project management practices
	  ○ The approach to project risk management
	  ○ A description of how project changes will be handled
	  ○ If applicable, the approach to Quality Assurance/Control
	  ○ How communications will be maintained among project team members
	• Market Transformation Plan: The applicant should provide a market transformation plan, including the following:

Section/Page Limit	Description
	○ Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including a mitigation plan ○ Identification of a product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, and product distribution.
Technical Qualifications and Resources (Approximately 20% 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. • Describe the technical services to be provided by DOE/NNSA FFRDCs, if applicable. • For multi-organizational or multi-investigator projects, describe succinctly: ○ The roles and the work to be performed by each PI and senior/key personnel; ○ Business agreements between the applicant and each PI and senior/key personnel; ○ How the various efforts will be integrated and managed; ○ Process for making decisions on scientific/technical direction; ○ Publication arrangements; ○ Intellectual Property issues; and ○ Communication plans.

iii. Resumes

A resume provides information that can be used by reviewers to evaluate the individual's skills, experience, and potential for leadership within the scientific community. Applicants are required to submit two-page resumes for the Principal Investigator and all Senior/Key Personnel that include the following:

1. Contact Information;
2. Education and training: Provide institution, major/area, degree, and year for undergraduate, graduate, and postdoctoral training;
3. Research and Professional Experience: Beginning with the current position, list professional/academic positions in chronological order with a brief description. List all current academic, professional, or institutional appointments, foreign or domestic, at the applicant institution or elsewhere, whether or not remuneration is received, and, whether full-time, part-time, or voluntary;
4. Awards and honors;
5. A list of up to 10 publications most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website address if available electronically. Patents, copyrights, and software systems developed may be provided in addition to or substituted for publications. An abbreviated style such as the Physical Review Letters (PRL) convention for citations (list only the first author) may be used for publications with more than 10 authors; and
6. Synergistic Activities: List up to five professional and scholarly activities related to the proposed effort.

Save the resumes in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Resumes".

In future FOAs, EERE may require a biographical sketch for the PI and senior/key personnel. In the meantime, in lieu of a resume, it is acceptable to use the biographical sketch format approved by the National Science Foundation (NSF). The biographical sketch format may be generated by the Science Experts Network Curriculum Vita (SciENcv), a cooperative venture maintained at https://www.ncbi.nlm.nih.gov/sciencv/, and is also available at https://nsf.gov/bfa/dias/policy/nsfapprovedformats/biosketch.pdf. The use of a format required by another agency is intended to reduce the administrative burden to researchers by promoting the use of common formats.

iv. Letters of Commitment

Submit letters of commitment from all subrecipient and third party cost share providers. If applicable, also include any letters of commitment from

partners/end users (one-page maximum per letter). Save the letters of commitment in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_LOCs".

v. Statement of Project Objectives (SOPO)

Applicants are required to complete a SOPO. A SOPO template is available on EERE Exchange at https://eere-Exchange.energy.gov/. The SOPO, including the Milestone Table, must not exceed 15 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 (except in figures or tables, which may be 10 point font). Save the SOPO in a single Microsoft Word file using the following convention for the title "ControlNumber_LeadOrganization_SOPO".

vi. 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_424".

vii. Budget Justification Workbook

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. 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".

viii. 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".

ix. Summary Slide

Applicants are required to provide a single slide summarizing the proposed project. This slide is used during the evaluation process.

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 senior/key personnel information; and
- Requested EERE funds and proposed applicant cost share.

Save the Summary Slide in a single Microsoft PowerPoint file using the following convention for the title "ControlNumber_LeadOrganization_Slide".

x. Subrecipient Budget Justification (if applicable)

Applicants must provide a separate budget justification 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".

xi. 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 WP in accordance with the requirements in DOE Order 412.1A, Work Authorization System, Attachment 3, available at:

https://www.directives.doe.gov/directives-documents/400-series/0412.1-BOrder-a-chg1-AdmChg Save the WP in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_WP".

xii. 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".

xiii. 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 the 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".

xiv. Waiver Requests: Foreign Entity and Foreign Work (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 C lists the necessary information that must be included in a request to waive this requirement.

2. **Performance of Work in the United States (Foreign Work Waiver)**
   As set forth in Section IV.J.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 C lists the necessary information that must be included in a foreign work waiver request.

   Save the Waivers in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Waiver".

xv. Diversity, Equity and Inclusion Plan

As part of the application, applicants are required to describe how diversity, equity, and inclusion objectives will be incorporated in the project. Specifically, applicants are required to submit a Diversity, Equity, and Inclusion Plan that describes the actions the applicant will take to foster a welcoming and inclusive environment, support people from groups underrepresented in STEM, advance equity, and encourage the inclusion of individuals from these groups in the project; and the extent the project activities will be located in or benefit underserved communities (also see Section I.A.iii.). The plan should include at least one SMART milestone per Budget Period supported by metrics to measure the success of the proposed actions, and will be incorporated into the award if selected. The Diversity, Equity, and Inclusion Plan should contain the following information:

- Equity Impacts: the impacts of the proposed project on underserved communities, including social and environmental impacts.
- Benefits: The overall benefits of the proposed project, if funded, to underserved communities; and
- How diversity, equity, and inclusion objectives will be incorporated in the project.

The following is a non-exhaustive list of actions that can serve as examples of ways the proposed project could incorporate diversity, equity, and inclusion elements. These examples should not be considered either comprehensive or prescriptive. Applicants may include appropriate actions not covered by these examples.

a. Include persons from groups underrepresented in STEM as PI, co-PI, and/or other senior personnel;
b. Include persons from groups underrepresented in STEM as student researchers or post-doctoral researchers;

c. Include faculty or students from Minority Serving Institutions as PI/co-PI, senior personnel, and/or student researchers, as applicable;
d. Enhance or collaborate with existing diversity programs at your home organization and/or nearby organizations;
e. Collaborate with students, researchers, and staff in Minority Serving Institutions;
f. Disseminate results of research and development in Minority Serving Institutions or other appropriate institutions serving underserved communities;
g. Implement evidence-based, diversity-focused education programs (such as implicit bias training for staff) in your organization;
h. Identify Minority Business Enterprises, Minority Owned Businesses, Woman Owned Businesses and Veteran Owned Businesses to solicit as vendors and sub-contractors for bids on supplies, services and equipment.

The Diversity, Equity, and Inclusion Plan must not exceed 5 pages. Save the Diversity, Equity and Inclusion Plan in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_DEIP".

xvi. Current and Pending Support

Current and pending support is intended to allow the identification of potential duplication, overcommitment, potential conflicts of interest or commitment, and all other sources of support. As part of the application, the principal investigator and senior/key personnel at the applicant and subrecipient level must provide a list of all sponsored activities, awards, and appointments, whether paid or unpaid; provided as a gift with terms or conditions or provided as a gift without terms or conditions; full-time, part-time, or voluntary; faculty, visiting, adjunct, or honorary; cash or in-kind; foreign or domestic; governmental or private-sector; directly supporting the individual's research or indirectly supporting the individual by supporting students, research staff, space, equipment, or other research expenses. All foreign government-sponsored talent recruitment programs must be identified in current and pending support.

For every activity, list the following items:

- The sponsor of the activity or the source of funding
- The award or other identifying number
- The title of the award or activity. If the title of the award or activity is not descriptive, add a brief description of the research being performed that would identify any overlaps or synergies with the proposed research
- The total cost or value of the award or activity, including direct and indirect costs and cost share. For pending proposals, provide the total amount of requested funding

- The award period (start date – end date)
- The person-months of effort per year being dedicated to the award or activity

If required to identify overlap, duplication of effort, or synergistic efforts, append a description of the other award or activity to the current and pending support.

Details of any obligations, contractual or otherwise, to any program, entity, or organization sponsored by a foreign government must be provided on request to either the applicant institution or DOE.

PIs and senior/key personnel must provide a separate disclosure statement listing the required information above regarding current and pending support. Each individual must sign and date their respective disclosure statement and include the following certification statement:

> I, [Full Name and Title], certify to the best of my knowledge and belief that the information contained in this Current and Pending Support Disclosure Statement is true, complete and accurate. I understand that any false, fictitious, or fraudulent information, misrepresentations, half-truths, or omissions of any material fact, may subject me to criminal, civil or administrative penalties for fraud, false statements, false claims or otherwise. (18 U.S.C. §§ 1001 and 287, and 31 U.S.C. 3729-3730 and 3801-3812). I further understand and agree that (1) the statements and representations made herein are material to DOE's funding decision, and (2) I have a responsibility to update the disclosures during the period of performance of the award should circumstances change which impact the responses provided above.

The information may be provided in the format approved by the National Science Foundation (NSF), which may be generated by the Science Experts Network Curriculum Vita (SciENcv), a cooperative venture maintained at https://www.ncbi.nlm.nih.gov/sciencv/, and is also available at https://www.nsf.gov/bfa/dias/policy/nsfapprovedformats/cps.pdf. The use of a format required by another agency is intended to reduce the administrative burden to researchers by promoting the use of common formats. If the NSF format is used, the individual must still include a signature, date, and a certification statement using the language included in the paragraph above.

Save the Current and Pending Support in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_CPS".

e. Content and Form of Replies to Reviewer Comments

If replies to reviewer comments are applicable, EERE will provide applicants with reviewer comments following the 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 the 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 (3) 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.

f. Post Selection Information Requests

If selected for award, EERE reserves the right to request additional or clarifying information regarding the following (non-exhaustive list):

- Personnel proposed to work on the project and collaborating organizations (See Section VI.B.xviii. Participants and Collaborating Organizations);

- Current and Pending Support (See Sections IV.D.xvi. and VI.B.xix. Current and Pending Support);
- An Intellectual Property Management Plan (if applicable) describing how the project team/consortia members will handle intellectual property rights and issues between themselves while ensuring compliance with federal intellectual property laws, regulations, and policies in accordance with VI.B.x. Intellectual Property Management Plan;
- A Data Management Plan (if applicable) describing how all research data displayed in publications resulting from the proposed work will be digitally accessible at the time of publications, in accordance with Section VI.B.xxi.;
- 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; and
- Environmental Questionnaire.

g. Dun and Bradstreet Universal Numbering System (DUNS) Number, Unique Entity Identifier (UEI) and System for Award Management (SAM)

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 SAM at https://www.sam.gov before submitting its application; (2) provide a valid DUNS number (until April 4, 2022) and UEI 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. Please note: A DUNS number will no longer be required after April 3, 2022. After that date, applicants will be required to provide ONLY a UEI. DOE may not make a federal award to an applicant until the applicant has complied with all applicable DUNS, UEI, 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 will 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.

h. Submission Dates and Times

All required submissions must be submitted in EERE Exchange no later than 5 p.m. Eastern Time on the dates provided on the cover page of this FOA.

i. Intergovernmental Review

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

j. 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:

- Federal Acquisition Regulation (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 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. **National Environmental Policy Act (NEPA) Requirements Related to Pre-Award Costs**
   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 pre-award costs incurred prior to receiving written authorization from the Contracting Officer. If the applicant elects to undertake activities that DOE determines 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 for their project 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. Likewise, if an application 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.

iii. Performance of Work in the United States (Foreign Work Waiver)

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 whether 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 foreign work waiver, the applicant must submit a written waiver request to EERE. Appendix C lists the necessary information that must be included in a request for a foreign work waiver.

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. 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

Foreign travel costs are not allowable under this FOA.

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. For-profit entity disposition requirements are set forth at 2 CFR 910.360. Property disposition requirements for other non-federal entities are set forth in 2 CFR 200.310 – 200.316.

vii. Domestic Preference – Infrastructure Projects

As appropriate and to the extent consistent with law, Applicants shall ensure that, to the greatest extent practicable, iron and aluminum as well as steel, cement, and other manufactured products (items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber) used in the proposed project shall be produced in the United States. This requirement shall flow down to all sub-awards including all contracts, subcontracts and purchase orders for work performed under the proposed project.

viii. 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 the 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.

ix. 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 Office of Management and Budget (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.

x. 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; and
- Other items as required by DOE.

V. Application Review Information

a. Technical Review Criteria

i. Concept Papers

Concept Papers are evaluated based on consideration the following factors. All sub-criteria are of equal weight.

Concept Paper Criterion: Overall FOA Responsiveness and Viability of the Project (Weight: 100%)
This criterion involves consideration of the following factors:

- The applicant clearly describes the proposed technology, describes how the technology is unique and innovative, and how the technology will advance the current state-of-the-art;
- The applicant has identified risks and challenges, including possible mitigation strategies, and has shown the impact that EERE funding and the proposed project would have on the relevant field and application;
- The applicant has the qualifications, experience, capabilities and other resources necessary to complete the proposed project; and
- The proposed work, if successfully accomplished, would clearly meet the objectives as stated in the FOA.

ii. Full Applications

Applications from Topic Areas 1, 2, and 3 will be evaluated against the Technical Review Criteria shown below. All sub-criteria are of equal weight.

Criterion 1: Technical Merit, Innovation, and Impact (50%)

This criterion involves consideration of the following factors:
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;
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state-of-the-art to the proposed advancement; 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

- How the project supports the topic area objectives and target specifications and metrics; and
- The potential impact of the project on advancing the state-of-the-art.

Criterion 2: Project Research and Market Transformation Plan (25%)
This criterion involves consideration of the following factors:
Research Approach, Workplan and SOPO

- Degree to which the approach and critical path have been clearly described and thoughtfully considered; and
- 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.

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

- The 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, and product distribution.

Criterion 3: Team and Resources (15%)
This criterion involves consideration of the following factors:

- The capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a high probability of success. The qualifications, relevant expertise, and time commitment of the individuals on the team;
- The sufficiency of the facilities to support the work;
- The degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further development and commercial deployment of the proposed technologies;
- The level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan; and
- The reasonableness of the budget and spend plan for the proposed project and objectives.

Criterion 4: Diversity, Equity, and Inclusion (10%)
This criterion involves consideration of the following factors:

- The quality and manner in which the measures incorporate diversity, equity and inclusion goals in the project; and
- Extent to which the project benefits underserved communities.

Applications from Topic Area 4 (including both Subtopic Areas) will be evaluated against the Technical Review Criteria shown below. All sub-criteria are of equal weight.

Criterion 1: Technical Merit, Viability, and Impact (40%)
This criterion involves consideration of the following factors:
Technical Merit and Viability

- Extent to which the proposed technology or process is technically feasible for the target community/ies;
- Sufficiency of technical detail in the application to assess whether the proposed work is technically meritorious, including relevant data, calculations and discussions of prior work in the literature with analyses that support the viability of the proposed work;
- Extent to which the submission communicates how the proposed work can help the community/ies make positive advancements towards the sustainability (economic, environmental, and social) goals specified; and
- Extent to which the submission clearly and convincingly demonstrates how the proposed work can help the community/ies successfully address

resource and energy recovery from waste objectives, challenges and opportunities beyond the current level of development or practice.

Impact of Proposed Project

- Extent to and manner in which the project supports the topic area objectives and target specifications and metrics;
- Extent to which the proposed approach is likely to yield tangible and transformative economic and environmental benefits to the community/ies.
- Extent to which the application demonstrates that the DOE funding will materially and substantially impact the outcome of the proposed effort and result in sustained positive impact to the community/ies; and
- Extent to which project and project outcomes can be model approaches for other communities.

Criterion 2: Project Workplan and Goals (20%)

This criterion involves consideration of the following factors:

Research Approach, Workplan and SOPO

- Degree to which the approach has been clearly described and thoughtfully considered; and
- 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.

Identification of Risks

- Thoroughness of discussion and demonstrated understanding of the key technical, political, and socio-economic risk areas involved in the proposed work and the quality of the mitigation strategies to address them.

Baseline, Metrics, and Deliverables

- The level of clarity in the definition of the baseline environmental, economic, and social indicators, metrics, and milestones/targets; and
- Degree to which outcomes and outputs can measure environmental improvement and/or can be directly linked to sustainability improvements, through quantitative and/or qualitative data collection and analysis. Include quantitative targets as appropriate.

Criterion 3: Multi-Stakeholder Team Composition and Capacity Building (30%)

This criterion involves consideration of the following factors:

Capacity/Expertise

- The capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a high probability of success.

This factor includes an evaluation of the qualifications, relevant expertise, and time commitment of the individuals on the team;

- Extent to which the proposed approach is likely to build organizational and/or staff capacity to support the installation of clean energy technologies located in the community/ies, and/or support the community's/ies' participation in the clean energy economy;
- Degree to which types of participants and project partners have defined roles and are integrated into the Workplan (include specific participants or partners as applicable);
- The sufficiency of the facilities to support the work; and
- The reasonableness of the budget and spend plan for the proposed project and objectives.

Multi-stakeholder Involvement

- Extent to which the proposed approach is likely to increase the community's/ies' ownership of and/or decision-making regarding elements of the energy system or economy that are the source of the stated challenges and opportunities;
- The extent to which the project addresses engagement with these communities and/or populations, especially local residents, to ensure their meaningful participation with respect to the design, project planning, and performance of the project; and
- The breadth of the involvement from diverse energy system stakeholders and the degree of the involvement of these diverse stakeholders.

Criterion 4: Diversity, Equity, and Inclusion (10%)

This criterion involves consideration of the following factors:

- The quality and manner in which the measures incorporate diversity, equity and inclusion goals in the project; and
- Extent to which the project benefits underserved communities.

iii. 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 "DOE Merit Review Guide for Financial Assistance," effective September 2020, 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 DOE 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 demonstrated ability to accelerate commercialization and 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;
- The degree to which the proposed project, or group of projects, represent a desired geographic distribution (considering past awards and current applications);
- The degree to which the proposed project incorporates diversity, equity, and inclusion elements, including but not limited to team members from Minority Serving Institutions (e.g., Historically Black Colleges and Universities (HBCUs)/Other Minority Institutions), Minority Business Enterprises, Minority Owned Businesses, Woman Owned Businesses, Veteran Owned Businesses, or members within underserved communities; and
- The degree to which the proposed project provides funding to disadvantaged communities or seeks to address environmental injustices that

disproportionately affect disadvantaged communities in accordance with Executive Order 14008.

Diversity (other than technological)

- The degree to which the proposed project collectively represents diverse types and sizes of applicant organizations.

Optimize Funding

- The degree to which the proposed project avoids duplication/overlap with other publicly or privately funded work.

Complementary Efforts

- The degree to which the proposed project supports complementary efforts or projects, which, when taken together, will best achieve the research goals and objectives.

Market Impact

- The degree to which the proposed project enables new and expanding market segments.

EE/Deployment

- The degree to which the project's solution or strategy will maximize deployment or replication.

Tech Transfer

- The degree to which the project promotes increased coordination with nongovernmental entities for demonstration of technologies and research applications to facilitate technology transfer.

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 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.

iii. 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 The Federal Awardee Performance and Integrity Information System 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 CFR 200.206.

iv. 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 Negotiation Dates

EERE anticipates notifying applicants selected for negotiation of award and negotiating awards by the dates provided on the cover page of this FOA.

VI. Award Administration Information

a. Award Notices

i. Ineligible Submissions

Ineligible Concept Papers and 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 Concept Paper or the Full Application is ineligible and not considered for further review.

ii. Concept Paper Notifications

EERE will notify applicants of its determination to encourage or discourage the submission of a Full Application. EERE will post these notifications to EERE Exchange.

Applicants may submit a Full Application even if they receive a notification discouraging them from doing so. By discouraging the submission of a Full Application, EERE intends to convey its lack of programmatic interest in the proposed project. Such assessments do not necessarily reflect judgments on the merits of the proposed project. The purpose of the Concept Paper phase is to save applicants the considerable time and expense of preparing a Full Application that is unlikely to be selected for award negotiations.

A notification encouraging the submission of a Full Application does not authorize the applicant to commence performance of the project. Please refer to Section IV.J.ii. of the FOA for guidance on pre-award costs.

iii. 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.

iv. 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.J.ii. of the FOA for guidance on pre-award costs.

v. 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.

vi. 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. **System for Award Management**
   Register with the SAM at https://www.sam.gov. Designating an Electronic Business Point of Contact (EBiz POC) and obtaining a special password called a Marketing Partner ID Number (MPIN) are important steps in SAM registration. Please update your SAM registration annually.

3. **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.

4. **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 Concept Papers, and Full Applications will not be accepted through Grants.gov.

5. **Electronic Authorization of Applications and Award Documents**
   Submission of an application and supplemental information under this FOA through electronic systems used by the DOE, 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

All applicants selected for an award under this FOA may be required to provide information to DOE in order to satisfy requirements for foreign nationals' access to DOE sites, information, technologies, equipment, programs or personnel. A foreign national is defined as any person who is not a U.S. citizen by birth or naturalization. If a selected applicant (including any of its subrecipients, contractors or vendors) anticipates involving foreign nationals in the performance of its award, the selected applicant may be required to provide DOE with specific information about each foreign national to ensure compliance with the requirements for access approval. National laboratory personnel already cleared for site access may be excluded.

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 NEPA (42 U.S.C. 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 https://www.energy.gov/nepa.

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 recipient may be required to prepare the records and 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 Classified Information Nondisclosure Agreement (https://fas.org/sgp/othergov/sf312.pdf), Form 4414 Sensitive Compartmented Information Disclosure Agreement (https://fas.org/sgp/othergov/intel/sf4414.pdf), 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 unusual 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 the Go/No-Go decision point(s).

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

x. Intellectual Property Management Plan (IPMP)

As a quarter 1 milestone or during negotiations if selected for award, applicants may be required per the discretion of the Contracting Officer to submit an executed IPMP between the members of the consortia or team.

The award will set forth the treatment of and obligations related to intellectual property rights between EERE and the individual members. The IPMP should describe how the members will handle intellectual property rights and issues between themselves while ensuring compliance with federal intellectual property laws, regulations, and policies (see Sections VIII.K.-VIII.N. of this FOA for more details on applicable federal intellectual property laws and regulations). Guidance regarding the contents of IPMP is available from EERE upon request.

The following is a non-exhaustive list of examples of items that the IPMP may cover:

- The treatment of confidential information between members (e.g., the use of NDAs);
- The treatment of background intellectual property (e.g., any requirements for identifying it or making it available);
- The treatment of inventions made under the award (e.g., any requirements for disclosing to the other members on an application, filing patent applications, paying for patent prosecution, and cross-licensing or other licensing arrangements between the members);
- The treatment of data produced, including software, under the award (e.g., any publication process or other dissemination strategies, copyrighting strategy or arrangement between members);
- Any technology transfer and commercialization requirements or arrangements between the members;
- The treatment of any intellectual property issues that may arise due to a change in membership of the consortia or team; and
- The handling of disputes related to intellectual property between the members.

xi. 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 ten (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.

xii. Intellectual Property Provisions

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

xiii. Reporting

Reporting requirements are identified on the Federal Assistance Reporting Checklist, attached to the award agreement. This helpful EERE checklist can be accessed at https://www.energy.gov/eere/funding/eere-funding-application-and-management-forms. See Attachment 2 Federal Assistance Reporting Checklist, after clicking on "Model Cooperative Agreement" under the Award Package section.

BETO Reporting Requirements

Attendance at the BETO Biennial Peer Review is required so that external subject matter experts can review project accomplishments and provide feedback to ensure optimal use of BETO funds.

xiv. 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. 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 EERE program goals and objectives. Federal funding beyond the Go/No-Go decision point (continuation funding) is contingent upon (1) availability of federal funds appropriated by Congress for the purpose of this program; (2) the availability of future-year budget authority; (3) recipient's technical progress compared to the Milestone Summary Table stated in Attachment 1 of the award; (4) recipient's submittal of required reports; (5) recipient's compliance with the terms and conditions of the award; (6) EERE's Go/No-Go decision; (7) the recipient's submission of a continuation application; and (8) written approval of the continuation application by the Contracting Officer.

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.

xv. 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.

xvi. Uniform Commercial Code (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.

xvii. Implementation of Executive Order 13798, Promoting Free Speech and Religious Liberty

States, local governments, or other public entities may not condition sub-awards in a manner that would discriminate, or disadvantage sub-recipients based on their religious character.

xviii. Participants and Collaborating Organizations

If selected for award negotiations, the selected applicant must submit a list of personnel who are proposed to work on the project, both at the recipient and subrecipient level and a list of collaborating organizations within 30 days after the applicant is notified of the selection. Recipients will have an ongoing responsibility to notify DOE of changes to the personnel and collaborating organizations, and submit updated information during the life of the award.

xix. Current and Pending Support

If selected for award negotiations, within 30 days of the selection notice, the selectee must submit 1) current and pending support disclosures and resumes for any new PIs or senior/key personnel and 2) updated disclosures if there have been any changes to the current and pending support submitted with the application. Throughout the life of the award, the Recipient has an ongoing responsibility to submit 1) current and pending support disclosure statements and resumes for any new PI and senior/key personnel and 2) updated disclosures if there are changes to the current and pending support previously submitted to DOE. Also See. Section IV.D.xvi.

xx. U.S. Manufacturing Commitments

A primary objective of DOE's multi-billion dollar research, development and demonstration investments is to cultivate new research and development ecosystems, manufacturing capabilities, and supply chains for and by U.S. industry and labor. Therefore, in exchange for receiving taxpayer dollars to support an applicant's project, the applicant must agree to the following U.S. Competitiveness Provision as part of an award under this FOA.

> U.S. Competitiveness
>
> The Recipient agrees that any products embodying any subject invention or produced through the use of any subject invention will be manufactured substantially in the United States unless the Recipient can show to the satisfaction of DOE that it is not commercially feasible. In the event DOE agrees to foreign manufacture, there will be a requirement that the Government's support of the technology be recognized in some appropriate

manner, e.g., alternative binding commitments to provide an overall net benefit to the U.S. economy. The Recipient agrees that it will not license, assign or otherwise transfer any subject invention to any entity, at any tier, unless that entity agrees to these same requirements. Should the Recipient or other such entity receiving rights in the invention(s): (1) undergo a change in ownership amounting to a controlling interest, or (2) sell, assign, or otherwise transfer title or exclusive rights in the invention(s), then the assignment, license, or other transfer of rights in the subject invention(s) is/are suspended until approved in writing by DOE. The Recipient and any successor assignee will convey to DOE, upon written request from DOE, title to any subject invention, upon a breach of this paragraph. The Recipient will include this paragraph in all subawards/contracts, regardless of tier, for experimental, developmental or research work.

A subject invention is any invention conceived or first actually reduced in performance of work under an award. An invention is any invention or discovery which is or may be patentable.

As noted in the U.S. Competitiveness Provision, at any time in which an entity cannot meet the requirements of the U.S. Competitiveness Provision, the entity may request a modification or waiver of the U.S. Competitiveness Provision. For example, the entity may propose modifying the language of the U.S. Competitiveness Provision in order to change the scope of the requirements or to provide more specifics on the application of the requirements for a particular technology. As another example, the entity may request that the U.S. Competitiveness Provision be waived in lieu of a net benefits statement or U.S. manufacturing plan. The statement or plan would contain specific and enforceable commitments that would be beneficial to the U.S. economy and competitiveness. Commitments could include manufacturing specific products in the U.S., making a specific investment in a new or existing U.S. manufacturing facility, keeping certain activities based in the U.S. or supporting a certain number of jobs in the U.S. related to the technology. If DOE, in its sole discretion, determines that the proposed modification or waiver promotes commercialization and provides substantial U.S. economic benefits, DOE may grant the request and, if granted, modify the award terms and conditions for the requesting entity accordingly.

The U.S. Competitiveness Provision is implemented by DOE pursuant to a Determination of Exceptional Circumstances (DEC) under the Bayh-Dole Act and DOE Patent Waivers. See Section VIII.J. Title to Subject Inventions of this FOA for more information on the DEC and DOE Patent Waivers.

xxi. Data Management Plan (DMP)

Each applicant whose Full Application is selected for award negotiations will be required to submit a DMP during the award negotiations phase. A DMP explains how, when appropriate, data generated in the course of the work performed under an EERE award will be shared and preserved in order to validate the results of the proposed work or how the results could be validated if the data is 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 publications.

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: FY22FeedstockConversionFOA@ee.doe.gov. Questions must be submitted not later than 3 business days prior to the application due date and time. Please note, feedback on individual concepts will not be provided through Q&A.

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. 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.

c. 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.

d. Treatment of Application Information

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. Applicants are advised to not include any critically sensitive proprietary detail.

If an application includes trade secrets or information that is commercial or financial, or information that is confidential or privileged, it is furnished to the Government in confidence with the understanding that the information shall be used or disclosed only for evaluation of the application. Such information will be withheld from public disclosure to the extent permitted by law, including the Freedom of Information Act. Without assuming any liability for inadvertent disclosure, EERE will seek to limit disclosure of such information to its employees and to outside reviewers when necessary for merit review of the application or as otherwise authorized by law. This restriction does not limit the Government's right to use the information if it is obtained from another source.

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

The cover sheet of the Full Application, and other submission must be marked as follows and identify the specific pages containing trade secrets, confidential, proprietary, or privileged information:

Notice of Restriction on Disclosure and Use of Data:
Pages [list applicable pages] of this document may contain trade secrets, confidential, proprietary, or privileged information that 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 confidential, proprietary, or privileged information must be marked as follows: "Contains Trade Secrets, Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure." In addition, each line or paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting.

e. Evaluation and Administration by Non-Federal Personnel

In conducting the merit review evaluation, the Go/No-Go Reviews and Peer Reviews, 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, including EERE contractors. The applicant, by submitting its application, consents to the use of non-federal reviewers/administrators. Non-federal reviewers must sign conflict of interest (COI) and non-disclosure acknowledgements (NDA) prior to reviewing an application. Non-federal personnel conducting administrative activities must sign an NDA.

f. 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.

g. 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).

h. 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.

i. Retention of Submissions

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

j. 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.

- Advance and Identified Waivers: For an applicant not covered by a Class Patent Waiver or the Bayh-Dole Act, the applicant 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.

- DEC: On June 07, 2021, DOE approved a DETERMINATION OF EXCEPTIONAL CIRCUMSTANCES (DEC) UNDER THE BAYH-DOLE ACT TO FURTHER PROMOTE DOMESTIC MANUFACTURE OF DOE SCIENCE AND ENERGY TECHNOLOGIES. In accordance with this DEC, all awards, including sub-awards, under this FOA shall include the U.S. Competitiveness Provision in accordance with Section VI.B.xx. U.S. Manufacturing Commitments of this FOA. A copy of the DEC can be found at https://www.energy.gov/gc/determination-exceptional-circumstances-decs. Pursuant to 37 CFR § 401.4, any nonprofit organization or small business firm as defined by 35 U.S.C. 201 affected by any DEC has the right to appeal it by providing written notice to DOE within 30 working days from the time it receives a copy of the determination.

k. Government Rights in Subject Inventions

Where prime recipients and subrecipients retain title to subject inventions, the U.S. government retains certain rights.

1. 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.

2. 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.

l. 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.

m. 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.

n. Export Control

The U.S. government regulates the transfer of information, commodities, technology, and software considered to be strategically important to the U.S. to protect national security, foreign policy, and economic interests without imposing undue regulatory burdens on legitimate international trade. There is a network of federal agencies and regulations that govern exports that are collectively referred to as "Export Controls". To ensure compliance with Export Controls, it is the prime recipient's responsibility to determine when its project activities trigger Export Controls and to ensure compliance.

Export Controls may apply to individual projects, depending on the nature of the tasks. When Export Controls apply, the recipient must take the appropriate steps to obtain any required governmental licenses, monitor and control access to restricted information, and safeguard all controlled materials. Under no circumstances may foreign entities (organizations, companies or persons) receive access to export controlled information unless proper export procedures have been satisfied and such access is authorized pursuant to law or regulation.

o. Personally Identifiable Information (PII)

All information provided by the applicant must to the greatest extent possible exclude PII. The term "PII" refers to information which can be used to distinguish or trace an individual's identity, such as their name, social security number, biometric records, 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. (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, personal landline/cell phone numbers, and personal emails. **Under no circumstances should Social Security Numbers (SSNs) be included in the application**. Federal agencies are prohibited from the collecting, using, and displaying unnecessary SSNs. (See, the Federal Information Security Modernization Act of 2014 (Pub. L. No. 113-283, Dec 18, 2014; 44 U.S.C. § 3551).

p. 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 CFR 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 CFR 200.501 and Subpart F.

Applicants and subrecipients (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.

q. Informational Webinar

EERE will conduct one informational webinar during the FOA process. It will be held after the initial FOA release but before the due date for Concept Papers.

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 for the webinar can be found on the cover page of the FOA.

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, 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. The 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 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. 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. 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.

3. Funds from other federal sources MAY NOT be counted as cost share. This prohibition includes FFRDC subrecipients. 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 FAR, 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; and

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 – SAMPLE COST SHARE CALCULATION FOR BLENDED COST SHARE PERCENTAGE

The following example shows the math for calculating required cost share for a project with $2,000,000 in federal funds with four tasks requiring different non-federal cost share percentages:

Task	Proposed Federal Share	Federal Share %	Recipient Share %
Task 1 (R&D)	$1,000,000	80%	20%
Task 2 (R&D)	$500,000	80%	20%
Task 3 (Demonstration)	$400,000	50%	50%
Task 4 (Outreach)	$100,000	100%	0%

Federal share ($) divided by federal share (%) = Task Cost

Each task must be calculated individually as follows:

Task 1
$1,000,000 divided by 80% = $1,250,000 (Task 1 Cost)
Task 1 Cost minus federal share = non-federal share
$1,250,000 - $1,000,000 = $250,000 (non-federal share)

Task 2
$500,000 divided 80% = $625,000 (Task 2 Cost)
Task 2 Cost minus federal share = non-federal share
$625,000 - $500,000 = $125,000 (non-federal share)

Task 3
$400,000 / 50% = $800,000 (Task 3 Cost)
Task 3 Cost minus federal share = non-federal share
$800,000 - $400,000 = $400,000 (non-federal share)

Task 4
Federal share = $100,000
Non-federal cost share is not mandated for outreach = $0 (non-federal share)

The calculation may then be completed as follows:

Tasks	$ Federal Share	% Federal Share	$ Non-Federal Share	% Non-Federal Share	Total Project Cost
Task 1	$1,000,000	80%	$250,000	20%	$1,250,000
Task 2	$500,000	80%	$125,000	20%	$625,000
Task 3	$400,000	50%	$400,000	50%	$800,000
Task 4	$100,000	100%	$0	0%	$100,000
Totals	$2,000,000		$775,000		$2,775,000

Blended Cost Share %
Non-federal share ($775,000) divided by Total Project Cost ($2,775,000) = 27.9% (non-federal)
Federal share ($2,000,000) divided by Total Project Cost ($2,775,000) = 72.1% (federal)

APPENDIX C – WAIVER REQUESTS AND APPROVAL PROCESSES: 1. FOREIGN ENTITY PARTICIPATION AS THE PRIME RECIPIENT; AND 2. PERFORMANCE OF WORK IN THE UNITED STATES (FOREIGN WORK WAIVER)

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 and have a physical location for business operations in 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 and the extent, if any, the entity is state owned or controlled;
- 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; and
- 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 (Foreign Work Waiver)

As set forth in Section IV.J.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 D – GLOSSARY

Applicant – The lead organization submitting an application under the FOA.

Continuation application – A non-competitive application for an additional budget period within a previously approved project period. At least ninety (90) days before the end of each budget period, the Recipient must submit to EERE its continuation application, which includes the following information:

i. A report on the Recipient's progress towards meeting the objectives of the project, including any significant findings, conclusions, or developments, and an estimate of any unobligated balances remaining at the end of the budget period. If the remaining unobligated balance is estimated to exceed 20 percent of the funds available for the budget period, explain why the excess funds have not been obligated and how they will be used in the next budget period.

ii. A detailed budget and supporting justification if there are changes to the negotiated budget, or a budget for the upcoming budget period was not approved at the time of award.

iii. A description of any planned changes from the negotiated Statement of Project Objectives and/or Milestone Summary Table.

Cooperative Research and Development Agreement (CRADA) – a contractual agreement between a national laboratory contractor and a private company or university to work together on research and development. For more information, see https://www.energy.gov/gc/downloads/doe-cooperative-research-and-development-agreements.

Federally Funded Research and Development Centers (FFRDC) – FFRDCs are public-private partnerships which conduct research for the United States government. A listing of FFRDCs can be found at http://www.nsf.gov/statistics/ffrdclist/.

Go/No-Go Decision Points – A decision point at the end of a budget period that defines the overall objectives, milestones and deliverables to be achieved by the recipient in that budget period. As of a result of EERE's review, EERE may take one of the following actions: 1) authorize federal funding for the next budget period; 2) recommend redirection of work; 3) discontinue providing federal funding beyond the current budget period; or 4) place a hold on federal funding pending further supporting data.

Project – The entire scope of the cooperative agreement which is contained in the recipient's Statement of Project Objectives.

Recipient or "Prime Recipient" – A non-federal entity that receives a federal award directly from a federal awarding agency to carry out an activity under a federal program. The term recipient does not include subrecipients.

Subrecipient – A non-federal entity that receives a subaward from a pass-through entity to carry out part of a federal program; but does not include an individual that is a beneficiary of such program. A subrecipient may also be a recipient of other federal awards directly from a federal awarding agency. Also, a DOE/NNSA and non-DOE/NNSA FFRDC may be proposed as a subrecipient on another entity's application. See Section III.E.i.

APPENDIX E – DEFINITION OF TECHNOLOGY READINESS LEVELS

TRL 1:	Basic principles observed and reported
TRL 2:	Technology concept and/or application formulated
TRL 3:	Analytical and experimental critical function and/or characteristic proof of concept
TRL 4:	Component and/or breadboard validation in a laboratory environment
TRL 5:	Component and/or breadboard validation in a relevant environment
TRL 6:	System/subsystem model or prototype demonstration in a relevant environment
TRL 7:	System prototype demonstration in an operational environment
TRL 8:	Actual system completed and qualified through test and demonstrated
TRL 9:	Actual system proven through successful mission operations

APPENDIX F – LIST OF ACRONYMS

BETO	Bioenergy Technologies Office
COI	Conflict of Interest
DEC	Determination of Exceptional Circumstances
DEI	Diversity, Equity, and Inclusion
DMP	Data Management Plan
DRE	Determination of Restricted Eligibility
DOE	Department of Energy
DOI	Digital Object Identifier
DUNS	Dun and Bradstreet Universal Numbering System
EERE	Energy Efficiency and Renewable Energy
FAR	Federal Acquisition Regulation
FAPIIS	Federal Awardee Performance and Integrity Information System
FFATA	Federal Funding and Transparency Act of 2006
FOA	Funding Opportunity Announcement
FOIA	Freedom of Information Act
FFRDC	Federally Funded Research and Development Center
GAAP	Generally Accepted Accounting Principles
GHG	Greenhouse Gases
IP	Intellectual Property
IPMP	Intellectual Property Management Plan
LCA	Life Cycle Assessment/Analysis
M&O	Management and Operating
MPIN	Marketing Partner ID Number
MRF	Material Recovery Facility
MSI	Minority-Serving institution
MSW	Municipal Solid Waste
NSF	National Science Foundation
NDA	Non-Disclosure Acknowledgement
NEPA	National Environmental Policy Act
NNSA	National Nuclear Security Agency
NREL	National Renewable Energy Laboratory
NREL-SI	National Renewable Energy Laboratory – Systems Integration
OMB	Office of Management and Budget
OSTI	Office of Scientific and Technical Information
PII	Personal Identifiable Information
R&D	Research and Development
RDD&D	Research, Development, Demonstration, and Deployment
RFI	Request for Information
RFP	Request for Proposal

SAF	Sustainable Aviation Fuel
SAM	System for Award Management
SOPO	Statement of Project Objectives
SMART	Specific, Measurable, Assignable, Realistic and Time-Related
SPOC	Single Point of Contact
STEM	Science, Technology, Engineering, and Mathematics
TEA	Technoeconomic Analysis
TIA	Technology Investment Agreement
TRL	Technology Readiness Level
TRY	Titer/Rate/Yield
UCC	Uniform Commercial Code
UEI	Unique Entity Identifier
WBS	Work Breakdown Structure
WP	Work Proposal

APPENDIX G — ACCEPTABLE FEEDSTOCKS

The Bioenergy Technologies Office works with biomass-based feedstocks, per the authorizing language in EPAct 2005 (see below). Each Topic Area and Subtopic has specific feedstock requirements and those are summarized here for reference.

Topic Area	Biomass (general definition, see next page)	Biomass Breakdown per Topic Area					Other Feedstocks			
		Lignocellulosic Feedstocks	Algae	Organic Wet Waste	Sorted Municipal Solid Waste	Biogas	Waste Carbon Dioxide	Syngas (derived from other allowable feedstocks)	Grain Starch	Oilseed Crops
1: MSW Feedstock Technologies	Yes	Yes, only if for blending with MSW at up to 50%	Yes, only if for blending with MSW at up to 50%	Yes	Yes	No	No	No	Yes, only if for blending with MSW at up to 50%	Yes, only if for blending with MSW at up to 50%
2a/2b: Robust Microbial Cells	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
3: Robust Catalytic Processes	Yes	Cellulosic sugars only	Yes	Yes	Yes	Yes	No	Yes	No	No
4a/4b: Community Organic Waste	No	No	No	Yes	Yes	Yes	No	No	No	No

"Biomass" is defined generally in the authorizing language of EPAct 2005, §932 (reproduced below). More specifically for the purposes of this FOA, biomass includes agricultural residues, forest resources, perennial grasses, woody energy crops, algae, organic wet waste (e.g., biosolids), sorted municipal solid waste, and biogas.

"Lignocellulosic Feedstocks" are defined generally in the authorizing language of EPAct 2005, §932 (reproduced below). More specifically for the purposes of this FOA, are defined as 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.

"Algae" for the purpose of this FOA, as included in the definition of "biomass" above is defined as eukaryotic microalgae, macroalgae (seaweed), and cyanobacteria.

"Organic 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 that are no longer suitable for human consumption; organic-rich wastewaters from industrial and commercial operations; manure slurries from animal husbandry operations.

"Sorted Municipal Solid Waste" for the for the purposes of this FOA, is defined as the organic and plastic constituents of the MSW stream going to the landfill (typically known as municipal garbage). The sorted MSW is not considered or used for recycling, and is discharged from MRFs and disposed in landfills (e.g., non-recycled paper and paperboard, plastics, yard trimmings, wood, food wastes, rubber and leather, textiles, and any relevant containments that could affect conversion of the MSW into a fuel and co-product). See chapter 2 in the Resource Conservation and Recovery Act Orientation Manual 2014 - https://www.epa.gov/sites/production/files/2015-07/documents/rom.pdf

"Feedstock quality improvement" is defined as the improvement of MSW chemical, physical, and biological characteristics to meet conversion specifications. The critical quality characteristics of interest for the baseline metric include but are not limited to: moisture content, particle size/shape metrics, purity, density, inorganic content/speciation, proximate/ultimate analysis, molecular/chemical composition, rheology, and contamination sources.

"Biogas" for the purpose of this FOA, refers to the mixture of gases produced by the breakdown of organic matter in the absence of oxygen, primarily consisting of methane and carbon dioxide.

"Waste Carbon Dioxide" 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.

"Grain Starch" for the purposes of this FOA, refers to commercially available starch derived yellow dent feed corn, wheat and grain sorghum/milo. Please note grain starch may only be used to produce fuel, bioproduct production in not allowed with grain starch.

"Oilseed Crops" for the purposes of this FOA, refers to US-produced, oil producing crops including, but not limited to soybeans, cottonseed, sunflower seed, canola, rapeseed, peanuts, camelina, and oil producing annual cover crops[11,12]. Please note that Greenhouse Gas reductions of at least 70% must be met if utilizing an oil seed crop(s).

EPAct 2005, §932, codified at 42 U.S.C. § 16232. BIOENERGY PROGRAM.

[11] https://www.ers.usda.gov/topics/crops/soybeans-oil-crops/oil-crops-sector-at-a-glance/#:~:text=The%20major%20U.S.%20oilseed%20crops,percent%20of%20U.S.%20oilseed%20production.&text=Field%20Crops%20for%20soybean%20dates%20by%20region).

[12] https://www.epa.gov/renewable-fuel-standard-program/approved-pathways-renewable-fuel.

(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.