U.S. Department of Energy
Office of Clean Energy Demonstrations

Industrial Decarbonization and Emissions Reduction Demonstration-to-Deployment Funding Opportunity Announcement

Funding Opportunity Announcement Number: DE-FOA-0002936
Type: Mod 000002
Assistance Listing Number: 81.255

Funding Opportunity Announcement Issue Date:	03/08/2023
Submission Deadline for Concept Papers:	04/21/2023 / 5:00pm ET
Informational Webinar:	06/2023 / Date and Time TBD
Submission Deadline for Full Applications:	08/11/2023 / 5:00pm ET
Expected Date(s) for Pre-Selection Interviews:	Fall/Winter 2023
Expected Date(s) for Selection Notifications:	Winter 2023/24
Expected Timeframe(s) for Award Negotiations:	Winter 2023/24 – Spring 2024

Modifications

All modifications to the FOA are [HIGHLIGHTED] in the body of the FOA.

Mod. No.	Date	Description of Modification
000001	06/01/2023	• The FOA Cover Page is updated to state that the Full Application deadline is changed to August 11, 2023 at 5:00pm ET, an Informational Webinar will take place in June 2023, and that the Expected Date(s) for Pre-Selection Interviews is Fall/Winter 2023. • Section 1.3.2.1 (General Expectations for All Topic Areas) is updated to add a footnote clarifying that the terms "Application" and "Full Application" are interchangeable in this FOA.

		• Section 3.1 (Eligible Applicants) is updated to add clarifying language regarding Eligible Entities for Topic Areas 2 and 3. • Section 3.4 (Limitation on Number of Concept Papers and Applications Eligible for Review) is updated to add clarifying language regarding substantially similar retrofits at multiple facilities. • Section 4.6.2.2(a) (Technical Volume – Project Summary) is updated to add categories of information to be addressed in the Project Summary. A new appendix, Appendix D (Example Project Summary for Full Applications), has been added to the FOA. This Appendix D is also available under the "Application Forms and Templates" section on the OCED eXCHANGE website. • Section 4.6.2.2(b) (Technical Volume – Business Development and Management) is updated to include detail on supply chain and offtake information, require the inclusion of a business case analysis and note the Excel file naming convention, and provide detail on information to be submitted regarding financial strength and organizational structure. • Section 4.6.2.2(c) (Technical Volume - Engineering, Procurement, Construction, and Operations) is updated to clarify the starting TRL level. • Section 4.6.2.2(f) (Technical Volume - Techno-Economic Analysis and Life Cycle Analysis Projections) is updated to include additional detail and clarifications and refer to LCA and TEA templates that are available under the "Application Forms and Templates" section on the OCED eXCHANGE website. • Section 4.6.2.6 (Letters of Commitment) is updated to clarify that letters of support are not required for project partners that are not contributing to cost share. • Section 4.6.2.12 (SF-LLL: Disclosure of Lobbying Activities) is updated to clarify that the SF-LLL form is required if any registrants under the Lobbying Disclosure Act of 1995 have made a lobbying contact on behalf of the applicant (including with non-federal funds) with respect to this funding opportunity, and the section title is updated to remove (required).

		• Section 4.8.5 (Risk Assessment) is updated to clarify that DOE considers threats to research, technology, and economic security from undue foreign government influence when evaluating risk. • Subsection numbering in Section 4.8.8 (Prohibition Related to Foreign Government-Sponsored Talent Recruitment Programs) is corrected. • Section numbering in Section 4.8.11 (Affirmative Action and Pay Transparency Requirements) is corrected. • Section 8.1 (Treatment of Application Information) is updated to add guidance for company submitters regarding how DOE will address FOIA requests. • Section 8.5 (Teaming Partner List) is updated to state in the Submission Instructions that the organization should provide a description of need in a partner instead of listing the Area of Interest. • Appendix A (Application Requirements Checklist) is updated to include updated file name conventions for the Business Plan and the TEA/LCA.
000002	07/21/2023	• Section 4.1 (Application Package) is updated to clarify certain exceptions to the form and content requirements. • Section 4.6.2.2(e) (Risk Analysis and Mitigation) is updated to remove the requirement for the TEA and LCA narratives to be included in the Risk Analysis and Mitigation document. • Section 4.6.2.2(f) (Techno-Economic Analysis and Life Cycle Analysis Projections), Section 4.6.2.3 (Community Benefits Plan: Job Quality and Equity), and Section 4.6.2.8 (Summary for Public Release) are updated to clarify the file naming conventions. • Section 4.6.2.2(f) (Techno-Economic Analysis and Life Cycle Analysis Projections) was updated to clarify the definition of reference flow. • Section 4.6.2.3 (Community Benefits Plan: Job Quality and Equity) is updated to clarify the name of the technical review criterion is Criterion 5: Community Benefits Plan (20%) and that it is located in Section 5.2.2. • Section 4.6.2.11 (Current and Pending Support Disclosures) is updated to correct a typographical error to say to “The information…”

		• Section 5.2.2 (Applications) is updated to add ““or support” to the fourth bullet under Criterion 4: Management Team and Project Partners. • Appendix A (Application Requirements Checklist) is updated to correct a typographical error in “lobbying.”

Office of Clean Energy Demonstrations

Table of Contents

Executive Summary

The U.S. Department of Energy (DOE) is releasing this Funding Opportunity Announcement (FOA) to solicit applications in accordance with the Infrastructure Investment and Jobs Act (IIJA), also known as the Bipartisan Infrastructure Law (BIL), and the Inflation Reduction Act of 2022 (IRA). When combined with private sector cost share, this FOA represents a more than $12 billion opportunity to catalyze high-impact, large-scale, transformational advanced industrial facilities to significantly reduce greenhouse gas (GHG) emissions in energy-intensive industrial subsectors.

U.S. industry is a backbone of the nation's economy, producing the goods critical to everyday life, employing millions of Americans in high-quality jobs, and providing an economic anchor for thousands of communities. Yet the energy- and carbon-intensity of the sector, which contributes nearly one third of the nation's primary energy-related carbon dioxide emissions, poses a significant challenge as the economy transitions towards net-zero.[1]

This FOA offers a critical opportunity to solidify a "first-mover" advantage for U.S. industry, bolstering its competitiveness globally for decades into the future. Activities funded under this FOA are further expected to create good-paying jobs for American workers, offer opportunities for broadly shared prosperity in communities, and enable a clean, more equitable future for all Americans.

Demonstrating the technical and commercial viability of industrial decarbonization approaches will promote widespread technology implementation and drive a U.S. edge in low- and net-zero carbon manufacturing while helping to substantiate a market for low-carbon products.

To maximize the transformative potential for these funds, DOE will prioritize a portfolio of projects that offer:

- **Deep decarbonization**, by demonstrating significantly less carbon-intensive industrial production processes leading to materials that can be labeled as having substantially lower levels of embodied greenhouse gas emissions;
- **Timeliness**, through rapid technology demonstrations that can address emissions in the near-term, meet funding horizons, and be replicated by fast followers;
- **Market viability,** with technological approaches designed to spur follow-on investments for widespread decarbonization as well as partnerships between buyers and sellers of the materials produced, with special consideration given to industries that are focusing on shifting entire ecosystems and enabling new market structures for low-carbon products; and
- **Community benefits**, tailored through substantial engagement with local and regional stakeholders, as well as labor unions and Tribal Nations across the project lifecycle, supporting environmental justice and economic opportunity for local communities.

[1] Total projected energy-related carbon dioxide emissions for the industrial sector in 2020 was 1,360 MMT CO_2 compared to 4,563 MMT CO_2 for all sectors. "Annual Energy Outlook 2021 with Projections to 2050," U.S. Energy Information Administration, February 2021, https://www.eia.gov/outlooks/archive/aeo21/, Table 19. Energy-Related Carbon Dioxide Emissions by End Use.

DOE expects to award up to approximately 65 projects in high GHG-emitting industries and for cross-cutting technologies as discussed in Section 1.3. DOE anticipates providing awards to teams that are led by a single, for-profit organization or owner/operator of an eligible facility and encourages applicants to strengthen projects by partnering with experts, universities, labor unions, community-based organizations, non-governmental organizations, product off-takers, and/or national laboratories, as outlined in Section 3.0.

Given the transformative potential of these funds, DOE seeks first- or early-of-a-kind commercial-scale projects. These could include new technologies that have been proven at a pilot scale but have yet to be deployed commercially, technologies that are being pursued internationally but do not have a foothold in the U.S., or other early-of-a-kind projects that face market or adoption risks. All projects should incorporate a path from demonstration to deployment that includes sustained operation after completion and substantiate the projects' ability to meet priority criteria.

DOE will apply the following four-phase structure for projects selected under this FOA.

- **Phase 1** will encompass initial planning and analysis activities to ensure that the overall concept is technologically and financially viable.
- **Phase 2** will finalize engineering designs and business development, site access, labor agreements, National Environmental Policy Act (NEPA) review, permitting, and offtake agreements.
- **Phase 3** will encompass installation, integration, and construction activities.
- **Phase 4** will ramp-up to full operations including data collection to analyze the plant's operations, performance, and financial viability.

This FOA solicits plans for all four phases of proposed activities; projects that have completed initial phases will be eligible to undergo accelerated early reviews for due diligence. DOE will work with project performers to tailor their specific approach after selections and anticipates that implementation approaches will vary between projects. All projects selected under this FOA will be eligible to complete all four phases pending successful execution of milestones; DOE is not planning a competitive down-select process among projects after awards. However, to manage risk DOE will regularly review and evaluate projects' progress on deliverables through Go / No-Go reviews that will occur between or within phases.

Opportunity at a Glance

Table 1. FOA Topic Areas and descriptions. All values anticipated. Details to be determined through merit reviews and project negotiations.

Topic Area (TA)	Description*	Funding Provision	TRL**	Anticipated # of Awards**	Anticipated Award Duration*	Anticipated Federal Funding per Award***
1. Near-Net-Zero Facility Build Projects	World-leading, first- or early-of-a-kind, full facility builds resulting in significant emissions reductions up to net-zero operations.	BIL Section 41008	7-9	2-5	8-12 years	$100M-250M
2. Facility-level Large Installations and Overhaul Retrofit Demonstrations	Large-scale overhauls for existing facilities, common technologies across multiple facilities, or new builds with accelerated planning, development, permitting, and financing strategies.	IRA Section 50161	7-9	10-30	3-7 years	$75M-500M
3. System Upgrades and Retrofits for Critical Unit Operations or Single Process Lines Within Existing Facilities	Upgrades, retrofits, and operational improvements that target decarbonization within a unit operation or process line at an existing facility.	IRA Section 50161	7-9	10-30	3-7 years	$35M-75M

*For more details, see Section 1.3.2.

**Subject to change depending on the number and quality of applications.

***Federal share of funds for all awards is ≤ 50% total project costs. For proposals outside of the technology readiness level (TRL), award duration, or total funding ranges stated, applicants must explain and provide sufficient justification of how the project fits within the applicable Topic Area. Total funding per Topic Area may shift depending on the number of projects awarded by Topic Area.

1.0 Funding Opportunity Description

1.1 Background and Context

The United States (U.S.) Department of Energy's (DOE) Office of Clean Energy Demonstrations (OCED) is issuing this Funding Opportunity Announcement (FOA) in collaboration with the Office of Manufacturing and Energy Supply Chain (MESC) and the Industrial Efficiency and Decarbonization Office (IEDO). Awards made under this FOA will be funded through appropriations under the Infrastructure Investment and Jobs Act, more commonly known as the Bipartisan Infrastructure Law (BIL), and the Inflation Reduction Act (IRA) of 2022.

The BIL and IRA are once-in-a-generation investments designed to modernize and upgrade American infrastructure to enhance U.S. competitiveness, drive the creation of good-paying union jobs, tackle the climate crisis, and ensure stronger access to economic, environmental, and other benefits for disadvantaged communities. These laws direct DOE to invest in American manufacturing and workers; expand access to energy efficiency and clean energy; deliver reliable, clean, and affordable power to more Americans; create a market for low- and net-zero carbon industrial and building products; and demonstrate and deploy the technologies of tomorrow through transformative, clean energy demonstrations.

As part of and in addition to upgrading and modernizing infrastructure, DOE's BIL and IRA investments will support efforts to build a clean and equitable energy economy that achieve a zero-carbon electricity system by 2035 and to put the U.S. on a path to achieve net-zero emissions economy-wide by no later than 2050 to benefit all Americans.

OCED's mission is to deliver clean energy technology demonstration projects at commercial scale in partnership with the private sector to accelerate deployment, market adoption, and the equitable transition to a decarbonized energy system. OCED was established in December 2021 and was first authorized and funded through the BIL. The founding of OCED builds on DOE's expertise in clean energy research and development and expands DOE's scope to fill a critical gap on the path to net-zero GHG emissions by 2050.

OCED works in close collaboration with other DOE industrial programs, complementing the efforts in IEDO supporting research, development, and smaller-scale demonstration activities; the deployment programs through MESC; and the support for testing and validation of subscale systems through the Office of Technology Transitions' (OTT) Technology Commercialization Fund (TCF). OCED also coordinates with other DOE initiatives, such as the Industrial Heat Shot™ which, as part of the DOE Energy Earthshots Initiative™, targets the development of cost-competitive industrial heat decarbonization technologies with at least 85% lower greenhouse gas emissions by 2035.[2] DOE's crosscutting portfolio view of investments that facilitate industrial decarbonization is integrated rather than duplicative.[3]

[2] "Industrial Heat Shot," U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, September 2022, https://www.energy.gov/eere/industrial-heat-shot.
[3] *See* 42 U.S.C. § 17113(f); 42 U.S.C. § 18631.

The statutory authorities for this FOA include: section 41008 of the BIL that authorizes appropriations of $500 million for demonstrations in the Industrial Emissions Reduction Technology Development Program at section 454(d)(3) of the Energy Independence and Security Act of 2007 (EISA) (42 U.S.C. § 17113(d)(3)) that are appropriated by Title III of Division J of BIL; and section 50161 of the IRA (42 U.S.C. § 17113b) that authorizes and appropriates $5.812 billion that is available through September 30, 2026, in support of advanced industrial facilities projects.

1.2 Program Purpose

This FOA makes available approximately $6 billion in federal funds for projects that will validate low-GHG emitting industrial facilities capable of manufacturing products and materials with low-carbon footprints. DOE aims to fund projects in the highest emitting, hardest-to-abate industries where rapidly deployed decarbonization technologies can have the greatest impact: iron, steel, steel mill products, aluminum, cement, concrete, glass, pulp, paper, industrial ceramics, chemicals, and other energy intensive industrial processes.[4]

Widespread demonstration and deployment of projects within these industries will support President Biden's initiative to rebuild U.S. leadership in manufacturing as countries, companies, and consumers around the world shift to low- to net-zero carbon commodities to meet their own decarbonization goals. Further, the U.S. has the potential to be more competitive in more advanced, value-added manufacturing including sustainable manufacturing. By proving out the most cutting-edge industrial decarbonization technologies, U.S. industry will become solutions providers to countries around the world.

Applications will be selected based on multiple factors that exhibit the expectations and details described throughout this FOA. Priority will be given to projects with the deepest GHG emissions reduction potential; facility readiness and ability of applicant to act quickly; the clean product market viability; community benefits; and statutory priority consideration factors as described in Section 5.2.2.[5] When reviewing applications, DOE may choose to prioritize applicants that are focused on, and best prepared to, transition their entire ecosystem to clean products.

Industrial GHG Emissions

The industrial sector, composed of manufacturing and non-manufacturing subsectors, represents unique and complex challenges to decarbonize the nation's economy due in part to the diversity of energy inputs into a wide array of industrial processes and operations.

[4] Section 50161(g)(3) of the IRA (42 U.S.C. § 17113b(g)(3). There is also a similar list of industries in section 454(c)(1)(A) of EISA (42 U.S.C. § 17113(c)(1)(A)), specifically: "iron, steel, steel mill products, aluminum, cement, concrete, glass, pulp, paper, and industrial ceramics."

[5] Section 50161(d) of the IRA (42 U.S.C. § 17113b(d)).

Using modeled data for 2020, DOE's Industrial Decarbonization Roadmap estimated the industrial sector accounted for about 33% of the nation's primary energy use[6] and around 30% of energy-related carbon dioxide (CO_2) emissions. The manufacturing portion of the industrial sector accounted for more than 75% of primary energy use and more than 80% of the CO_2 emissions of the entire industrial sector.[7]

Industrial emissions primarily arise from the combustion of fossil fuels on-site for direct use or for steam (e.g., for process heating), the generation of electricity on-site or off-site (e.g., for motor-driven systems), and non-energy-related process emissions (e.g., CO_2 emissions from calcination in the production of cement). More detailed manufacturing energy consumption survey (MECS) data from the U.S. Energy Information Administration (EIA) illustrates the energy- and process-related CO_2 equivalent (CO_2e) emissions for the major manufacturing sectors in 2018 (Figure 1).[8] Energy-intensive industrial subsectors listed in section 50161(g)(3) of the IRA[9] account for approximately 75% of all manufacturing-related CO_2e emissions.

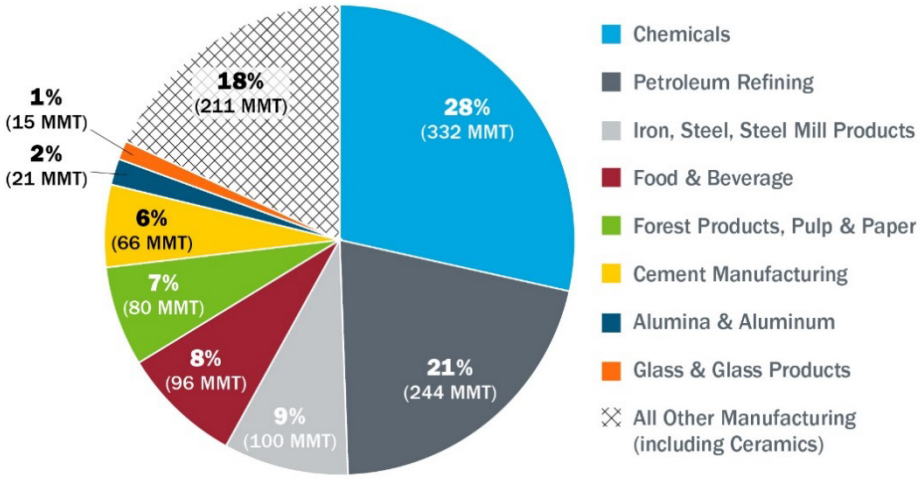

Figure 1. U.S. primary energy- and process- related CO_2e emissions (MMT CO_2e) for manufacturing industries (NAICS 31-33). Energy-intensive industrial sectors, along with food and beverage, account for approximately 80% of manufacturing-related emissions.

Figure derived from DOE's Manufacturing Energy and Carbon Footprints; source of data for footprints from DOE Energy Information Administration's 2018 Manufacturing Energy Consumption Survey.

[6] Primary energy includes energy that is consumed both offsite and onsite during the manufacturing process. Offsite energy consumption includes generation and transmission losses associated with bringing electricity and steam to the plant boundary. The roadmap includes fuels as feedstocks – fossil inputs to material production (e.g., natural gas as both fuel and feedstock for certain chemicals).

[7] "Industrial Decarbonization Roadmap," U.S. Department of Energy, September 2022, https://www.energy.gov/sites/default/files/2022-09/Industrial%20Decarbonization%20Roadmap.pdf, Figure 2. U.S. Primary Energy Consumption by End Use Sector and Figure 3. U.S. Primary Energy-Related CO_2 Emissions by End Use Sector. Note: These figures do not include non-energy related CO_2 emissions or other GHG emissions.

[8] "Manufacturing Energy and Carbon Footprints (2018 MECS)," U.S. Department of Energy, December 2021, https://www.energy.gov/eere/amo/manufacturing-energy-and-carbon-footprints-2018-mecs. Figure 1 does not include fuel used as feedstock.

[9] 42 U.S.C. § 17113b(g)(3).

Transformative industrial decarbonization will require demonstration and deployment of emerging and existing technologies that currently face commercial adoption challenges due to first-of-a-kind barriers, lack of demand signals, and/or capital constraints. DOE anticipates that projects funded under this FOA will demonstrate significant GHG emissions reduction potential in nonpower[10] industrial sectors in support of the Biden-Harris Administration's decarbonization goals of a 50-52% reduction in GHG emissions from 2005 levels by 2030.

The goals also include a carbon-pollution-free power sector by 2035, and a net-zero GHG emissions economy by 2050[11,12,13] using one or more of these cross-cutting industrial decarbonization approaches: energy efficiency; industrial electrification; low-carbon fuels, feedstocks, and energy sources (LCFFES); material efficiency or substitution; carbon capture utilization and storage (CCUS); and others. These approaches align with but are not limited to the DOE Industrial Decarbonization Roadmap.[14]

As DOE has other commercial-scale demonstration efforts underway that are directly focused on hydrogen production and carbon management, in this FOA, hydrogen- and carbon capture-specific projects should be transformative and specific to the industrial decarbonization objectives described previously.
For example:

- Projects focusing on hydrogen could prioritize the use of hydrogen rather than the production of hydrogen (e.g., facility-specific needs to use hydrogen in process(es), such as flexible fuel switching technologies) in complement with DOE's hydrogen-specific technology portfolio.
- Projects focusing on carbon capture could prioritize carbon utilization to complement DOE's carbon management portfolio, which has an emphasis on projects that will demonstrate sequestration for long-term storage in novel contexts.

DOE will consider all responsive project proposals and will seek to construct a diversified portfolio in combination with other funding opportunities.

Substantially lower embodied carbon materials and products resulting from facilities funded through this FOA can assist in setting the standard for transparency in reporting a product's embodied emissions through environmental product declarations (EPDs).

[10] "Nonpower" facility means a facility whose primary purpose is not power generation.
[11] EO 14030, "Executive Order on Climate-Related Financial Risk (Executive Order 14030)," May 2021.
[12] "FACT SHEET: President Biden sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies," The White House, April 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies.
[13] "The United States' Nationally Determined Contribution. Reducing Greenhouse Gases in the United States: A 2030 Emissions Target," United Nations Climate Change Coalition, June 2022, https://unfccc.int/sites/default/files/NDC/2022-06/United%20States%20NDC%20April%2021%202021%20Final.pdf.
[14] "Industrial Decarbonization Roadmap," U.S. Department of Energy, September 2022, https://www.energy.gov/sites/default/files/2022-09/Industrial%20Decarbonization%20Roadmap.pdf.

Through the federal Buy Clean Initiative and relevant sections of BIL and IRA funding, efforts are underway to prioritize these types of materials for federal procurement and federally funded infrastructure projects. Multiple agencies and regulatory bodies are currently working to expand the disclosure of GHG emissions at a product, facility, and corporate level, including:

- The U.S. Environmental Protection Agency's (EPA) Request for Information for an IRA-funded program to identify and label construction materials and products that have substantially lower levels of embodied greenhouse gas emissions associated with all relevant stages of production, use, and disposal, as compared to estimated industry averages of similar materials or products.[15]
- Multiple cities, states, and companies are setting Buy Clean policies and sending demand signals for the procurement of lower embodied carbon materials and products through the use of EPDs.[16,17]
- A proposed U.S. Securities and Exchange Commission rule change that would require annual climate-related disclosures, including a registrant's GHG emissions across its overall operations and supply chains, from publicly traded companies.[18]
- A proposed Federal Acquisitions Regulations (FAR) rule that would require major contractors to the Federal government to annually disclose their GHG emissions and climate-related financial risk and set science-based GHG emissions reduction targets.[19]

DOE expects that cleaner products resulting from facilities funded through this FOA should assist in setting the standard for transparency in reporting a product's embodied emissions.

Replicability and Timeliness

The International Energy Agency (IEA) cites a need for annual clean energy investment worldwide to reach $4 trillion annually by 2030 to achieve net-zero emissions by 2050.[20] Given the scale of the challenge, replicable projects that can be deployed with urgency will be best positioned to catalyze follow-on investments to yield the most significant carbon reductions across the industrial sector in the next few decades.

---

[15] "Request for Information (RFI) to Support New Inflation Reduction Act Programs to Lower Embodied Greenhouse Gas Emissions Associated with Construction Materials and Products," U.S. Environmental Protection Agency, January 2023, https://www.regulations.gov/document/EPA-HQ-OPPT-2022-0924-0002.

[16] https://carbonleadershipforum.org/clf-policy-toolkit/#map

[17] "FACT SHEET: Biden-Harris Administration Rallies States, Cities, and Companies to Boost Clean American Manufacturing," The White House, October 2022, https://www.whitehouse.gov/briefing-room/statements-releases/2022/10/20/fact-sheet-biden-harris-administration-rallies-states-cities-and-companies-to-boost-clean-american-manufacturing/.

[18] "The Enhancement and Standardization of Climate-Related Disclosures for Investors," U.S. Securities and Exchange Commission, April 2022, https://www.federalregister.gov/documents/2022/04/11/2022-06342/the-enhancement-and-standardization-of-climate-related-disclosures-for-investors.

[19] "Federal Acquisition Regulation: Disclosure of Greenhouse Gas Emissions and Climate-Related Financial Risk," U.S. Department of Defense, U.S. General Services Administration, and National Aeronautics and Space Administration, November 2022, https://www.federalregister.gov/documents/2022/11/14/2022-24569/federal-acquisition-regulation-disclosure-of-greenhouse-gas-emissions-and-climate-related-financial

[20] https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroby2050-ARoadmapfortheGlobalEnergySector_CORR.pdf.

Near-term movement on decarbonization will also bolster U.S. industrial technology leadership within the global economy as countries throughout the world look to adopt advanced industrial decarbonization technologies in the coming decade.[21,22]

Market Viability for Clean Products

This FOA seeks to drive a U.S. competitive edge in low- and net-zero carbon manufacturing. In a 2022 Global Sustainability Study, 85% of people indicated that they have shifted their purchase behavior towards being more sustainable over the last five years.[23] Adoption of lower-carbon technologies has also been proven in certain industries, such as the Leadership in Energy and Environmental Design (LEED) standards in the building industry, organic/genetically modified organism-free food designations, and renewable electricity in certain jurisdictions.

Yet the market for clean products is still being established, and the success of industrial decarbonization technologies will depend on purchasers. Projects funded under this FOA should help establish the viability and competitiveness of domestically manufactured low-carbon products, which can be especially impactful as global consumers look for increased transparency on carbon intensity of their goods.[24] Relationships between buyers and sellers for early low-carbon products can speed this transition.

Moreover, the collective impact of aligned industries has the potential to shift entire ecosystems and enable new market structures for the offtake of goods produced by advanced industrial facilities. The private sector has started to prioritize these activities through groups like the First Movers Coalition,[25] which is designed to harness the purchasing power of companies to send market signals around the growing demand for cleaner products.

Projects funded through this FOA have the potential to capitalize on and accelerate progress within the following federal demand-side initiatives that coordinate federal procurement power.

[21] 42 U.S.C. § 17113(b)(1)(A)
[22] "Federal Buy Clean Initiative," Office of the Federal Chief Sustainability Officer, December 2021, https://www.sustainability.gov/buyclean/.
[23] https://www.simon-kucher.com/en/insights/2022-global-sustainability-study-growth-potential-environmental-change.
[24] 42 U.S.C. § 17113(b)(1)(B)
[25] "Launching the First Movers Coalition at the 2021 UN Climate Change Conference," U.S. Department of State, November 2021, https://www.state.gov/launching-the-first-movers-coalition-at-the-2021-un-climate-change-conference/.

Buy Clean: The Federal government recognizes its role as the largest purchaser of goods and services in the world, with annual purchasing power of over $630 billion. To harness that procurement power to support acceleration toward a net-zero economy by 2050, President Biden's Executive Order 14057[26] on catalyzing American clean energy industries and jobs through federal sustainability and accompanying Federal Sustainability Plan[27] outlines an ambitious path to achieve net-zero emissions from federal procurement by 2050 while increasing the sustainability of federal supply chains.

These supply chain initiatives include major contractor GHG emission disclosures paired with science-based targets, the Buy Clean initiative for low-carbon materials,[28] and a sustainable products and procurement policy. In particular, the Buy Clean initiative prioritizes the Federal government's purchase of steel, concrete, asphalt, and flat glass that have lower levels of embodied GHG emissions,[29] as these four construction materials account for nearly half of all U.S. manufacturing GHG emissions and represent 98% of the government's purchased construction materials.[30]

Federal agencies are also updating specifications to prioritize the procurement and funding of lower and substantially lower embodied emissions construction materials which will reduce greenhouse gas emissions from federally funded building, infrastructure, and construction projects. For example, the EPA sent an interim determination for low carbon materials to the Department of Transportation (DOT) and the General Services Administration (GSA) on their IRA-funded procurement of construction materials and products with substantially lower embodied GHG emissions.[31]

[26] EO 14057, "Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability," December 2021.
[27] "Federal Sustainability Plan: Catalyzing America's Clean Energy Industries and Jobs," The White House, December 2021, https://www.sustainability.gov/federalsustainabilityplan/index.html.
[28] "Federal Buy Clean Initiative," U.S. Council on Environmental Quality, December 2021, https://www.sustainability.gov/buyclean/index.html.
[29] Embodied emissions refer to the amount of greenhouse gas (GHG) emissions associated with the extraction, production, transport, and manufacturing of material. Low embodied carbon materials have less climate impact associated with mining, manufacturing, and transportation. Traditionally, steel, concrete, asphalt, and flat glass contain a high quantity of embodied emissions due to the energy-intensive processes used to extract raw materials like limestone, taconite ore, and silica and then converting those raw materials via industrial processes to produce a product.
[30] "FACT SHEET: Biden-Harris Administration Announces New Buy Clean Actions to Ensure American Manufacturing Leads in the 21st Century," The White House, September 2022, https://www.whitehouse.gov/briefing-room/statements-releases/2022/09/15/fact-sheet-biden-harris-administration-announces-new-buy-clean-actions-to-ensure-american-manufacturing-leads-in-the-21st-century/.
[31] "Inflation Reduction Act Programs to Fight Climate Change by Reducing Embodied Greenhouse Gas Emissions of Construction Materials and Products," U.S. Environmental Protection Agency, January 2023, https://www.epa.gov/inflation-reduction-act/inflation-reduction-act-programs-fight-climate-change-reducing-embodied#federal.

GSA's *Facilities Standards for the Public Buildings Service (P100)* guidelines already include low-embodied carbon concrete and environmentally preferable asphalt requirements, and DOT has committed to "address the embodied carbon emissions that come from the engineering, design, construction, procurement, maintenance, and disposal of transportation projects."[32,33,34]

Build America, Buy America Act (Buy America): Buy America requires that, for federally assisted projects that involve infrastructure work undertaken by applicable recipient types, all iron, steel, and manufactured products used in the infrastructure work are produced in the United States, and all construction materials used in the infrastructure work are manufactured in the United States. See Section 4.8.3 for more information about Buy America.

Community Benefits

Together, Buy Clean and Buy America advance America's industrial competitiveness to supply low-carbon and sustainable goods of the future while creating good-paying jobs with a free and fair chance to join a union, anchored in American communities. It is also imperative that federally funded projects promote environmental benefits and mitigate harms. In addition to emitting large quantities of GHGs, industrial facilities emit other pollutants, waste streams, and by-products that may have harmful impacts on human and environmental health. In the U.S., black and indigenous communities, communities of color, and low-income communities are disproportionately exposed to elevated levels of air pollution and, consequently, experience higher rates of adverse health impacts compared to the general population.[35,36]

This FOA seeks to address pollution from the industrial sector as an integral step towards remediating social, economic, and health burdens on those disproportionately harmed by industrial sector emissions.[37] Assessing community-level impacts and prioritizing energy and environmental justice (EEJ) help ensure the benefits of investments to decarbonize industry will flow to overburdened and underserved communities.

[32] "Federal Buy Clean Initiative," U.S. Council for Environmental Quality, December 2021, www.sustainability.gov/buyclean.
[33] "Facilities Standards (P100) Overview," U.S. General Services Administration, November 2022, https://www.gsa.gov/real-estate/design-and-construction/engineering-and-architecture/facilities-standards-p100-overview.
[34] "Policy Statement on Buy Clean Initiative," U.S. Department of Transportation, September 2022, https://www.transportation.gov/sites/dot.gov/files/2022-09/Signed_Buy_Clean_Policy_Statement.pdf.
[35] Liu, et al., "Disparities in Air Pollution Exposure in the United States by Race/Ethnicity and Income, 1990–2010," Environmental Health Perspectives, December 2021, https://doi.org/10.1289/EHP8584.
[36] Tessum, et al., "PM2.5 polluters disproportionately and systemically affect people of color in the United States," Science Advances, April 2021, https://doi.org/10.1126/sciadv.abf4491.
[37] "How Energy Justice, Presidential Initiatives, and Executive Orders Shape Equity at DOE," DOE Office of Economic Impact and Diversity, January 2022, https://www.energy.gov/diversity/articles/how-energy-justice-presidential-initiatives-and-executive-orders-shape-equity.

As part of the whole-of-government approach to advance equity and encourage worker organizing and collective bargaining,[38,39,40] this FOA and any related activities will seek to encourage meaningful engagement and participation of workforce organizations, including labor unions, as well as underserved communities and underrepresented groups, including consultation with Tribal Nations.[41,42] Consistent with Executive Order 14008,[43] this FOA is designed to help meet the goal that 40% of the overall benefits of the Administration's investments in clean energy and climate solutions flow to disadvantaged communities, as defined by the Department pursuant to the Executive Order and to drive the creation of accessible good-paying jobs with the free and fair chance for workers to join a union. These goals are further reflected in section 50161(d)(2) of the IRA, which specifies priority consideration for "the extent to which the project would provide the greatest benefit for the greatest number of people within the area in which the eligible facility is located."[44]

1.3 Topic Areas

1.3.1 Terminology

Projects funded through this FOA should be commercial-scale or commercially relevant, include a path from demonstration to deployment that includes sustained operation after completion, and have the goal of enabling widespread, non-federally funded follow-on investments after the project period. This could include full first-of-a-kind projects, projects that are first-of-their-kind in the U.S., and/or other early-of-a-kind projects that face market or adoption risks. All applicants should substantiate their project's ability to meet this FOA's priority criteria. By proving first- or early-of-a-kind operations, DOE aims to bring new technologies and integrated systems to widespread deployment throughout the industry sector or across industries for cross-cutting technologies. As discussed in Section 1.4, applicants must plan to continue commercial operations following completion of the project period. The specific types of projects this FOA supports are discussed in the Topic Area Descriptions in Section 1.3.2.

[38] EO 13985, "Advancing Racial Equity and Support for Underserved Communities Through the Federal Government," January 20, 2021.
[39] EO 14025, "Worker Organizing and Empowerment," April 26, 2021.
[40] EO 14052, "Implementation of the Infrastructure Investment and Jobs Act," November 18, 2021.
[41] EO 13175, "Consultation and Coordination with Indian Tribal Governments," November 6, 2000. This EO charges all executive departments and agencies with engaging in regular, meaningful, and robust consultation with Tribal officials in the development of federal policies that have Tribal implications.
[42] "Memorandum on Tribal Consultation and Strengthening Nation-to-Nation Relationships," The White House, January 2021, https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/26/memorandum-on-tribal-consultation-and-strengthening-nation-to-nation-relationships/.
[43] EO 14008, "Tackling the Climate Crisis at Home and Abroad," January 27, 2021.
[44] 42 U.S.C. § 17113b(d)(2).

For Topic Areas 2 and 3, section 50161(g)(1) of the IRA[45] defines "advanced industrial technology" as a technology directly involved in an industrial process, as described in section 454(c)(1)-(6) of the EISA[46] and designed to accelerate GHG reduction progress to net-zero at an eligible facility, as determined by the Secretary.

In this FOA, "industrial decarbonization" means phasing out GHG emissions from the industrial sector. "GHG" is defined under section 50111 of the IRA as carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, and this definition of GHG applies to both the BIL-funded and IRA-funded projects described in this FOA.[47] "CO_2e" is a unit of measurement that is used to assess global warming impacts allowing the common comparison of GHG emissions relative to CO_2 by use of Global Warming Potentials, typically in metric tons CO_2e per kilogram (kg) product (MT CO_2e/kg).[48]

GHG emissions reductions should be shown as a total reduction and normalized reduction. "Total annual GHG emissions" means total facility GHG emissions emitted from on-site operations and primary energy generation in a calendar year. For normalized emissions, the amount of GHG emitted per "functional unit" or unit output (e.g., mass, volume, or other measurement of product) in an industrial process is referred to as the "carbon intensity." Carbon intensity per product and facility is to be substantiated through Life Cycle Analysis (LCA).

Products, feedstocks, fuels, or processes that either have lower carbon intensities themselves or enable a lower carbon intensity for the purposes of industrial decarbonization are referred to as "low-carbon."[49] "Metric" is a term that is used to identify important measurements and calculations that will be used to evaluate applications and awarded projects. Carbon intensity and annual GHG emissions are the main metrics to evaluate GHG reduction; however, there are many other metrics the applicant will need to identify and define to validate all requirements of the FOA.

To validate decarbonization and show reduction in GHG emissions, applicants will need to provide on-site baselines and benchmarks. "On-site" refers to an eligible facility's property boundary. A "baseline" is an evaluation at a certain point in time at an operating facility. A "benchmark" is an assessment relative to an industry-standard best practice representing commercially available off-the-shelf technology, referred to as "state-of-the-art." The benchmark should be justified and documented using widely recognized U.S. and/or international reference documents.[50] Further details can be found in Section 4.6.2.2(f).

[45] 42 U.S.C. § 17113b(g)(1).
[46] 42 U.S.C. § 17113(c)(1)-(6).
[47] Section 50111(1) of the IRA (42 U.S.C. § 17113b note); section 1610(a) of the Energy Policy Act of 1992 as amended (42 U.S.C. § 13389(a)).
[48] "Understanding Global Warming Potentials," U.S. Environmental Protection Agency, May 2022, https://www.epa.gov/ghgemissions/understanding-global-warming-potentials.
[49] "Industrial Decarbonization Roadmap," U.S. Department of Energy, September 2022, https://www.energy.gov/sites/default/files/2022-09/Industrial%20Decarbonization%20Roadmap.pdf.
[50] Widely recognized U.S. and international reference documents include, but are not limited to, U.S. Environmental Protection Agency Available and Emerging Technologies for Reducing GHG Emissions; U.S. DOE

While the focus of this FOA is on GHG emissions reductions, other pollutants and wastes are also relevant considerations for the projects and awards. These may include criteria air pollutants,[51] hazardous air pollutants,[52] and other pollutants or wastes subject to federal, state, or local regulations due to their ability to produce harmful environmental and health effects in the areas surrounding industrial facilities.

1.3.2 Topic Area Descriptions

1.3.2.1 General Expectations for all Topic Areas

Industrial GHG emissions are generated through a wide variety of processes, and therefore no single technology solution exists to eliminate them. In this FOA, DOE will take a broad, multifaceted approach to solving industrial decarbonization challenges across various industrial subsectors. DOE seeks to fund industrial decarbonization projects of commercial-scale demonstrations for world-leading, full facility builds and facility-wide overhauls, as well as targeted retrofits for critical units or individual process lines to prove technology suitability for widespread implementation across large, complex facilities.

DOE understands that retrofits and brownfield project proposals will be highly varied and may involve aspects of both project types. DOE will work closely with awardees to establish appropriate project structures and objectives based on specific projects proposed.

The funding source, scale, and type of projects envisioned for these funds is defined in three Topic Areas, described in Sections 1.3.2.2 to 1.3.2.4 below. Areas of Interest (AOI), which are further elaborated in Section 1.3.3, describe the industrial subsectors and crosscutting technologies of interest to DOE. Applicants must identify the Topic Area and AOI most suited to their proposed project.

Each award will be made under one of the three Topic Areas within the Topic Area-specific minimum and maximum anticipated award amount as indicated in Table 1, though total funding per Topic Area may shift depending on the number of projects awarded by Topic Area. This approach is designed to align with the applicable statutes and incorporates significant input from industry through stakeholder engagement activities.

All Topic Areas include projects starting nominally at TRL 7 and advancing to TRL 9 by the end of the project, as defined in Section 4.6.2.2. For technologies below this TRL range, DOE's other industrial programs are available to support R&D and the testing and validation of subscale or pilot systems as precursors to future first- or early-of-a-kind commercial demonstrations.

National Laboratory Reports on World Energy Intensity Best Practices (and similar); International Energy Agency Best Practice Technologies; European Union Integrated Pollution Prevention and Control Best Available Techniques; refereed journal articles, etc.

[51] "Criteria Air Pollutants," U.S. Environmental Protection Agency, last updated August 2022, https://www.epa.gov/criteria-air-pollutants.

[52] "Hazardous Air Pollutants," U.S. Environmental Protection Agency, last updated February 2022, https://www.epa.gov/haps.

For example, IEDO released a FOA in Fall 2022 that focuses on funding high-impact, applied research and development and prototype or pilot-scale technology validation and demonstration projects[53] with plans for future programmatic growth. OTT recently released a TCF Lab Call aimed at accelerating commercialization of carbon dioxide removal technologies, including direct air capture, by advancing measurement, reporting, and verification best practices, and capabilities.[54]

Each applicant to this FOA must clearly show how the proposed project will:

- Reduce GHG emissions at the eligible facility and contribute to the acceleration of industry toward net-zero GHG emissions by 2050;
- Demonstrate favorable technical and economic feasibilities and its potential for timely replicability in other facilities;
- Offer potential for financial and market viability for the clean products, with priority for partnerships with clean product purchasers;
- Provide the greatest good for the greatest number of people in its surrounding communities, including through the reduction of other pollutants and waste streams;
- Support the creation and retention of good-paying, stable industrial sector jobs that will support broadly shared prosperity in the communities in which the facilities are located; and
- Contribute to energy and national security by, for example, reducing dependence on foreign products or positioning U.S. industry for long-term competitiveness.

More details on each of these requirements are provided in subsequent sections of this FOA.

Projects must maintain parity or reduce energy intensity with commercially available state-of-the-art technology unless otherwise justified by enabling deeper decarbonization, e.g., process electrification in preparation for a clean grid. Carbon and energy intensity justifications must be compared to current, commercially available state-of-the-art technology if broadly implemented at the national level. Proposed technology must establish potential to be cost competitive with commercially available state-of-the-art technology, or a justification must be provided to show there would be broad market uptake at a premium cost. In addition, the applicant must explicitly identify their strategy for managing commercial risk exposure. For example, if the proposed project is to electrify a process heating operation, then the applicant would indicate they will manage rate structure risks through energy storage technologies, power purchase agreements or other contracts, or process operation flexibility. These strategies and their impacts on costs and operations should be evident through the techno-economic analysis (TEA).

[53] "Industrial Efficiency and Decarbonization Funding Opportunity Announcement (DE-FOA-0002804)," U.S. Department of Energy, September 2022, https://eere-exchange.energy.gov/FileContent.aspx?FileID=e2c5db7d-a269-475c-9cd8-8978307b0913.

[54] "Department of Energy Releases 2023 Technology Commercialization Fund Solicitation on Carbon Dioxide Removal Measurement, Reporting, and Verification," U.S. Department of Energy, December 2022, https://www.energy.gov/technologytransitions/articles/department-energy-releases-2023-technology-commercialization-fund.

Each application[55] must include a preliminary LCA and TEA. Details the applicant uses for calculating the carbon intensity reduction should be evaluated through the preliminary LCA, while TEA will aid reviewers in assessing the long-term financial viability of each proposed project. Requirements and expectations for LCA and TEA are in Section 4.6.2.2(f). As shown in Table 2, applicants should aim to demonstrate the ability to achieve the facility-level reductions for Topic Areas 1-2, and critical unit or process-level reductions for Topic Area 3 compared to the industry baseline and benchmarks as defined in Section 1.3.1.

If the proposed target is not reasonably achievable currently, applicants must provide a clear explanation of why and how the proposed project will ultimately accelerate the industry towards net-zero operations.

Table 2. Target metrics for facility- or process-level contributions to product carbon intensity reduction by Topic Area.

Objective	Metric	Project Topic Area	Target	Stretch Target
Reduce carbon intensity	% Carbon intensity reduction in MT CO_2e/kg product	Topic 1	75% facility	>90% facility
		Topic 2	50% facility	>90% facility
		Topic 3	75% process	>90% process

Additional metrics that may help in promoting widespread adoption at an industry level of successful technologies should also be identified in the application. Applications must identify and justify appropriate metrics for their project and clearly indicate how the proposed innovations will satisfy the selected metrics. Relevant benchmarks/baselines, targets, and stretch targets should be included for each metric. A non-exhaustive list of examples of applicant-identified metrics are shown in Table 3.

Table 3. Examples of applicant-identified metrics that will be relative to the industry benchmark and facility baseline.

Goal	Metric
Reduce energy intensity	Btu per physical unit output
Process improvements	Increased yield, or production rate per unit of time
Process efficiency	Decreased energy or material per unit output
Reduced cost	Physical unit output cost vs. state-of-the-art output cost
Alternative low-carbon fuel and feedstock incorporation/recycled content	Percent alternative low-carbon fuel and feedstock/recycled content of product
Reduce criteria air pollutant emissions	Percent decrease in emissions per unit output
Reduce water intensity	Decrease in gallons of fresh or treated water per functional unit
Reduced effluent discharge	Decrease effluent in gallons per functional unit

[55] Please note that "Application" and "Full Application" are used interchangeably in this document.

During the award performance period, identified metrics must be demonstrated empirically and verified and validated via onsite data collection and by using LCA and TEA analyses as detailed in Section 4.6.2.2(f).[49] This includes assessing other pollutants and wastes and ensuring the necessary operating permits to comply with all applicable Clean Water Act, Clean Air Act, and other applicable Federal, State, local, and Tribal laws and regulations can be obtained. Applicants must also provide data to demonstrate the project's replicability, adoption potential in project design to accelerate broad commercialization towards industrial decarbonization, as well as providing good jobs and meaningful community benefits. Applicants across all Topic Areas must plan for newly constructed, retrofitted, or upgraded facilities to remain in commercial operation beyond the award performance period.

1.3.2.2 Topic Area 1: BIL: Near-Net-Zero Facility Build Projects

Topic Area 1, funded by section 41008 of the BIL,[56] will fund demonstration projects that are world-leading, first- or early-of-a-kind, full facility builds that will test and validate technologies resulting in significant emissions reductions, up to net-zero operations. For Topic Area 1, DOE is interested in comprehensive projects that will integrate multiple technology pathways to achieve the greatest emissions reduction possible for a facility of its type. These projects may be either greenfield or brownfield sites, though the overall emissions reduction objective remains the same.[57]

Applicants proposing full facility builds under Topic Area 1 should plan to use multiple technologies and may draw from any of the decarbonization approaches as discussed in Section 1.2 and the focus areas listed in 42 U.S.C. § 17113(c), potentially including but not limited to: smart manufacturing principles, energy efficiency, alternative low-carbon feedstocks or fuels, potential reuse of waste streams in other industries, electrification of industrial processes, and carbon capture and utilization. Through this Topic Area, DOE intends to fund demonstration projects (such as net-zero) that will set the bar for industrial decarbonization worldwide.

For clarification only, a non-exhaustive list of illustrative examples includes:

- A greenfield net-zero electric arc furnace facility or hydrogen-based direct reduced ironmaking facility; or
- Low-carbon feedstocks, alternative fuels, onsite renewables, and carbon capture for a full net-zero cement plant.

DOE anticipates selecting approximately 2 to 5 projects ranging from approximately $100M-$250M DOE share per project, with a minimum 50% non-federal cost share required per project.[58]

[56] This funding is authorized by section 41008 of the BIL and appropriated by Title III of Division J of the BIL.
[57] "Brownfield Overview and Definition," U.S. Environmental Protection Agency, No Date, Brownfield Overview and Definition.
[58] Section 454(d)(5) of the EISA (42 U.S.C. § 17113(d)(5)); Section 988 of the Energy Policy Act of 2005 as amended (42 U.S.C. § 16532).

Selected projects under this Topic Area are expected to have performance periods of approximately 8- to 12-years, though they could be completed in a shorter timeframe, depending on the project scope and readiness, as discussed in Section 2.0.

Responsive applications addressing any AOI listed in Section 1.3.3 below will be considered under this Topic Area.

1.3.2.3 Topic Area 2: IRA: Facility-Level Large Installations and Overhaul Retrofit Demonstrations

Topic Area 2, funded by section 50161(a) of the IRA to provide financial assistance under section 50161(b) of the IRA,[59] will focus on large-scale facility-level overhaul retrofits for existing facilities, common technologies across multiple facilities, or new builds with accelerated planning, development, permitting, and financing strategies. Priority will be placed on demonstrations of multiple technology solutions that are replicable within an industry and across multiple industries to drive decarbonization within facilities.

Proposals may address:

- Single facility concepts;
- A group of facilities within the same industrial subsector utilizing a common technology base or approach (e.g., alternative material integration or separations technologies at multiple plants within a subsector like cement or chemicals); or
- A crosscutting technology approach deployed in multiple facilities and/or in different industrial subsectors (e.g., electrification of process heat, advanced energy storage solutions, combined heat and power cogeneration, industrial heat pumps, and similar).

The applicant must be an eligible entity as defined in section 50161(g)(2) of the IRA[60] for all facilities it proposes under this Topic Area. Each facility must be an eligible facility as defined in section 50161(g)(3) of the IRA for both single facility and multiple facility projects.[61]

Overhauls may involve re-equipping an existing facility with new or modified equipment that is not yet commercially available. Projects should aim to reach Phase 3 by September 30, 2026, in alignment with the IRA funding obligation requirements (see Section 1.4 for more information). Applicants should expect to substantiate the viability of their proposed timeline, specific milestones, and decision points, which will be confirmed in partnership with DOE during negotiations after a project is selected.

For clarification only, a non-exhaustive list of illustrative examples include:

- Hydrogen-based direct reduced ironmaking;
- Calcium silicate- or aluminosilicate-based cement with ready mix offtake; or
- Hybrid glass furnace approaches such as hydrogen fueling with electrification.

[59] 42 U.S.C. § 17113b(a); 42 U.S.C. § 17113b(b).
[60] 42 U.S.C. § 17113b(g)(2).
[61] 42 U.S.C. § 17113b(g)(3).

DOE anticipates selecting around 10 to 30 projects ranging from approximately $75M - $500M DOE share per project, with a minimum 50% non-federal cost share required per project.[62] Selected projects under this Topic Area are expected to have performance periods of approximately 3 to 7 years, though they could be completed in a shorter timeframe, depending on the project scope and readiness, as discussed in Section 2.0.

Due to the funding horizon specified by legislation, DOE solicits proposals that will be able to start construction (Phase 3) no later than September 30, 2026 (see Section 1.4 for more information).[63] This could include, but is not limited to, projects that have already completed substantial planning, permitting, and financing activities, or have a reasonable expectation that they can accelerate early-phase work. For example, a new industrial facility construction project already underway that would benefit from integrated first- or early-of-a-kind technologies to decarbonize more than the current project plan could be proposed under this topic area. Projects funded under this Topic Area must be complete by September 30, 2031.

Responsive applications addressing any AOI listed in Section 1.3.3 below will be considered under this Topic Area.

1.3.2.4 Topic Area 3: IRA: System Upgrades and Retrofits for Critical Unit Operations or Single Process Lines Within Existing Facilities

Topic Area 3, funded by section 50161(a) of the IRA to provide financial assistance under section 50161(b) of the IRA,[64] will focus on upgrades, retrofits, and operational improvements to target emissions reductions within critical unit operations or single process lines. For example, projects may propose completely replacing a single process line while maintaining operations at the remainder of the facility, thereby minimizing impacts on production. After completion, a successful project should be able facilitate long-term decarbonization, such as through replicability across the facility or facilities to enable a facility-wide or multi-asset decarbonization plan. Multi-facility retrofits utilizing a common technology base or approach or utilizing common infrastructure (e.g., electrical or thermal inputs, energy storage) will also be considered. Retrofits should be compatible with other changes necessary to achieve significant GHG reductions across the facility or facilities.

For clarification only, a non-exhaustive list of illustrative examples includes:

- Converting existing infrastructure to upcycle captured CO_2 into consumer-facing, low-carbon chemicals such as in ethylene manufacturing;
- Solutions to reduce emissions for high temperature process heating operations; or
- New separations process or replacement of thermal process heating with electrified heating in the food and beverage industry.

[62] Section 50161(e) of the IRA (42 U.S.C. § 17113b(e)).
[63] Section 50161(a) of the IRA (42 U.S.C. § 17113b(a)).
[64] 42 U.S.C. § 17113b(a); 42 U.S.C. § 17113b(b).

The applicant must meet the statutory definition of eligible entity in section 50161(g)(2) of the IRA[65] for all facilities it proposes under this Topic Area. Each facility must be an eligible facility as defined in section 50161(g)(3) of the IRA for both single facility and multiple facility projects.[66]

DOE anticipates selecting around 10 to 30 projects on the order of $35M - $75M DOE share per project, with a minimum 50% non-federal cost share required per project.[67] Selected projects under this Topic Area are expected to have performance periods of approximately 3 to 7 years, though they could be completed in a shorter timeframe, depending on the project scope and readiness, as discussed in Section 2.0. These awards will be funded by appropriations under section 50161 of the IRA,[68] which must be obligated by September 30, 2026, with the goal of projects reaching Phase 3 by that date (see Section 1.4 for more information). Projects funded under this topic area must be complete by September 30, 2031.

Responsive applications addressing any AOI listed in Section 1.3.3 below will be considered under this Topic Area.

1.3.3 Areas of Interest

Areas of Interest (AOI) represent potential opportunities for GHG emissions reduction within the manufacturing industries, with special emphasis on the high energy and carbon intensive processes described below and shown in Figure 1 above. Responsive applications addressing any AOI will be considered for all Topic Areas, and DOE may select projects from all, some, or none of these AOIs. AOIs were selected based on statutory language, by analysis of the highest emitting industries, by the greatest potential for industrial decarbonization, and through substantial engagement with industry. Applications for industries not listed below may be considered, but applicants must substantiate their project's ability to achieve priority criteria and will be judged in context of all responses.

Applicants should demonstrate integrated solutions that accelerate the commercial readiness of emerging technologies, which will provide GHG emissions reduction and a realistic pathway to net-zero GHGs by 2050. Resulting low-carbon materials should meet industry-standard performance requirements. The given technology examples are intended to be illustrative of the types of technologies that may be considered by DOE and are not meant to be prescriptive.

Crosscutting decarbonization projects are an area in which one project may be applicable to multiple industrial subsectors. These opportunities may include thermal energy utilization, recovery, and management, specifically process heating and steam generation. An application that has potential as a crosscutting project should explain how the project (or aspects of the project) can be demonstrated in multiple industries.

[65] 42 U.S.C. § 17113b(g)(2).
[66] 42 U.S.C. § 17113b(g)(3).
[67] Section 50161(e) of the IRA (42 U.S.C. § 17113b(e)).
[68] Section 50161(a) of the IRA (42 U.S.C. § 17113b(a)).

The applicant should address whether the opportunity could be adopted in series or in parallel, as this funding is intended to reduce industry burden on first- or early-of-a-kind costs.

The industries identified in section 50161(g)(3) of the IRA are listed as follows: iron, steel, steel mill products, aluminum, cement, concrete, glass, pulp, paper, industrial ceramics, chemicals, and other energy intensive industrial processes.[69] All of these sub-sectors can benefit from a first mover advantage by pioneering advanced decarbonization technologies that will allow U.S. products to lead in product quality and sustainability – especially as global consumers are demanding greater accountability around embodied carbon. Further, industries around the world will look to U.S. technologies developed through this FOA to address their emissions. These industries are described below.

Iron, Steel, and Steel Mill Products

Background: Steel is a vital material for many economic sectors with an estimated economic value of about $110 billion annually in the U.S. Steel is used for infrastructure, automobiles, residential and commercial buildings, electrical and mechanical equipment, appliances, and many other products used in everyday life. In 2018, U.S. steel mills produced around 88 million tons of raw steel and 22 million tons of pig iron, accounting for about 3.3% of the world's production and employing approximately 149,000 people. The U.S. apparent consumption of steel was 101 million tons.[70] The global demand for steel is expected to continue rising with economic and population growth, with some models forecasting a nearly 40% increase in end-use demand between 2019 and 2050.[71]

Opportunity: In 2018, the steel industry accounted for an estimated 9% of U.S. industrial primary energy- and process-related GHG emissions.[72] Electric arc furnaces (EAFs) are used to produce about 70% of raw steel in the U.S.,[70] with other key industry operations including basic oxygen furnace (BOF) steelmaking, integrated steelmaking, direct reduced iron production, and downstream steel mill operations. Steelmaking remains a relatively energy-intensive process with considerable emissions, due in part to the need for high temperature process heat. In the areas of the U.S. where steelmaking is concentrated, the industry has been identified as a major source of criteria and hazardous air pollutant (HAP) emissions, including particulate matter, metal dust, and organic HAPs such as benzene and toluene.[73]

---

[69] 42 U.S.C. § 17113b(g)(3). Note also that there is a similar list of industries in section 454(c)(1)(A) of the Energy Independence and Security Act of 2007 (42 U.S.C. § 17113(c)(1)(A)), specifically: "iron, steel, steel mill products, aluminum, cement, concrete, glass, pulp, paper, and industrial ceramics;"

[70] "Mineral Commodity Summary for Iron and Steel," U.S. Geological Survey, January 2022, https://pubs.usgs.gov/periodicals/mcs2022/mcs2022-iron-steel.pdf. Similar production numbers of raw steel and pig iron are estimated for 2021 as of 2018.

[71] "Iron and Steel Technology Roadmap: Towards More Sustainable Steelmaking," International Energy Agency, October 2022, https://www.iea.org/reports/iron-and-steel-technology-roadmap.

[72] "Manufacturing Energy Consumption Survey (MECS): 2018 Survey Data," U.S. Energy Information Administration, December 2021, https://www.eia.gov/consumption/manufacturing/data/2018/.

[73] "Iron and Steel Foundries: National Emissions Standards for Hazardous Air Pollutants (NESHAP)," U.S. Environmental Protection Agency, last updated April 2022, https://www.epa.gov/stationary-sources-air-pollution/iron-and-steel-foundries-national-emissions-standards-hazardous#:~:text=The%20EPA%20has%20identified%20iron%20and%20steel%20foundries,application%20of%20the%20maximum%20achievable%20control%20technology%20%28MACT%29.

Through this FOA, DOE intends to fund innovative, integrated approaches that enable decarbonization in ore-based or scrap-based iron and steelmaking operations, inclusive of ore-based route from beneficiation, reduction, blast furnace (BF), BOF, and refining; and scrap-based route from scrap and metallics use, through EAF and refining operations. Opportunities for decarbonization of iron, steel, and steel mill products include, but are not limited to, the following:

- New ironmaking or steelmaking technologies such as BF alternative injection processes, coke substitution, EAF variable metallic feedstock processing, or hydrogen integration;
- Feedstock flexibility such as increased scrap use and heat recovery; and
- Conversion of other existing iron and steelmaking thermal processes to utilize clean fuels, including the integration of hydrogen, or electricity at the commercial scale.

Aluminum

Background: Aluminum is a widely used material in defense manufacturing, aerospace, automobiles, and consumer products and is known for its lightweight properties. The apparent consumption of aluminum in the U.S in 2018 was 4.9 million metric tons, and consumption is predicted to grow due to its use as a critical component of decarbonization-enabling technologies including electric vehicles, wind turbines, and solar panels.[74]

Primary aluminum production typically occurs via molten electrolysis of alumina ore (aluminum oxide) using a carbon anode composed of pet coke and coal tar. Secondary production is recovered from new (manufacturing) scrap and old scrap (discarded aluminum products). In 2018, the U.S. aluminum industry employed over 331,000 people and produced an estimated 0.9 million metric tons through primary production – down from 3 million metric tons in 2000 – and 3.7 million metric tons through secondary production.

Opportunity: In 2018, the U.S. aluminum industry accounted for an estimated 2% of U.S. industrial primary energy- and process- related GHG emissions. However, the U.S. produced only 1.4% of global production in the same year, a significant decline over the last two decades. [75] The U.S. has the opportunity to bolster the aluminum manufacturing subsector, bring good jobs back to the U.S., and lead the world in the production of low-carbon aluminum products. The most significant emissions source is the energy required for high-temperature process heat. Additionally, opportunities exist to lower carbon intensity and increase material efficiency through recycling and use of end-of-life aluminum scrap. Global collection rates for aluminum recycling are approximately 95% for new scrap but only 70% for end-of-life scrap.[76]

[74] "Mineral Commodity Summary for Aluminum," U.S. Geological Survey, January 2020, https://pubs.usgs.gov/periodicals/mcs2020/mcs2020-aluminum.pdf.
[75] "Manufacturing Energy Consumption Survey (MECS): 2018 Survey Data," U.S. Energy Information Administration, December 2021, https://www.eia.gov/consumption/manufacturing/data/2018/.
[76] "Aluminum," International Energy Agency, September 2022, https://www.iea.org/reports/aluminium.

Decarbonization technologies can also reduce the creation and emission of hazardous air pollutants from aluminum manufacturing.[77,78] Opportunities for decarbonization of aluminum include, but are not limited to, the following:

- Low-carbon process heating;
- Increased material efficiencies, recycling yields, and utilization of end-of-life scrap; and
- Alternative feedstock supply for carbon anodes from renewable sources or alternative electrode composition.

Cement and Concrete

Background: Cement and concrete are vital components of the nation's infrastructure as well as industrial, commercial, and residential buildings. Few construction materials have the resilience, versatility, low cost, ease of production, and resistance to severe weather events like concrete. Over 86 million metric tons of cement were produced in the U.S. in 2018 to meet market demands for concrete production.[79] In the United States, concrete is the most widely used building material, with over 500 million tons produced in the U.S. each year.[80] Moreover, federal, city, state, and Tribal governments represent a substantial share of this procurement demand, making demand-side policies such as Buy Clean particularly impactful for this subsector.

Concrete is most often produced utilizing Portland cement. Portland cement clinker is produced by heating raw materials, generally limestone and clay, in a kiln. The high temperature calcination and sintering of the raw materials results in cement clinker. Portland cement clinker typically contains a relatively high (65-70%) lime (calcium oxide) content. Following the pyroprocessing, clinker is then combined with other ingredients (e.g., gypsum) to achieve the desired setting qualities and ground finely to form cement. Mixing cement, aggregate (sand and gravel), and water forms a strong material known as concrete, which further strengthens as it cures.

[77] "Primary Aluminum Reduction Industry - National Emission Standards for Hazardous Air Pollutants (NESHAP)," U.S. Environmental Protection Agency, last updated May 2022, https://www.epa.gov/stationary-sources-air-pollution/primary-aluminum-reduction-industry-national-emission-standards.

[78] "Secondary Aluminum Production: National Emission Standards for Hazardous Air Pollutants," U.S. Environmental Protection Agency, last updated December 2022, https://www.epa.gov/stationary-sources-air-pollution/secondary-aluminum-production-national-emission-standards.

[79] "Mineral Commodity Summary for Cement," U.S. Geological Survey, January 2022, https://pubs.usgs.gov/periodicals/mcs2022/mcs2022-cement.pdf.

[80] "GSA Lightens the Environmental Footprint of its Building Materials," U.S. General Services Administration, March 2022, https://www.gsa.gov/about-us/newsroom/news-releases/gsa-lightens-the-environmental-footprint-of-its-building-materials-03302022.

Opportunity: In 2018, the cement industry produced an estimated 6% of U.S. industrial primary energy- and process- related GHG emissions,[81] about one third is from energy use and two-thirds from process generated CO_2 emissions.[82] Most importantly, the CO_2 emissions associated with the pyroprocessing step to produce lime-rich Portland cement accounts for the vast majority, about 86%, of the total GHG emissions from the cement industry. Therefore, the greatest potential for emissions reductions is in the pyroprocessing step.

Around a half-ton of CO_2 is emitted as by-product of the high temperature calcination process for every ton of Portland cement clinker produced. Decarbonization technologies can also reduce the creation and emission of criteria air pollutants from cement manufacturing.[83] Opportunities for decarbonization of cement and concrete include, but are not limited to, the following:

- Lowering the clinker content of cement, the carbonated content of the cement feedstock, or the lime content of the clinker (lower lime contents reduce clinker process CO_2 emissions and allow for lower clinker pyroprocessing temperatures, translating to reduced fuel consumption), or, alternatively, increasing the carbonated content of finished cement or concrete;
- Low-carbon process heating of kilns; and
- Carbon capture and novel utilization for captured carbon.

Applicants should substantiate how low-carbon cements can meet industry material performance standards, such as ASTM C595, *Standard Specification for Blended Hydraulic Cements*, ASTM C618, *Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete,* ASTM C1240, *Standard Specification for Silica Fume Used in Cementitious Mixtures,* or ASTM C989, *Standard Specification for Slag Cement for Use in Concrete and Mortars*.

Glass

Background: The U.S. glass industry produces over 20 million tons of glass annually.[84] Glass production in the United States can be broken down into four primary segments—flat glass, container glass, specialty glass, and fiberglass.[85] The glass industry manufactures a variety of products, including food and beverage containers, fiberglass insulation, windows for automobiles and buildings, video displays, cookware, and light bulbs.

[81] "Manufacturing Energy Consumption Survey (MECS): 2018 Survey Data," U.S. Energy Information Administration, December 2021, https://www.eia.gov/consumption/manufacturing/data/2018/.
[82] "Manufacturing Energy and Carbon Footprints (2018 MECS), Cement (NAICS 327310)." U.S. Department of Energy, December 2021, https://www.energy.gov/sites/default/files/2021-12/2018_mecs_cement_energy_carbon_footprint_0.pdf.
[83] "Cement Manufacturing Enforcement Initiative," U.S. Environmental Protection Agency, September 2022, https://www.epa.gov/enforcement/cement-manufacturing-enforcement-initiative.
[84] "Glass Melting Technology: A Technical and Economic Assessment," Glass Manufacturing Industry Council prepared with the U.S. Department of Energy, Office of Industrial Technologies, October 2004, ISBN 0-9761283-0-6.
[85] Worrell, et al., "Energy Efficiency Improvement and Cost Saving Opportunities for the Glass Industry," U.S. Department of Energy sponsored by U.S. Environmental Protection Agency, March 2008, https://www.energystar.gov/sites/default/files/buildings/tools/Glass-Guide.pdf.

The Buy Clean Initiative prioritizes the Federal Government's purchase of low-carbon construction materials, including flat glass.[86]

Glass making is very energy-intensive, and more than half the energy consumption in glass production is needed for the melting process, including both raw feed materials or cullet (recycled or waste glass). Furnace design is dependent on the choice of energy source, heat-recovery method, and heating technique. Natural gas is the most common fuel for glass furnaces, although some glass furnaces use electric boosters to help melt the glass, which can account for 10 to 30% of the energy input to the furnace. Energy costs are significant for the U.S. glass industry and, on average, account for around 14% of direct glass production costs.[87]

Opportunity: In 2018, the glass industry produced an estimated 1% of U.S. industrial primary energy- and process- related GHG emissions;[88] 90% of emissions from the glass industry were from process generated CO_2 emissions.[89] CO_2 is also emitted from the carbonates decomposition in the batch materials (e.g., limestone and soda ash). Decarbonization technologies can also reduce the creation and emission of HAPs from glass manufacturing.[90] Opportunities for decarbonization of glass manufacturing include, but are not limited to, the following:

- Low-carbon process heating;[91]
- Increased cullet use, which can both reduce the energy used in processing and eliminate CO_2 emissions from raw materials processing; and
- Waste heat capture and utilization.

[86] "FACT SHEET: Biden-Harris Administration Announces New Buy Clean Actions to Ensure American Manufacturing Leads in the 21st Century," The White House, September 2022, https://www.whitehouse.gov/briefing-room/statements-releases/2022/09/15/fact-sheet-biden-harris-administration-announces-new-buy-clean-actions-to-ensure-american-manufacturing-leads-in-the-21st-century/.
[87] "Glass Industry Technology Roadmap," Glass Manufacturing Industry Council, April 2002, https://er-co.com/pdf/glass2002roadmap.pdf.
[88] "Manufacturing Energy Consumption Survey (MECS): 2018 Survey Data," U.S. Energy Information Administration, December 2021, https://www.eia.gov/consumption/manufacturing/data/2018/.
[89] "Manufacturing Energy and Carbon Footprints (2018 MECS), Glass and Glass Products (NAICS 3273, 327993)," U.S. Department of Energy, December 2021, https://www.energy.gov/sites/default/files/2021-12/2018_mecs_glass_energy_carbon_footprint.pdf.
[90] "Glass Manufacturing Area Sources: National Emission Standards for Hazardous Air Pollutants (NESHAP)," U.S. Environmental Protection Agency, last updated April 2022, https://www.epa.gov/stationary-sources-air-pollution/glass-manufacturing-area-sources-national-emission-standards.
[91] Bandwidth Study U.S. Glass Manufacturing," U.S. Department of Energy, December 2017, https://www.energy.gov/eere/amo/articles/bandwidth-study-us-glass-manufacturing.

Pulp and Paper

Background: The U.S. pulp and paper industry (PPI) is approximately a $60 billion dollar per annum industry,[92] providing products for wrapping and packaging, printing, writing, sanitary, newsprint, and other specialty products. With approximately 200 manufacturing facilities,[93] the U.S. is one of the world's largest producers of pulp and paper. PPI facilities consist of integrated pulp and paper mills, pulp mills, paper mills, and recycle mills. Each mill handles a different set of cellulosic materials as their feedstocks (e.g., hardwood, softwood, pulp, and recycled paper and board products) and requires different energy sources (steam and electricity), water, and chemical inputs for unit process operations to produce paper products.

Opportunity: In 2018, the PPI accounted for an estimated 7% of U.S. primary energy- and process-related GHG emissions from the industrial manufacturing sector.[94] The PPI processes that are the largest consumers of energy, and therefore contributors of GHG, are pulping and bleaching, pulp slurry heating, liquor evaporation, pulping chemical recovery and preparation, paper machine wet end, and paper machine dry end (paper drying).[95] Decarbonization technologies can also reduce the creation and emission of harmful non-GHG air pollutants from pulp and paper manufacturing.[96] Opportunities for decarbonization include but are not limited to, the following:

- Reducing the process chemical, water or energy needs while maintaining fiber integrity;
- Electrification of paper drying processes;
- Reducing the energy used or improve separation techniques for water evaporation; and
- Improving combustion efficiency of boilers and recovery units.

Industrial Ceramics

Background: The industrial ceramic subsector utilizes high temperature kilns to make a variety of products from bricks, wall tiles, and tableware to specialty products such as high-temperature refractories, armor plating, electronic substrates, and artificial joints. Ceramics play a vital role in energy storage devices, such as portable electronic devices, electric vehicles, and battery storage to support the growth of renewable energy. Throughout the entire subsector, drying and firing processes use large amounts of energy, predominantly from natural gas, while a smaller number of specialist kilns are heated using electricity.

[92] " Interactive Access to Industry Economic Accounts Data," U.S. Bureau of Economic Analysis, last revised on December 2022, BEA Interactive Data Application.
[93] "GHGRP Pulp and Paper," U.S. Environmental Protection Agency, last updated October 2022, https://www.epa.gov/ghgreporting/ghgrp-pulp-and-paper.
[94] "Annual Energy Outlook 2021 with Projections to 2050," U.S. Energy Information Administration, February 2021, https://www.eia.gov/outlooks/archive/aeo21/, Table 19. Energy-Related Carbon Dioxide Emissions by End Use.
[95] "Bandwidth Study on Energy Use and Potential Energy Savings Opportunities in U.S. Pulp and Paper Manufacturing," U.S. Department of Energy, June 2015, https://www.energy.gov/sites/default/files/2015/08/f26/pulp_and_paper_bandwidth_report.pdf.
[96] Mandeep et al., "Pulp and Paper Industry–Based Pollutants, their Health Hazards and Environmental Risks," Current Opinion in Environmental Science and Health, December 2019, https://www.sciencedirect.com/science/article/abs/pii/S2468584419300479.

The combustion of fossil fuel, indirect emissions from electricity consumption, plus process emissions (resulting from chemical changes in the raw materials during firing) account for the ceramic subsector GHG emissions.[97]

Opportunity: The industrial ceramic subsector contributes toward the 18% of "other" U.S. industrial manufacturing primary energy- and process- related GHG emissions in Figure 1. In 2007, the International Energy Agency estimated that global emissions from the ceramic industry surpass 400 Mt CO_2/year from calcination of carbonates and energy end-use.[98] In the U.S., the ceramics market size in 2021 was approximately $53.8 billion.[99] Decarbonization technologies can also reduce the creation and emission of HAPs from ceramics manufacturing.[100] Key opportunities for decarbonization of the industrial ceramics subsector include, but are not limited to, the following:

- Low-carbon process heating;
- Carbon capture at large facilities;[101] and
- Energy savings in ceramics production through more efficient kilns.

Chemicals and Refining

Background: The U.S. manufactures 70,000 chemical products across 11,000 facilities through an interconnected supply chain producing various materials (e.g., polymers and plastics), ingredients (e.g., fertilizers), and consumer products.[102] Chemical products are typically manufactured through energy-intensive reaction, conversion, and separation operations. Many chemical products are formed from "building block" feedstocks manufactured in petroleum refining facilities which transform fossil-based resources (i.e., oil and gas) into valuable petrochemicals such as fuels, primary organic feedstocks, and finished products**.**

[97] "Industrial Decarbonisation & Energy Efficiency Roadmaps to 2050: Ceramics Sector," Prepared for United Kingdom's Department of Energy and Climate Change and Department of Business, Innovation, and Skills by WSP and Parsons Brinckerhoff and DNV GL, March 2015, https://assets.publishing.service.gov.uk/government/Ceramic_Report.pdf

[98] https://iea.blob.core.windows.net/assets/84e31bc6-6ebd-4026-9060-3c9ae64e4c11/tracking_emissions.pdf.

[99] https://www.grandviewresearch.com/industry-analysis/ceramics-market.

[100] "Clay Ceramics Manufacturing: National Emission Standards for Hazardous Air Pollutants (NESHAP)," U.S. Environmental Protection Agency, last updated October 2022, US EPA - Clay Ceramics Manufacturing: NESHAP.

[101] "Industrial Decarbonization & Energy Efficiency Roadmaps to 2050: Ceramics Sector," Prepared for United Kingdom's Department of Energy and Climate Change and Department of Business, Innovation, and Skills by WSP and Parsons Brinckerhoff and DNV GL, March 2015, https://assets.publishing.service.gov.uk/government/Ceramic_Report.pdf.

[102] "Chemical Sector Profile," Cybersecurity & Infrastructure Agency, May 2019, https://www.cisa.gov/publication/chemical-sector-profile.

The chemicals industry is economically vast, accounting for 25% of U.S. gross domestic product as a $486 billion industry. Refineries shipped $315 billion in products and directly employed approximately 63,000 workers in 2020.[103] Due largely to decreasing costs for feedstocks and energy, the U.S. is one of the lowest-cost chemicals producers in the world, exporting $153 billion of goods in 2021.[104] The U.S. provides 14% of the world's chemicals, with production growing 13% between 2009 and 2020.[105]

Opportunity: In 2018, the U.S. chemicals and petroleum refining subsectors accounted for an estimated 28% and 21% of U.S. industrial primary energy- and process- related GHG emissions, respectively.[106,107] Process heating alone accounted for over 70 MMT CO_2e in the chemical industry in 2018,[108] with distillations and separations comprising 40% of energy consumption.[109] Despite the diversity of products, a subset of 18 high volume chemicals accounts for 80% of global energy demand and 75% of global GHG emissions within the industry.[110]

The largest opportunities for subsector-wide emissions reductions exist in targeting high volume chemicals with downstream supply chain impacts and/or targeting upstream, energy-intensive processes such as those in refining (e.g., cracking, atmospheric distillation, and reforming) and in manufacturing of building block compounds. Principles of sustainable chemistry[111,112] integrated into project design can also enable decarbonization co-benefits, including, but not limited to, reducing waste and resource demand, increasing material circularity, and mitigating risk through safer chemicals and processes.

---

[103] "Annual Survey of Manufacturers (ASM)," U.S. Census Bureau, last modified April 2022, https://www.census.gov/programs-surveys/asm.html.

[104] https://www.americanchemistry.com/media/files/acc/chemistry-in-america/data-industry-statistics/us-chemicals-trade-by-the-numbers/files/us-chemicals-trade-by-the-numbers.

[105] https://www.americanchemistry.com/chemistry-in-america/data-industry-statistics/resources/2020-guide-to-the-business-of-chemistry.

[106] "Manufacturing Energy and Carbon Footprints (2018 MECS), Chemicals (NAICS 325)," U.S. Department of Energy, December 2021, https://www.energy.gov/sites/default/files/2021-12/2018_mecs_chemicals_energy_carbon_footprint_0.pdf.

[107] "Manufacturing Energy and Carbon Footprints (2018 MECS), Petroleum Refining (NAICS 324110), U.S. Department of Energy, December 2021, https://www.energy.gov/sites/default/files/2021-12/2018_mecs_petroleum_refining_energy_carbon_footprint.pdf.

[108] "Manufacturing Energy and Carbon Footprint, (2018 MECS) Chemicals (NAICS 325)," U.S. Department of Energy, December 2021, https://www.energy.gov/sites/default/files/2021-12/2018_mecs_chemicals_energy_carbon_footprint_0.pdf.

[109] "A Research Agenda for Transforming Separation Science," The National Academies of Science, Engineering, and Medicine, 2019, ISBN 978-0-309-49170-9.

[110] https://www.iea.org/reports/technology-roadmap-energy-and-ghg-reductions-in-the-chemical-industry-via-catalytic-processes.

[111] "Sustainable Chemistry in Manufacturing Processes Roundtable," U.S. Department of Energy, November 2020, https://www.energy.gov/sites/default/files/2021/03/f83/2020%20AMO%20Sustainable%20Chemistry%20Roundtable%20Report_Final_02_24_2021_compliant.pdf.

[112] Green chemistry is the design of chemical products and processes that reduce or eliminate the generation of hazardous substances. "Green Chemistry," U.S. Environmental Protection Agency, last updated December 2022, https://www.epa.gov/greenchemistry.

The chemicals and refining subsectors present immense opportunities for decarbonization given their energy footprints and inherent reliance on fossil-derived primary feedstocks. Opportunities for decarbonization of chemicals and refining include, but are not limited to, the following:

- Lower-energy and lower-carbon unit operations (e.g., reactions and separations), including process intensification or electrification;
- Alternatives to fossil-derived feedstocks and/or improved material efficiency and circularity; and
- Low-carbon process heating.

Other Energy Intensive Industrial Processes

In addition to the industries specified above, other manufacturing industries also account for about 18% of U.S. industrial primary energy- and process- related GHG emissions (including industrial ceramics, as outlined above). The sources of these emissions are derived from the onsite generation of steam and electricity, manufacturing processes, other non-process activities including lighting and facility heating and cooling, as well as offsite emissions pertaining to electricity and steam generation and transmission. A detailed breakdown of energy use and emissions for manufacturing industries is visualized in the Manufacturing Energy and Carbon Footprints.[113]

Under this AOI, DOE seeks applications for demonstration-to-deployment projects of innovative technologies that decarbonize operations in other energy-intensive manufacturing industries not previously mentioned. Applicants should substantiate the energy intensity of their industry in their application.

In addition to the subsectors outlined above, the **Food and Beverage** subsector contributed 8% of U.S. industrial primary energy- and process- related GHG emissions.[114] Emissions are driven by energy-intensive unit operations and process heating, which account for over 55% of onsite energy. The processes involved are diverse, comprising various unit operations such as processing, drying, separations, and heating. However, the industry is strategically aligned for near term electrification and heat pump integration, as an estimated 97% of heating requirements in the food industry are for applications in low temperature ranges (<130°C).[115]

Many facilities in the Food and Beverage subsector operate at smaller scales relative to those in other manufacturing subsectors, and projects in this AOI may be unable to meet the minimum funding levels described in the Topic Areas. In this case, proposals for Topic Area 2 or Topic Area 3 in this AOI may comprise groups of facilities to increase decarbonization impact at scales corresponding to the Topic Area funding thresholds.

---

[113] "Manufacturing Energy and Carbon Footprints (2018 MECS)," U.S. Department of Energy, December 2021, https://www.energy.gov/eere/amo/manufacturing-energy-and-carbon-footprints-2018-mecs.

[114] "Annual Energy Outlook 2021 with Projections to 2050," U.S. Energy Information Administration, February 2021, https://www.eia.gov/outlooks/archive/aeo21/, Table 19. Energy-Related Carbon Dioxide Emissions by End Use.

[115] McMillan. Colin, "Manufacturing Thermal Energy Use in 2014," National Renewable Energy Laboratory on behalf of the U.S. Department of Energy, September 2019, https://doi.org/10.7799/1570008.

Additionally, individual applicants may apply to those Topic Areas below the budget minimums, but these proposals must clearly justify how the proposed projects are still responsive to the FOA intent.

Key opportunities for decarbonization in the Food and Beverage subsector include, but are not limited to, the following:

- Lowering energy unit operations, including non-thermal separations;
- Low-carbon process heating;
- Optimizing productivity and minimizing waste through smart manufacturing and supply chain logistics;
- Increasing material circularity and waste valorization for products and packaging; and
- Cross-cutting and integrated process improvements in energy efficiency.

1.4 Award and Project Management Structure

Awards selected under this FOA will adhere to a four-phased structure for managing scope, schedule, deliverables, and budget. Figure 2 shows an example of the requirements and deliverables for each phase. The items listed under the "Application" phase in Figure 2 are indicative of the type and scope of materials DOE will require applicants to submit for consideration of Phase 1 funding. Items listed under Phases 1-4 are indicative of the type and scope of activities applicants should plan to execute in each phase if the award continues into that phase of funding. These activities will also be further defined during award negotiations and subsequent negotiations between phases. DOE anticipates all projects to be funded through Phase 4 pending successful go / no-go reviews, which will be designed to manage risk and will occur between and within phases.

While Figure 2 and the text below provide approximate timetables for each phase, these timetables are representative only. It is DOE's intention to work with awardees to progress projects through the phased project implementation as prudently as possible.

The funding appropriated under section 50161 of the IRA for Topic Areas 2 and 3 is available through September 30, 2026,[116] and such funds must be spent by no later than September 30, 2031.[117] This timing will be addressed in negotiations for all phases of projects under Topic Areas 2 and 3, and DOE expects that projects under Topic Areas 2 and 3 are in Phase 3 by September 30, 2026.

[116] Section 50161(a) of the IRA (42 U.S.C. § 17113b(a)).
[117] *See* 31 U.S.C. § 1552.

Initial Application Go/No-Go Decisions	Application Phase	Phase 1: Detailed Project Plan	Phase 2: Project Development	Phase 3: Construct & Integrate	Phase 4: Ramp-Up & Operate
Topic Area 1 Phase 1-4: 50% Cost Share	Pre-DOE funding	Up to $10M DOE Funding 12-18 Months	TBD DOE Funding 2-3 Years	TBD DOE Funding, 2-4 Years	TBD DOE Funding, 2-4 Years
Topic Area 2 Phase 1-4: 50% Cost Share	Pre-DOE funding	Up to $10M DOE Funding About 12 months	DOE Funding: To be negotiated About 2 years	DOE Funding: To be negotiated About 2 years	DOE Funding: To be negotiated About 2 years
Topic Area 3 Phase 1-4: 50% Cost Share	Pre-DOE funding	Up to $2M DOE Funding About 12 months	DOE Funding: To be negotiated About 2 years	DOE Funding: To be negotiate About 2 years	DOE Funding: To be negotiated About 2 years
Engineering, Procurement, Construction, Operations	• Engineering concept (~5%) • Tech readiness descriptions • Project L1 integrated project schedule (IPS), Phase 1 L2 IPS • Class 4/5 total project cost (TPC) estimate	• Engineering & design (~30%) • Tech readiness analysis, including uncertainties, risk • Project L2 IPS, Phase 2 L3 IPS • Class 3 TPC estimate	• Engineering & design (~90%) • Tech updates • Project L3 IPS, Phase 3 L4 IPS • Class 1 TPC estimate • Standard project management (PM) tool in use • Operations plan	• Tech risk updates, tracking • Progress execution reports	• Regular operations status reporting • Tech risk updates, tracking • Final TPC accounting
Business Development & Management	• Business strategy • Team description • Workforce plan • Finance plan • Market potential analysis	• Project Management Plan (PMP) • Risk Management Plan (RMP) • Financial model • Updated workforce plans • Market & off-take commitments • Sites selection	• Teaming, offtake, & feedstock agreements • Sites access secured • Integrated RMP updated • Confirmed project financing • Labor agreements	• Regular progress/status reporting for all agreements • Regular financial status reports • Updated RMP covering Phases 3 and 4	• Financial models updated with offtake & production data • Revised growth plans and projections • Updated RMP covering ramp and steady state operations
Permitting & Safety	• Safety history/culture description • Permitting timeline overview • Environmental approval overview (state & federal)	• Site Safety Plans (SSP) • Physical, information, cyber security plans • Environmental data package • Initial National Environmental Policy Act (NEPA) Documentation	• Execution-ready SSP • Final physical, information & cyber security plans • Permits in place for construction • Environmental reviews/assessments	• Status reporting on required permits and environmental • Safety & security incident reporting & audits • Permits for operations	• Ongoing permit, safety, and security reporting
Community Benefits	• Community Benefits Plan (CBP), including community & labor engagement; workforce; DEIA; Justice 40 Initiative	• Implement CPB Phase 1 Scope • Update CPB for Phases 2 – 4 based on Phase 1 activities.	• Implement CBP Phase 2 Scope • Update CBP Phase 3-4 based on Phase 2 activities	• Implement CBP Phase 3 Scope • Update CBP for Phase 4 based on Phase 3 activities	• Implement CBP Phase 4 Scope • Update CBP based on activities and findings from ramp-up to commercial scale operation
Technical Data & Analysis	• Preliminary LCA Analysis • Preliminary TEA Analysis	• Performance Model • Updated LCA • Updated TEA	• Mature LCA • Verification & validation (V&V) plans • Mature TEA w/risk analysis • Technical V&V data and plans • Project completion testing	• Periodic TEA and LCA updates • V&V data collection & analysis • Project completion testing and performance	• Validated performance model • LCA and TEA incorporating operational data • Ongoing data collection and dissemination

Figure 2. Summary of activities and outcomes in each phase of the projects awarded under this FOA.

Phase 1 – Detailed Project Planning

Phase 1 activities will focus on completing specific details about the overall project plan and analysis to refine projections submitted as part of the proposal. These activities must provide assurance to DOE that the overall project plan is technologically, financially, and legally viable, with buy-in from relevant local and community stakeholders. This could include any plans to develop a skilled labor pool and provide community benefits through Workforce and Community Agreements. Teams will complete preliminary engineering, construction, and commercial-scale designs. This will include finalization of a Project Management Plan (PMP), a Risk Management Plan (RMP), an Intellectual Property Management Plan (IPMP), the initial Safety Plan, an initial financial plan for the entire 4-phase effort, and final site selection for the various technologies to be included in the award.

Phase 1 should also include a continuation of analysis activities to refine and update LCA and TEA data provided in the application. Outreach and stakeholder engagement, which should be active prior to the application process, should continue in Phase 1 as the project site(s) details are finalized and community economic and development impacts become clearer. Applicants should be fully engaged with the DOE's NEPA team as they develop environmental and regulatory plans to prepare for permitting and approval processes in Phase 2.

Applicants should plan approximately 12 - 18 months for Phase 1, depending on the Topic Area; the extent of advanced planning and analysis each team has already completed; and how quickly the awardee can move through the negotiated Go/No-Go requirements to move into Phase 2.

DOE anticipates that some teams will have already performed extensive analysis, planning, design, and community engagement as required in Phase 1, and will seek to advance these projects to Phase 2 on a shorter timeline.

Phase 2 – Project Development, Permitting, and Financing

Phase 2 encompasses advanced planning activities. Recipients will finalize their project development plans, commercial agreements, financial structure, and complete the necessary permitting and approval activities required to begin construction. By the end of Phase 2, engineering designs should be sufficiently mature to support completion and execution of relevant procurement or construction contracts and overall commencement of major project execution tasks. Long-lead procurement activities may be started in Phase 2 with prior DOE approval. Third-party financing agreements should be completed and any relevant offtake or Buy Clean agreements in place. Risk management plans should be revised and updated to reflect progress made and risks mitigated as well as new or emerging risks and corresponding management plans. Evidence of a contingency reserve is required prior to beginning Phase 3 activities.

By the completion of Phase 2, safety and security plans should be finalized and execution ready. All necessary permits and approvals should be in place to prepare for construction, including completion of required NEPA reviews. Final pre-implementation LCA and TEA activities should be completed according to DOE expectations and corresponding verification and validation (V&V) plans should be in place. Community and labor engagement should have progressed, and an updated comprehensive Community Benefits Plan (CBP) should reflect community and labor input and implementation experience to date and set the stage for ongoing engagement. Community impact targets should be finalized, and tracking plans should be in place to monitor economic, environmental, and social impacts of the projects as they progress to implementation.

Phase 3 – Installation, Integration, and Construction

Phase 3 activities will focus on implementation. DOE expects this phase to be the longest in duration and the most cost intensive. Recipients will employ industry standard project management tools and will be required to provide regular status updates and reports. Plans developed in the preceding phases will be revised and updated as appropriate to reflect actual performance. Engineering drawings may be further developed within this phase.

Previously and newly developed risks will be tracked, actively managed, and regularly reported to DOE. Reporting frequencies and content requirements will be unique to each award and negotiated prior to Phase 3 commencement.

While recipients will manage implementation, DOE will closely monitor progress and evaluate it against the plans developed through Phase 2. DOE and/or its third-party representatives will visit the site(s) regularly to verify progress and collect data, including data related to community benefits, consistent with the established reporting requirements and substantial involvement.

During Phase 3, recipients will continue to implement their community benefits plans and provide ongoing mechanisms for community and labor input that will support the realization of meaningful benefits and minimization of any project negative impacts. Outcomes and impacts related to CBP efforts will be tracked to assess progress.

Phase 3 may look significantly different for each award as there will be varying amounts of construction and retrofitting. Applicants must propose a funding level that is appropriate for the scale of the technologies and infrastructure being installed and constructed, within the limits outlined in Section 2.0. Time needed for Phase 3 activities will vary depending on Topic Area; applicants may propose shorter or longer lengths. Specific details will be addressed for selected projects during the negotiation phase.

Phase 4 – Ramp-Up and Sustained Operations

In Phase 4, recipients will transition to operations. Phase 4 will commence with completion of award-specific criteria which will be negotiated in prior phases. Phase 4 activities will then focus on integrated system performance and ramp-up. By the end of Phase 4, each award will have demonstrated full commercial-scale design operations over an extended period. The time needed for Phase 4 activities will vary depending on Topic Area and on award-specific characteristics, including factors such as the rate of production ramp-up. Specific details will be addressed during negotiations.

A key objective is for DOE-funded commercial demonstration projects to catalyze follow-on private sector investments as well as meeting CBP goals. To meet this key objective, Phase 4 will also include substantial financial, socio-economic, environmental, and operational data collection and reporting to DOE. To the extent practicable and while protecting sensitive and proprietary information, DOE will synthesize, anonymize, or otherwise incorporate site and operations data into quantitative and qualitative analyses that can be promulgated to external stakeholders for the purpose of informing future private sector investment decisions.

Applicants must propose a funding level that is appropriate for the scale of the project ramp-up and initial operation using DOE funding within the limits outlined in Section 2.0. Like Phase 3, a contingency reserve will also be required for Phase 4. Applicants are also encouraged to review the regulations regarding program income[118] and be aware of the ways in which program income can be treated during the award.

Transitions between Phases

All projects selected under this FOA will be eligible to complete all four phases pending successful execution of milestones. DOE is not planning a competitive down-select process among projects after awards are made; however, to manage risk, all projects will be required to complete regular Go/No-Go reviews at the end of each phase. Specific Go/No-Go criteria will be negotiated with each selected project for transitions between each phase.

[118] *See, e.g.,* 2 C.F.R. § 200.307.

This may include a requirement to submit a standardized set of data to provide quantitative and qualitative insight on metrics spanning the technological, environmental, economic, market, workforce, community benefits, and other components of the project's analysis activities. DOE may also require the negotiation of additional Go/No-Go decision points within phases (i.e., phases may include one or more budget periods with Go/No-Go points at the end of each budget period). Applicants must propose quantitative Go/No-Go criteria for each budget period as part of the Workplan.

If DOE determines that an award is making insufficient progress, additional scrutiny and oversight by DOE or its representatives may be employed, and corrective measures negotiated. Awards may be discontinued at any of the Go/No-Go decision points if the Go/No-Go criteria, project, and/or program requirements are not met. If awards are proceeding on an accelerated schedule, it may be possible to move to a Go/No-Go review earlier than originally planned and advance to the next phase if the review is successfully completed.

Specific project structure details for each recipient will be negotiated on a project-by-project basis to produce the best possible balance between project outcomes and DOE risk exposure. Examples of factors that may be considered as part of such negotiations include project and risk management processes, team capabilities, cost share amounts, financial contingencies, and engagement of independent monitors such as an Independent Engineers and/or CBP consultants. DOE will require access to project performance and financial data necessary to track progress against a project baseline (or similar). As these projects are new commercial demonstrations, project progress will be shared with interested stakeholder to the greatest extent possible.

If funded through all four phases, DOE expects that the projects will reach technical and commercial viability under this FOA and will continue to operate beyond the financial assistance project period (well beyond DOE funding). Achieving DOE's broad end goals will necessitate review and evaluation of proposed project characteristics that include cost, schedule, and scope; technology; environmental; business; market; financial; management; community support or other factors throughout the project to validate assumptions made for determining commercial viability.

The phased approach is designed to guide awardees through the project development process incrementally. Each subsequent phase is structured to ensure that each award meets a standard level of maturity, employs a robust execution approach, and that technical and non-technical project risks are adequately and appropriately managed throughout DOE's award.

As the projects are expected to continue as self-sustaining entities operating fully independent of federal funds, DOE may also request financial sustainability plans or long-term disposition and/or decommissioning plans as part of future decision points. This may include proposed sources of funding/revenue and the business model which will support the projects beyond the DOE award. This may also include an estimate of profit and loss demonstrating how the projects will maintain financial self-sufficiency and strategies to grow beyond the initial award.

2.0 Award Information

Anticipated Type of Award: Cooperative Agreement

Application Type(s) Allowed: New

Estimated Number of Awards: 22-65

Anticipated Funding Amount: In total, up to approximately $6B.

Award Budget: Application budgets are limited to the maximum amount of DOE share per project by Topic Area.

Award Project Period: The maximum expected project period is 7 or 12 years depending on Topic Area; the scope of the proposed project would determine that specific project period within the maximum project period.

DOE may issue awards in one, multiple, or none of the following Topic Areas listed in Table 4. Depending on the number and quality of applications, DOE may not award the full FOA funding amount and may issue other FOAs to support additional strategies and approaches or incorporate lessons learned from the first round of applications.

Table 4. FOA Topic Areas. All values anticipated.

Topic Area Number	Topic Area Title	Anticipated Number of Awards**	Anticipated Minimum Award Size for Any One Individual Award (DOE Share)***	Anticipated Maximum Award Size for Any One Individual Award (DOE Share)***	Anticipated Period of Performance (years)
1	BIL: Near-Net-Zero Facility Build Projects	2 – 5	$100M	$250M	8 – 12 years
2	IRA: Facility-Level Large Installations and Overhaul Retrofit Demonstrations	10 – 30	$75M	$500M	3 – 7 years *
3	System Upgrades and Retrofits for Critical Unit Operations or Single Process Lines Within Existing Facilities	10 – 30	$35M	$75M	3 – 7 years *

* Awards selected for Topic Areas 2 and 3 will be funded through section 50161 of the IRA. These IRA funds must be obligated by September 30, 2026, and spent by September 30, 2031.
** Subject to change depending on the number and quality of applications. Total funding per Topic Area may shift depending on number of projects awarded by Topic Area.
***For proposals outside of the award duration or total funding ranges stated, applicants must explain and provide sufficient justification of how the project fits within the applicable Topic Area. Details will be determined through merit reviews and project negotiations.

DOE has substantial involvement in work performed under Cooperative Agreements awarded through this FOA. Substantial involvement includes, but is not limited to, the following:

1. DOE shares responsibility with the recipient for the management, control, direction, and performance of the project.
2. DOE may intervene in the conduct or performance of the award for programmatic reasons. Intervention includes the interruption or modification of the conduct or performance of project activities.
3. DOE may redirect or discontinue funding the project based on the outcome of DOE's evaluation of the project at the applicable Go/No-Go decision points.
4. DOE participates in major project decision-making processes.

The applicant will propose four phases for the project. Upon award, DOE will only fund the initial phase (Phase 1) or otherwise less than all four phases. Ongoing funding is dependent on Go/No-Go determinations and recipient performance.

A contingency reserve is required for all Phase 3 and 4 activities. The amount of contingency will be determined based on the quantitative risk analysis performed by the recipient. The required contingency may be adjusted based on the level of remaining project risks and other considerations as the project progresses in Phase 3 and 4. Recipients must demonstrate that they can meet unexpected financial needs of the project.

The full design package needed to advance to Phase 3 must also include documentation showing that the recipient has access to the required contingency reserve.

Typically, DOE expects contingency reserve funds must be: (a) liquid, (b) immediately available, and (c) unrestricted funds dedicated exclusively to the project for the purpose of mitigating project performance baseline risk. The contingency reserve is in addition to total project costs and does not count toward the awardee's minimum 50% non-federal cost share requirement. If expended, the contingency will not result in reimbursement by DOE above the total federal share approved in the award. DOE discourages recipients from reducing scope to comply with the contingency reserve requirement.

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

This announcement and awards made under this announcement will fall under the purview of 2 C.F.R. Part 200 and 2 C.F.R. Part 910.

3.0 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 all these eligibility requirements, it will be considered ineligible and removed from further evaluation.

DOE 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.

3.1 Eligible Applicants

The proposed prime recipient must meet the applicable eligibility requirements as defined in the BIL and IRA provisions, shown in Table 5 below by Topic Area.

Table 5. Eligible Entities by Topic Area.

	Funding Provision	Eligible Entities for Prime Recipient
Topic Area 1	BIL 41008	For-profit organizations
Topic Area 2	IRA 50161	Owners or operators of a domestic, non-federal nonpower industrial or manufacturing facility engaged in energy intensive industrial processes as stated in the areas of interest[119]
Topic Area 3	IRA 50161	

Eligibility for prime recipients under Topic Area 1 is restricted to private entities that are for-profit organizations. Given the complexity and scope of the projects expected under Topic Area 1 as described in Section 1.3.2.2, as well as the objective to demonstrate replicability and ensure adoption of successful solutions, for-profit organizations are considered best aligned and most capable of supporting the objectives of Topic Area 1.

Consistent with the requirements of section 50161 of the IRA,[120] Eligible Facilities for Topic Areas 2 and 3 are domestic, non-federal, nonpower industrial or manufacturing facilities engaged in energy intensive industrial processes, including production processes for the industries described in Section 1.3.3. Eligible Entities under Topic Areas 2 and 3 can include co-owners or co-operators.

It is anticipated given the complexity, scope, testing, and validation that may be required that other types of entities will be necessary partners to support the success of the projects and overall programs.

[119] Section 50161(g)(2)-(3) of the IRA (42 U.S.C. § 17113b(g)(2)-(3)).
[120] Section 50161(g)(3) of the IRA (42 U.S.C. § 17113b(g)(3)).

Domestic Entities

For all Topic Areas, the proposed prime recipient and subrecipient(s) must be domestic entities except as stated below. To qualify as a domestic entity, the entity must be organized, chartered, or incorporated (or otherwise formed) under the laws of a particular state or territory of the United States; have majority domestic ownership and control; and have a physical place of business in the United States.

Entities that are eligible as sub-recipients or that can be contracted under this FOA include, but are not limited to:

- Scientist or other individual with knowledge and expertise in emissions reduction; an institution of higher education;
- Nongovernmental organization;
- National Laboratory;
- Private entity; and
- Partnership or consortium of 2 or more entities described in this list.

Federal agencies and instrumentalities (other than DOE), DOE/National Nuclear Security Administration (NNSA) Federally Funded Research and Development Centers (FFRDC)[121], and Non-DOE/NNSA FFRDCs, are eligible to participate only as a subrecipient and are not eligible to apply as a prime recipient.

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 the award.

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 funding for the FFRDC will flow through the prime recipient. 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."

[121] As specified in the Federal Acquisition Regulation (FAR) 35.017(a)(2), a FFRDC "meets some special long-term research or development need which cannot be met as effectively by existing in-house or contractor resources." A FFRDC is "operated, managed, and/or administered by either a university of consortium of universities, other not-for-profit or nonprofit organization, or an industrial firm, as an autonomous organization or as an identifiable separate operating unit of a parent organization." FAR 35.017(a)(3). A list of FFRDCs can be found at http://www.nsf.gov/statistics/ffrdclist/.

Foreign Entities

In limited circumstances, DOE may approve a waiver to allow a foreign entity to participate as a prime recipient or subrecipient. A foreign entity may submit an application to this FOA, but the application must be accompanied by an explicit written waiver request. Likewise, if the applicant seeks to include a foreign entity as a subrecipient, the applicant must submit a separate explicit written waiver request in the application for each proposed foreign subrecipient.

Appendix C lists the information that must be included in a foreign entity waiver request. The Applicant does not have the right to appeal DOE's decision concerning a waiver request.

3.2 Cost Sharing

Applicants are bound by the cost share proposed in their applications if selected for award negotiations. The cost share must be at least **50% of the total project costs.**[122,123] The cost share must come from non-federal sources unless otherwise allowed by law, such as project participants, state or local governments, or third-party financing. Cost share may be provided in the form of cash or cash equivalents, or in-kind contributions.

Federal financing, such as DOE Loan Guarantees, cannot be leveraged by applicants to provide the required cost share or otherwise cover the same scope that is proposed in the application. Also, in general, deferred or avoided costs such as tax credits may not be used as cost share.

A contingency reserve will also be required for all Phase 3 and 4 activities. More information on contingency reserves can be found in Section 2.0. Neither contingency funds nor any program income should be included as cost share in the applicant's budget.

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, provided that the cost share requirement for the project as a whole is met.

Although the cost share requirement applies to the entire project, 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.

[122] Total project costs are the sum of the government share, including FFRDC costs if applicable, and the recipient share of project costs.

[123] The cost sharing requirements for demonstration projects authorized and appropriated by section 41008 of the BIL and Title III of Division J of the BIL, respectively, are governed by section 988 of the Energy Policy Act of 2005 as amended (42 U.S.C. § 16352). *See* section 454(d)(5) of the EISA (42 U.S.C. § 17113(d)(5). The cost sharing for projects authorized and appropriated under section 50161 of the IRA is set forth in section 50161(e) of the IRA (42 U.S.C. § 17113b(e)). *See also* 2 C.F.R. § 200.306 and 2 C.F.R. § 910.130 for additional cost sharing requirements.

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.

3.3 Applications Specifically Not of Interest

The following types of applications will be deemed nonresponsive and will not be reviewed or considered:

- Applications that fall completely outside the technical parameters specified in Sections 1.1 Background and Context, 1.2 Program Purpose, and 1.3 Topic Areas of the FOA.
- Applications for proposed technologies that are not based on sound scientific principles (e.g., violates the laws of thermodynamics).
- Applications including research, development, and pilot-scale activities.

3.4 Limitation on Number of Concept Papers and Applications Eligible for Review

An entity may submit more than one Concept Paper and 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 application.

NOTE: If an applicant plans to propose substantially similar retrofits at multiple facilities and locations, those retrofits should be proposed as a single, cross-cutting project in one Application. For details, please see Section 1.3.2.3 and Section 1.3.2.4.

4.0 Application and Submission Information

4.1 Application Package

All submissions must conform to the form and content requirements described below, including maximum page lengths:

- 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;

- A **control number** will be issued when an applicant begins the OCED eXCHANGE application process. The control number must be included with all application documents. Specifically, the control number must be prominently displayed on the upper right corner of the header of every page and included in the file name (i.e., *Control Number_Applicant Name_Application*);
- 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, DOE will review only the authorized number of pages and disregard any additional pages.
- Exceptions: Templates provided by DOE or other government forms may be used in the native formatting of those documents.

Note: The maximum file size that can be uploaded to the OCED eXCHANGE website is 50MB. Files exceeding 50MB cannot be uploaded and hence cannot be submitted for review. If a file exceeds 50MB 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:

ProposalContent_Part_1
ProposalContent_Part_2

DOE will not accept late submissions that resulted from technical difficulties due to uploading files that exceed 50MB.

4.2 Application Submission

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 discussed in the sections that follow.

4.2.1 OCED eXCHANGE

To apply to this FOA, applicants must register with and submit application materials through OCED's online application portal, OCED eXCHANGE, at https://oced-exchange.energy.gov. See detailed instructions at Financial Opportunities: Manuals. OCED eXCHANGE is designed to enforce the deadlines specified in this FOA. The "Apply" and "Submit" buttons will automatically disable at the defined submission deadlines. If an applicant experiences technical difficulties with a submission, the applicant should contact the OCED eXCHANGE helpdesk for assistance (OCED-ExchangeSupport@hq.doe.gov).

4.2.2 Unique Entity Identifier (UEI) and System for Award Management (SAM)

Each applicant (unless the applicant is excepted from those requirements under 2 C.F.R. § 25.110) is required to: (1) Be registered in the SAM at https://www.sam.gov before submitting its application; (2) provide a valid UEI number in its application; and (3) continue to maintain an active SAM registration with current information at all times during which it has an active federal award or an application or plan under consideration by a federal awarding agency. DOE may not make a federal award to an applicant until the applicant has complied with all applicable 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, 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. Designating an Electronic Business Point of Contact and obtaining a special password called a Marketing Partner ID Number are important steps in SAM registration.

NOTE: Due to the high demand of UEI requests and SAM registrations, entity legal business name and address validations are taking longer than expected to process. Entities should start the UEI and SAM registration process as soon as possible. If entities have technical difficulties with the UEI validation or SAM registration process, they should utilize the HELP feature on SAM.gov. Additional entity validation resources can be found here: GSAFSD Tier 0 Knowledge Base - Validating your Entity.

4.2.3 FedConnect

Register in FedConnect at https://www.fedconnect.net. To create an organization account, the applicant'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.

4.2.4 Grants.gov

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

As applicable, modifications to this FOA will be posted on the OCED eXCHANGE website and the Grants.gov system. However, the applicant will only receive an email when a modification is posted if registered for email notifications for this FOA in Grants.gov. OCED recommends that the applicant register as soon as possible after the release of the FOA to ensure receipt of timely notice of any modifications to this FOA.

4.2.5 Electronic Authorization of Applications and Award Documents

Submission of an application and supplemental information under this FOA through electronic systems used by DOE, including OCED eXCHANGE and FedConnect.net, constitutes the authorized representative's approval and electronic signature.

4.3 Application Forms

Further information and detailed instructions regarding application forms are available on OCED eXCHANGE. To access these materials, go to https://OCED-exchange.energy.gov and select the appropriate FOA number.

4.4 Submission Dates and Times

All required submissions must be submitted in OCED eXCHANGE no later than 5 p.m. ET on the dates provided on the cover page of this FOA.

4.5 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:

- Termination of award negotiations;
- Modification, suspension, and/or termination of a funding agreement;
- 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.

4.6 Proposal Content

This application process includes multiple phases: Concept Paper, Application, and possibly, in person interviews or site visits.

4.6.1 Concept Paper

Each Concept Paper must be limited to a single concept for a project; however, projects can be an aggregation of technologies demonstrated at multiple eligible facilities, or multiple technologies demonstrated at a single eligible facility (e.g., large retrofit facility overhaul). The Concept Paper must conform to the requirements listed below, including the stated page limits.

DOE makes an independent assessment of each Concept Paper based on the criteria in Section 5.2.1 of the FOA. DOE will encourage a subset of applicants to submit Applications. Other applicants will be discouraged from submitting an application. See Section 6.1.2.

Each applicant must provide the following information as part of the Concept Paper:

- Cover Page (1 page maximum): The cover page must include the project title, the specific Topic Area being addressed, the industry sector(s) in which the project will be demonstrated, Area(s) of Interest, both the technical and business points of contact, names of all team member organizations, the project location(s), and any statements regarding confidentiality as described in Section 8.1.
- Project Plan & Project Team Description (6 pages maximum): Applicants are required to describe succinctly:
  - The proposed project, including the technology and systems to be developed, construction activities, and infrastructure development.
  - A preliminary development plan and timeline, including any key risks and challenges, showing the impact that the proposed project would have on industrial decarbonization.
  - The impact that DOE funding would have on the proposed project.
  - How the proposed project, if successful, would meet the FOA objectives, including how the facility will achieve long term financial and operational viability, market liftoff (including existing or potential procurement commitments such as partnerships with purchasers of the facility's output, and special consideration given to shifting entire industries toward low-carbon products), and stimulate follow-on funding from the private sector.
  - The proposed project's target level of performance for carbon intensity reduction. Applicants must provide technical data or other support to show how the proposed target could be met, a preliminary project or facility-level baseline, state-of-the-art estimate, and anticipated improvement and reporting/declaration plan for relevant metrics (see Table 2).
  - The proposed project's replicability and how the project will catalyze industry-wide change through deployment at additional facilities and/or by accelerating domestic or global standard setting.
- Community Benefits Plan (2 pages maximum): Applicants are required to describe succinctly the approach to be taken with respect to:
  - Supporting meaningful community and labor engagement;
  - Investing in the American workforce by supporting quality jobs;
  - Advancing diversity, equity, inclusion, and accessibility (DEIA);
  - Contributing to the Justice40 Initiative goal that 40% of the overall benefits of climate and clean energy investments flow to disadvantaged communities; and
  - Providing the greatest benefit for the greatest number of people within the area of the facility, including but not limited to creation or retention of quality jobs and reductions of air pollution, water pollution, and other waste streams.
- Management and Organization (1 page maximum): Applicants must succinctly describe the qualifications, experience, and capabilities of the proposed Project Team, including:
  - Whether the Lead Project Manager (LPM) and Project Team have the skills and expertise needed to successfully design, develop, and operate the proposed industrial decarbonization project.
  - Whether the applicant has prior experience which demonstrates an ability to perform tasks of similar risk and complexity.

- Whether the applicant has previously worked together with its teaming partners on similar projects or programs.
- Whether the applicant has adequate access to resources (e.g., financing, equipment, facilities, site(s), infrastructure, workforce) necessary to accomplish the effort and/or clearly explain how it intends to obtain access to the necessary resources.
- A summary organization chart of the team must be provided.
- Applicants may provide other graphs, charts, or data to supplement their Demonstration plan and Project Team Descriptions.

4.6.2 Application

Only applicants who have submitted an eligible Concept Paper will be eligible to submit an Application.

Applicants will have approximately 2.5 months from DOE's posting of the Concept Paper Encourage/Discourage notification on OCED eXCHANGE to prepare and submit an application. Regardless of the date the applicant receives the Encourage/Discourage notification, the submission deadline for the application remains the date and time stated on the FOA cover page.

All application documents must be marked with the control number issued to the applicant. Each application must be limited to a single proposal. Applications must conform to the content and form requirements listed below and must not exceed the stated page limits. Applicants must provide sufficient citations and references to justify the claims and approaches made to DOE. However, DOE and reviewers are under no obligation to review cited sources.

The Application Requirements Checklist is in Appendix A.

4.6.2.1 Application for Federal Assistance (SF-424)

(PDF)	**File Naming Convention:** ControlNumber_LeadOrganization_App424

The Standard Form (SF-424) represents the government-wide standard form for grant application packages and requires basic information about the applicant (name, address, telephone number, type of applicant, etc.), including a list of sources of proposed funding and a description of the proposed project. Complete all required fields in accordance with the instructions on the form.

In Field 21 of the SF-424, the authorized representative must certify and agree with the Certification and Assurances found at http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms.

Note: The dates and dollar amounts on the SF-424 are for the complete project, Phases 1-4.

4.6.2.2 Technical Volume

An application must include a Technical Volume, which includes the following components that are further detailed below: a) Project Summary; b) Business Development and Management; c) Engineering, Procurement, Construction, and Operations; d) Safety, Security, and Regulatory Requirements; e) Risk Analysis and Mitigation; f) TEA and LCA Projections; and g) Workplan. The Technical Volume may not exceed 50 pages for Topic Areas 1 and 2, or 40 pages for Topic Area 3, including the Table of Contents and all citations, charts, graphs, maps, photos, or other graphics, and must include all the components listed above. Maximum page limits for each component of the Technical Volume according to Topic Area are provided in the Application Requirements Checklist in Appendix A. The applicant should consider the weighting of each of the technical review criterion (see Section 5.2.2 of the FOA) when preparing the Technical Volume.

a) Project Summary	
(PDF)	**File Naming Convention:** ControlNumber_LeadOrganization_Project_Summary

See an example Project Summary page in Appendix D. Applicants are strongly encouraged but not required to use Appendix D, but all the information included in Appendix D must be included in the project summary. The project summary must include the project title, OCED eXCHANGE Control Number, the specific FOA Topic Area and Area of Interest being addressed, the prime applicant name, both the demonstration project manager and the business point of contact, names of all team member organizations (e.g., sub-recipients, key technology providers, and project partners), senior/key personnel and their organizations, the project facility location(s) by the city, state, and zip code + 4 for each location where project work will be performed by the prime recipient or subrecipient(s), and any statements regarding confidentiality as described in Section 8.1. For each proposed prime recipient and subrecipient(s) that meets the criteria for domestic entity as stated in Section 3.1, the applicant must state and certify that entity's domestic entity status. For each proposed prime recipient and subrecipient(s) that does not meet the criteria for domestic entity as stated in Section 3.1, the applicant must state the entity's status as a foreign entity and submit a foreign entity waiver request as specified in Appendix C. The project summary must also state the total period of performance (years), total DOE funding request ($M USD), total non-federal cost share ($M USD). As applicable, the project summary must indicate all decarbonizing levers that the project will deploy for the following categories: on-site clean power, hydrogen use, alternative fuels/feeds, electrification, energy efficiency, carbon capture: CO_2 source, carbon capture: method, carbon capture: post capture. The project summary must also state the number of facilities included in the project, specify whether this project has been submitted to any other DOE funding opportunities, and indicate infrastructure needs. See appendix D for additional information.

b) Business Development and Management	
(PDF)	**File Naming Convention:** ControlNumber_LeadOrganization_BDM
(MS Excel)	**File Naming Convention:** ControlNumber_LeadOrganization_BusinessCase

The Business Development and Management document must include the Project Plan Summary, Business Plan, Management Plan, and Financial Plan as necessary elements detailed below. The project's level of development and level of detail within these plans will evolve over the four phases as detailed in Figure 2.

As part of the application and throughout the award, the project team will assess and evaluate the project's commercial adoption readiness, which OCED will in turn verify and validate. Applicants should use the risk dimensions outlined in DOE's Adoption Readiness Level Framework (ARL) or a similar framework to develop a commercial adoption plan as an overview of key project risks and opportunities.

In assessing the project's ARL risk dimensions, applicants should indicate which elements of the application address which risk dimensions (e.g., Delivered Cost is currently "medium risk," and the TEA section demonstrates the cost-curve pathway to "low risk," or cost parity with incumbent solutions). OCED expects awardees to actively manage outstanding commercial adoption risks, including those driven by product value (e.g., Delivered Cost, Functional Performance), solution inputs (e.g., Supply Chain, Capital Flow), and external factors (e.g., Permitting, Community Acceptance).

The commercial adoption plan should include a description of commercial adoption-based risks and how they will be managed. Projects selected for award will be expected to execute the commercial adoption plan. Analyses and documents included in the Business Development and Management section of the application (and elsewhere) will be updated and revised as needed through each phase. Quantitative and qualitative analysis of remaining risks will inform subsequent phase negotiations including for contingency, budget, and cost share.

DOE will assess progress made as part of the Go/No-Go decision points. Adequate progress made in the commercial adoption plan and an overall acceptable commercial adoption risk exposure will be required for projects to advance through phases.

Project Plan Summary
This summary must describe the overall team, scope, and objectives of the project. The applicant must explain the impact of DOE funding and how the DOE funding, relative to prior, current, or anticipated funding from other public and private sources, is necessary to achieve the project objectives. The applicant must also discuss how, if successful, the awardee will unlock follow-on funding from the private sector for replicability. Applications must describe the overall long-term vision and strategy for the project, detailed plans for Phase 1 activities, and higher-level plans for Phase 2 through 4 activities along with planned partnerships and financing strategies/commitments.

Applicants must thoroughly describe the rationale for the preliminary site locations, system designs, market potential, and commercial viability. DOE understands that some applicants will be unable to initially provide a complete, detailed plan for all activities beyond Phase 1 and that certain partnering agreements and financing details will emerge during the early phases.

Additionally, the applicant should explain the geographic region and preliminary site(s) selected. The Proposed Project Summary must include a Level 1 schedule for executing on the project (Phases 1-4).

Applicants are encouraged to include a summary schematic (e.g., Process Flow Diagram) that depicts the project and a high-level Gantt Chart for the schedule. Note that the Gantt Chart should be consistent with the Integrated Project Schedule discussed in the Engineering, Procurement, Construction and Operations section below.

Business Plan

The business plan must include key success metrics and high-level milestones to be completed during each phase (see Figure 2), such as signing key contracts and agreements, securing permits, completing NEPA reviews, executing financial close, commencing site preparation and construction, achieving commercial operations (i.e., near or full design capacity), and evaluating/analyzing potential markets. It must also address the items listed below and any other pertinent information to understand the project business plans. The information presented in the Business Plan must be consistent with the overall Workplan.

Commercial Feasibility: The plan must describe the commercial feasibility of the proposed technologies and related infrastructure and how the applicant intends to employ such technologies and related infrastructure in the award.

Key Contracts, Permits, and Agreements: The plan must provide a top-level description, schedule, and status of all known major project milestones and deliverables, encompassing permits, NEPA, design, engineering, technology licensing, financing, construction, startup, commissioning, shakedown, operation, and maintenance of the project. Any known critical path contracts and agreements relevant to the project should also be included, with the understanding that many will continue to evolve and mature through Phases 1 and 2.

Preliminary Site Selection: The plan must describe the rationale for selection of the project site(s) and contain evidence of control over the site(s) or the plan to establish control over the site(s). When relevant according to Topic Area, recipients are encouraged to leverage and repurpose/retrofit existing facilities and infrastructure to the greatest extent possible to minimize environmental impacts. In addition, site selection should consider regional specific resources, supply chains, as well as climate and physical risks (e.g., fire, flood) to ensure resilience/sustainability. If utilizing an existing facility, recipients must describe the impact on any current operations and a plan to manage commercial and technical risks.

Market Analysis: The plan must include an analysis of the current and projected markets for the proposed and competing technologies. The analysis must discuss the prevailing economic and demographic trends in the target market(s), both on a macroeconomic basis and for the specific technology.

The analysis must identify the market dependencies on tax benefits or other government policies and incentives. The analysis should also describe the projected customer base and feedstock suppliers (availability and capacity) including storage and transportation related requirements, if applicable. The applicant must provide a justification for revenue and cost projections (price and volume) and include proposed marketing of the project's products. The application must also include current and potential competitors for the project's products and provide a detailed description of any competitive advantages. Applicants should include partnerships with clean product purchasers and the overarching market potential for the low-embodied carbon products.

Supply Chain and Offtake Arrangements: The plan must provide a description of plans for ensuring an adequate supply of major raw materials or supplies, and any offtake/customer plans. If available, the applicant should provide letters of commitment or term sheets (including power purchase agreements) for prospective suppliers, customers, and/or offtakers. The prospective offtake/customer discussion should include expected commencement date, expected quantity supplied, contract length, pricing if known, and status of negotiations. Any letters of commitment should be submitted in a separate attachment in OCED eXCHANGE (see Section 4.6.2.6. for more information).

Growth Plan: The plan must describe the potential for expanding the proposed project beyond the award performance period. The plan should also discuss how the proposed project will achieve market liftoff, including the ability to attract follow-on private sector investments beyond the award performance period.

Business Case Analysis: The business plan must include a pro forma which quantifies the projected financial parameters such as operating costs, operating revenues, financing cash flows, EBITDA, tax credits/liabilities, and expected ROI over the project lifespan. This business case should be submitted as a separate MS Excel that includes key assumptions as a separate tab.

Management Plan

This plan must describe 1) the prime applicant's and project partners' organizational structure, capabilities, and operations plan; 2) the financial strength of the prime recipient and any major project partners; and 3) prior experience of the senior/key personnel in similar or related undertakings. Senior/key personnel includes the leadership/management team and other project personnel who contribute in a substantive, and meaningful way to the successful execution of the project.

Organizational Structure: As part of the management plan, the applicant must provide an organizational chart of key entities and senior/key personnel. The organizational chart and related description should show the prime recipient and any major project partners. The application must describe the operational plan for the prime recipient and major project partners, including business relationship(s) and the various roles and responsibilities held by each organization to execute the project. Major project partners include subsidiaries, affiliates, parent organizations, or joint ventures associated with the project. The application must describe the existing or proposed legal structure (e.g., corporation, partnership, LLC) to execute the project. The applicant must also identify the domestic or foreign entity status of any entities involved in the project, consistent with Section 3.1.

Management: The applicant must provide a description of the management and operations strategies to be employed in executing on the proposed plan. The application must list the names of senior/key personnel as well as their positions or titles and the percentage of their time dedicated to executing on the project. If any key management and staff are not expected to spend 100 percent of their time executing on the project, the plan must provide a brief description of their other responsibilities or other activities outside of the award.

Experience: The plan must describe in detail the unique capabilities and expertise of the prime recipient and any major project partners or subrecipients for Phase 1, and any known debt or equity sponsors, contractors/vendors, and any other significant counterparties that the prime recipient believes will enable the project to be successful. In addition, the plan must summarize the prior experience of the prime recipient and any major project partners in similar undertakings (in both technical scope and financial size) and current or previous infrastructure projects. The plan must describe the following:

- Examples of projects in the industry sector similar in nature and scope to the project being proposed that have been completed (developed, financed, and managed construction) by the applicant or project partners.
- Examples of projects in the industry sector for which the applicant or project partners were responsible for managing the operations and maintenance for a minimum of two years. Note, each project example must be a project for which construction has been completed.
- Examples of infrastructure projects where the applicant or project partners engaged and collaborated with a disadvantaged community to develop, finance, and manage construction (if available).
- Any additional relevant information, such as budget adherence and timeline.

Applicants that are not able to include the above examples in their description of current and previous experience should provide a detailed description of the facts as evidenced in current or previous project experience that they believe are sufficient to demonstrate to DOE that they have the required expertise.

Pending Investigations: The plan must provide a summary of any pending or threatened (in writing) action, suit, proceeding, or investigation, including any action or proceeding by or before any governmental authority, that relates to the senior/key personnel, and the status of any appeals.

Financial Plan

The Financial Plan must describe the following elements for the proposed project: the preliminary funding plan, including the total amount for funding for project development in Phases 1 and 2; the funding for Phase 3, including medium-term financing for machinery and equipment, and longer-term financing for the site and facility, including sources and uses; and any required funding beyond internal cash flow, including working capital financing in Phase 4.

The Financial Plan must provide a detailed plan and schedule for achieving long-term financial viability beyond DOE and other federal funding; the amount of expected traditional equity investments (identify participants and level of participation, if applicable); the timing of expected equity contributions and/or debt funding; and the timing of repayment of expected debt funding.

A preliminary plan for sourcing projected contingency reserves (described in Section 2.0) should be detailed in the financial plan.

Prime Applicant and Project Partners: In line with the Organization Structure in the Management Plan section, the application must describe the financial relationship of the prime recipient to major project partners, including entities that are not domestic entities as defined in Section 3.1 who are contributing cost share and/or performing work.

It must include a table that identifies the name of the organization or entity that are expected to contribute debt or equity financing and any person, organization, or entity who owns or will own five percent (5%) or more of the project. The plan must indicate the prime recipient, project partners, and other debt or equity contributors by listing the organization or entity name, website address, mailing address, city and state, and postal code.

Financial Strength: The plan must describe the prime recipient's and major project partner's financial strengths, as well as the project's strategic significance to the prime recipient and major project partner involved. Applicants should include financial ratings, a narrative description of their most recent audit conducted, and findings where available.

Other Federal Support: Federal financing, such as grants or loan guarantees from federal agencies, cannot be leveraged by applicants to provide the required cost share or to otherwise support the same scope of the award. However, other federal support may be used for activities that fall outside of the award scope/budget.

The financial plan must identify whether the award will benefit directly or indirectly from other forms of federal support, such as grants, loan guarantees, tax credits, having federal agencies or entities as a customer or offtaker of the project's products or services, or other federal contracts, including acquisitions, leases, and other arrangements, that may indirectly support the award.

Non-Federal Support: The plan must identify other non-federal governmental (including state or local) incentives or other assistance on which the proposed project relies, including grants, tax credits, and loan guarantees to support the financing, construction, and operation, as well as offtake agreements for the project's products. It must indicate the terms of such support which could result in termination or reduction of anticipated/actual non-federal support, whether any such incentives or assistance are subject to clawback, and the circumstances under which a clawback could occur.

c) Engineering, Procurement, Construction, and Operations	
(PDF)	**File Naming Convention:** ControlNumber_LeadOrganization_EPCO

Applications must include initial versions of Engineering, Procurement, Construction, and Operations (EPC&O) project documents described in the subsections below. These documents should meet a minimum level of maturity, as described below, but may be more advanced. During each phase, selected projects will further develop this set of documents. Within phases, recipients will report on execution status and progress to DOE and its third-party representatives. The EPC&O category of requirements focuses on the project development process. Data, information, and related documents will cover (1) technology, (2) performance projections, (3) engineering, design, and procurement (4) cost estimates, (5) execution schedules, and (6) operating and disposition plans.

Applicants are required to provide estimated values of key parameters that influence project performance and financial viability, including but not limited to capital costs, tax credits, operating costs, and revenue streams. The demonstrations will provide revised data of increasing fidelity based on the best information available at the time. In Phase 4, DOE will require the projects to provide detailed operational, environmental, and financial data for technology and business case validation, along with other data such as socio-economic data for Justice40 goals. DOE will specify additional details for recipients' performance validation upon successful completion of Phase 3.

Technology

As part of the application and throughout the award, the project team will assess and evaluate the project's technology maturity or readiness, including level of system integration and infrastructure, which DOE will in turn verify and validate. This assessment will form DOE's technical risk analysis basis. DOE expects the awardee to actively manage outstanding technology risks, including those driven by technology maturation, level of system integration, and infrastructure needs.

Applications must include a conceptual engineering design that is reasonably achievable and a technology development and integration plan that achieves TRL 9 by the completion of Phase 4.

Through the course of the four phases, projects will be expected to develop their concept and strategy into full-fledged and executable designs and execution plans. As such, applicants are encouraged to focus on integrated system technologies that are starting at TRL 7 or higher and where market adoption will likely occur. While DOE may consider individual components with lower TRLs, they will be considered higher risk deployments and will require corresponding mitigations which may require development activities outside of the award scope and funding. Award funding may not be used for pilot-scale or earlier activities, such as research and development.

Each application will require a technology plan that includes the following:

- Description of all non-commercial technologies and any key commercial technologies to be employed in the project, including existing equipment, facilities, and infrastructure;
- Description of and path to secure required intellectual property rights;
- Assessment of the integrated system and component level TRLs;
- Detailed analysis used to justify TRLs and commercial status if relevant;
- Description of all technology maturation needs and corresponding maturation plans, described by phase; and
- Description of technology-based risks and how they will be managed.

While DOE is not requiring its use, applicants are encouraged to review DOE's Technology Readiness Assessment Guide. Applicants must ensure technology descriptions, TRL assessments, maturation needs, technical risks, and supporting analyses described in this section correspond to the proposed conceptual design plans, project schedules, and analyses required under Section 4.6.2.2(f).

Projects selected for award will be expected to execute the technology maturation and technical risk management plans described in the application. Analyses and documents included in the Technology section of the application will be updated and revised as needed through each phase. Quantitative and qualitative analysis of remaining risks will inform subsequent phase negotiations including for contingency, budget, and cost share.

DOE will assess progress made as part of the Go/No-Go decision points. Adequate progress made in technology maturation and risk management activities, as well as an overall acceptable technology risk exposure will be required for projects to advance through phases.

Performance Projections

Understanding performance assumptions, risks, uncertainties, timelines, and variabilities is critical for individual project viability. Applications must include detailed information about performance projections and supporting information. These projections should correspond to data, information, and assumptions provided in response to requirements described in the Business Development and Management as well as the TEA and LCA Projections sections of this FOA. If not already available, applicants must develop a detailed performance model in Phase 1.

Projects will be required to quantify the direct GHG emissions reductions as carbon intensity reductions from their projects through detailed LCA as described in Section 4.6.2.2(f) below. Applications should include other metrics and milestones necessary to define the success of the project, including reductions of non-CO_2 emissions or other pollutants, water intensity, waste streams, increased community benefits, energy efficiency improvements, speed of adoption, or other metrics as developed in the application and project negotiations.

The application should discuss the potential to scale commercially and applications to other industrial processes, beyond what is proposed under the DOE award, particularly for system upgrades and retrofits for unit operations or single process lines. The overarching performance goal of all projects funded by this FOA is to ultimately demonstrate long-term financial viability by the time the DOE funding has ended, thereby spurring market uptake.

Engineering, Design, and Procurement

Engineering, design, and procurement information is required as part of the application. DOE expects applications will reflect a spectrum of project maturities. At a minimum, the applications should include a comprehensive conceptual design that reflects initial engineering studies such as pre-FEED or FEED (Front End Engineering Design) studies. It is expected that engineering and design should be at least ~5% complete at the application stage. Conceptual designs should be consistent with information provided in response to requirements described in other sections of the application.

Engineering information submitted with the application must provide a conceptual description of the type of technology, system integration, and connective infrastructure needed in each step along the pathway from feedstocks through production of industrial goods and their end-use. Key facilities, systems, and technically complex components should be described in detail. Where applicable, proposals should also cite prior successful utilization of the proposed technologies, systems, and infrastructure in like environments at the pilot scale as a minimum.

To the extent information is available and if applicable to the proposed demonstration, applications must include a detailed description of the project infrastructure in terms of major subsystems and their interconnection(s) and a description of how the project is intended to operate. If available, high-level schematic, technical specifications, equipment supplier and vendor information for all technologies, systems, and connective infrastructure should be included in the application.

If available, equipment descriptions should include consideration of how equipment would be used dynamically within the system. Plans and the need to balance variable supply and demand signals, as well as resiliency aspects necessary to handle maintenance outages and external system shocks should also be described.

Engineering designs will evolve and be revised in the early phases of the project and will be monitored and reviewed as part of Go/No-Go decisions between phases. Final project as-built plans, change orders, punchlists, and costs, shall be submitted, as applicable, as part of the project reporting requirements, subject to IP agreements in place. A lessons-learned summary will be required in annual project reporting. In addition, collection and submittal of operating air and GHG emissions data, major maintenance costs, and operating performance data will be required in annual project reporting.

Applications must include a description of the proposed procurement plan in accordance with 2 C.F.R. § 200.317-327 as available including, but not limited to, the following:

- Long lead items and critical equipment and connective infrastructure;
- Potential or planned major equipment providers;
- Procurement timelines and/or critical path procurements; and
- Third-party contracting plans.

The application must also describe the applicant's strategy to leverage existing U.S. manufacturing and supply chains and support the growth of these domestic capabilities consistent with U.S. job creation goals, the Buy America language in BIL (see Section 4.8.3), and related executive orders, as applicable. Applications should clearly identify any known supply chain risks and plans for timely procurement of supplies from underdeveloped supply chains.

Cost Estimates

Applicants will be expected to develop detailed cost estimates that meet industry standards for the size and complexity of the proposed project. Cost estimates should be consistent with other financial data and analysis provided as part of the application, such as those elements described in the Business Development and Management and Techno-Economic Analysis and Life Cycle Analysis Projections sections of the FOA. DOE expects that projects will employ industry standard cost estimating methodologies and tools. Cost estimates should correspond to the project design maturity and reflect appropriate uncertainties. While DOE is not requiring its use, applicants are encouraged to review DOE's Cost Estimating Guide. Table 6 below is included in the DOE Cost Estimating Guide and highlights examples of industry standard cost estimating approaches and use cases.

Table 6. Cost Estimate Classification for Process Industries.

	Primary Characteristic	*Secondary Characteristic*		
ESTIMATE CLASS	**MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical variation in low and high ranges
Class 5	0% to 2%	Concept screening	Capacity factored, parametric models, judgement, or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bid/tender	Detailed cost unit with force detailed take-off	L: -5% to -15% H: +5% to +20%
Class 1	65% to 100%	Control or bid/tender	Detailed cost unit with force detailed take-off	L: -3% to -10% H: +3% to +15%

Applications must include a current total project cost (TPC) estimate that covers the entirety of the project, including construction and 2-4 years of operations. All project costs falling within the project must be included, including capital, labor, finance, and other cost categories as appropriate for individual plans. Any costs associated with CBP activities should also be included in the TPC estimate. Narratives accompanying cost estimates should include an explanation of the estimate class and/or maturity, a description of the methodology employed, and the uncertainty or accuracy range.

While DOE is not requiring specific escalation assumptions be used for the application TPC, cost estimate narratives should explain what assumptions were used and appropriateness. The expected estimate class for the application is Class 4 or better. Subsequent phases will require more refined estimates: Class 3 by end of Phase 1 and Class 1 by end of Phase 2. DOE may require use of standard cost estimating assumptions, including escalation assumptions in future phases.

Cost estimates should include itemized breakdowns that reflect at a minimum capital, labor, and financing costs. An overview of the project's current TPC estimate should be included in the application and supporting itemized data can be provided as part of the "TEA and LCA Projections" in Section 4.6.2.2(f) as well as the "Budget Justification" Excel spreadsheets. Note, during award negotiations DOE will conduct a third-party review of the TPC.

Execution Schedules

An Integrated Project Schedule (IPS) that reflects all elements of the overall project should be included in the application (as part of the Workplan, see Section 4.6.2.2(g)). The initial IPS should include all major project activities and milestones (consistent with the overall Workplan), including technology maturation, engineering, design, procurement, construction, and CBP activities. A minimum Level 1 IPS for the full project and a minimum Level 2 IPS for proposed Phase 1 activities should be provided with the application.

The IPS levels are:

- Level 1: Summary schedule including major project milestones, deliverables, and related activities.
- Level 2: A more detailed version of the Level 1 schedule that should include a breakdown into major project categories such as engineering, design, construction, procurement, permitting and regulatory, CBP implementation, and others as appropriate.
- Level 3: Integrated roll up of Level 4 schedules that should reflect breakout of activities underlying elements of the Level 2 schedule including anticipated start and finish dates for each activity. Often developed by the executing contractor using detailed information from project and/or construction managers and is used for project progress reporting.
- Level 4: Detailed working schedule used to manage day-to-day activities or other near term work plans. Should be resource loaded. Often called Execution or Working schedule or similar.

This IPS will be revised, expanded, and updated in future phases. By the end of Phase 2 it is expected that the IPS will be execution ready and reflect comprehensive schedule risk and uncertainty analyses. During each phase, recipients will report actual progress against their execution schedule or schedules as part of regular project management reporting requirements.

Operating & Disposition Plans

A high-level description of Operating & Disposition plans must be included with the application. The Operating plan must describe the project's concept of operations throughout the four phases. It is expected that this conceptual plan will be developed into a fully implementable Operations & Maintenance (O&M) plan prior to completion of Phase 3.

Despite full intention that projects will continue operating well beyond the award period, DOE acknowledges that unforeseen circumstances may arise that result in operations ending. Recipients must therefore develop and appropriately fund a disposition and decommissioning (D&D) plan. This plan will vary based on the status of the site and project details, but all applications must include a high-level description of the proposed D&D approach. It is expected that this approach will be fully developed, including cost estimates, prior to completion of Phase 2 and with appropriate funding plans in place prior to completion of Phase 3. DOE expects the applicant to seek and maintain community input of the eventual site end-state.

D) Safety, Security, and Regulatory Requirements	
(PDF)	**File Naming Convention:** ControlNumber_LeadOrganization_SafetySecurity

The Safety, Security, and Regulatory Requirements document must include Safety, Cybersecurity, Permitting, and NEPA requirements as detailed below.

Safety and Environmental Compliance

Applications must include a detailed description of the safety culture that includes a five-year construction/operations safety, industrial hygiene, and environmental compliance performance history (such as an OSHA 300A form, Experience Modification Rating, Overview of Annual Environmental Compliance Metrics, Industrial Hygiene Surveys Overview, etc.) of the entities and management involved in the award.

Cybersecurity

While a cybersecurity plan is not required as part of the application submission for this FOA, applications must include an assessment of potential cybersecurity threats or vulnerabilities and address cybersecurity challenges in their work scope.

If selected for award negotiations, recipients must submit an initial cybersecurity plan during the award negotiations phase (prior to the issuance of an award). Recipients must develop tailored cybersecurity plans outlining the specific plan to secure the project according to the unique needs of the proposed plan and its associated technologies as applicable.

DOE recommends using open guidance and standards such as the National Institute of Standards and Technology's (NIST) Cybersecurity Framework (CSF) and the DOE Cybersecurity Capability Maturity Model (C2M2).[124] The cybersecurity plan created pursuant to BIL section 40126 should document any deviation from open standards, as well as the utilization of proprietary standards where the awardee determines that such deviation is necessary.

- Cybersecurity plans should be commensurate to the threats and vulnerabilities associated with the proposed efforts and demonstrate the cybersecurity maturity of the project.

[124] NERC critical infrastructure protection (CIP) standards for entities responsible for the availability and reliability of the bulk electric system. NISTIR 7628: Guidelines for Smart Grid Cybersecurity. NIST SP800-53, Recommended Security Controls for Federal Information Systems and Organizations: Catalog of security controls in 18 categories, along with profiles for low-, moderate-, and high-impact systems. NIST SP800-82, Guide to Industrial Control Systems (ICS) Security. NIST SP800-39, Integrated Enterprise-Wide Risk Management: Organization, mission, and information system view. AMI System Security Requirements: Security requirements for advanced metering infrastructure. ISO (International Organization for Standardization) 27001, Information Security Management Systems: Guidance on establishing governance and control over security activities (this document must be purchased). IEEE (Institute of Electrical and Electronics Engineers) 1686-2007, Standard for Substation Intelligent Electronic Devices (IEDs) Cyber Security Capabilities (this document must be purchased). DOE Cybersecurity Capability Maturity Model (C2M2).

- Cybersecurity plans may cover a range of topics relevant to the proposed project, e.g., software development lifecycle, third-party risks, and incident reporting.
- At a minimum, cybersecurity plans should address questions noted in BIL section 40126 (b) 'Contents of Cybersecurity Plan'.[125]

Permitting

Applications must include a permitting workflow overview that identifies anticipated federal, state, tribal, and local codes, regulations, and permitting requirements applicable to siting, construction, and operation of the proposed project. Additionally, the Integrated Project Schedule should clearly identify and incorporate timelines for application and expected completion or receipt of all required federal, state, tribal, or local permits, approvals, or reviews.

Projects that have pre-approved sites, cooperation agreements with local authorities, or expedited permitting processes should outline such agreements and incorporate them into the overall Workplan.

National Environmental Policy Act

DOE's decision of whether and how to distribute federal funds under this FOA is subject to NEPA (42 U.S.C. §§ 4321 *et seq*.), which 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 and guidance on NEPA refer to the DOE NEPA Website.[126]

While NEPA compliance is a federal agency responsibility and the ultimate decisions remain with the federal agency, all recipients selected for negotiation of an award will be required to assist in the timely and effective completion of the NEPA process. If DOE determines certain records or studies must be prepared to complete the NEPA review process (e.g., a biological assessment or other environmental baseline studies), the recipient may be required to prepare the records and studies; costs required to prepare the necessary records and studies may be included as part of the project costs. Proposed projects that include new construction or significant modification of existing facilities and/or infrastructure will likely require preparation of an Environmental Assessment (EA) or Environmental Impact Statement (EIS). NEPA compliance activities should be accounted for in the project scope, schedule, and budget.

[125] 42 U.S.C. § 18725.
[126] "National Environmental Policy Act," U.S. Department of Energy, https://www.energy.gov/nepa or https://ceq.doe.gov/index.html.

Applications must include an Environmental Considerations Summary attachment that provides the information requested in Section 4.6.2.10 "Environmental Considerations Summary." Responses to the Environmental Considerations Summary questions will be used to: (1) ensure that the environmental factors are considered in the decision-making process; (2) assess the applicant's awareness of project-related requirements, including requirements for mitigating any project-related adverse environmental risks and impacts; and (3) contribute to the evaluation and selection decision.

If an application is selected and an award is successfully negotiated, recipients will complete an Environmental Information Volume (EIV) during Phase 1.

Other Considerations

Applicants are encouraged to undertake a thorough review of all relevant federal, state, tribal, and local statutory and regulatory authorities. Knowledge of these authorities and associated processes will aid applicants in developing their proposed projects both in the application and award phases. Relevant federal statutes and authorities could include, but are not limited to: Clean Air Act, Clean Water Act, Endangered Species Act, and National Historical Preservation Act. DOE strongly encourages applicants to include in their proposals frequent and extensive consultation with local community stakeholders with a potential interest in the proposed site(s), aligned with activities in the CBP. Applications should also include plans for monitoring their sites and the environmental effects of their projects from site assessment through commissioning and throughout the entire life of the project.

e) Risk Analysis and Mitigation	
(PDF)	**File Naming Convention:** ControlNumber_LeadOrganization_RiskAnalysis

The Risk Analysis and Mitigation document must include a Risk Management Plan and a Risk Register as necessary elements. DOE expects recipients to understand and actively manage risks. The applicant must provide a comprehensive Risk Management Plan (RMP) that is accompanied by a corresponding risk register that can be used for ongoing risk management. The RMP must provide a narrative that analyzes the commercial, technical, construction, schedule, regulatory, permitting, safety, scale-up, infrastructure, financial, management, organizational, labor/workforce, surrounding community, supply chain, market related and physical climate risks. Each identified risk in the RMP should be clearly described, including its probability of realization, potential impacts, and proposed mitigations. ~~The Risk Analysis and Mitigation document must include the project TEA and LCA narratives (see Section 4.6.2.2(f)~~).

As appropriate, identified risks should be incorporated into other project documentation, such as execution schedules, cost estimate maturity, and contingency. The risk management plan and risk register will be revised and updated as needed throughout the project life cycle. At a minimum, the risk management plan and risk register will be reviewed and assessed for accuracy and adequacy as part of each transition between phases. Where and when appropriate, quantitative risk analyses may be required and subsequently incorporated into relevant risk management plans and contingency evaluations and will be used to inform negotiations with DOE.

f) Techno-Economic Analysis and Life Cycle Analysis Projections	
(PDF)	**File Naming Convention:** ControlNumber_LeadOrganization_TEA_LCA
(MS Excel)	**File Naming Convention**: ControlNumber_LeadOrganization_TEA ControlNumber_LeadOrganization_LCA

Each application must include a preliminary TEA and LCA at an integrated systems level. The TEA and LCA document must include a Preliminary TEA Narrative (Generally Accepted Accounting Principles (GAAP) analyses) and a LCA Narrative as necessary elements. Applicants are strongly encouraged to use the provided "Industrial Demonstrations TEA Assumptions" and "Industrial Demonstrations Preliminary LCA" Excel spreadsheets, which are available under the "Application Forms and Templates" section on the OCED eXCHANGE website. These spreadsheets itemize key parameters that DOE is requesting to verify each analysis.

Awardees will be required to perform and collect data to further refine and validate the TEA and LCA analyses throughout the lifetime of the project. TEA and LCA will be used to validate the assessment of cost, technical performance, and carbon emissions, respectively. As part of the Technical Volume, applicants must describe their assumptions, rationale, and specific system design boundaries as part of their preliminary TEA and LCA. All applicants must define credible and measurable baselines for benchmark comparisons for both the TEA and LCA. The quality and scientific depth of these proposed baselines will be an important element of the technical evaluation of applications.

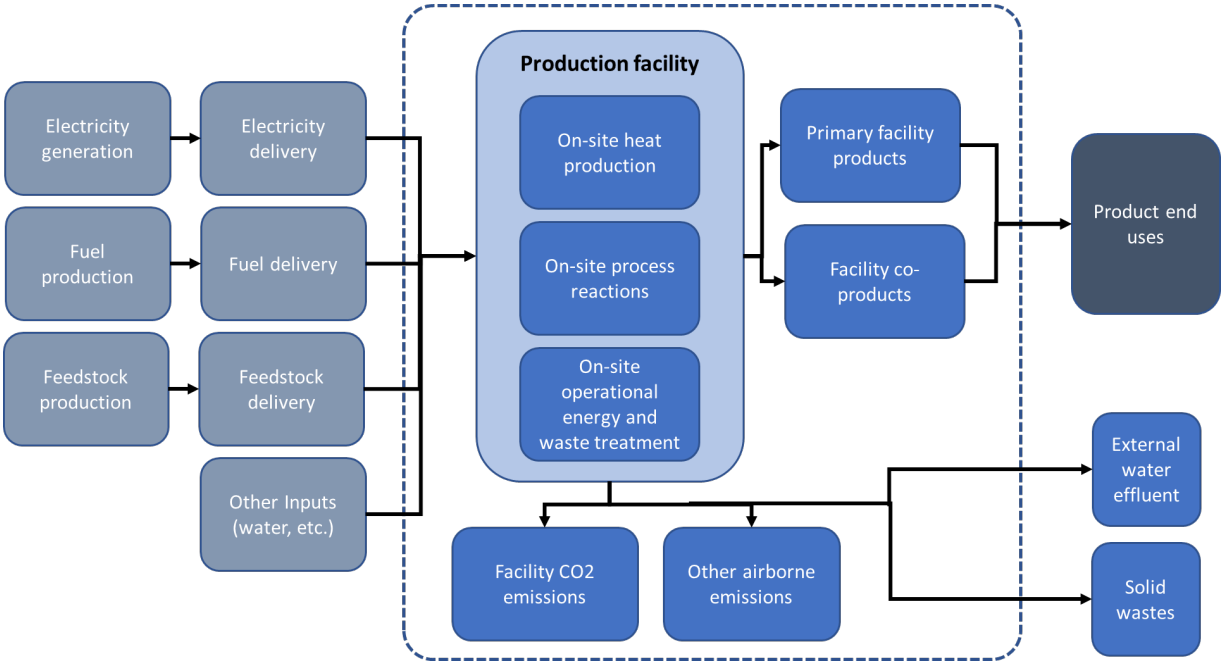

Figure 3. Key industrial TEA and LCA components.

Preliminary Techno-Economic Analysis

A TEA is necessary to assess the long-term financial viability of each proposed project. Projects must complete a baseline TEA and a project TEA to clearly show a production performance and cost comparison. Applicants must clearly indicate the factors and assumptions used to determine cost benchmarking and clearly define the functional unit (cost normalization) used for comparison. Applicants should conduct their own TEA to estimate the TPC that informs and is consistent with the values in the Financial and Business Plans and to estimate material and energy balances that are consistent with the Business Development and Management and Engineering, Procurement, Construction, and Operations sections above.

The preliminary TEA should be conducted with the best available information from prior successful utilization of the proposed technologies, systems, and infrastructure in like environments at the pilot scale as a minimum at the time the application is submitted. Facility or production line boundaries for TEA should match those used in the preliminary LCA. Applicants should articulate expected values of key parameters that influence baseline and financial viability for proposed facilities, including the following:

- Cost of capital and inflation
- Capital expenditures
- Tax credits and other incentives
- Operating costs
- Revenue streams
- Production rate/Plant capacity
- Operational period/asset life and capacity factor

Updates to the TEA will be repeated in future phases as more refined performance data and cost estimates become available. Any cost that is expected to contribute more than 5% to the annual operating expenditures should be provided in the TEA document and spreadsheet, with remaining costs noted as delineated in the spreadsheet instructions. TEA within Phase 1 may leverage proprietary and published data, existing DOE tools, estimates or quotes from industry representatives, or any other sources as needed. The preliminary TEA should be presented in narrative form in the technical volume and accompanying Excel spreadsheet. Applicants may provide the analysis in the underlying format of their choosing but key assumptions must be dynamically linked to the assumptions template provided i.e., applicants should use the provided TEA spreadsheet as a reference tab within their model. Preferably, applicants will use an Excel multi-year GAAP financial articulation for the TEA, using nominal dollars for financial inputs. Additionally, applicants should provide key outputs and updates from their TEA for DOE to verify the TEA and consistently evaluate applications.

Other Incentives Availability: If applicants are pursuing federal or state tax incentives in addition to this FOA, they should clearly show the projected financial impact from these incentives on an annual basis for the performance period of the project and provide supporting documentation where possible. If applicants are pursuing a tax credit, they should clearly state the credit value that they are targeting.

Preliminary Life Cycle Analysis

Overview

Applicants are required to complete a preliminary gate-to-gate (facility or production line boundary) comparative LCA to quantify the potential changes to emissions and energy utilization and intensity of their facilities. DOE will utilize LCA to evaluate the decarbonization potential of each project relative to the baseline through carbon intensity. If the facility or process that the project affects has multiple throughputs or products, the applicant must provide the detailed calculation for normalizing carbon intensity and other metrics to a facility- or process-level. The preliminary LCA should clearly define the following:

- Goal and scope – define and describe product, functional unit, process boundaries, and environmental effects to be assessed. Rationale to support gate-to-gate, cradle-to-gate, or additional boundary conditions selected.
- Inventory analysis – identify and quantify energy and material inputs and outputs.
- Impact category assessment – state the environmental impact categories with associated emissions factors.
- Tools and resources – identify the software and databases the team will use to complete the preliminary and final LCA.
- Assumptions – clearly state any assumptions used and the rationale, including assumptions on input characteristics from relevant Environmental Product Declarations or similar.

The LCA should be composed of a narrative and an accompanying spreadsheet capturing more detailed assumptions, data, and calculations. Applicants must provide detailed inventory and process flow diagram in the LCA Sheet for each process that the applicant is planning to consider for decarbonization along with business-as-usual inputs for that process as well.

LCAs are expected to be expanded and refined within the project. An initial, quantitative cradle-to-gate evaluation will be completed in Phase 1 and refined in Phases 2 and 3, along with a highly detailed facility gate-to-gate evaluation. All TEAs and LCAs will be validated in Phase 4. For reference, the National Renewable Energy Laboratory Materials Flows through Industry modeling tool, the National Energy Technologies Laboratory LCA of Energy Technology and Pathways, and Techno-economic, Energy, & Carbon Heuristic Tool for Early-Stage Technologies (TECHTEST)[127] provide examples of the types of analysis and considerations that should be included in application LCA narratives and calculations. DOE encourages applicants to leverage common approaches and data structures where possible, such as those in the Federal LCA Commons.

[127] https://www.energy.gov/eere/iedo/techno-economic-energy-carbon-heuristic-tool-early-stage-technologies-techtest-tool

Baselines and Comparators

For TEA and LCA, applicants will need to provide a representative benchmark to compare to project outcomes. For all Topic Areas, applicants will need to define the state-of-the-art benchmark to compare expected results. This benchmark represents best commercially available off-the-shelf technology that would be used to build a similar industrial facility today, including associated emissions, and costs. For projects at existing facilities, applicants will need to create a baseline of their current standard operations to compare with the project expectations and the industry benchmark.

The current operations baseline should represent steady state operating conditions for the eligible facility. Applicants must note if there are instances when the facility has not or does not meet the baseline operation parameters and how the adoption of the project may alter baseline conditions (e.g., startup, shutdown, malfunction, etc.). Decarbonization is essential both at the facility-level and in a broad deployment scenario, and applicants should aim to demonstrate the ability to achieve the on-site reductions shown in Table 2 for the relevant Topic Area. If an eligible facility has already made substantial decarbonization improvements to their processes, then their potential for reductions via carbon intensity may be less than the targets in Table 2.

Total annual GHG emissions and facility contributions to product carbon intensity will be the metrics used to evaluate GHG emissions reductions. Applicants must identify the proposed targets for the selected Topic Area. Applicants for the eligible facilities need to provide historical and forecasted total annual GHG emissions from 2005 (as available) to 2030 with and without the proposed project. For carbon intensity, DOE expects applicants to provide carbon intensity for multiple functional units, specifically for each product, process line (if applicable), and the facility. The calculations, emission factors, process inputs and outputs, and other values used to determine these values need to be clearly indicated in the LCA Sheet.

System Boundaries and Considerations

In general, the on-site boundary lines for projects under this FOA will include the facility line or process operation inputs and outputs, including feedstocks, process chemicals, water, energy, waste streams, emissions, and other factors pertinent to the industry-specific operations. Preliminary LCA is not required to include construction or equipment production or purchase.

In Figure 3, this boundary is shown as a dashed line. All projects must include the components within the dashed line in their evaluations. The reference flow refers to the amount (value and units) of the needed inputs from a process in a system to define the functional unit.

While not required for the preliminary quantitative LCA, all other components from outside the facility must be described in the narrative section, with a specific focus on any changes to total amounts or production intensities that may result from the proposed project.

As this FOA encompasses many industries and will receive multiple project requests with various technologies, the applicant needs to clearly narrate any special analyses, boundaries, or considerations for emissions and economic evaluations DOE should consider for the project.

Depending on the specific proposal, applicants may need to include additional components and analyses.

For example:

- If utilizing alternative, low carbon feedstocks that are critical to overall carbon intensity reduction strategy, feedstocks should be included in the LCA.
- If fuel production is carbon negative and proposed as part of the overall carbon intensity reduction strategy, fuels should be included in the LCA.
- If there is a significant change anticipated to energy or water intensity, energy and water inputs should be included in the LCA.
- If the financial viability of the project depends on a long-term electricity PPA, generation and delivery should be included in the LCA.

Specific Topic Area Direction

For Topic Area 3 only, applicants may limit the comparative LCA to the specific production line or unit process under consideration. However, they should include a narrative description of contribution of these processes to the overall facility energy and emissions profiles, the anticipated impact on the overall facility if the project is successful and the solution more broadly implemented, and similar.

LCA Validation and Refinement

As the process continues with the awardees, more refined analyses will be necessary. Successful applicants will be required to have a periodic assessment of their metrics during the award to evaluate potential impacts. Within each phase (see Figure 2) the LCA and therefore carbon intensity reductions will be verified and validated using onsite data collection or independent third parties to ensure that the project is still able to meet the emissions reductions expressed upon award. To the greatest extent practical, applicants should seek to leverage and align with methodologies, assumptions, and standard practices for related embodied-emission labeling and certification programs such as potential EPA EPDs and/or future regulations for these materials and products.[128,129] OCED intends to align validation and reporting requirements throughout the award with these programs wherever possible.

g) Workplan	
(PDF)	**File Naming Convention:** ControlNumber_LeadOrganization_Workplan

The Workplan must include the Project Objectives, Technical Scope Summary, Work Breakdown Structure (WBS) and Task Description Summary, Go/No-Go Decision Points, End of Project Goal, and Integrated Project Schedule as necessary elements. The Workplan will form the basis of the Cooperative Agreement that will be negotiated if selected for award.

[128] "Inflation Reduction Act Programs to Fight Climate Change by Reducing Embodied Greenhouse Gas Emissions of Construction Materials and Products," U.S. Environmental Protection Agency, January 2023, https://www.epa.gov/inflation-reduction-act/inflation-reduction-act-programs-fight-climate-change-reducing-embodied.

[129] "SEC Proposes Rules to Enhance and Standardize Climate-Related Disclosures for Investors," U.S. Securities and Exchange Commission, March 2022, https://www.sec.gov/news/press-release/2022-46.

Project Objectives

The applicant must provide a clear and concise (high-level) statement of the goals and objectives of the project as well as the expected outcomes.

Buy America Requirement for Infrastructure Projects: Within the first 2 pages of the proposed Workplan or project description, include a short statement on whether the project will involve the construction, alteration, maintenance and/or repair of public infrastructure in the United States. More information about Buy America is available in Section 4.8.3.

Technical Scope Summary

The applicant must 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 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, including milestones specific to their project outcomes and including those detailed in the CBP. Applicants should define milestones in a quantitative, precise manner and are encouraged to use the SMART (Specific, Measurable, Achievable, Relevant, and Timely) approach or similar.

WBS and Task Description Summary

The Workplan must describe the work to be accomplished and how the applicant will achieve the project schedule, accomplish the final project goal(s), and produce all deliverables. The Workplan is to be structured with a hierarchy of performance period, 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 (including project construction and operations). 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.

If selected for award negotiations, the summary will be incorporated into the Work Plan which will contain a more detailed description of the WBS and tasks.

Go/No-Go Decision Points

Provide a summary of project-wide Go/No-Go decision points at appropriate points in the project schedule. At a minimum, each project must have at least one project-wide Go/No-Go decision point at the end of each Phase of the project. Interim Go/No-Go decision points may also be used. The Applicant should also provide the specific technical and Community Benefits criteria to be used to evaluate the project at the Go/No-Go decision point. The summary provided should be consistent with the description in the PMP.

End of Project Goal

The applicant must provide a summary of the project's end of project goal(s), including successfully demonstrating commercial operations and financial viability, contributing to the decarbonization of multiple subsectors, providing positive community benefits, and the ability to achieve market liftoff and catalyze follow-on investments beyond the award.

Integrated Project Schedule

As described in Section 4.6.2.2 under the "Engineering, Procurement, Construction, and Operations" subsection, the applicant must provide a schedule for the entire project, including task and subtask durations, milestones, and Go/No-Go decision points. Projects that can justify an ability to execute on shorter time horizons will be prioritized as defined in the Technical Review Criteria.

4.6.2.3 Community Benefits Plan: Job Quality and Equity

(PDF)	**File Naming Convention:** ControlNumber_LeadOrganization_CBP

Advanced industrial technologies supported by this program can and should provide meaningful benefits to surrounding communities and the workforce. To ensure these goals are met, applications must include a CBP that describes how the proposed project will: support meaningful community and labor engagement; invest in America's workforce through quality job creation; advance DEIA; and contribute to the President's goal that 40% of the overall benefits of climate and clean energy investments flow to disadvantaged communities (the Justice40 Initiative). Section 50161(g)(2) of IRA specifically supports these goals by giving priority to projects that "provide the greatest benefit for the greatest number of people within the area in which the eligible facility is located."[130] For projects under all Topic Areas, the CBP must make clear the type and quantity of benefits provided specifically to the members of the community or communities in the vicinity of the host site(s).

The sections below outline the requirements for these goals and priorities. Requirements are intentionally flexible to generate the best approaches from the project team that are responsive to impacted communities, workers, and other groups. If there is content overlap between a specific CBP section and other parts of the CBP or the overall application, applicants should point reviewers to more comprehensive efforts addressed elsewhere. In cases where information is incomplete, applicants should clearly explain the reason for missing information and provide plans to address those gaps during the project.

[130] 42 U.S.C. § 17113b(d)(2).

Within the CBP, the applicant is encouraged to provide specific detail on how to ensure accountability and the delivery of measurable benefits, ideally through the use of negotiated agreements between the applicant and the community or communities and/or the applicant and labor unions referred to collectively here as "Workforce and Community Agreements".[131] Such agreements facilitate community and labor input and social buy-in, identify how concerns will be mitigated, and specify the distribution of community and economic benefits (including job quality, access to jobs and business opportunities for local residents, and mitigating community harms), thus reducing or eliminating these types of risks.

Plans should be specific, actionable, and measurable with the intent to move beyond vision or assessment to concrete goals, outcomes, and implementation plans. Each CBP section should therefore propose specific milestones and metrics to measure progress. Applicants are encouraged to use SMART milestones whenever possible. Major milestones and work descriptions relevant to the plan should be included within the project schedule, workplan, budget, and other key documents. Each section should also include information about the resources intended to implement the specified activities. For multi-site projects, CBPs should address all impacted communities.

The CBP should provide the most details regarding actions the applicant would take during Phase 1 but should also describe in a higher-level summary what goals, deliverables, outcomes, and implementation strategies the applicant would pursue in Phases 2 – 4.

When DOE selects a specific project, DOE will provide feedback and require an updated CBP during award negotiations. Public transparency around community benefit activities can support project success and buy-in, and DOE will work to develop publicly available summaries of the CBP with project performers after awards are made as appropriate. Applicants and awardees may share details of their CBP with stakeholders and other parties at their own discretion.

Awardees must implement their CBP as part of carrying out the project; the CBP is expected to deepen and evolve during each phase for awarded projects. During the life of the award DOE or its representative(s) will independently evaluate the recipient's implementation status and effectiveness, including as part of the Go/No-Go review process.

Applicants are also encouraged to provide Community and Labor Partnership Documentation from representative organizations reflecting substantive engagement and feedback on applicant's approach to community benefits. These letters of support should be submitted under the Community Partnership Documentation (see Section 4.6.2.4) and do not count toward the CBP page limit.

[131] Workforce and Community Agreements include good neighbor agreements, community benefits agreements, community workforce agreements, project labor agreements, and other collective bargaining agreements.

Detailed guidance and examples on creating each section of the CBP will be provided under the application documents section on the OCED eXCHANGE website at https://OCED-Exchange.energy.gov. Applicants are encouraged to read these resources prior to writing their CBP. Applicants are also encouraged to leverage information generated in other portions of this FOA to support CBP development, including the Environmental Considerations Summary, TEA, and LCA.

This Plan must address the technical review criterion titled, "Criterion 5: Community Benefits Plan (20%)." See Section 5.2.2.

1. **Community and Labor Engagement**
   The CBP must describe the applicant's actions to date and future plans to engage with labor unions, Tribes, and community stakeholders – such as community-based organizations representing local residents and businesses, workforce development organizations, local government, emergency responders, communities with environmental justice concerns, disadvantaged communities, and community-based organizations that support or work with disadvantaged communities. By facilitating community input, social buy-in, and accountability, such engagement can substantially reduce or eliminate stalls or slowdowns, litigation, and other risks associated with project implementation.

   Community and labor engagement should be responsive to the priorities of impacted groups, ensure community and labor input can impact project decisions, and support transparency and accountability. Ideally, engagement can lay groundwork for eventual negotiation of Workforce and Community Agreements, which could take the form of one or more kinds of negotiated agreements with communities, labor unions, or, ideally, both.

   If awarded and in conjunction with DOE, awardees will also identify to DOE any federally recognized Indian Tribes (who are not project partners), which include Alaska Native Regional Corporations and Village Corporations, for whom the proposed project may have implications. The awardee will provide information to support DOE's development of a Tribal engagement plan that acknowledges each Tribe's consultation policies, traditions, and expectations, and adheres to DOE Order 144.1 on Tribal consultation. Appropriate mitigation will be identified through government-to-government consultation to off-set any such potentially adverse implications. DOE is and remains responsible for government-to-government consultation with any federally recognized Indian Tribes, which include Alaska Native Regional Corporations and Village Corporations about the proposed project.
   At minimum, the Community and Labor Engagement section should include the following elements:
   - **Background and Experience.** A description of prior and ongoing efforts by the project team to engage community stakeholders, Tribes, and workforce organizations including labor unions in all impacted communities.

- **Community History and Dynamics**. A description of the current and historical social, cultural, economic, labor, and environmental landscape, decision-making structures, and other relevant information about the project's affected areas and groups. This is a first step of "getting to know the area" that should be completed before conducting a more structured stakeholder analysis and can identify sources of influence and conflicts to establish a foundation for proactive engagement around major projects.

- **Stakeholder Analysis**. A description of key stakeholder groups (subsectors, labor unions, communities, organizations, etc.); how they were identified; and anticipated level of engagement (e.g., advisory committee, working group member, active public participant).
- **Existing Community and Labor Support**. A description of any existing labor and surrounding community/communities support for and/or concerns with the project and existing facility (if applicable), including a description of steps taken to gather this information. This may reference the "Community and Labor Partnership Documentation" if appropriate.
- **Engagement Implementation Strategies, Methods, and Timeline.** A proposed engagement plan which includes objectives for engagement and when and how project teams will engage stakeholders, workforce organizations including labor unions, and communities. This should include a description of specific engagement methods (e.g., listening sessions, town halls, open houses, mediated discussions) matched to project phases and goals. Applicants should describe how they will extend these methods to include traditionally excluded stakeholders, especially those in the project's vicinity. If selected, awardees will work in conjunction with the Department of Energy to develop a Tribal engagement plan as appropriate. <u>This section should demonstrate how engagement will explicitly address topics related to changes in air pollution, other waste streams, and quality job retention or creation.</u>
- **Two-way Engagement Statement.** A statement discussing how the project will incorporate community input from all communities within the vicinity of project sites. The statement should describe elements of the project where engagement can impact project decisions or characteristics—and specifically identify whether project site(s) could be changed based on social considerations and what opportunities exist for community participation in and access to project data.
- **Workforce and Community Agreements Statement.** A description of any plans to negotiate a Community Benefits Agreement, Good Neighbor Agreement, Project Labor Agreement, Community Workforce Agreement, and/or other collective bargaining agreements. Given project complexity and sensitivities, applicants should consider pursuing multiple agreements. Applicants proposing multi-site projects should consider agreements with each impacted community.
- **Engagement Evaluation Strategy.** A description of how stakeholder engagement success will be evaluated, including evaluation of stakeholder perceptions of the progress.
- **Resource Summary.** A summary of the resources dedicated to implementing the plan including staff with relevant expertise and budget.

2. Investing in the American Workforce

A well-qualified, skilled, and trained workforce is necessary to ensure project stability, continuity, and success. High-quality jobs are critical to attracting and retaining the qualified workforce required.

This section should describe the applicant's comprehensive plan for the creation and retention of high-paying quality jobs and development of a skilled workforce. Meaningful engagement with labor unions can be a key component of job quality and workforce development and is covered in detail in the community and labor engagement section.

At minimum, the Investing in the American Workforce section should include the following elements:

- **Background and Experience.** A summary of the project team's previous or ongoing efforts to provide above average pay and benefits to properly classified employees in both the construction and ongoing operations; support the rights of workers to a free and fair chance to join a union; ensure worker involvement in workplace health and safety plans; and invest in workforce education and training.
- **Quality Jobs.** A description of plans to attract, and retain a skilled, qualified, local, and diverse workforce for construction, ongoing operations/production/maintenance, and scale-up activities. This should describe the quality of jobs the project will create (i.e., wages– beyond prevailing wages and benefits for construction or average wages and benefits for the region and industry as applicable, opportunities for wage progression, classification as employees, jobs for in-state workers, etc.). Describe how these jobs will be sufficiently attractive to skilled and trained workers under competitive labor market conditions.
- **Workforce Development.** A description of plans for workforce development, including:
    - Investing in workforce education and training (e.g., labor-management training programs, registered apprenticeships, partnerships with community colleges, and sector-based approaches to workforce development);
    - Supporting workers' skill acquisition and opportunities for advancement; and
    - Utilizing an appropriately credentialed workforce (e.g., requirements for appropriate and relevant professional and safety training, certification, and licensure, including where appropriate utilization of graduates from registered apprenticeship programs).

- **Worker Rights.** Employees' ability to organize, bargain collectively, and participate, through labor organizations of their choosing, in decisions that affect them; contribute to the effective conduct of business; and facilitate amicable settlements of any potential disputes between employees and employers, providing assurances of project efficiency, continuity, and multiple public benefits. Provide information including:
    - How the applicant will ensure workers can form and join unions of their choosing, and how they will have the opportunity to organize within the workplace during construction and ongoing operations. An affirmative commitment could be an intention or willingness to permit union recognition through card check (as opposed to requiring union elections); intention or willingness to enter into binding arbitration to bargain first contracts with a union; a pledge to allow union organizers access to appropriate onsite non-work places (e.g. lunch rooms); and/or other supportive commitments or pledges.
    - Plans to ensure project success and continuity by mitigating labor disputes or strikes (e.g., good faith negotiations, etc.);
    - Activities and policies to ensure worker engagement in the design and execution of workplace safety and health plans;
    - Plans to ensure workplace health and safety and worksites are free from harassment and discrimination;
    - Descriptions of how Project Labor Agreements or Community Workforce Agreements will be utilized in construction activity (e.g., collective bargaining agreements between unions and contractors that govern terms and conditions of employment for all workers on a construction project); and
    - Plans to track retention rates and address areas of worker or workplace concern.
- **Milestones and Timelines.** A list of milestones and timelines for the proposed activities.
- **Resource Summary.** A description of project resources dedicated to implementing activities including staff with relevant expertise and budget.

3. **Diversity, Equity, Inclusion, and Accessibility**

The CBP must include a section describing how DEIA objectives will be incorporated into the project. The section should detail how the applicant will partner with underrepresented businesses, educational institutions, and training organizations that serve workers who face barriers to accessing quality jobs, and/or other project partners to help address DEIA.

Minority Serving Institutions, Minority Business Enterprises, Minority-Owned Businesses, Woman-Owned Businesses, Veteran-Owned Businesses, Tribal Colleges and Universities, community-based groups, faith-based organizations, or entities located in an underserved community that meet the eligibility requirements are encouraged to participate on the application team. The Selection Official may consider the inclusion of these types of entities as part of the selection decision.

DEIA plans should describe steps taken to ensure an inclusive workplace environment committed to equal opportunity and free of harassment. This should include compliance with civil rights obligations and nondiscrimination laws, including Title VI of the Civil Rights Act of 1964 (2 U.S.C. §§ 2000d *et seq.*) and implementing regulations, the Americans with Disabilities Act of 1990 (ADA), Section 504 of the Rehabilitation Act of 1973, and all other applicable civil rights laws and regulations. Note that DOE regulations for "Non-Discrimination in Federally Assisted Programs or Activities" are codified at 10 C.F.R. Part 1040.

At minimum, the DEIA section should include the following elements:

- **Background and Experience.** A description of prior and ongoing efforts by the project team relevant to DEIA.
- **Strategies, Milestones, and Timelines.** A description of targeted DEIA outcomes and implementation strategies, including milestones and timelines. For example, applicants can discuss any commitments to partner with Minority Business Enterprises, Minority Owned Businesses, Woman Owned Businesses, and Veteran Owned Businesses for contractor support needs; plans to partner with workforce training organizations serving under-represented communities and those facing systemic barriers to quality employment such as those with disabilities, returning citizens, opportunity youth, and veterans; and/or plans to provide comprehensive support services to increase representation and access in project's construction and operations jobs.
- **Resource Summary.** A description of project resources dedicated to implementing DEIA activities including staff with relevant expertise and budget.

4. **Greatest Benefit for the Greatest Number**

Section 50161 of IRA specifies priority consideration to be given for projects that provide the "greatest benefit for the greatest number of people within the area in which the eligible facility is located." Applicants must describe the type and magnitude of benefits that will flow to those within the area in which the eligible facility or facilities is/are located ("surrounding community/communities"). This section should include an assessment of benefits; a description of plans to measure, track, and report benefits; and a strategy to ensure these anticipated benefits are delivered. This section also includes an assessment of potential negative impacts and ways to minimize and mitigate them. Applicants must address how their plans will be transparent and accountable to surrounding communities.

This section may summarize, or reference information already described in other parts of the CBP or application but must clearly delineate benefits to the *surrounding community or communities within the vicinity of the facility or facilities* specifically.

- **Assessment of facility/facilities vicinity and surrounding community/communities.** If not clearly described within the Community and Labor Engagement Section, the applicant should describe what boundaries are used to define the "surrounding community/communities" and the methodology use to make that determination. For example, applicants could describe areas of effect related to pollution reduction and worker recruitment in relation to nearby population areas. Multi-site projects should include this description for each site. Applicants should also describe how many people are within the defined area(s) and the source used to make that determination.
- **Surrounding Community Benefits.** Applicants should describe in detail all anticipated project benefits. This description should include the expected magnitude of those benefits and under what conditions they could occur. This description should clearly enumerate:
    - Specific project benefits (type and magnitude) and metrics that will be used to track each benefit. At a minimum, applicants should discuss any benefits related to creation or retention of quality jobs and reductions of air pollution, water pollution, and other waste streams;
    - Where/to whom project benefits are expected to flow within the surrounding community/communities; and
    - How well the anticipated benefits align with the surrounding community's/communities' priorities ascertained through community engagement.
- **Surrounding Community Negative Impacts**. Applicants should describe all anticipated project negative impacts. If this project could result in air or water pollution, ecological impacts, aesthetic, historic, cultural, economic, social, or health impacts, applicants should clearly describe the expected magnitude of those impacts and under what conditions they could occur. Consider direct impacts, indirect impacts, and cumulative impacts. This section may refer to the impacts identified in the NEPA Environmental Considerations Summary. This description should clearly enumerate:
    - Specific project negative impacts (type and magnitude) and metrics that will be used to track each impact;
    - Where/to whom impacts are expected to flow within the surrounding community/communities;
    - How additional project negative impacts relate to the existing concerns of the surrounding community/communities.
- **Assessment of information gaps.** Describe where additional work is needed to fully assess or measure potential project benefits or negative impacts or impacted communities. Applicants should outline research, engagement, and analytical goals to clarify the unknowns as part of their implementation plan.

- **Implementation Plan, Milestones and Timelines**. An Implementation plan which includes strategies, methods, and milestones to maximize benefits, minimize negative impacts and measure, track, and report impacts. Applicants should specifically address what instrumentation, testing, and data analysis will be used to monitor air pollution and water pollution during the entire project lifecycle, including baseline information if at an existing facility. Applicants should clearly describe how the plan includes accountability, feedback, and transparency mechanisms with the surrounding community/communities, such as community agreements and access to/participation in collecting project data.
- **Addressing barriers to realizing benefits and minimizing negative impacts**. A discussion of potential barriers to realizing benefits and minimizing negative impacts and plans for mitigating those barriers.
- **Resource Summary**. Describe resources dedicated to implementing the plan including staff with relevant expertise and budget.

5. **Justice40 Initiative**

   Applicants must provide an overview of benefits to disadvantaged communities that the project can deliver, supported by measurable milestones, and a description of plans to advance EEJ through their project. Justice40 impacts should be quantifiable, measurable, and trackable. If no project sites or related activities are located within or near a community and/or disadvantaged communities, applicants should provide a detailed explanation to support this conclusion.

   This section may summarize or reference information already described in other parts of the CBP but must clearly delineate impacts to *disadvantaged communities* specifically.

   At minimum, the Justice40 Initiative section should include the following elements:

   - **Background and Experience**. A description of any prior or ongoing efforts by the project team to advance EEJ.
   - **Assessment of disadvantaged communities**. An identification of disadvantage communities to which anticipated project benefits and negative impacts will flow.[132] For each disadvantaged community, applicants should characterize the existing burdens they are facing using EJSCREEN, disadvantaged community definition tools, or other analytic tools. Applicants should include which tool was used in their analysis. Impacts to communities and Tribes/Alaska Native Corporations should be considered for all inputs and outputs along all four phases of the project, in addition to impacts at the project site(s) or work location(s).

[132] Pursuant to E.O. 14008 and the Office of Management and Budget's Interim Justice40 Implementation Guidance M-21-28, DOE has developed a definition and tools to locate and identify disadvantaged communities. These resources can be located at https://energyjustice.egs.anl.gov/. DOE will also recognize disadvantaged communities as defined and identified by the White House Council of Environmental Quality's Climate and Economic Justice Screening Tool (CEJST), which can be located at https://screeningtool.geoplatform.gov/. DOE's Justice40 Implementation Guidance is located at https://www.energy.gov/sites/default/files/2022-07/Final%20DOE%20Justice40%20General%20Guidance%20072522.pdf.

- **Project benefits to disadvantaged communities.** Applicants should describe in detail what benefits will flow to disadvantaged communities. This should include a description of how and when anticipated benefits are expected to flow to disadvantaged communities. Benefits should be quantifiable, measurable, and trackable, and at minimum discuss the relevance of each of the eight DOE Justice40 Initiative benefits:
  (1) Decrease in energy burden;
  (2) Decrease in environmental exposure and burdens;
  (3) Increase in access to low-cost capital;
  (4) Increase in job creation, the clean energy job pipeline, and job training for individuals;
  (5) Increases in clean energy enterprise creation and contracting (e.g., minority-owned or disadvantaged business enterprises);
  (6) Increases in energy democracy, including community ownership;
  (7) Increased parity in clean energy technology access and adoption; and (8) Increase in energy resilience.
- **Project negative impacts to disadvantaged communities**. Applicants should note which of the negative impacts mentioned above (Subsection 4. Greatest Benefit for the Greatest Number) will flow to disadvantaged communities. This description should clearly enumerate the type and quantity of negative impacts expected to flow to disadvantaged communities, metrics that will be used to track each impact, and how additional project negative impacts will interact with existing cumulative burdens.[133]
- **Implementation Plan, Milestones and Timelines**. An Implementation plan which includes strategies to maximize benefits, minimize negative impacts, and measure, track, and report impacts specifically to disadvantaged communities. Applicants should clearly describe how the plan includes accountability, feedback, and transparency mechanisms with the disadvantaged communities.
- **Resource Summary**. Describe resources dedicated to implementing the plan including staff with relevant expertise and budget.

For projects funded under this FOA, DOE may provide specific reporting guidance for the community benefits topics described above.

[133] Within the context of cumulative impacts created by the project, applicants should use Environmental Protection Agency EJSCREEN tool to quantitatively discuss existing environmental impacts in the project area. *See* https://www.epa.gov/ejscreen.

4.6.2.4 Community Partnership Documentation

(PDF, each letter may not exceed 3 pages)	**File Naming Convention:** ControlNumber_LeadOrganization_PartnerDoc

In support of the CBP, applicants may submit documentation to demonstrate existing or planned partnerships with Tribes and community entities, such as, organizations that work with local stakeholders such as residents and businesses, organizations that carry out workforce development programs, trade associations, worker organizations including labor unions, Tribal organizations, and community-based organizations that work with disadvantaged communities. The Partnership Documentation could be in the form of a letter on the partner's letterhead outlining the planned partnership signed by an officer of the entity, a Memorandum of Understanding, or other similar agreement. Such letters must state the specific nature of the partnership and must not be general letters of support. If the applicant intends to enter into a Workforce and Community Agreement as part of the CBP, please include letters from proposed partners as appropriate.

4.6.2.5 Resumes

(PDF, 2 pages each)	**File Naming Convention:** ControlNumber_LeadOrganization_Resumes

A resume must be provided for all senior and key personnel. A resume provides information that may be used by reviewers to evaluate the individual's relevant skills, and experience of the personnel. Applicants must submit a two-page resume for each project manager, senior, and key personnel that includes the following:

1. Contact information;
2. Education: Include all academic institutions attended, major/area, degree;
3. Training: e.g., certification or credential from a Registered Apprenticeship or Labor Management Partnership;
4. Professional Experience: Beginning with the current position, list professional/academic positions in chronological order with a brief description;
5. List all current academic, professional, or institutional appointments, foreign or domestic, at the applicant institution or elsewhere, whether remuneration is received, and, whether full-time, part-time, or voluntary; and
6. There should be no lapses in time over the past ten years or since age 18, whichever time period is shorter.

4.6.2.6 Letters of Commitment

(PDF, 1 page each)	**File Naming Convention:** ControlNumber_LeadOrganization_LOCs

Submit letters of commitment from all subrecipient and third-party cost share providers. If applicable, the letter must state that the third-party cost share provider is committed to providing a specific minimum dollar amount or value of in-kind contributions allocated to cost sharing. The following information for each third party contributing to cost sharing should be identified: (1) the name of the organization; (2) the proposed dollar amount to be provided; and (3) the proposed cost sharing type (cash or in-kind contributions). Each letter must not exceed 1 page.

Letters of support or endorsement for the project from entities that do not have a substantive role in the project are not accepted. Letters of support are not required for project partners that are not contributing to cost share.

4.6.2.7 Budget and Budget Justification

(MS Excel)	ControlNumber_LeadOrganization_Budget_Justification ControlNumber_LeadOrganization_Subrecipient_Budget_Justification

The Budget and Budget Justification must include the Budget Justification Workbook, Subrecipient budget justification (if applicable), Contract budget justification (if applicable), and Budget for DOE/NNSA FFRDC (if applicable) as necessary elements.

Budget Justification Workbook

Applicants must complete the Budget Justification Workbook, which is available on OCED eXCHANGE at https://OCED-exchange.energy.gov/. Applicants 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 must include costs associated with implementing the various requirements as applicable (e.g., Buy America requirements for infrastructure projects, Davis-Bacon Act, CBP, reporting, oversight) and with required annual audits and incurred cost proposals in their proposed budget documents. Such costs may be reimbursed as a direct or indirect cost.

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 above File Naming Convention for the title.

Subrecipient Budget Justification

Applicants must provide a separate budget justification for each subrecipient that is expected to perform work. The budget justification must include the same justification information described in the "Budget Justification Workbook" section above. Save each subrecipient budget justification in a Microsoft Excel file using the above File Naming Convention for the title.

Funding, Cost Share and Subaward with FFRDC

DOE will NOT fund DOE/NNSA FFRDCs participating as a subrecipient through the DOE field work authorization process. DOE will NOT fund non-DOE/NNSA FFRDCs through an interagency agreement with the sponsoring agency. Therefore, the prime recipient and FFRDC are responsible for entering into an appropriate subagreement that will govern, among other things, the funding of the FFRDC portion of the work from the prime recipient under its DOE award. Such an agreement must be entered into before any project work begins.

The applicant must prepare the budgets utilizing rates appropriate for funding the FFRDCs through subawards. The applicant's non-federal 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.

4.6.2.8 Summary for Public Release

(PDF, 1 page)	**File Naming Convention:** ControlNumber_LeadOrganization_Public_Release

Applicants must submit a one-page summary of their project that is suitable for dissemination to the public. It should be a self-contained document that identifies the name of the applicant, the lead project manager/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), major participants (for collaborative projects), and the project's commitments and goals described in the CBP. This document must not include any proprietary or sensitive business information as DOE may make it available to the public after selections are made.

4.6.2.9 Summary Slide

(MS PowerPoint, 1 slide)	**File Naming Convention:** ControlNumber_LeadOrganization_Slide

Applicants must provide a single slide summarizing the proposed project. The Summary Slide template must include the following information:

- Project title, prime recipient, principal investigator/lead project manager, and senior/key personnel information;
- Requested total project costs with DOE funds and applicant cost share;

- Relevant Topic Area;
- Project summary including a description of project impact;
- Proposed project metrics and goals;
- Topline community benefits;
- Industry value proposition; and
- Key graphics (illustrations, charts and/or tables).

4.6.2.10 Environmental Considerations Summary

(PDF)	**File Naming Convention:** ControlNumber_LeadOrganization_Environmental_Considerations

DOE's decision whether and how to distribute federal funds under this FOA is subject to NEPA (42 U.S.C. §§ 4321 *et seq.*). The applicant's responses will assist DOE in determining the appropriate level of NEPA review (if your proposal is selected) and in preparing a categorical exclusion (CX), environmental assessment (EA), or environmental impact statement (EIS), if necessary. While not all information may be available at the proposal stage, please provide as much detail and information as is currently available. Consultation with experts or advisors in your organization to assist with your responses is highly recommended.

1. **Please provide a brief summary of the proposed project.** Describe proposed activities (not goals and objectives) and specify if this project is part of a larger project or connected to another project.

2. **Is there ongoing or anticipated federal government involvement in any aspect of this project (e.g., funding, permitting, technical assistance, project located on federally administered land)?** If "yes," please list the agency and describe the nature of the involvement.

3. **Is the project fully defined (i.e., all sites and activities are known)?** If "no", please describe the sites and/or activities/tasks that are yet to be defined.

4. **Add a table including column headers shown below for each location where proposed project activities would take place:**

Proposed location	Setting of the proposed location and the current condition or use of the site	General description of the proposed activities	Land administration
Physical address or coordinates	Urban, industrial, suburban, agricultural, university campus, manufacturing facility, etc.	Example: Retrofit	Example: Federal [specify BLM, USFS, etc.], Tribal, state, local, private

5. **Attach a map showing the location(s) of the proposed project, and a site layout map showing the proposed facilities and associated infrastructure.** *(A GIS shapefile is preferrable, if available.)* The map showing the location(s) of the proposed project and site layout map requested with the Environmental Considerations Summary may be submitted as separate files and may be in larger engineering formats. While the maps may be created as a GIS shapefile or other engineering formats, the maps must be saved and submitted as a PDF file.

6. **Describe new facilities to be constructed, any modifications of existing facilities, and any new infrastructure or facilities necessary for the construction or operation of the proposed project.** *(e.g., access roads, laydown areas, off-site parking areas, railroad links, docks, water outfalls and intakes, pipelines, electrical transmission, waste treatment facilities, etc.)*

7. **Identify and describe any existing, modifications to, or new permits, licenses, or authorizations that would be required to perform project activities.** *(e.g., environmental permits, operating permits, or drilling permits)*

8. **Provide a brief description of the existing environmental burdens at the proposed project location(s) and surrounding areas, including those contributed to or exacerbated by existing facilities the project will leverage or modify.**

   Existing environmental burdens can be identified using available tools, such as DOE's Energy Justice Dashboard (beta) (https://www.energy.gov/diversity/energy-justicedashboard-beta) or the U.S. EPA's EJSCREEN (https://www.epa.gov/ejscreen).

9. **Would any of the following have the potential to be impacted (directly or indirectly) by the proposed project?** If "yes", provide a detailed description of: (1) the resources that could be affected, and (2) how project activities may affect those resources (including potential direct and indirect [visual, noise, etc.] impacts).

   a. Tribal lands or resources of Tribal interest and/or sensitivity.
   b. Environmental justice (EJ) populations (EJ populations include minority, low income, and Tribal populations).
   c. Historic, archeological, or cultural resources (includes listed and eligible resources over 50 years old or of cultural significance).
   d. Areas having a special designation (e.g., federal and state designated wilderness areas, national parks, national natural landmarks, wild and scenic rivers, state and federal wildlife refuges, and marine sanctuaries).
   e. Threatened or endangered species (whether proposed or listed by state or federal governments), including their habitat.
   f. Land resources (e.g., prime farmland, unique farmland, or other farmland of statewide or local importance, tundra, rainforests).
   g. Floodplains.
   h. Wetlands.
   i. Air quality (indoor and/or outdoor).

j. GHG emissions.
k. Water quality (surface and/or ground water and/or special sources of water including sole source aquifers).
l. Ocean resources (e.g., coral reefs) or coastal zones.
m. Marine mammals or essential fish habitat land use.
n. Socioeconomic conditions.
o. Sensitive receptors (e.g., hospitals, schools, daycare facilities, elderly housing).
p. Navigable airspace.
q. Transportation infrastructure.

10. **Please describe:**

a. Coordination or discussions that have been initiated or the plan to coordinate with state and/or federal agencies (e.g., State Historic Preservation Office, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, Nuclear Regulatory Commission, etc.).
b. Coordination or discussions that have been initiated with Tribal governments.
c. Issues that would generate public controversy regarding the proposed project.
d. Studies, reviews, and/or plans that have been completed for the proposed project (e.g., environmental site assessments, waste management plans, health and safety plans, cultural resource surveys, identification of prime or unique farmland, wildlife surveys, etc.).
e. Environmental considerations and/or mitigation strategies that have been incorporated into the proposed project (e.g., measures to reduce and/or avoid GHG emissions, and/or impacts to cultural resources, historic properties, state or federally protected species, wetlands, floodplains, traffic, ambient noise, etc.).
f. Discussions with affected communities.

4.6.2.11 Current and Pending Support Disclosures

(PDF)	**File Naming Convention:** ControlNumber_LeadOrganization_Current_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 lead project manager and all 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 connections with foreign government-sponsored talent recruitment programs must be identified in current and pending support.

For every activity, list the following items:

- Sponsor of the activity or the source of funding;

- Award or other identifying number;
- 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;
- 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;
- Award period (start date – end date); and
- Person-months of effort per year being dedicated to the award or activity.

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. Supporting documents of any identified source of support must be provided to DOE on request, including certified translations of any document.

The lead project manager(s) 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. §§ 3729-3733 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.

Definitions:

Current and pending support
(a) All resources made available, or expected to be made available, to an individual in support of the individual's research, development, demonstration, and deployment (RDD&D) efforts, regardless of

i. whether the source is foreign or domestic;
ii. whether the resource is made available through the entity applying for an award or directly to the individual; or
iii. whether the resource has monetary value; and

(b) includes in-kind contributions requiring a commitment of time and directly supporting the individual's RDD&D efforts, such as the provision of office or laboratory space, equipment, supplies, employees, or students. This term has the same meaning as the term Other Support as applied to researchers in NSPM-33:

For researchers, "Other Support" includes all resources made available to a researcher in support of and/or related to all of their professional RDD&D efforts, including resources provided directly to the individual or through the organization, and regardless of monetary value (e.g., even if the support received is only in-kind, such as office/laboratory space, equipment, supplies, or employees).

This includes resource and/or financial support from all foreign and domestic entities, including but not limited to, gifts provided with terms or conditions, financial support for laboratory personnel, and participation of student and visiting researchers supported by other sources of funding.

Senior/key personnel – an individual who contributes in a substantive, meaningful way to the scientific development or execution of a RDD&D project proposed to be carried out with DOE award.[134]

4.6.2.12 SF-LLL: Disclosure of Lobbying Activities

(PDF)	**File Naming Convention:** ControlNumber_LeadOrganization_SF-LLL

Prime recipients and subrecipients may not use any federal funds to influence or attempt to influence, directly or indirectly, any officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress, in connection with any Federal contract, grant, loan, or cooperative agreement. In addition, if any registrants under the Lobbying Disclosure Act of 1995 have made a lobbying contact on behalf of the applicant (including with non-federal funds) with respect to this funding opportunity, the applicant must complete and submit SF-LLL, "Disclosure of Lobbying Activities" (https://www.grants.gov/web/grants/forms/sf-424-individual-family.html).

[134] Typically, these individuals have doctoral or other professional degrees, although individuals at the masters or baccalaureate level may be considered senior/key personnel if their involvement meets this definition. Consultants, graduate students, and those with a postdoctoral role also may be considered senior/key personnel if they meet this definition.

4.6.2.13 Potentially Duplicate Funding Notice

(PDF)	**File Naming Convention:** ControlNumber_LeadOrganization_DuplicateFunding

If the applicant or project team member has other active awards of federal funds, the applicant must determine whether the activities of those awards potentially overlap with the activities set forth in its application to this FOA. If there is a potential overlap, the applicant must notify DOE in writing of the potential overlap and state how it will ensure any project funds (i.e., recipient cost share and federal funds) will not be used for identical cost items under multiple awards.

Likewise, for projects that receive funding under this FOA, if a recipient or project team member receives any other award of federal funds for activities that potentially overlap with the activities funded under the DOE award, the recipient must promptly notify DOE in writing of the potential overlap and state whether project funds from any of those other federal awards have been, are being, or are to be used (in whole or in part) for one or more of the identical cost items under the DOE award.

If there are identical cost items, the recipient must promptly notify the DOE Contracting Officer in writing of the potential duplication and eliminate any inappropriate duplication of funding.

4.6.2.14 Transparency of Foreign Connections

(PDF)	**File Naming Convention:** ControlNumber_LeadOrganization_ForeignConnections

Applicants must identify the following as they relate to the proposed recipient and subrecipients:

1. Identity of all owners and covered individuals who are a party to any Foreign Government-Sponsored Talent Recruitment Program of a foreign country of risk (i.e., China, Iran, North Korea, and Russia);

2. Existence of any joint venture or subsidiary that is based in, funded by, or has a foreign affiliation with any foreign country of risk;

3. Current or pending contractual or financial obligation or other agreement specific to a business arrangement, or joint venture-like arrangement with an enterprise owned by a foreign state or any foreign entity;

4. Percentage, if any, that the proposed recipient or subrecipient has foreign ownership or control;

4. Percentage, if any, that the proposed recipient or subrecipient is wholly or partially owned by an entity in a foreign country of risk;

5. Percentage, if any, of venture capital or institutional investment by an entity that has a general partner or individual holding a leadership role in such entity who has a foreign affiliation with any foreign country of risk;

6. Technology licensing or intellectual property sales to a foreign country of risk, during the 5-year period preceding submission of the proposal; and

7. Foreign business entity, offshore entity, or entity outside the United States related to the proposed recipient or subrecipient.

DOE reserves the right to request additional or clarifying information based on the information submitted.

Save the Transparency of Foreign Participation information in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_ForeignConnections."

4.7 Intergovernmental Review

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

4.8 Funding Restrictions

4.8.1 Allowable Costs

All expenditures must be allowable, allocable, and reasonable in accordance with the applicable federal cost principles. Pursuant to 2 C.F.R. § 910.352, the cost principles in the Federal Acquisition Regulations (48 C.F.R. Part 31 Subpart Part 31.2) apply to for-profit entities. The cost principles contained in 2 C.F.R. Part 200, Subpart E apply to all entities other than for-profits.

4.8.2 Pre-Award Costs

Applicants selected for award negotiations 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 DOE Grants and Agreements Officer. Pre-award costs cannot be incurred prior to the Selection Official signing the Selection Statement and Analysis.

Pre-award expenditures are made at the applicant's risk. OCED 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 applicant anticipated. This includes 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 DOE completing the NEPA review process.

4.8.3 Buy America Requirements for Infrastructure Projects

Pursuant to the Build America, Buy America Act (referred to here as "Buy America") in Title IX of Division G of the BIL, federally assisted projects that involve infrastructure work undertaken by applicable recipient types, require that:

- All iron, steel, and manufactured products used in the infrastructure work are produced in the United States; and
- All construction materials used in the infrastructure work are manufactured in the United States.

Whether a given project must apply this requirement is project-specific and dependent on several factors, such as the recipient's entity type, whether the work involves "infrastructure" as that term is defined in Section 70912 of the BIL, and whether the infrastructure in question is publicly owned or serves a public function.

Applicants are strongly encouraged to assess whether their project may have to apply this requirement, both to make an early determination as to the need of a waiver, as well as to determine what impact, if any, this requirement may have on the proposed project's budget. More information is available at https://www.energy.gov/management/build-america-buy-america.

4.8.4 Davis-Bacon Act Requirements

Projects awarded under Topic Area 1 of this FOA will be funded under Division D of the BIL. Accordingly, per section 41101 of the BIL, all laborers and mechanics employed by the recipient, subrecipients, contractors or subcontractors in the performance of construction, alteration, or repair work funded in whole or in part under this FOA shall be paid wages at rates not less than those prevailing on similar projects in the locality, as determined by the Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code commonly referred to as the "Davis-Bacon Act" (DBA). There are weekly reporting requirements.

Recipients of funding under Topic Area 1 of this FOA will also be required to undergo DBA compliance training and to maintain competency in DBA compliance. The Grants and Agreements Officer will notify the recipient of any DOE sponsored DBA compliance trainings. The Department of Labor offers free Prevailing Wage Seminars several times a year that meet this requirement, at https://www.dol.gov/agencies/whd/government-contracts/construction/seminars/events.

For additional guidance on how to comply with the DBA provisions and clauses, see https://www.dol.gov/agencies/whd/government-contracts/construction and https://www.dol.gov/agencies/whd/government-contracts/protections-for-workers-in-construction.

Projects awarded under Topic Areas 2 and 3 of this FOA will be funded under section 50161 of the IRA. Section 50161 of the IRA is not a Davis-Bacon Related Act and the above-stated DBA requirements do not apply.

4.8.5 Risk Assessment

Pursuant to 2 C.F.R. § 200.206, DOE will conduct an additional review of the risk posed by applications submitted under this FOA.

Such risk assessment will consider:

1. Financial stability;
2. Quality of management systems and ability to meet the management standards prescribed in 2 C.F.R. Part 200 as amended and adopted by 2 C.F.R. Part 910;
3. History of performance;
4. Audit reports and findings; and
5. Applicant's ability to effectively implement statutory, regulatory, or other requirements imposed on non-federal entities.

In addition, the risk assessment should include assessment of community opposition, potential labor disputes, availability of a skilled workforce, and public and worker health and safety considerations.

DOE may make use of other publicly available information. DOE may also make use of the history of an applicant's performance under DOE or other federal agency awards. DOE reserves the right to ask for information pertaining to prior practices or violations at facilities included in the applicant's proposal. Depending on the severity of the findings and whether the findings were resolved, DOE may elect not to fund the applicant.

In addition to this review, DOE must comply with the guidelines on government-wide suspension and debarment in 2 C.F.R. Part 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.

The applicant should consider that for large construction projects, DOE may require a Project Labor Agreement (PLA), an agreement between a private entity (or entities) and a labor organization (or organizations) representing individuals who will be working on a construction project. Assessment of applicability will be conducted on a case-by-case basis.

Further, as DOE invests in critical infrastructure and funds critical and emerging technology areas, DOE also considers possible threats to United States research, technology, and economic security from undue foreign influence when evaluating risk. If high risks are identified and cannot be sufficiently mitigated, DOE may elect to not fund the applicant.

4.8.6 Human Subjects Research

No funding will be provided under this FOA for any activities involving human subjects.

4.8.7 Performance of Work in the United States (Foreign Work Waiver)

a. Requirement
All work performed under awards issued under this FOA must be performed in the United States. The recipient must flow down this requirement to its subrecipients.

b. Failure to Comply
If the recipient fails to comply with the Performance of Work in the United States requirement, DOE may deny reimbursement for the work conducted outside the United States and such costs may not be recognized as allowable recipient cost share.
The recipient is responsible should any work be performed outside the United States, absent a waiver, regardless of whether the work is performed by the recipient, subrecipients, contractors, or other project partners.

c. Waiver
To seek a foreign work waiver, the applicant must submit a written waiver request to DOE. Appendix C lists the information that must be included in a request for a foreign work waiver.

4.8.8 Prohibition related to Foreign Government-Sponsored Talent Recruitment Programs

4.8.8.1 Prohibition

Persons participating in a *Foreign Government-Sponsored Talent Recruitment Program of a Foreign Country of Risk* are prohibited from participating in projects selected for federal funding under this FOA. Should an award result from this FOA, the recipient must exercise ongoing due diligence to reasonably ensure that no individuals participating on the DOE-funded project are participating in a *Foreign Government-Sponsored Talent Recruitment Program of a Foreign Country of Risk*. Consequences for violations of this prohibition will be determined according to applicable law, regulations, and policy.

Further, the recipient must notify DOE within five (5) business days upon learning that an individual on the project team is or is believed to be participating in a foreign government talent recruitment program of a foreign country of risk. DOE may modify and add requirements related to this prohibition to the extent required by law.

4.8.8.2 Definitions

Foreign Government-Sponsored Talent Recruitment Program. An effort directly or indirectly organized, managed, or funded by a foreign government, or a foreign government instrumentality or entity, to recruit science and technology professionals or students (regardless of citizenship or national origin, or whether having a full-time or part-time position). Some foreign government-sponsored talent recruitment programs operate with the intent to import or otherwise acquire from abroad, sometimes through illicit means, proprietary technology or software, unpublished data and methods, and intellectual property to further the military modernization goals and/or economic goals of a foreign government.

Many, but not all, programs aim to incentivize the targeted individual to relocate physically to the foreign state for the above purpose. Some programs allow for or encourage continued employment at United States research facilities or receipt of federal research funds while concurrently working at and/or receiving compensation from a foreign institution, and some direct participants not to disclose their participation to U.S. entities. Compensation could take many forms including cash, research funding, complimentary foreign travel, honorific titles, career advancement opportunities, promised future compensation, or other types of remuneration or consideration, including in-kind compensation.

Foreign Country of Risk. DOE has designated the following countries as foreign countries of risk: Iran, North Korea, Russia, and China. This list is subject to change.

4.8.9 Affirmative Action and Pay Transparency Requirements

All federally assisted construction contracts exceeding $10,000 annually will be subject to the requirements of Executive Order 11246, as amended, Equal Employment Opportunity.

1. Recipients, subrecipients, contractors, and subcontractors are prohibited from discriminating in employment decisions on the basis of race, color, religion, sex, sexual orientation, gender identity, or national origin.
2. Recipients and Contractors are required to take affirmative action to ensure that equal opportunity is provided in all aspects of their employment. This includes flowing down the appropriate language to all subrecipients, contractors, and subcontractors.
3. Recipients, subrecipients, contractors, and subcontractors are prohibited from taking adverse employment actions against applicants and employees for asking about, discussing, or sharing information about their pay or, under certain circumstances, the pay of their co-workers.

The Department of Labor's ("DOL") Office of Federal Contractor Compliance Programs ("OFCCP") uses a neutral process to schedule contractors for compliance evaluations. OFCCP's Technical Assistance Guide should be consulted to gain an understanding of the requirements and possible actions the recipients, subrecipients, contractors, and subcontractors must take. The OFCCP Technical Assistance Guide is located at: https://www.dol.gov/sites/dolgov/files/ofccp/Construction/files/ConstructionTAG.pdf?msclkid=9e397d68c4b111ec9d8e6fecb6c710ec. Additional guidance may also be found in the National Policy Assurances, produced by DOE.

Additionally, for construction projects valued at $35 million or more and lasting more than one year, the recipients, subrecipients, contractors, and subcontractors may be selected by OFCCP to participate in the *Mega Construction Project Program*. DOE, under relevant legal authorities including Sections 205 and 303(a) of Executive Order 11246, will require participation as a condition of the award. This program offers extensive compliance assistance with EO 11246. For more information regarding this program, see https://www.dol.gov/agencies/ofccp/construction/mega-program.

4.9 Other Submission Requirements

4.9.1 Post Submission Materials and Just-In-Time Documents

Some materials will be required as post submission materials that are due after the merit review is complete. The applicant will be notified on what documents and materials to submit, the format required, and where and when to submit.

4.10 Administrative and National Policy Requirements

To receive a federal award under this FOA, all applicants must follow applicable cross-cutting administrative and national policy requirements. The policies are requirements based on social, economic, or other objectives or considerations that may be attached to the expenditure of federal funds by award recipients, consortium participants, and contractors, in general, or may relate to the expenditure of federal funds for other specified activities.

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.

These administrative and national policy requirements include, but are not limited, to the following:

- Clean Air Act (42 U.S.C. § 7401 *et seq.*)
- Clean Water Act (33 U.S.C. § 1251 *et seq.*)
- National Flood Insurance Act of 1968 and Flood Disaster Prevention Act of 1973 (42 U.S.C. § 4001 *et seq.*), DOE regulations at 10 C.F.R. Part 1022, and Executive Order 13690 – establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d *et seq.*) and DOE regulations at 10 C.F.R. Part 1040 Subpart B
- Section 504 of the Rehabilitation Act of 1973 as amended (29 U.S.C. § 794) and DOE regulations at 10 C.F.R. Part 1040 Subpart D
- Age Discrimination Act of 1975 as amended (42 U.S.C. § 6101 *et seq.*) and DOE regulations at 10 C.F.R. Part 1040 Subpart E
- Title IX of the Education Amendments of 1972 (20 U.S.C. § 1681 *et seq.*) and DOE regulations at 10 C.F.R. Part 1042
- Federal Funding and Transparency Act of 2006; 2 C.F.R. Part 170

5.0 Application Review Information

5.1 Compliance Criteria

All applicant submissions must:

- Comply with the applicable content and form requirements listed in Section 4.0 of the FOA;
- Include all required documents;
- Upload successfully in OCED eXCHANGE including clicking the "Submit" button; and
- Comply with the submission deadline stated in the FOA.

DOE will not review or consider submissions submitted through means other than OCED eXCHANGE, submissions submitted after the applicable deadline, or incomplete submissions.

5.2 Technical Review Criteria

5.2.1 Concept Papers

Concept Papers are evaluated based on 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:

- Applicant clearly describes the proposed scope of the demonstration project including the key technologies and systems, total cost of the project, and non-federal cost share amount, GHG emissions reductions, proposed timeline, and other applicant proposed metrics.

- Applicant clearly identifies how the proposed project would ultimately facilitate a transition to significant industrial decarbonization in the U.S., including the decarbonization potential of the project itself, the replicability and uptake potential of the technology or technologies used, and the market potential of the manufactured low-carbon product(s), including existing or potential procurement commitments prioritizing low-embodied carbon materials and products and/or partnerships with clean product purchasers, if available.
- Degree to which the proposed project aligns with and demonstrates potential to accelerate progress within demand-side objectives set forth in the Buy Clean Initiative and/or the First Movers Coalition.
- Where appropriate, the applicant demonstrates how it plans to leverage other federal and/or state programs and partnerships.
- Applicant has identified a preliminary project development plan and timeline, including a finance plan, any key risks, challenges, and possible mitigation strategies, and has shown the impact that DOE funding and the proposed project would have on supporting decarbonization goals.
- Applicant and proposed team have the qualifications, experience, capabilities, and other resources necessary to design, develop, build, and operate the proposed project.
- Description of strategies to ensure meaningful community and labor engagement, quality jobs and workforce development, DEIA, benefits to the surrounding community, the Justice40 Initiative, and methods to ensure accountability for all strategies.
- Proposed work, if successfully accomplished, would meet the objectives as stated in the FOA, including achieving market liftoff and attracting follow-on investments from the private sector.

5.2.2 Applications

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

Criterion 1: Technical Merit, Innovation, and Impact (25%)

This criterion involves consideration of the following factors:

- Degree to which the proposed technologies achieve GHG emissions reduction from carrying out the project.[135]
- Extent to which the application specifically and convincingly demonstrates how the proposed project will be capable of meeting the technical objectives outlined in the FOA.
- Degree to which the proposed project can justify an ability to quickly achieve its technical objectives, proposed production rate, and build out the related infrastructure to expand end use markets.

[135] Section 50161(d)(1) of the IRA (42 U.S.C. § 17113b(d)(1)).

- Degree to which the proposed technologies are replicable, and through demonstration, will enable and encourage broader industry-wide acceleration toward net-zero GHG emissions.
- Adequacy of metrics in the preliminary lifecycle analysis provided to describe the proposed project's reduction in carbon intensity in comparison to baseline and benchmark technologies.
- Adequacy of the details in the preliminary techno-economic analysis to justify viability and feasibility of the project and the value proposition and timeline of the technology to be replicated.
- Degree to which the proposed technologies and integrated systems are clearly described in the application. This includes the sufficiency of technical detail provided in the application addressing whether the proposed technologies and systems are commercially viable (i.e., able to deploy at scale).
- Adequacy and clarity of the risk assessment and risk management discussion. These components should include a demonstrated understanding of the key technical, construction, regulatory, permitting, safety, scale-up, supply chain, and infrastructure integration risks involved in the proposed work as well as the quality of the mitigation strategies to address them. Adequate and accurate assessment of project readiness should also be included.
- Degree to which the proposed project can benefit workers and the surrounding communities by reducing safety burdens and/or mitigating risk, either through safer processes and products, reduced waste and emissions, or other sustainability co-benefits to decarbonization.
- Where appropriate, the extent to which the applicant demonstrates how it plans to leverage other federal and/or state programs and partnerships.

Criterion 2: Financial and Market Viability (20%)

This criterion involves consideration of the following factors:

- Degree to which the applicant assesses and demonstrates potential market competitiveness and sustainability for the proposed project, technology, and manufactured product(s) through market analysis and offtake agreements.[136]
- Availability, credibility, and risk/terms of non-federal cost share sources and funds necessary to meet ongoing cost share needs. This includes the ability to leverage DOE financial assistance funding from this FOA with state and local incentives and private financing.
- Degree to which the applicant addresses each key participating organization's financial commitment to the proposed project including overall financial strength and financial capability to implement the proposed plan.
- Degree to which the application justifies the proposed project's economic viability, sustainability, and potential growth beyond DOE funding, including achieving market adoptability and follow-on investments.

[136] *See* section 50161(d)(2) of the IRA (42 U.S.C. § 17113b(d)(2)).

- Degree to which the proposed project aligns with and demonstrates potential to accelerate progress within demand-side objectives set forth in the Buy Clean Initiative, Federal Sustainability Plan, and/or the First Movers Coalition.
- Degree to which the proposed project utilizes and leverages available regional resources such as infrastructure, workforce, supplies, or equipment to meet the required FOA objectives.
- Adequacy and justification of the proposed budget and spend plan covering both DOE funding and non-federal cost share. This includes applicant's ability to provide contingency to meet unknown project cost overruns often seen with large demonstration projects.
- Adequacy of the business plan for developing key project agreements such as financing, acquisition strategies, power purchase agreements, supply chain, offtake (sales) agreements, and other relevant project documents.
- Adequacy and clarity of the financial risk management discussion and a demonstrated understanding of financial and market risks involved in the proposed work, as well as the quality of the mitigation strategies to address them.

Criterion 3: Workplan (15%)

This criterion involves consideration of the following factors:

- Overall reasonableness of the Integrated Project Schedule based on the associated complexity of the proposal.
- Degree to which the proposed Workplan and critical path have been clearly and thoroughly described and thoughtfully considered.
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed Workplan will succeed in meeting the project goals.
- Strength and level of clarity in the definition of the project phases, metrics, Integrated Project Schedule, and Go/No-Go criteria.
- Strength of the deliverables as defined in the application, such that DOE and independent experts will be able to review key technical, financial, regulatory, permitting, and community benefit milestones at appropriate project Go/No Go decision points to mitigate project risk and enable the successful design, procurement, construction, and operation of the proposed project.
- Potential for disruption to current facility operations and the degree to which a management plan for that disruption is presented.
- Extent to which the CBP is integrated into the project management schedule and provides mechanisms with measurable actions that enable impacts to project direction in a timely manner.

Criterion 4: Management Team and Project Partners (20%)

This criterion involves consideration of the following factors:

- Capability of the prime recipient, the proposed team, and key personnel to manage and address all aspects of the proposed work with a high probability of success.
- Qualifications and relevant experience, including number of years, demonstrated safety performance history, and specific project experience, of the key project participants in performing similar projects and the allocation of responsibility commensurate with this experience.
- Reasonableness of time commitment from key personnel to successfully manage a project of this size and complexity.
- Level of participation by project participants as evidenced by letter(s) of commitment or support and how well they are integrated into the Workplan.
- Degree to which existing facilities and/or infrastructure provided by the applicant team are leveraged to support the project.
- Strength of the project management discussion in the project Workplan to give confidence in a high likelihood of project success.
- Degree to which the applicant has defined and described a project management structure that addresses interfaces with DOE and key team members.
- Clarity and appropriateness of the roles of the team members.
- Adequacy and clarity of the risk management discussion as it pertains to the project team and project management aspects of the proposed project.
- Demonstrated understanding of key team and project management risks involved in the proposed work, as well as the quality of the mitigation strategies to address them.

Criterion 5: Community Benefits Plan (20%)

Overall Approach

- Extent to which the actions outlined in the CBP are supported by enforceable, negotiated Workforce and Community Agreements (e.g., good neighbor agreements, workforce agreements, project labor agreements, collective bargaining agreements, and similar agreements).
- Extent to which the team and resources—including staff, facilities, capabilities, and budget—are capable of implementing plans outlined in the CBP.
- Extent to which the CBP is integrated into the project management schedule and other key documents and provides mechanisms, supported by measurable actions, to impact project direction in a timely manner.

Community and Labor Engagement

- Extent to which the project demonstrates a clear and appropriately robust plan to meaningfully engage local stakeholders, including community-based organizations, organizations that support or work with disadvantaged communities, labor unions and/or Tribes, in a manner that can impact project decisions.

- Extent to which the applicant demonstrates community and labor engagement to date that results in support for the proposed project.

Investing in the American Workforce

- Extent to which the CBP demonstrates that the jobs supported by the proposed project will be quality jobs and provides a robust and credible plan to attract and retain skilled workers (e.g., through a workforce and community agreement and commitment to workers' free and fair choice to join a union or labor organization of their choosing, and/or commitments to wages above prevailing wage requirements, benefits, or other worker support).
- Extent to which the CBP demonstrates plans to invest in workforce education and training, support workers' skill acquisition and opportunities for advancement, and utilize an appropriately credentialed workforce, including but not limited to partnerships with high-quality workforce development programs.

Diversity, Equity, Inclusion, and Accessibility

- Extent to which the CBP includes specific and high-quality actions to meet DEIA goals, which may include DEIA recruitment procedures, supplier diversity plans, and other DEIA initiatives; and
- Quality of partnerships and agreements with apprenticeship readiness programs, or community-based workforce training and support organizations serving workers facing systematic barriers to employment to facilitate participation in the project's construction and operations, with supportive services to help train, place, and retain individuals from underrepresented communities in good-paying jobs or registered apprenticeships.

Greatest Benefit for the Greatest Number (IRA Priority Consideration)

- Extent to which the proposal will provide the greatest benefit for the greatest number of people within vicinity of facilities, including high-paying jobs with the free and fair chance to join a union at both the construction and the long-term O&M phases and reduction of criteria emissions, other waste streams, and other environmental impacts.[137]

Justice40 Initiative

- Extent to which the CBP identifies specific and measurable benefits, how the benefits will flow, and how negative impacts would be mitigated for disadvantaged communities.
- Extent to which the project illustrates the ability to support the overall goal of the Justice40 Initiative that 40% of the overall benefits of certain federal investments flow to disadvantaged communities.

[137] Section 50161(d)(3) of the IRA (42 U.S.C. § 17113b(d)(3)).

5.3 Standards for Application Evaluation

Applications that are determined to be eligible will be evaluated in accordance with this FOA and the guidance provided in the "DOE Merit Review Guide for Financial Assistance and Unsolicited Proposals" available at https://www.energy.gov/management/articles/merit-review-guide-financial-assistance-and-unsolicited-proposals-current.

5.4 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 DOE contractors. The applicant, by submitting its application, consents to the use of non-federal reviewers/administrators. Non-federal reviewers must sign conflict of interest and non-disclosure acknowledgements (NDA) prior to reviewing an application. Non-federal personnel conducting administrative activities must sign an NDA.

5.5 Other Selection Factors

5.5.1 Program Policy Factors

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

IRA Priority Considerations:

- Degree to which the proposed project contributes to a portfolio that enables the highest potential for greenhouse gas emissions reductions in industry;
- Degree to which the proposed project contributes to a portfolio that provides the greatest benefit for the greatest number of people;
- Extent to which the proposed project contributes to a portfolio that ensures the maximum potential for the output of selected projects to be purchased and builds demand for low-carbon products;

Other Factors:

- Degree to which the proposed project exhibits technological diversity in technology and implementation approach when compared to the existing DOE project portfolio and other projects selected from the subject FOA;
- Level of industry involvement and demonstrated ability to accelerate demonstration and commercialization and overcome key market barriers;
- Potential for the project to contribute to a portfolio that shifts an industry or market ecosystem toward a low-carbon product;
- Degree to which the proposed demonstration supports secure, resilient domestic clean energy supply chains;

- Degree to which the proposed project will accelerate industry-wide movement toward net-zero by substantially increasing transparency of embodied emissions and/or demonstrating substantial ability to accelerate movement of global or domestic standards or U.S. government supported purchasing coalitions (First Movers Coalition) for embodied emissions toward net-zero;
- Degree to which the proposed project is likely to lead to increased high-quality employment and manufacturing in the United States;
- 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;
- Degree to which the proposed project, or group of projects, represent a desired geographic distribution (considering past awards and current applications);
- Degree to which the proposed technological approach has broad public support from the communities most directly impacted by the project;
- Degree to which the project contributes to a portfolio that meets Justice40 requirements and meets the goals reflected in the CBP criteria by producing additional benefits to communities, particularly disadvantaged communities, such as, reducing co-pollutants and other environmental (e.g., air, water) burdens;
- Degree to which the proposed project incorporates applicant or team members from Minority Serving Institutions (e.g., Historically Black Colleges and Universities (HBCUs)/Other Minority Serving Institutions); and partnerships with minority business enterprises, minority-owned businesses, woman-owned businesses, veteran-owned businesses, or Tribal nations;
- Degree to which the project will increase the availability of low- or zero-carbon U.S. iron, steel, manufactured products, and construction materials for infrastructure projects (including, for example, projects to build or improve domestic transportation, electric grid, and broadband infrastructure);
- Degree to which the proposed project will employ procurement of U.S. iron, steel, manufactured products, and construction materials;
- Degree to which the project's solution or strategy will maximize deployment or replication;
- Degree to which the proposed project promotes onshoring of critical manufacturing operations and supports the enhancement of American competitiveness in a global net-zero economy.

5.6 Evaluation and Selection Process

5.6.1 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.

5.6.2 Pre-Selection Interviews and Site Visits

As part of the evaluation and selection process, DOE may invite one or more applicants to participate in pre-selection interviews. Pre-selection interviews are distinct from and more formal than pre-selection clarifications (see Section 5.6.3). The invited applicant(s) will meet with DOE representatives to provide clarification on the contents of the applications and to provide DOE an opportunity to ask questions regarding the proposed project. The information provided by applicants to DOE through pre-selection interviews contributes to DOE's selection decisions.

DOE will arrange to meet with the invited applicants in person at DOE's offices or a mutually agreed upon location. DOE may also arrange site visits at certain applicants' facilities. In the alternative, DOE may invite certain applicants to participate in a one-on-one conference with DOE via webinar, videoconference, or conference call. The pre-selection interviews and site visits may also include discussions with affected stakeholders or communities potentially impacted to understand their concerns/risks. In the alternative, DOE may invite certain applicants to participate in a one-on-one meeting with DOE virtually.

DOE will not reimburse applicants for travel and other expenses relating to the pre-selection interviews or site visits, nor will these costs be eligible for reimbursement as pre-award costs.

Participation in pre-selection interviews or site visits with DOE does not signify that applicants have been selected for award negotiations.

5.6.3 Pre-Selection Clarification

DOE 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. 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 response to DOE's written clarification questions or video or conference calls with DOE representatives.

The information provided by applicants to DOE through pre-selection clarifications is incorporated in their applications and contributes to the merit review evaluation and DOE's selection decisions.

If DOE 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.

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

5.6.4 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)[138]).

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

DOE will consider any written comments by the applicant, in addition to the other information in the designated integrity and performance system, in making a judgment about the applicant's integrity, business ethics, and record of performance under federal awards when completing the review of risk posed by applicants as described in 2 C.F.R. § 200.206.

5.6.5 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.

5.7 Anticipated Notice of Selection and Award Negotiation Dates

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

[138] *See* 41 U.S.C. § 2313

6.0 Award Administration Information

6.1 Notifications

6.1.1 Ineligible Submissions

Ineligible Concept Papers and applications will not be further reviewed or considered for award. The Grants and Agreements Officer will send a notification letter by email to the technical and administrative points of contact designated by the applicant in OCED eXCHANGE. The notification letter will state the basis upon which the Concept Paper or the Application is ineligible and not considered for further review.

6.1.2 Concept Paper Notifications

DOE will notify applicants of its determination to encourage or discourage the submission of an application. DOE will post these notifications to OCED eXCHANGE. DOE may include general comments provided from reviewers on an applicant's Concept Paper in the encourage/discourage notifications.

Applicants may submit an application even if they receive a notification discouraging them from doing so. By discouraging the submission of an application, DOE 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 an application that is unlikely to be selected for award negotiations.

6.1.3 Application Notifications

DOE 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 OCED eXCHANGE.

The notification letter will inform the applicant whether or not its application was selected for award negotiations. Alternatively, DOE may notify one or more applicants that a final selection determination on particular applications will be made at a later date, subject to the availability of funds or other factors.

6.1.4 Successful Applicants

Receipt of a notification letter selecting an 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 DOE to issue an award.

Applicants do not receive an award until award negotiations are complete and the Grants and Agreements 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 OCED eXCHANGE with whom DOE will communicate to conduct award negotiations. The applicant must be responsive during award negotiations by providing requested documentation, including just-in-time documentation and meeting the negotiation deadlines. If the applicant fails to do so or if award negotiations are otherwise unsuccessful, DOE will cancel the award negotiations and rescind the Selection. DOE reserves the right to terminate award negotiations at any time for any reason.

6.1.5 Alternate Selection Determinations

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

6.1.6 Unsuccessful Applicants

DOE 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.

6.2 Award Conditions and Reporting

Recipients of an award made under this FOA must comply with requirements of all applicable federal, state, and local laws, regulations, DOE policy and guidance, instructions in this FOA, and the award terms and conditions. Applicants must require subrecipients' compliance with all applicable requirements. Reporting requirements are identified on the Federal Assistance Reporting Checklist, attached to the award agreement.

7.0 Questions/Agency Contacts

Upon the issuance of a FOA, DOE 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 this FOA must be submitted to OCED_Industrial@hq.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 OCED eXCHANGE at: https://OCED-exchange.energy.gov. You must first select this specific FOA Number to view the questions and answers specific to this FOA. OCED 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 OCED eXCHANGE website should be submitted to: OCED-ExchangeSupport@hq.doe.gov, with the FOA name and number included in subject line.

8.0 Other Information

8.1 Treatment of Application Information

DOE takes very seriously the confidentiality of all applicants and will treat information submitted in applications, as well as the identity of applicants, as confidential to the fullest extent permissible under Federal law. For DOE to protect confidential information, the applicant must also treat the information as confidential and properly mark it as described below. DOE will not be able to protect information that the applicant has released publicly or is in the public domain. For additional information on DOE's Freedom of Information Act (FOIA) regulations, see 10 C.F.R. Part 1004.

Applicants should not include business sensitive (e.g., commercial or financial information that is privileged or confidential), trade secrets, proprietary, or otherwise confidential information 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 business sensitive, trade secrets, proprietary, or otherwise confidential information, it is furnished to the federal government (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 FOIA.

Without assuming any liability for inadvertent disclosure, DOE 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.

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 FOIA 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 application, and other submissions 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.

Important Guidance for Company Submitters:

As per DOE's FOIA regulations and Department of Justice FOIA guidance, if DOE receives a FOIA request the following general steps will be taken:

1) DOE will review the request to determine whether your company's information is subject to the request. Only federal records are subject to FOIA requests. Depending on the circumstances, information submitted by an outside entity may be considered "federal records" for purposes of FOIA.
2) If your company information is determined to be a federal record and responsive to a FOIA request, DOE will review what is submitted in order to determine if DOE can make a determination whether the information is legally exempt.
    a) If DOE determines your information is fully exempt under an exemption and that it will not be released, DOE may not contact you.
    b) If DOE is unable to determine whether the information is exempt under an exemption or is planning on releasing some or all of your information, DOE will first contact you in order for you to have an opportunity to respond and provide additional justification as to why it may be exempt. DOE will do all that it can to work with company submitters to be in compliance with the law and maintain positive relations with company submitters.
    c) It is critical if DOE or DOE's contractors who are processing your FOIA contact you that you respond in a timely manner. DOE is under strict deadlines when processing a FOIA request.

8.2 Retention of Submissions

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

8.3 Personally Identifiable Information

All information provided by the applicant must to the greatest extent possible exclude Personally Identifiable Information (PII), which is 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.[139] 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 collecting, using, and displaying unnecessary SSNs.[140]

8.4 Informational Webinar

DOE will conduct one or more informational webinars during the FOA process. It will be held after the initial FOA release but before the due date for the full application.

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.

8.5 Teaming Partner List

DOE is compiling a "Teaming Partner List" to facilitate the formation of new project teams for this FOA. The teaming partner list allows organizations who may wish to participate on an application to express their interest to other applicants and to explore potential partnerships.

Updates to the teaming partner list will be available in OCED eXCHANGE. The teaming partner list will be regularly updated to reflect new teaming partners who provide their organization's information.

SUBMISSION INSTRUCTIONS: Any organization that would like to be included on this list should submit the following information: Organization Name, Contact Name, Contact Address, Contact Email, Contact Phone, Organization Type, Area of Technical Expertise, Brief Description of Capabilities, and Description of Need in a Partner.

Interested parties should email the information to OCED_Industrial@hq.doe.gov with the subject line "Teaming Partner Information."

---

[139] "Memorandum M-07-16: Safeguarding Against and Responding to the Breach of Personally Identifiable Information," Office of Management and Budget, May 2007, https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/memoranda/2007/m07-16.pdf.

[140] *See* the Federal Information Security Modernization Act of 2014 (Pub. L. No. 113-283, Dec 18, 2014; 44 U.S.C. § 3551).

DISCLAIMER: By submitting a request to be included on the teaming partner list, the requesting organization consents to the publication of the above-referenced information. By facilitating the teaming partner list, DOE is not endorsing, sponsoring, or otherwise evaluating the qualifications of the individuals and organizations that are self-identifying themselves for placement on this teaming partner list. DOE will not pay for the provision of any information, nor will it compensate any applicants or requesting organizations for the development of such information.

8.6 Uniform Commercial Code Financing Statements

Per 2 C.F.R. § 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 DOE'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 Grants and Agreements 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 Grants and Agreements 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 Grants and Agreements Officer may direct.

8.7 Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment

As set forth in 2 C.F.R. § 200.216, applicants and subrecipients are prohibited from obligating or expending project funds (federal funds and recipient cost share) to procure or obtain; extend or renew a contract to procure or obtain; or enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Section 889 of Public Law 115-232, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

See Public Law 115-232, Section 889, 2 C.F.R. § 200.216, and 2 C.F.R. § 200.471 for additional information.

8.8 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); and
- Class Patent Waiver.

DOE may issue 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 DOE within the timeframes set forth in the award's intellectual property data terms and conditions. Any patent waiver that may be granted is subject to certain terms and conditions in 10 C.F.R. Part 784.

DETERMINATION OF EXCEPTIONAL CIRCUMSTANCES: 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 the U.S. Manufacturing Commitments section further below. A copy of the DEC can be found at https://www.energy.gov/gc/determination-exceptional-circumstances-decs. Pursuant to 37 C.F.R. § 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.

DOE may issue and publish on the website above further DECs prior to the issuance of awards under this FOA. DOE may require additional submissions or requirements as authorized by any applicable DEC.

8.9 Government Rights in Subject Inventions

Where Applicants retain title to subject inventions, the United States government retains certain rights.

Government Use License
The United States 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.

March-In Rights
The United States 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:

- 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;
- Owner or licensee has not taken action to alleviate health or safety needs in a reasonably satisfied manner;
- Owner has not met public use requirements specified by federal statutes in a reasonably satisfied manner; or
- The United States 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.

8.10 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 United States 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 United States 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 DOE 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 award's 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.

8.11 Copyright

The prime recipient and subrecipients may assert copyright in copyrightable works, such as software, first produced under the award without DOE 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.

8.12 Fraud, Waste, and Abuse

The mission of the DOE Office of Inspector General (OIG) is to strengthen the integrity, economy and efficiency of the DOE's programs and operations including deterring and detecting fraud, waste, abuse, and mismanagement.

The OIG accomplishes this mission primarily through investigations, audits, and inspections of DOE activities to include grants, cooperative agreements, loans, and contracts. The OIG maintains a Hotline for reporting allegations of fraud, waste, abuse, or mismanagement. To report such allegations, please visit https://www.energy.gov/ig/ig-hotline.

Additionally, recipients of DOE awards must be cognizant of the requirements of 2 C.F.R. § 200.113. Applicants and subrecipients (if applicable) are encouraged to allocate sufficient costs in the project budget to cover the costs associated for personnel and data infrastructure needs to support performance management and program evaluation needs including but not limited to independent program and project audits to mitigate risks for fraud, waste, and abuse.

8.13 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 United States industry and labor.

Therefore, in exchange for receiving taxpayer dollars to support an applicant's project, the applicant must agree to a U.S. Competitiveness provision requiring 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. Award terms, including the specific U.S. Competitiveness Provision applicable to the various types of recipients and projects, are available here.

Please note that a subject invention is any invention conceived or first actually reduced to practice in performance of work under an award. An invention is any invention or discovery which is or may be patentable. The recipient includes any awardee, recipient, sub-awardee, or sub-recipient.

As noted in the U.S. Competitiveness Provision, if 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 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 United States manufacturing plan.

The statement or plan would contain specific and enforceable commitments that would be beneficial to the United States economy and competitiveness.

Examples of such commitments could include manufacturing specific products in the United States, making a specific investment in a new or existing United States manufacturing facility, keeping certain activities based in the United States or supporting a certain number of jobs in the United States related to the technology. DOE may, in its sole discretion, determine that the proposed modification or waiver promotes commercialization and provides substantial United States economic benefits, and grant the request. If granted, DOE will modify the award terms and conditions for the requesting entity accordingly.

More information and guidance on the waiver and modification request process can be found in the DOE Financial Assistance Letter on this topic. Additional information on DOE's Commitment to Domestic Manufacturing for DOE-funded R&D is available here.

The U.S. Competitiveness Provision is implemented by DOE pursuant to a DEC under the Bayh-Dole Act and DOE Patent Waivers. See Section 8.8 Title to Subject Inventions for more information on the DEC and DOE Patent Waivers.

8.14 Government Right to Reject or Negotiate

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

8.15 Export Control

The United States government regulates the transfer of information, commodities, technology, and software considered to be strategically important to the United States 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".
All recipients and subrecipients are responsible for ensuring compliance with all applicable United States Export Control laws and regulations relating to any work performed under a resulting award.

The recipient must immediately report to DOE any export control violations related to the project funded under the DOE award, at the recipient or subrecipient level, and provide the corrective action(s) to prevent future violations.

8.16 Interim Conflicts of Interest Policy for Financial Assistance

The DOE Interim Conflict of Interest Policy for Financial Assistance (COI Policy) can be found here. The interim COI policy is applicable to all non-federal entities that receive DOE funding by means of a financial assistance award (e.g., a grant, cooperative agreement, or technology investment agreement) and, through the implementation of the interim COI policy by the entity, to each investigator who is planning to participate in, or is participating in, the project funded wholly or in part under the DOE financial assistance award. The interim COI policy establishes standards that provide a reasonable expectation that the design, conduct, and reporting of projects funded wholly or in part under DOE financial assistance awards will be free from bias resulting from financial conflicts of interest or organizational conflicts of interest. The Recipient is subject to the requirements of the interim COI policy, and the recipient must certify that it is compliant with all the requirements in the interim COI policy. The Recipient must flow down the requirements of the interim COI policy to any subrecipient non-federal entities.

APPENDIX A – APPLICATION REQUIREMENTS CHECKLIST

Component	File Format	Maximum Page Limit per Topic Area		File Name
		1 & 2	3	
SF-424 Application for Federal Assistance	PDF	N/A	N/A	ControlNumber_LeadOrganization_App424
Project Summary	PDF	2	2	ControlNumber_LeadOrganization_Project_Summary
Business Development and Management	PDF	13	11	ControlNumber_LeadOrganization_BDM
Business Development and Management	MS Excel	N/A	N/A	ControlNumber_LeadOrganization_BusinessCase
Engineering, Procurement, Construction, and Operations	PDF	13	10	ControlNumber_LeadOrganization_EPCO
Safety, Security, and Regulatory Requirements	PDF	5	4	ControlNumber_LeadOrganization_SafetySecurity
Risk Analysis and Mitigation	PDF	5	4	ControlNumber_LeadOrganization_RiskAnalysis
Techno-Economic Analysis and Life Cycle Analysis Projections	PDF	5	4	ControlNumber_LeadOrganization_TEA_LCA
Techno-Economic Analysis and Life Cycle Analysis Projections	MS Excel	N/A	N/A	ControlNumber_LeadOrganization_TEA ControlNumber_LeadOrganization_LCA
Workplan	PDF	7	5	ControlNumber_LeadOrganization_Workplan
Community Benefits Plan: Job Quality and Equity	PDF	15	10	ControlNumber_LeadOrganization_CBP
Community Partnership Documentation	PDF	3 each	3 each	ControlNumber_LeadOrganization_PartnerDoc
Resumes	PDF	2 each	2 each	ControlNumber_LeadOrganization_Resumes
Letters of Commitment	PDF	1 each	1 each	ControlNumber_LeadOrganization_LOCs
Budget Justification Workbook	MS Excel	N/A	N/A	ControlNumber_LeadOrganization_Budget_Justification
Subrecipient Budget Justification	MS Excel	N/A	N/A	ControlNumber_LeadOrganization_Subrecipient_Budget_Justification
Summary of Public Release	PDF	1	1	ControlNumber_LeadOrganization_Public_Release
Summary Slide	MS PowerPoint	1	1	ControlNumber_LeadOrganization_Slide
Environmental Considerations Summary	PDF	3 each	3 each	ControlNumber_LeadOrganization_Environmental_Considerations
Current and Pending Support Disclosures	PDF	N/A	N/A	ControlNumber_LeadOrganization_Current_Support
SF-LLL: Disclosure of Lobbying Activities	PDF	N/A	N/A	ControlNumber_LeadOrganization_SF-LLL
Potentially Duplicate Funding Notice	PDF	N/A	N/A	ControlNumber_LeadOrganization_DuplicateFunding
Transparency of Foreign connections	PDF	N/A	N/A	ControlNumber_LeadOrganization_ForeignConnections

APPENDIX B – LIST OF ACRONYMS

AOI	Area of Interest
BF	Blast furnace
BIL	Bipartisan Infrastructure Law
BTU	British Thermal Unit
CaO	Calcium Oxide
CAP	Criteria Air Pollutants
CBP	Community Benefits Plan
C.F.R.	Code of Federal Regulations
CO_2e	Carbon dioxide equivalents
DEC	Determination of Exceptional Circumstances
DEIA	Diversity, Equity, Inclusion, and Accessibility
DOE	Department of Energy
EAF	Electric arc furnace
EEJ	Energy and Environmental Justice
EIA	Energy Information Administration
EPA	Environmental Protection Agency
EPD	Environmental product declaration
FAPIIS	Federal awardee performance and integrity information system
FFRDC	Federally Funded Research and Development Center
FOA	Funding Opportunity Announcement
FOIA	Freedom of Information Act
GAAP	Generally Accepted Accounting Principles
GHG	Greenhouse Gas
HAP	Hazardous Air Pollutant
IEDO	Industrial Efficiency and Decarbonization Office
IIJA	Infrastructure Investment and Jobs Act
IRA	Inflation Reduction Act
LCA	Life Cycle Analysis
MESC	Manufacturing Energy Supply Chain Office
MT/MMT	Metric tons/Million Metric Tons
NDA	Non-Disclosure Acknowledgement
NEPA	National Environmental Policy Act
NNSA	National Nuclear Security Administration
OCED	Office of Clean Energy Demonstrations
OMB	Office of Management and Budget
OTT	Office of Technology Transitions
PII	Personal Identifiable Information
SAM	System for Award Management
SPOC	Single Point of Contact
TCF	Technology Commercialization Fund
TEA	Techno-economic Analysis
TRL	Technology Readiness Level
UCC	Uniform Commercial Code
UEI	Unique Entity Identifier
WBS	Work Breakdown Structure
WP	Work Proposal

APPENDIX C – WAIVER REQUESTS FOR FOREIGN ENTITY PARTICIPATION AND FOREIGN WORK

Waiver for Foreign Entity Participation

Many of the technology areas DOE funds fall in the category of critical and emerging technologies (CETs). CETs are a subset of advanced technologies that are potentially significant to United States national and economic security.[141] For projects selected under this FOA, all recipients and subrecipients must be organized, chartered, or incorporated (or otherwise formed) under the laws of a state or territory of the United States; have majority domestic ownership and control; 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 application.

Waiver Criteria

Foreign entities seeking to participate in a project under this FOA must demonstrate to the satisfaction of DOE that:

a. Participation is in the best interest of the United States industry and United States economic development;
b. Project team has appropriate measures in place to control sensitive information and protect against unauthorized transfer of scientific and technical information;
c. Adequate protocols exist between the United States subsidiary and its foreign parent organization to comply with export control laws and any obligations to protect proprietary information from the foreign parent organization;
d. Work is conducted within the United States and the entity acknowledges and demonstrates that it has the intent and ability to comply with the U.S. Competitiveness Provisions (see Section 8.13); and
e. Foreign entity will satisfy other conditions that may be deemed necessary by DOE to protect United States government interests.

[141] "Critical and Emerging Technologies List Update," National Science and Technology Council, Office of Science and Technology Policy, February 2022, https://www.whitehouse.gov/wp-content/uploads/2022/02/02-2022-Critical-and-Emerging-Technologies-List-Update.pdf.

Content for Waiver Request

A foreign entity waiver request must include the following:

a. Information about the entity: name, point of contact, and proposed type of involvement in the project;
b. Country of incorporation, the extent of the ownership/level of control by foreign entities, whether the entity is state owned or controlled, a summary of the ownership breakdown of the foreign entity and the percentage of ownership/control by foreign entities, foreign shareholders, foreign state or foreign individual(s);
c. Rationale for proposing that a foreign entity participate (must address the criteria above);
d. Description of the project's anticipated contributions to the United States economy;
e. Description of how the foreign entity's participation is essential to the project, including;
    - How the project will benefit the United States, including manufacturing, contributions to employment in the United States and growth in new markets and jobs in the United States;
    - How the project will promote manufacturing of products and/or services in the United States;
f. Description of the likelihood of Intellectual Property (IP) being created from the work and the treatment of any such IP; and
g. Countries where the work will be performed (Note: if any work is proposed to be conducted outside the United States, the applicant must also complete a separate foreign work waiver request).

DOE may also require:

- Assessment of risk with respect to intellectual property (IP) and data protection protocols that includes the export control risk based on the data protection protocols, the technology being developed and the foreign entity and country. These submissions could be prepared by the project lead (if not the prime recipient), but the prime recipient must make a representation to DOE as to whether it believes the data protection protocols are adequate and make a representation of the risk assessment – high, medium, or low risk of data leakage to a foreign entity.
- Additional language may be added to any agreement or subagreement to protect IP, mitigate risk, or other related purposes.
- Additional information before considering a waiver request.

DOE's decision concerning a waiver request is not appealable.

Waiver for Performance of Work in the United States (Foreign Work Waiver)

As set forth in Section 4.8.7 all work funded under this FOA must be performed in 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 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 DOE 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 for a foreign work waiver must include the following:

1. Rationale for performing the work outside of the United States ("foreign work");
2. Description of the work proposed to be performed outside the United States;
3. Explanation of how the foreign work is essential to the project;
4. Description of the anticipated benefits to be realized by the proposed foreign work and the anticipated contributions to the United States economy;
5. Associated benefits to be realized and the contribution to the project from the foreign work;
6. How the foreign work will benefit the United States, including manufacturing, contributions, to employment in the United States and growth in new markets and jobs in the United States;
7. How the foreign work will promote manufacturing of products and/or services in the United States;
8. Description of the likelihood of IP being created from the foreign work and the treatment of any such IP;
9. Total estimated cost (DOE and recipient cost share) of the proposed foreign work;
10. Country(ies) in which the foreign work is proposed to be performed; and
11. Name of the entity that would perform the foreign work. Information about the entity(ies) involved in the work proposed to be conducted outside the United States (e.g., the entity seeking a waiver and the entity(ies) that will conduct the foreign work).

DOE may require additional information before considering a waiver request.

DOE's decision concerning a waiver request is not appealable.

APPENDIX D – EXAMPLE PROJECT SUMMARY FOR FULL APPLICATIONS

Project Title:	OCED eXCHANGE Control Number:
Prime Applicant:	Topic Area:
Project Facility Location(s) by city, state, and zip code +4:	Area of Interest:
Team Member Organizations (e.g., Sub-Recipients, Key Technology Providers, and Project Partners):	
Senior/Key Personnel and Their Organizations:	
Do the proposed prime recipient and all subrecipients qualify as domestic entities*? ☐ Yes ☐ No If not, specify which entities do not qualify as domestic entities will require a foreign entity waiver here and include necessary foreign entity waivers with the application:	* To qualify as a domestic entity, the entity must be organized, chartered, or incorporated (or otherwise formed) under the laws of a particular state or territory of the United States; have majority domestic ownership and control; and have a physical place of business in the United States.
Demonstration Project Manager:	Email: Phone:
Business Point of Contact:	Email: Phone:
Confidentiality Statement (if applicable):	
Total Period of Performance *(yrs)*:	
Total DOE Funding Request *($M USD)*:	Total Non-Federal Cost Share *($M USD)*:

For each category, as applicable, please select all decarbonizing levers that this project will deploy:

On-site clean power:	Electrification:	Carbon capture: CO_2 source
☐ Renewables: _____	☐ High-T heat (400+ °C)	☐ Steam methane reformer
☐ Nuclear	☐ Mid-T heat (200 °C – 400 °C)	☐ Fuel cell
☐ Thermal Storage	☐ Low-T heat (-30 °C – 200 °C)	☐ Oxy-burner
☐ Electrical Storage	☐ Compressors/Pumps	☐ Coal
☐ Other: _____	☐ E-Cracker	☐ Biomass
Hydrogen Use:	☐ Power-to-X	☐ Calcination
☐ Process input	☐ Other:_____	☐ Other: _____
☐ High-T heat (400+ °C)	Energy Efficiency:	Carbon capture: Method
☐ Mid-T heat (200 °C – 400 °C)	☐ Compressors/pumps	☐ Post-combustion (solvent)
☐ Low-T heat (-30 °C – 200 °C)	☐ Process heating	☐ Pre-combustion (solvent)
☐ Other: _____	☐ Steam system	☐ Cryogenic
Alternative fuels/feeds:	☐ Refrigeration system	☐ Solid adsorbent
☐ Renewable Natural Gas	☐ Other machine drive	☐ Other: _____
☐ Biofuels	☐ Materials efficiency	Carbon capture: Post capture
☐ Waste	☐ HVAC	☐ Utilization
☐ Other: _____	☐ Other: _____	☐ Storage

Additional project information:

# of facilities impacted:	Has this project been submitted to any other DOE funding opportunities? ☐ Yes ☐ No If yes, state the funding opportunity number(s): _____ If yes, state the application number(s): _____	Infrastructure needs: ☐ Grid upgrade ☐ H_2 Pipeline ☐ CO_2 Pipeline/Well ☐ Other: _____