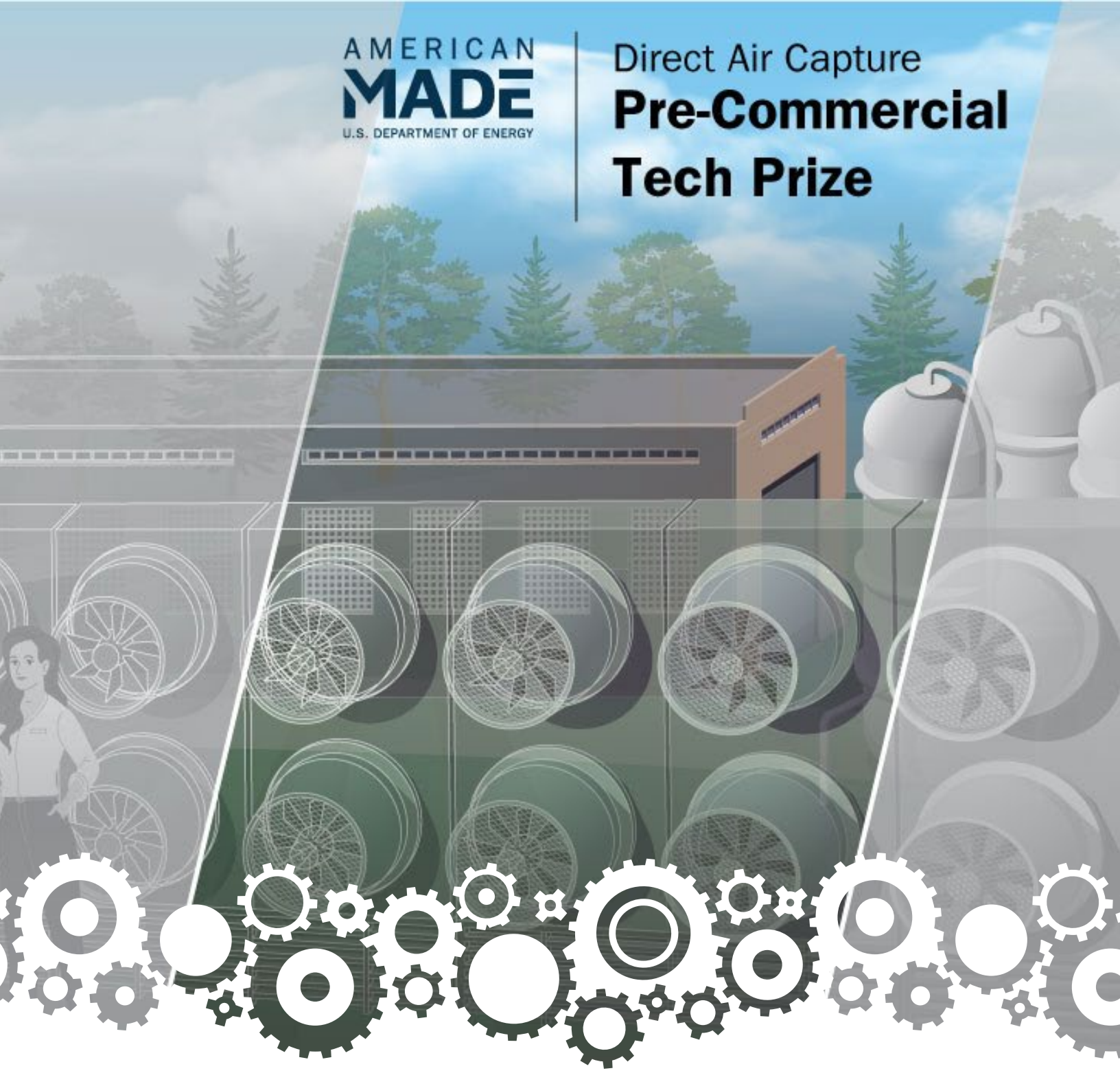

Official Rules

Direct Air Capture Pre-Commercial Technology Prize

THESE RULES ARE EFFECTIVE March 9, 2023

Preface

The Direct Air Capture (DAC) Pre-Commercial Technology Prize awards cash prizes to catalyze rapid DAC technology advancement. Teams must identify a critical need in the DAC industry, mature a breakthrough solution to address this gap, and test the idea to a specified degree of scale. The three-phase prize competition focuses on the steps of ideation and entrepreneurship needed to prepare a technology and business for commercialization. The development of innovative DAC technologies supports the Biden administration's decarbonization goals of a 50%–52% reduction in greenhouse gases (GHGs) from 2005 level emissions by 2030 and a net-zero GHG emission economy by 2050.

The U.S. Department of Energy's DAC Pre-Commercial Technology Prize will be governed by 15 U.S.C. §3719 and this Official Rules document. This is not a procurement under the Federal Acquisitions Regulations and will not result in a grant or cooperative agreement under 2 Code of Federal Regulations 200. The Prize Administrator reserves the right to modify this Official Rules document if necessary and will publicly post any such notifications as well as notify registered prize participants.

To learn more and sign up, go to https://www.herox.com/DAC-pre-commercial-tech.

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1 Program Summary

1.1 Direct Air Capture Pre-Commercial Prizes Overview

The American-Made Direct Air Capture (DAC) Pre-Commercial Prizes are a suite of prizes that work together in concert to advance DAC technologies and the incubators that make the technology innovation and development process possible. Funded by the U.S. Department of Energy's (DOE's) Office of Fossil Energy and Carbon Management (FECM), the DAC Pre-Commercial Prizes offer up to $15 million in prizes and support to be split among two competitions: the DAC Pre-Commercial Energy Program for Innovation Clusters (EPIC) Prize and the DAC Pre-Commercial Technology Prize. This Official Rules document outlines the structure, objectives, and eligibility requirements of the DAC Pre-Commercial Technology Prize. For brevity, both Pre-Commercial prizes may be referenced as the DAC EPIC Prize and the DAC Technology Prize.

In recognition of the fact that there are numerous steps involved in moving an innovation from idea to marketable product, the DAC prizes each address a different phase of the technology development process. The DAC Technology Prize focuses on developing hard technology DAC innovations, such as novel materials or systems integration. While the DAC Prize explicitly supports capture improvements, competitors will need to consider the full carbon management value chain which includes transport and outcomes such as secure geologic storage or conversion to value-added products. Other programs, such as the DAC EPIC Prize, will support the surrounding ecosystem to help move technologies from an idea to equitable, commercial impact.[1]

Together, the Pre-Commercial DAC Prizes will advance technological innovation, support new businesses, and help achieve emissions reductions targets.

This document contains the rules for the Pre-Commercial DAC Technology Prize. Competitors in this prize are innovators. If you are an incubator or accelerator, refer to the rules for the DAC EPIC Prize.

1.2 Background

DOE's FECM, in collaboration with the National Renewable Energy Laboratory (NREL) and the National Energy Technology Laboratory (NETL), is issuing this DAC Pre-Commercial Technology Prize. In 2021, President Biden signed the Infrastructure Investment and Jobs Act (Public Law 117-58), also known as the Bipartisan Infrastructure Law (BIL).[2] The BIL authorizes and appropriates a total of up to $115 million for the development and execution of Direct Air Capture (DAC) Prize Competitions which includes up to $15 million for a Pre-Commercial Prize (BIL Section 41005a) and up to $100 million for the Commercial Prize (BIL Section 41005b). These prizes will catalyze rapid DAC technology advancement for carbon management while incorporating environmental justice, community benefits, stakeholder engagement, equity and workforce development.

The development of innovative DAC technologies supports the Biden administration's decarbonization goals of a 50%–52% net reduction in greenhouse gases (GHGs) from 2005 level emissions by 2030 and a net-zero GHG emission economy by 2050. DAC technologies capture carbon dioxide (CO_2) from the

[1] https://www.energy.gov/technologytransitions/energy-program-innovation-clusters
[2] Reference section 969D(e)(2)(A) and (B) of the Energy Policy Act of 2005 (42 U.S.C. 16298d(e)(2)(A)–(B)), Infrastructure Investment and Jobs Act, Public L. No. 117-58, 135 Stat. 429 (2021)[hereinafter BIL], available at https://www.congress.gov/117/plaws/publ58/PLAW-117publ58.pdf.

atmosphere and will be a critical tool to counterbalance the difficult-to-decarbonize sectors (e.g., agriculture, shipping, and aviation) in order to achieve net-zero GHG goals. This approach is very technically challenging compared to point-source carbon capture systems that prevent additional emissions from being released, e.g., from power plants or industrial facilities. The activities to be funded under the DAC Pre-Commercial Technology Prize aim to catalyze breakthrough DAC technologies into the commercial carbon management industry and provide more options for the United States to achieve a net-zero GHG economy by 2050 in an efficient manner.

DOE is aware of and is working to address environmental, climate, and energy justice concerns regarding how DAC projects may impact communities in terms of local environmental quality and economic benefits. To ensure DAC is designed, developed, and commercialized responsibly and equitably, this prize competition will include several requirements designed to establish an inclusive and diverse landscape of entrepreneurs, develop businesses for technologies that optimize environmental co-benefits, and create good, high-wage jobs across the country as part of the Community Benefits Plan (CBP).[3] The intent of the DAC Pre-Commercial Technology Prize is to deliver scalable and environmentally responsible DAC technologies in pursuit of a robust domestic DAC industry and to maximize the benefits of the clean energy transition as the nation works to curb the climate crisis, empower workers, and advance environmental justice.

1.3 DAC Pre-Commercial Technology Prize Summary

The DAC Pre-Commercial Technology Prize awards cash prizes to teams that identify a critical need in the DAC industry, mature a breakthrough solution to address this gap, and test the idea to a specified degree of scale with CO_2 sourced from dilute media.[4] It focuses on the steps of ideation and entrepreneurship needed to prepare a technology and business for commercialization.

Teams will win increasingly large prizes as they successfully meet technology milestones over the course of three phases: Develop, Design, and Deliver. Each phase requires teams to compound progress on their DAC technology developments.

Because DOE recognizes the significance of iteration in the innovation process and understands the value of offering multiple chances for emergent technology developers, DOE will launch a second round of the Develop, Design, and Deliver phases in the future.

1.4 Phases: Develop, Design, and Deliver

Competitors in the DAC Pre-Commercial Technology Prize compete in three escalating phases:[5]

Develop (approximately 6 months) – Competitors identify and describe the specific critical need in the DAC industry they are addressing; detail a breakthrough component- or system-level solution; develop a conceptual design for an integrated, bench-scale proof of concept system; and craft a plan to validate the breakthrough DAC technology. Winners will receive $100,000 in cash and a $50,000 voucher for

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[3] U.S. Department of Energy. 2022. "Community Benefits Plan Frequently Asked Questions (FAQs)." Clean Energy Infrastructure. https://www.energy.gov/clean-energy-infrastructure/community-benefits-plan-frequently-asked-questions-faqs.

[4] The term "dilute media" means media in which the concentration of carbon dioxide is less than 1% by volume. 42 U.S.C. 16298d(e)(1)(A).

[5] The term Pre-Commercial in the context of this prize refers to successful bench-scale operation (at a minimum) of a carbon capture technology.

technical assistance from DOE's National Energy Technology Laboratory (NETL) and will be eligible to compete in the Design Phase.

Design (approximately 8 months) – Competitors finalize the design and cost of the integrated, bench-scale proof of concept system; conduct a preliminary techno-economic analysis (TEA), life cycle analysis (LCA), and environmental, health, and safety (EH&S) risk assessment; develop a preliminary CBP, monitoring, reporting, and verification (MRV) plan, and engineering, procurement, construction, and testing plan; and develop a schedule to validate the breakthrough DAC technology. Winners will receive $500,000 in cash and a $150,000 voucher to use with EPIC incubators, national laboratories, or a facility in the American-Made Network, and will be eligible to compete in the Deliver Phase.

Deliver (approximately 10 months) – Competitors construct and test the integrated, bench-scale proof of concept system across a range of relevant environmental conditions for at least 500 hours with appropriate MRV methods to validate the breakthrough DAC technology, conduct an updated TEA and LCA, and develop a CBP. Competitors will deliver a technology maturation plan (TMP) that provides plans for the next scale of integrated system testing and includes, at a minimum, a conceptual design for the scaled DAC system, as well as a long-term plan for the ongoing success of the effort—specifically, a compelling case that there is, or will soon be, sufficient funding in place to keep the effort going beyond this prize contest. One winner will receive $1,000,000 in cash.

The three phases offer a cumulative total of up to $3.2 million in cash prizes and up to $800,000 in vouchers.

Contest Funding:

Phases	Winners	Prize
1. Develop	Up to seven	$100,000 in cash and a $50,000 voucher for DOE/NETL technical assistance
2. Design	Up to three	$500,000 in cash and $150,000 in vouchers
3. Deliver	One	$1,000,000 in cash

1.5 American-Made Network

The American-Made Network cultivates resources and builds connections that enhance, accelerate, and amplify competitors' efforts. The objective is to link participants with the people, resources, financing, perspectives, and industry expertise necessary for long-term success.

The American- Made Network is composed of the following elements:

1. **Prize and Network Administrator (NREL):** DOE has partnered with NREL to administer the DAC Pre-Commercial Technology Prize. NREL, as the administrator, helps competitors locate and leverage the vast array of national laboratory resources. NREL also connects elements of the network with the competitors, as described below.
2. **Vouchers:** Winners may receive vouchers that can be used to fund work at national laboratories and within the American-Made Network to accelerate the production, improvement, or validation of their prototypes.

3. **DAC Pre-Commercial EPIC Prize Incubators** – The DAC Pre-Commercial EPIC Prize provides cash prizes to regional incubator teams that submit creative and impactful plans to support entrepreneurs and innovators in developing DAC solutions and create meaningful community engagement. Competitors in the DAC Pre-Commercial Technology Prize are encouraged to use these incubators as resources. More information about the DAC Pre-Commercial EPIC Prize can be found here: https://www.herox.com/DAC-pre-commercial-EPIC.

1.6 Important Dates

These rules are applicable to the DAC Pre-Commercial Technology Prize. Please visit https://www.herox.com/DAC-pre-commercial-tech to view the key dates such as phase deadlines.

1.7 Eligibility Requirements

Competitors in the DAC Pre-Commercial Technology Prize must comply with the eligibility requirements below. By uploading a submission package, a competitor certifies that they followed these eligibility requirements. Eligibility is subject to verification before prizes are awarded. As soon as the Prize Administrator becomes aware that a competitor is not eligible to win the Develop, Design, or Deliver Phases, the competitor may be disqualified. The registered competitor is the individual or entity that registers in HeroX to compete.

As mentioned, any competitor or team that complies with the eligibility criteria below may apply to the initial Develop Phase. A single competitor or team may submit a maximum of three submissions. If more than three submissions are received from a single competitor or team, the three most recently submitted submissions will be considered. Only winners from the previous phase may progress and compete in the subsequent phase. For example, only winners of the Develop Phase are eligible to compete in the Design Phase. Then, only winners of the Design Phase are eligible to compete in the Deliver Phase.

In keeping with the goal of growing a community of innovators, competitors are encouraged to form diverse, multidisciplinary teams while developing their concepts. The HeroX platform provides a space where parties interested in collaboration can post information about themselves and learn about others who are also interested in competing in this contest.

Eligibility for All Contests

- Individuals, private entities (for-profits and nonprofits), and nonfederal government entities (such as states, counties, tribes, municipalities, and academic institutions) are subject to the following requirements:
    - An individual prize competitor (who is not competing as a member of a group) must be a U.S. citizen or a permanent resident.
    - A group of individuals competing as one team may win, provided that the online account holder of the submission is a U.S. citizen or a permanent resident. Individuals competing as part of a team may participate if they are legally authorized to work in the United States.
    - Private entities must be incorporated in and maintain a primary place of business in the United States with majority domestic ownership and control.
        - If an entity seeking to compete does not have majority domestic ownership and control, DOE may consider issuing a waiver of that eligibility requirement if (1) the entity submits a compelling justification; (2) the entity is incorporated in and maintains a primary place of business in the United States; and (3) the entity otherwise meets the eligibility requirements. DOE may require additional information before making a determination on

the waiver request. There are no rights to appeal DOE's decision on the waiver request. See Appendix 2 for more information on the waiver process.

- Academic institutions must be based in the United States.

- Non-DOE federal entities and federal employees are not eligible to win any prize contests in this program.
- Employees of an organization that co-sponsors this program with DOE are not eligible to participate in any prize contests in this program.
- Individuals who worked at DOE (federal employees or support service contractors) within six months prior to the submission deadline of any contest are not eligible to participate in any prize contests in this program. Additionally, members of their immediate families (i.e., spouses, children, siblings, or parents) and anyone who lives in their household, regardless of relation, are not eligible to participate in the prize.
- NREL employees directly involved in the administration of this prize are not eligible to participate in any prize contest in this program; however, NREL and other national laboratory employees, including lab researchers, may compete and win a prize contest in this competition, provided they are not competing in their official capacity.
- Entities and individuals publicly banned from doing business with the U.S. government, such as entities and individuals debarred, suspended, or otherwise excluded from or ineligible for participating in federal programs, are not eligible to compete.
- Entities identified by the Department of Homeland Security (DHS) Binding Operational Directives (BOD) as an entity publicly banned from doing business with the United States government are not eligible to compete. See https://cyber.dhs.gov/directives/.
- Entities and individuals identified as a restricted party on one or more screening lists of the Departments of Commerce, State, and the Treasury are not eligible to compete. See the Consolidated Screening List: https://www.trade.gov/consolidated-screening-list.
- This prize competition is expected to positively impact U.S. economic competitiveness. Participation in a foreign government talent recruitment program[6] could conflict with this objective by resulting in unauthorized transfer of scientific and technical information to foreign government entities. Therefore, individuals participating in foreign government talent recruitment programs of foreign countries of risk are not eligible to compete. Further, teams that include individuals participating in foreign government talent recruitment programs of foreign countries of risk[7] are not eligible to compete.

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[6] A foreign government talent recruitment program is defined as an effort directly or indirectly organized, managed, or funded by a foreign government to recruit science and technology professionals or students (regardless of citizenship or national origin, and regardless of whether they have 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 physically relocate to the foreign state for the above purpose. Some programs allow for or encourage continued employment at U.S. 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.

[7] Currently, the list of countries of risk includes Russia, Iran, North Korea, and China.

- The submission must propose a novel solution that has not exceeded a demonstrated scale of 100 metric tons/year of CO_2 capture capacity or more.

As part of your submission to this prize program, you will be required to sign the following statement:

> I am providing this submission package as part of my participation in this prize. I understand that in providing this submission to the Federal Government, I certify under penalty of perjury that the named competitor meets the eligibility requirements for this prize competition and complies with all other rules contained in the Official Rules Document. I further represent that the information contained in the submission is true and contains no misrepresentations. I understand false statements or misrepresentations to the Federal Government may result in civil and/or criminal penalties under 18 U.S.C. § 1001 and § 287.

1.8 Program Goal Requirements

Only submissions relevant to the goals of this program are eligible to compete. The Prize Administrator will make selections based on which competitors have demonstrated the most progress in achieving the following statements:

- The proposed solution is a breakthrough DAC technology that will move the industry beyond its current state and demonstrates progress toward DOE's Carbon Negative Shot,[8] which is a pathway-neutral "Energy Earthshot" that aims to develop <$100/net metric ton (tonne) CO_2-equivalent (CO_2e) removal by 2032, with costs including MRV. The breakthrough DAC technology should maximize the CO_2 capture efficiency from dilute media (>70%), space velocity (>150,000 hour^{-1}), and volumetric productivity (>2 gmol CO_2/hour/liter), while minimizing pressure drop (<150 Pa), capacity fade per cycle, and electrical and thermal energy duty (<3 GJ/tonne CO_2).
- Most activities that are described in and support the submission package are performed in the United States and have the potential to benefit the domestic DAC market.
- The proposed solution will have a pathway to economic viability in the DAC market.
- The proposed solution does not involve the lobbying of any federal, state, or local government office.
- The proposed solution is based on fundamental technical principles and is consistent with a basic understanding of the U.S. market economy, including potential eligiblity for participation in voluntary and compliance carbon markets.
- The submission content sufficiently confirms the competitor's intent to commercialize early-stage technology and establish a viable U.S.-based business in the near future, with revenues that do not solely depend on licensing fees of intellectual property.

1.9 Find Help

Visit https://americanmadechallenges.org/network.html to review and contact the members of the American-Made Network who have signed up to help you succeed.

[8] https://www.energy.gov/sites/default/files/2021-11/Carbon-Negative-Shot-Infographic.pdf

1.10 Additional Requirements

Please read and comply with the additional requirements in Appendix 1.

COMPETITORS WHO DO NOT COMPLY WITH THESE REQUIREMENTS MAY BE DISQUALIFIED.

2 Develop Phase Rules

2.1 Introduction

The Develop Phase is the first in this three-phase series and has a total of up to $700,000 in cash prizes. Anyone meeting the eligibility requirements can compete in the Develop Phase, but only winners of this contest (referred to as Develop Phase winners or semifinalists) can compete in the subsequent Design Phase. **The following rules are for competitors in the Develop Phase. "You" and "your" reference competitors in the contest.**

Develop Phase Prizes
• Up to seven semifinalists • Up to $700,000 in total cash prizes. Each semifinalist receives a cash prize of $100,000. • Each semifinalist receives a $50,000 voucher for technical assistance at NETL.

2.2 Goal

The goal for the Develop Phase is to rapidly address a specific critical need in the DAC industry by identifying a breakthrough component- or system-level solution, developing a detailed conceptual design for an integrated, bench-scale proof of concept system with appropriate MRV methods, and crafting a plan to validate the breakthrough DAC technology.

2.3 Prizes To Win

The Develop Phase offers up to seven (7) cash prizes of $100,000 each and a $50,000 voucher for technical assistance at NETL.

2.4 How To Enter

Complete a submission package online at https://www.herox.com/DAC-pre-commercial-tech before the contest closing date.

2.5 Develop Phase Process

The Develop Phase consists of four steps:

1. **Preparation, Activation, and Submission** – Competitors identify and describe the specific critical need in the DAC industry they are addressing; detail a breakthrough component- or system-level solution; develop a conceptual design for an integrated, bench-scale proof of concept system; and craft a plan to validate the breakthrough DAC technology. One-person teams can compete, but building a diverse, multidisciplinary team may help strengthen capabilities and team competencies. Competitors can also engage the American-Made Network to gain help and support. Competitors must complete their submission packages and submit them online before the Develop Phase closes.

2. **Assessment** – The Prize Administrator screens submissions for eligibility and completion and assigns subject-matter expert reviewers to independently score the content of each submission. The judging criteria assess the following competitor activities:
    - **Problem-Solution Fit and Technical Merit**: Develop a credible solution concept for a real-world problem facing the DAC industry. Perform substantive due diligence to gather feedback and validate that the proposed solution is technically feasible. The proposed solution should have technical, economic, and operational benefits within an identified market.
    - **Team Capabilities and Network Engagement:** Form an exceptional and committed team to accomplish the stated goals of the proposed solution. Cultivate relationships with DOE national laboratories, members of the American-Made Network, and/or other entities to maximize the likelihood of creating a viable business based on the proposed solution and to enhance the quality of the submission package. The American- Made Network is there to help you succeed, and its members are rewarded for assisting you, so do not hesitate to engage them to help make your solution better.
    - **Breakthrough Plan:** Craft a plan to design and validate the breakthrough DAC technology with appropriate MRV methods. Define goals for the Develop and Deliver Phases and discuss your team's readiness to meet your goals, including any plans to acquire additional talent and resources. Provide a high-level budget and plan for meeting your goals and describe how you plan to leverage the Develop Phase cash prize and NETL technical assistance voucher. Detail risks to the development plan and define mitigation strategies.
3. **Selection** – The selection committee will select up to seven (7) winners, considering the written and audiovisual submissions and expert reviewer feedback.
4. **Announcement** – After the semifinalists are assessed and selected, the Prize Administrator will notify them, request the necessary information to distribute cash prizes, and issue a public announcement. After winning the Develop Phase, semifinalists will design their solutions in accordance with their plan to compete in the Design Phase.

2.6 What To Submit

A complete submission package for the Develop Phase should include the following items:

Item	Content
Submission Package	• Ninety-second video • Cover page content • Narrative that answers four questions about the *problem, solution, accomplishments and team,* and *breakthrough plan* (not to exceed 2,500 words) • One summary PowerPoint slide (public) • Letters of commitment or support • State-point data tables.

Note: Portions of the submission package are made available to the public. These have been denoted as such, and DOE does not intend to release the remaining parts of the submission to the public. See Appendix 1 for additional details.

All documents must be uploaded as a PDF.

Video – What Is Your Innovation in 90 Seconds?	
Suggested content to provide • The real-world problem you are solving • Your solution and why it is transformational • Who you are and why you have a competitive edge.	**A single score is provided, taking the following statements into consideration** • The video explains a compelling real-world problem. • The video describes a unique innovation that is implementable within the next five years. • The video shows a knowledgeable and skillful team.

Post your accessible video online (e.g., YouTube, Vimeo). Be creative and produce a video that conveys the required information in exciting and interesting ways, but do not focus on time-consuming activities that only improve production values (i.e., technical elements such as décor, lighting, and cinematic techniques). Assistance from others with experience in this area may be helpful. Members of the American-Made Network may be able to help you create your video. Please note that upon winner selection, semifinalists' videos may be made publicly available. The Prize Administrator will notify semifinalists prior to videos becoming public.

Cover Page – List Basic Information About Your Submission *Template*[9]
• Project name • Innovation tagline (e.g., your mission in a few words) • Link to your 90-second online video • Key project members (names, contacts, and links to their LinkedIn profiles) • Keywords that best describe your solution • Your city, state, and nine-digit zip code • The partner(s) and affiliate(s) that significantly helped you advance your solution and the major items they helped with (if applicable).

[9] Use of the template is optional; however, all components listed here must be included in your document if you chose to create your own. https://www.herox.com/DAC-pre-commercial-tech/resources.

You should answer each of the following four questions. The content bullets are only suggestions to guide your responses. You decide where to focus your answers. The individual answers to the four questions do not have a word limit; however, **the aggregate response to these four questions must not exceed 2,500 words,** not including captions, figures/graphs, and references. A word count must be included at the end of your submission (see template for details). You may also include **up to five supporting images, figures, or graphs**. The reviewers will score the questions based on the content you have provided.

Narrative – Max 2,500 words and five supporting images or figures (PDF)
Template[10]: https://www.herox.com/DAC-pre-commercial-tech/resources

Question 1: *Problem* – What is the problem, and why is solving it important?

Suggested content to provide	A single score is provided, taking the following statements into consideration
• Describe the problem, quantify its significance with metrics, and explain why now is the right time to solve it. Be specific to the problem space that your innovation addresses. • Explain why existing solutions are inadequate. Be as technically specific as possible to your innovation area, providing examples where possible. • Show how you know this is a significant problem using evidence-based validation (e.g., interviews with users, case studies, literature).	• The competitor quantifies a critical problem using important metrics and provides a compelling argument for why now is the right time to address it. • The competitor's assessment of current solutions and their limitations shows a comprehensive understanding of the problem-solution space. • The competitor uses real-world evidence to validate key assumptions about industry needs.

Question 2: *Solution* – What is your solution, and why will it be successful?

Suggested content to provide	A single score is provided, taking the following statements into consideration
• Describe how your solution is better than the existing products or emerging solutions described in Question 1. • Describe your component- or system-level innovation in as much detail as possible, including component integration into an existing system (if applicable), while also discussing technical feasibility and maturity. • Describe how your technical component- or system-level innovation compares to the current state of the art or commercially relevant competition from a techno-economic and life cycle perspective. • Describe your component- or system-level innovation's unique value proposition and how it will lead to a sustainable business.	• Sufficient technical detail was provided to understand the underlying principles of operation of the innovation. • The solution represents an innovative approach built on reasonable assumptions, valid technical foundations, and lessons learned from other notable efforts in this space. • The competitor is pursuing an innovative and compelling solution that will lead to a sustainable business. • The innovation improves DAC beyond the current state of technology, mitigates environmental impacts, and has a feasible path to deployment.

[10] Use of the template is optional; however, all components listed here must be included in your document if you chose to create your own.

Question 3: *Accomplishments and Team* – What have you done to date, and what qualities give you a competitive edge?	
Suggested content to provide • Describe your efforts to advance your solution concept prior to or since the announcement of the Prize contest, and highlight key milestones achieved. • Define the integrated, bench-scale proof of concept system conceptual design by providing, at a minimum, a process flow diagram with a description of each individual technology used in the overall system, highlighting the breakthrough component- or system-level solution(s). Competitors are encouraged to include heat and material balances, provide utility requirements, and discuss appropriate MRV methods and system integration. • Explain what critical failures would cause you to reconsider your approach. • Introduce your team, explain how the team came together, and highlight the knowledge and skills that make the team uniquely capable of achieving success. • Highlight your team's diversity and experience and the track record that makes it likely to succeed in the prize competition. What experience do you have trying new things, solving difficult problems, and overcoming barriers to bring ideas to reality? • Describe your team's readiness to meet your goals and whether your team requires additional talent and resources. • Describe what drives your team to realize this solution and why you will continue when facing difficulties.	**A single score is provided, taking the following statements into consideration** • A considerable amount of high-quality effort was put into defining and advancing the proposed solution. • The planned integrated, bench-scale proof of concept system is reasonably ambitious and validates the critical assumptions necessary to advance. • The team's track record demonstrates notable entrepreneurial qualities, such as adaptability, creativity, decisiveness, and resourcefulness. • The team is diverse and has the knowledge, experience, and determination to transform their proposed solution into a viable business in the near future.

Question 4: *Breakthrough Plan* – What is your plan to achieve your goals?	
Suggested content to provide • Describe where you stand in your solution's development cycle and define goals for the Design and Deliver Phases and a one-year goal **(see special instructions below)**. • Explain why winning the Develop Phase will substantively change the likely outcome for the proposed solution. • Provide a high-level budget for meeting your goals. Explain how you will leverage program resources, DOE national laboratories, members of the American-Made Network, and/or other entities (include references to letters of support/commitment, if applicable). • Describe risks to the development plan and mitigation strategies (e.g., data requirements and plans to acquire the necessary data).	**A single score is provided, taking the following statements into consideration** • The stated goals are ambitious, reduce risks, and show a commitment to an accelerated development cycle. • Meeting the stated goals will demonstrate critical progress toward developing, testing, and validating the functionality and market demand of this innovation. • Winning the Develop Phase will significantly increase the team's chances of creating a viable business based on this solution. • The proposed plan effectively uses the resources available in this program to advance the innovation and help the team address upcoming commercialization challenges. • Sufficient risks to the development plan have been identified, and reasonable risk mitigation strategies have been described.

Special Instructions

- Use only specific, measurable, achievable, relevant, and timely (SMART) outcome-based goals, not activity-based goals, so that a neutral third party can validate them.
    - For example: Demonstrate a definitive achievement of progress (e.g., "X letters of interest signed" or "achieved Y% efficiency"); do **not** describe how you spent your time (e.g., "provide a report," "talk to customers," or "perform experiments").
- In defining your SMART goals, include quantified, risk-reducing, meaningful, practical, and testable interim milestones.
- SMART goals should include assessment and feedback from many relevant stakeholders (e.g., possible investors, customers, experts in the solution space, labor groups such as unions in relevant fields for future deployment, and entities that would be the eventual customers or end users of the product).
- Members of the American-Made Network may be able to help you formulate your SMART goals.

Submission Summary Slide (a PowerPoint slide as a PDF will be made public)
Make your own public-facing, one-slide submission summary that contains technically specific details but can be understood by most people. There is no template, so feel free to present the information as you see fit. Please make any text readable in a standard printout and conference room projection.

Letters of Commitment or Support
Attach one-page letters of support, intent, or commitment from relevant entities (e.g., potential users of the proposed innovation, labor groups such as unions, or strategic manufacturing partners) to provide context. Letters of support from partners or others that are critical to the success of your proposed solution will likely increase your score. General letters of support from parties that are not critical to the execution of your solution will likely not factor into your score. Please do not submit multipage letters.

State-Point Data
Submit data tables with preliminary estimates for the transformative DAC technology. See Appendix 3 for guidance for State-Point Data Tables.

Please read and comply with the additional requirements about your submission in Appendix 1.

COMPETITORS WHO DO NOT COMPLY WITH THESE REQUIREMENTS MAY BE DISQUALIFIED.

2.7 How We Score

Reviewers and the selection committee will evaluate your submissions on a scale of 1 (nonresponsive) to 5 (very thorough response) using their subject-matter expertise and the guidance provided for each component.

The scoring of submissions will proceed as follows:

- Submissions must be complete and contain all the requested components (e.g., summary slide) to be eligible for scoring.
- A panel of expert reviewers reads, scores, and comments on each submission. The video submission and each section of the narrative questions will receive a weighted score, based on the bulleted list of statements.
- Additional components are evaluated based on the requirements detailed in this Official Rules document and the respective Appendix (i.e., Appendix 3 for state-point data tables).
- The final score from an individual reviewer for a submission package equals the weighted sum of the scores for all the sections. Individual reviews also provide written comments on the overall strengths and weakness of the competitor, which are informed by every aspect of the application.

Application Component	Weight
Narrative Question 1	10%
Narrative Question 2	20%
Narrative Question 3	30%
Narrative Question 4	20%
Video Assessment	10%
State-Point Data Tables	10%

- All reviewers' scores are then averaged for a final reviewer score for the submission package. The selection committee considers reviewer scores and overall comments when deciding the winners.
    - Reviewers may not have personal or financial interests in, or be an employee, officer, director, or agent of any entity that is a registered participant in this contest or have a familial or financial relationship with an individual who is a registered competitor.

Note: Expert reviewers also provide comments on the submissions they review. The Prize Administrator intends to provide comments to competitors after the winners are announced. These comments are intended to help competitors continue to improve and iterate on their submissions. The comments are the opinions of the expert reviewers and do not represent the opinions of DOE.

- Interviews: The Prize Administrator, at its sole discretion, may decide to hold a short interview with a subset of the prize competitors. Interviews would be held prior to the announcement of winners and would serve to help clarify questions the selection committee may have. Attending interviews is not required, and interviews are not an indication of winning.

The DOE's final determination of winners takes the reviewer scores, interview findings (if applicable), and program policy factors listed in Appendix 1 into account. DOE is the final decision maker and may elect to award all, none, or some of the submissions accepted at each submission deadline.

2.8 Find Help

Visit https://americanmadechallenges.org/network.html to review and contact the members of the American-Made Network who have signed up to help you succeed.

2.9 Additional Requirements

Please read and comply with the additional requirements in Appendix 1.

COMPETITORS WHO DO NOT COMPLY WITH THESE REQUIREMENTS MAY BE DISQUALIFIED.

3 Design Phase Rules

3.1 Introduction

The Design Phase is the second phase in this three-phase series and has a total of up to $1,500,000 in cash prizes and up to $450,000 in vouchers. Only winners of the Develop Phase can compete in the Design Phase. Winning the Design Phase is required to compete in the Deliver Phase. **The following rules are for competitors in the Design Phase. "You" and "your" reference competitors in the contest.**

Design Phase Prizes
• Up to three winners • Up to $1.5 million in total cash prizes and up to $450,000 in total vouchers • Each winner receives a cash prize of $500,000 and $150,000 in vouchers.

3.2 Goal

The goal for the Design Phase is to finalize the design and cost of the integrated, bench-scale proof of concept system; conduct a preliminary TEA, LCA, and EH&S risk assessment; develop a preliminary CBP, MRV plan, and engineering, procurement, construction, and testing plan; and develop a schedule to validate the breakthrough DAC technology. Additionally, you will scope the market demand/business case for your innovation, including a pathway to acquire potential customers.

3.3 Prizes To Win

The Design Phase offers up to three (3) cash prizes of $500,000 each and a $150,000 voucher for technical assistance.

3.4 How To Enter

Complete a submission package online at https://www.herox.com/DAC-pre-commercial-tech before the contest closing date.

3.5 Design Phase Process

The Design Phase consists of four steps:

1. **Progress and Submission** – Competitors finalize the design and cost of the integrated,[11] bench-scale proof of concept system; conduct a preliminary TEA, LCA, and EH&S risk assessment; develop a preliminary CBP, MRV plan, and engineering, procurement, construction, and testing plan; and schedule to validate the breakthrough DAC technology. Competitors are encouraged to work with NETL and the American-Made Network to advance their solutions as much as possible. Competitors will then create their Design Phase submission packages and submit them online before the deadline.
2. **Assessment** – The Prize Administrator screens submissions for eligibility and completion and assigns subject-matter expert reviewers to independently score the content of each submission. The judging criteria assess the following competitor activities:

[11] For the DAC Pre-Commercial Technology Prize, the term "integrated" signifies a system that, at minimum, is capable of cyclical CO_2 capture from dilute media and regeneration. Systems that incorporate more unit processes of the potential commercial system, such as steam cycles, offtake, balance-of-plant power sources, etc., are favored.

- **Innovation**: Design and estimate the cost of an integrated solution concept for a real-world problem facing the DAC industry. Conduct a preliminary TEA and LCA to assess system viability and benefits; perform an EH&S risk assessment and MRV plan; and develop a preliminary CBP.
- **Team Capabilities and Network Engagement**: Leverage an exceptional and committed team to accomplish the stated goals of the proposed solution. Cultivate relationships with DOE national laboratories, members of the American-Made Network, and/or other entities to maximize the likelihood of creating a viable business based on the proposed solution and to enhance the quality of the submission package. The American-Made Network is there to help you succeed, and its members are rewarded for assisting you, so do not hesitate to engage them to help make your solution better.
- **Testing Plan:** Craft an engineering, procurement, construction, and testing plan and a schedule to validate the breakthrough DAC technology across relevant environmental conditions. Describe the specific functional improvements your integrated solution concept will demonstrate in the Deliver Phase. Update goals for the Deliver Phase and discuss your team's readiness to meet your goals, including any plans to acquire additional talent and resources. Provide a high-level budget and plan for meeting your goals and describe how you plan to leverage the Design Phase cash prize and NETL technical assistance voucher. Detail risks to the development plan and define mitigation strategies.

3. **Selection** – The selection committee selects up to three (3) winners, considering the written and audiovisual submissions, interviews, and expert reviewer feedback.
4. **Announcement** – After receiving the Design Phase prize, winners can develop their solutions in accordance with their plan to compete in the Deliver Phase.

3.6 What To Submit

A complete submission for the Design Phase must include the following items:

Item	Content
Submission Package	• 120-second video • Cover page content • Narrative that answers three questions about *innovation, team,* and *testing plan* (not to exceed 3,000 words) • Summary PowerPoint slide (public) • State-point data tables • Preliminary techno-economic analysis (TEA) and life cycle analysis (LCA) • Environmental, health, and safety (EH&S) risk assessment • Community Benefits Plan Development Proposal (CBPDP).

Note: Portions of the submission package are made available to the public. These have been denoted as such, and DOE does not intend to release the remaining parts of the submission to the public. See Appendix 1 for additional details.

All documents must be uploaded as a PDF.

Note: This submission package is being reviewed by DAC industry and entrepreneurial professionals. Cumulatively, they have decades of experience in assessing novel ideas and solutions. However, their background may not be in specific problem you are solving. Transition quickly from general background into the details of your problem, solution, and plan.

120-Second Video – 2-minute pitch on your innovation, company, and proof of concept design	
Suggested content to provide	**A single score is provided, taking the following statements into consideration**
• Describe the real-world problem you are solving. • Describe your solution and why it is transformational compared to existing solutions. • What is the scale of the opportunity, and what is your target market? • Who are you, and why do you have a competitive edge? • What progress has been made over the competition period? • Explain the design of your integrated, bench-scale proof of concept system and plans for engineering, procurement, construction, testing, and MRV.	• The video explains a compelling real-world problem and solution. • The video identifies a reasonable target market and a path to making a significant impact on the domestic DAC industry. • The video shows a knowledgeable and skillful team. • Progress has been demonstrated during the competition period. • The video details the integrated, bench-scale proof of concept system design and cost. • The video discusses the team's plans for engineering, procurement, construction, testing, and MRV.

Post your accessible video online (e.g., YouTube, Vimeo). Be creative and produce a video that conveys the required information in exciting and interesting ways, but do not focus on time-consuming activities that only improve production values (i.e., technical elements such as décor, lighting, and cinematic techniques). Assistance from others with experience in this area may be helpful. Members of the American-Made Network may be able to help you create your video. Please note that upon winner selection, finalists' videos may be made publicly available. The Prize Administrator will notify finalists prior to videos becoming public.

Cover Page – List basic information about your submission ***Template[12]:*** https://www.herox.com/DAC-pre-commercial-tech/resources
• Project name • Innovation tagline (e.g., your mission in a few words) • Link to your online pitch video • Key project members (names, contacts, and links to their LinkedIn profiles)

[12] Use of the template is optional; however, all components listed here must be included in your document if you chose to create your own.

- Keywords that best describe your solution
- Your city, state, and nine-digit zip code
- The partners, affiliates, and connectors that significantly helped you advance your solution and the major items they helped with (if applicable).

You should answer each of the following four questions. The content bullets are only suggestions to guide your responses. You decide where to focus your answers. The individual answers to the questions do not have a word limit; however, **the aggregate response to these three questions must not exceed 3,000 words,** not including captions, figures/graphs, and references. **A word count must be included** at the end of your submission (see template for details). You may also include **up to five supporting graphs or charts**. The reviewers will score the questions based on the content you have provided.

Note: If your concept/innovation has substantially pivoted from your original submission, you must provide an explanation of how and why this happened. It is understood that innovation and entrepreneurship are not usually a linear path, but major changes in direction should always be well rationalized. You were selected based on the strengths of the idea submitted in the Develop Phase, and significant changes without justification are unlikely to be successful.

Narrative (PDF) – Max 3,000 words and five supporting images or figures
Template[13]*: **https://www.herox.com/DAC-pre-commercial-tech/resources***

Question 1: *Innovation* – What progress have you made to prove your solution will be successful

Suggested content to provide	A single score is provided, taking the following statements into consideration
• Describe the current state of development of your integrated, bench-scale system and its technical specifications, and provide sufficient underlying details on how it will work to facilitate external evaluation of your performance claims.[14] • Define the integrated, bench-scale proof of concept system design by providing, at a minimum, an engineering design package with design basis, mass and energy balances, estimates of heating and cooling duties and electric power requirements covering the DAC system and balance-of-plant, the cost of the	• Sufficient technical detail was provided to understand the underlying principles of the innovation. • The proof of concept is grounded in real-world assumptions and resolves critical technical risks. • A considerable amount of high-quality effort was put into designing and advancing an integrated, bench-scale proof of concept system. • The planned integrated, bench-scale proof of concept system is well-defined, reasonably

[13] Use of the template is optional; however, all components listed here must be included in your document if you chose to create your own. The provided template has been updated from the Develop Phase.
[14] Avoid characterizing core innovations as proprietary and thus preventing independent evaluation by the expert selection committee. It is the intent of the Prize Administrator that, unless otherwise noted, no parts of the submitted materials be released to the public (see Appendix 1 for more details).

DAC system (i.e., Class 3 estimate with expected cost accuracy of +/- 15% and project definition maturity of 40%), and an MRV Plan. • Explain what critical failures would cause you to reconsider your approach. • Describe the progress made over the contest period and highlight key engagements, relationships, and milestones. • Describe how you have validated your technical performance assumptions. • Describe who gave feedback on your integrated system, why it is important, and the changes you made as a result of that feedback. • Describe your innovation's unique value propositions and how these will lead to a sustainable business.	ambitious, and validates the critical assumptions necessary to advance. • The competitor is pursuing an innovative and compelling solution that will lead to a sustainable business.
Question 2: ***Team*** – What qualities give you a competitive edge, and how have you grown?	
Suggested content to provide	**A single score is provided, taking the following statements into consideration**
• (Re)introduce your team and highlight the diversity, knowledge, and skills that make the team uniquely capable of achieving success. • Describe the core network of mentors and partners you are working with to advance the proposed solution. This network can include national labs, members of the American-Made Network, funders, labor groups such as unions, and private partners. • Describe how your team has evolved during the competition, including any strategic hires or partnerships. • Explain why winning the Design Phase will substantively change the likelihood of your success.	• The team's drive, diversity, knowledge, and complementary skill sets provide a strong competitive edge toward realizing this solution in the near future. • The team identified skill gaps and brought in the right people or partners to fill those gaps. • Winning the Design Phase will significantly increase the team's chances of creating a viable business based on this solution.
Question 3: ***Testing Plan*** – What is your plan to achieve your goals?	
Suggested content to provide	**A single score is provided, taking the following statements into consideration**
• Provide the goals submitted in the Develop Phase submission package and describe the	

actual outcomes. Update goals for the Deliver Phase and define goals for the next 180 and 365 days (**see special instructions below**). • Describe your team's readiness to meet your goals and the need for additional talent and/or resources. • Provide your engineering, procurement, construction, and testing plan and schedule and describe how it will allow you to fully evaluate the integrated system across relevant environmental conditions with well-defined MRV methods. Describe whether your breakthrough technology will improve current procurement or construction practices, such as by using commonly available materials or improving manufacturability. • Describe the specific functional improvements your bench-scale system will provide at the Deliver Phase. • Provide a high-level budget plan to meet your goals for the next 180 days, including how you will leverage program resources—specifically the voucher funds, members of the American-Made Network, and/or other entities. • Describe risks to the development plan and mitigation strategies (e.g., certification timelines or dependence on third parties).	• The team has successfully met their prior goals and is demonstrating continued critical progress toward constructing, testing, and validating the functionality and market demand of this innovation. • Stated Deliver Phase goals and 180- and 365-day goals are ambitious and reduce risk, and they show a commitment to an accelerated solution development cycle. • The team's approach to completing their proposed plan is well-reasoned and makes good use of the program resources available to them (such as national laboratories and the American-Made Network). • The team's test plan and MRV methods are robust and appropriate for integrated system evaluation. • Sufficient risks to the development plan have been identified and reasonable risk mitigation strategies have been described.

Special instructions

- Use only specific, measurable, achievable, relevant, and timely (SMART) outcome-based goals, not activity-based goals, so that a neutral third party can validate them (if possible).
    - For example: Demonstrate a definitive achievement of progress (e.g., "X letters of interest signed" or "achieved Y% efficiency"); do **not** describe how you spent your time (e.g., "provide a report," "talk to customers," or "perform experiments").
- SMART goals for the Deliver Phase should include validating an integrated, bench-scale proof of concept system based on learning throughout the competition and securing at least one committed pilot test partner.
- In defining your SMART goals, include quantified, risk-reducing, meaningful, practical, and testable interim milestones.
- SMART goals should include assessment and feedback from many relevant stakeholders (e.g., possible investors, customers, experts in the solution space, labor groups such as unions in relevant fields for future deployment, and entities that would be the eventual customers or end users of the product).

- Members of the American-Made Network may be able to help you to formulate your SMART goals.

Submission Summary Slide (a PowerPoint slide as a PDF will be made public)
Make your own public-facing, one-slide submission summary that contains technically specific details but can be understood by most people. There is no template, so feel free to present the information as you see fit. Please make any text readable in a standard printout and conference room projection.

Letters of Commitment or Support (as a PDF)
Submit one-page letters of support, intent, or commitment from relevant entities (e.g., labor groups such as unions or potential users of the proposed innovation) to provide context. Letters of support from partners or others who are critical to the success of your proposed solution will likely increase your score. General letters of support from parties that are not critical to the execution of your solution will likely not factor into your score. Please do not submit multipage letters.

State-Point Data Tables
Submit data tables with refined estimates for the breakthrough DAC technology. See Appendix 3 for guidance.

Preliminary Techno-Economic Analysis (TEA) and Life Cycle Analysis (LCA)
Provide results of a preliminary screening-level LCA and a preliminary TEA covering both the DAC system and balance-of-plant for a reference DAC plant that captures at least 50,000 net tonnes of CO_2e/year from dilute media based on cradle-to-gate LCA. CO_2 pressure and quality, and quantity at the carbon capture plant "gate," should meet the requirements of the intended transport and storage or carbon utilization/conversion solution. The summary results should provide: (i) mass and energy balances, (ii) estimates of heating and cooling duties and electric power requirements covering the DAC system and balance-of-plant, (iii) the estimated cost of the proposed DAC system, (iv) the estimated land and water usage, and (vi) the cost of CO_2 capture on a $/net tonne CO_2e basis. The preliminary TEA does not necessarily have to conform to the requirements in Appendix 4. The screening LCA only needs to include energy inputs, covering the DAC system for a reference plant that captures at least 50,000 net tonnes of CO_2e/year. The GHG emissions will be converted to global warming potentials using the factors in Appendix 5. At a minimum, two scenarios should be presented: (1) electricity provided by the current national grid mix (450 kg CO_2e/MWh), and (2) electricity provided by renewable sources (23 kg CO_2e/MWh). If other energy sources are required, such as natural gas, refer to the Appendix 5 for links to data resources. The functional unit will be 1 tonne of captured CO_2 at the carbon capture plant "gate." The preliminary screening-level LCA does not necessarily have to

conform to the requirements in Appendix 5.

Environmental, Health and Safety (EH&S) Risk Assessment

Submit an EH&S analysis of the anchoring integrated DAC system in accordance with the format provided in Appendix 6, as a separate document. The EH&S analysis should include a discussion of air and water emissions, water consumption, solid waste streams, noise, and potential environmental impacts of the technology, including toxicological effects and hazards of emissions and waste streams.

Monitoring, Reporting and Verification (MRV) Plan

Development of project-specific robust monitoring, reporting, and verification (MRV) plans will be crucial to ensuring the credibility of and public confidence in CO_2 removal. Because the downstream storage and/or utilization of the CO_2 generated from the DAC process is outside the scope of this DAC Technology Prize, it is expected that the capture medium will capture CO_2 and regenerate in a cyclic manner. Therefore, for the purposes of this technology prize, MRV plans must include, at a minimum, the following:

- Identification of boundaries of the DAC process
- Quantification of emissions from the DAC process on a cradle-to-gate basis (including operational and embodied emissions), with uncertainty clearly labeled
- Quantification of leakage
- Description of quantification methods for detecting captured CO_2 (e.g., gravimetric, volumetric, barometric, gas analyzer etc.) in real time; preferably two or more methods are employed
- Description of sensor calibration procedures
- Estimate of total uncertainty in the reported captured CO_2 quantities
- Calculation of DAC efficiency (with uncertainty clearly labeled) of overall process (e.g., (tonnes CO_2 captured from the air − tonnes CO_2 emitted)/tonnes CO_2 captured from the air).

It is possible that some of the results obtained from the LCA will be used to inform the MRV plan.

Community Benefits Plan (CBP)

Submit a preliminary CBP that advances the following goals: 1) support meaningful community and labor engagement; 2) invest in the American workforce; 3) advance diversity, equity, inclusion, and accessibility (DEIA); and 4) contribute to President's goal that 40% of the overall benefits from certain federal investments flow to disadvantaged communities (the Justice40 Initiative). Given the low technology readiness scale (TRL) scale of the pre-commercial technology prize, the elements of community and labor engagement are not necessary but are highly encouraged. The plan must improve upon the Develop submission. See "Community Benefits Plan Guidance" in Appendix 10.

Please read and comply with the additional requirements about your submission in Appendix 1.

COMPETITORS WHO DO NOT COMPLY WITH THESE REQUIREMENTS MAY BE DISQUALIFIED.

3.7 How We Score

Reviewers and the selection committee will evaluate your submissions on a scale of 1 (nonresponsive) to 5 (very thorough response) using their subject-matter expertise and the guidance provided for each component.

The scoring of submissions will proceed as follows:

- Submissions must be complete and contain all the requested components (i.e., summary slide) to be eligible for scoring.
- A panel of expert reviewers reads, scores, and comments on each submission. The video submission and each section of the narrative questions will receive a weighted score, based on the bulleted list of statements.
- Additional components are evaluated based on the requirements detailed in this Official Rules document and the respective Appendix (i.e., Appendix 3 for state-point data tables).
- The final score from an individual reviewer for a submission package equals the weighted sum of the scores for all the components. Individual reviewers also provide written comments on the overall strengths and weaknesses of the competitor, which are informed by a holistic perspective of the application.

Application Component	Weight
Narrative Question 1	15%
Narrative Question 2	10%
Narrative Question 3	20%
Preliminary TEA and LCA	15%
Video Assessment	5%
State-Point Data Tables	5%
EH&S Risk Assessment	10%
Preliminary CBP	10%
MRV Plan	10%

- All reviewers' scores are then averaged for a final reviewer score for the submission package. The selection committee considers reviewer scores and overall comments when deciding the winners.
    - Reviewers may not have personal or financial interests in, or be an employee, officer, director, or agent of any entity that is a registered participant in this contest or have a familial or financial relationship with an individual who is a registered competitor.

The DOE's final determination of winners will take reviewer scores, reviewer deliberation, interview findings (if applicable), and the program policy factors listed in Appendix 1 into account. DOE is the judge and final decision maker and may elect to award all, none, or some of the submissions accepted at each submission deadline.

3.8 Find Help

Visit https://network.americanmadechallenges.org/ to review and contact the members of the American-Made Network who have signed up to help you succeed.

3.9 Additional Requirements

Please read and comply with the additional requirements in Appendix 1.

COMPETITORS WHO DO NOT COMPLY WITH THESE REQUIREMENTS MAY BE DISQUALIFIED.

4 Deliver Phase Rules

4.1 Introduction

The Deliver Phase is the third phase in this three-phase series and has up to a $1,000,000 cash prize. Only winners of the Design Phase can compete in the Deliver Phase. **The following rules are for competitors in the Deliver Phase. "You" and "your" reference competitors in the contest.**

Deliver Phase Prize
• Up to one winner • Up to $1 million prize.

4.2 Goal

The goal for the Deliver Phase is to construct and test the integrated, bench-scale proof of concept system across a range of relevant environmental conditions for at least 500 cumulative hours with appropriate MRV methods to validate the breakthrough DAC technology, conduct a TEA and LCA, and develop a CBP. Competitors will deliver a technology maturation plan (TMP) that provides plans for the next scale of integrated system testing, describe why this scale of testing is appropriate for technology maturation, and deliver, at a minimum, a conceptual design for the scaled system. Competitors will submit a long-term plan for the ongoing success of the effort—specifically, a compelling case that there is, or will soon be, sufficient funding in place to keep the effort going beyond this prize contest.

Additionally, competitors will identify committed partners that demonstrate commercial viability and use continual customer and stakeholder feedback to substantially advance their solution from bench to pilot scale.

4.3 Prizes To Win

The Deliver Phase offers a single $1,000,000 cash prize.

4.4 How To Enter

Complete a submission package online at https://www.herox.com/DAC-pre-commercial-tech before the contest closing date.

4.5 Deliver Phase Process

The Deliver Phase consists of four important steps:

1. **Progress and Submission** – Competitors construct and test the integrated, bench-scale proof of concept system across a range of relevant environmental conditions for at least 500 hours with appropriate MRV methods and data verification to validate the breakthrough DAC technology, conduct a TEA and LCA, and develop an improved CBP. Competitors then create their Deliver Phase submission packages and submit them online before the deadline.
2. **Assessment** – The Prize Administrator screens submissions for eligibility and completion and assigns subject-matter expert reviewers to independently score the content of each submission. The judging criteria assess the following competitor activities:
    - **Production and Progress**: Construct and test an integrated solution concept for a real-world problem facing the DAC industry. Conduct a TEA and LCA to assess system viability and benefits and develop an improved CBP.

- **Team Capabilities and Network Engagement:** Leverage an exceptional and committed team to accomplish the stated goals of the proposed solution. Cultivate relationships with members of the American-Made Network and/or other entities to maximize the likelihood of creating a viable business based on the proposed solution and to enhance the quality of the submission package. The American-Made Network is there to help you succeed, and its members are rewarded for assisting you, so do not hesitate to engage them to help make your solution better.
- **Business Plan:** Competitors will deliver a business plan that describes their innovation's unique value propositions and how these will lead to a sustainable business. Competitors will present their business model, cost model, and potential price points. Competitors will deliver a TMP that provides plans for the next scale of integrated system testing and includes, at a minimum, a conceptual design for the scaled DAC system, as well as a long-term plan for the ongoing success of the effort—specifically, a compelling case that there is, or will soon be, sufficient funding in place to keep the effort going beyond this prize contest. The plan should show a pathway to achieving DOE's Carbon Negative Shot, which is a pathway-neutral "Energy Earthshot" that aims to develop pathways capable of providing less than $100/tonne CO_2e removal by 2032, with costs including ongoing MRV. The plan should also discuss all regulatory and permitting requirements, responsible regulatory and permitting authorities, current status, and remaining issues.

3. **Selection** – The selection committee selects one winner, considering the written and audiovisual submissions and the expert reviewer feedback.
4. **Announcement** – After receiving the Deliver prize, winners can develop their solutions in accordance with the plan submitted as a part of the Deliver Phase plan.

4.6 What To Submit

A complete submission for the Deliver Phase competition must include the following items:

Item	Content
Submission Package	• Six-minute video (public) • Cover page content • Narrative that answers four questions about the *problem and solution, innovation, team,* and *plan* (not to exceed 4,000 words) • Summary PowerPoint slide (public) • Letter of commitment or support • Operating data • State-point data tables • Techno-economic analysis (TEA) and life cycle analysis (LCA) • Technology maturation plan (TMP) • Community Benefits Plan (CBP).

Note: Portions of the submission package are made available to the public. These have been denoted as such, and DOE does not intend to release the remaining parts of the submission to the public. See Appendix 1 for additional details.

All documents must be uploaded as a PDF.

Video – Six-minute pitch on your innovation, company, and breakthrough solution (public)	
Suggested content to provide • Describe your solution and why it is transformational compared to existing solutions. • Explain the features of your integrated, bench-scale proof of concept system and how it works. Demonstrate its functionality or testing of its known possible failure modes. • What progress has been made over the competition period? • What is the scale of the opportunity, and what is your target market? • Who are you, and why do you have a competitive edge? Provide a demonstration of the integrated, bench-scale proof of concept system. • Explain the features of your proof of concept and how it works. Demonstrate its functionality or testing of its known possible failure modes.	**A single score is provided, taking the following statements into consideration** • Progress has been demonstrated during the competition period. • The video identifies a reasonable target market and a path to making a significant impact on the domestic DAC industry. • The video shows a knowledgeable and skillful team. • The video demonstrates an integrated, bench-scale proof of concept system for an exciting innovation. • The integrated, bench-scale proof of concept system has mitigated significant technical risk.

Post your accessible video online (e.g., YouTube, Vimeo). Be creative and produce a video that conveys the required information in exciting and interesting ways, but do not focus on time-consuming activities that only improve production values (i.e., technical elements such as décor, lighting, and cinematic techniques). Assistance from others with experience in this area may be helpful. Members of the American-Made Network may be able to help you create your video. Please note that upon winner selection, the winner's video may be made publicly available. The Prize Administrator will notify the winner prior to the video becoming public.

Cover Page – List basic information about your submission *Template*[15]*:* https://www.herox.com/DAC-pre-commercial-tech/resources
• Project name • Innovation tagline (e.g., your mission in a few words) • Link to your online pitch video • Key project members (names, contacts, and links to their LinkedIn profiles)

[15] Use of the template is optional; however, all components listed here must be included in your document if you chose to create your own.

- Keywords that best describe your solution
- Your city, state, and nine-digit zip code
- The partners, affiliates, and connectors that significantly helped you advance your solution and the major items they helped with (if applicable).

You should answer each of the following four questions. The content bullets are only suggestions to guide your responses. You decide where to focus your answers. The individual answers to the four questions do not have a word limit; however, **the aggregate response to these four questions must not exceed 4,000 words,** not including captions, figures/graphs, and references. **A word count must be included** at the end of your submission (see template for details). You may also include **up to five supporting images, figures, or graphs**. The reviewers will score the questions based on the content you have provided.

Narrative (PDF) – Max 4,000 words and five supporting images or figures *Template[16]: https://www.herox.com/DAC-pre-commercial-tech/resources*	
Question 1: ***Production and Progress*** – What progress have you made to prove your solution will be successful?	
Suggested content to provide	**A single score is provided, taking the following statements into consideration**
• Describe the current state of development of your integrated, bench-scale proof of concept system and its technical specifications. • Provide operating data showing a full evaluation across relevant environmental conditions with well-defined MRV methods.[17] • Describe the details of the test (strategy, timeline, outcomes, critical test, etc.). • Describe the progress made over the contest period and highlight key engagements, relationships, and milestones. • Describe how you have validated your technical performance assumptions. • Describe how you utilized the voucher to get feedback on your prototype, why it is important, and the changes you made as a result of that feedback.	• Sufficient technical detail was provided to understand the underlying principles of operation of the innovation. • The integrated, bench-scale proof of concept system is grounded in real-world assumptions and resolves critical technical risks. • A considerable amount of high-quality effort was put into building an integrated, bench-scale proof of concept system and advancing the innovation. • The voucher was effectively utilized to uncover key insights and gather relevant feedback on the integrated, bench-scale proof of concept system. • The team's test campaign and MRV methods were effective for integrated system evaluation and verification.

[16] Use of the template is optional; however, all components listed here must be included in your document if you chose to create your own. The provided template has been updated from the Design Phase competition.
[17] Avoid characterizing core innovations as proprietary and thus preventing independent evaluation by the expert selection committee. It is the intent of the Prize Administrator that, unless otherwise noted, no parts of the submitted materials be released to the public (see Appendix 1 for more details).

Question 2: *Team* – What qualities give you a competitive edge, and how have you grown?	
Suggested content to provide	**A single score is provided, taking the following statements into consideration**
• (Re)introduce your team and how it has evolved, highlighting the diversity, knowledge, and skills that make the team uniquely capable of achieving success. • Describe how you identified your committed pilot test partner(s) and discuss the rationale behind working with this partner versus others. • Describe your committed test partner(s), their interest in your solution, their level of commitment, and expected testing outcomes. • Explain why winning the Deliver Phase will substantively change the likelihood of your success.	• The team's drive, diversity, knowledge, and complementary skill sets provide a strong competitive edge toward realizing this solution in the near future. • The committed pilot test partner is highly relevant to the identified path to market. • The committed test partner can text and potentially utilization this innovation. • Winning the Deliver Phase significantly increases the team's chances of creating a viable business based on this solution.
Question 3: *Business Plan* – What is your plan to achieve your goals?	
Suggested content to provide	**A single score is provided, taking the following statements into consideration**
• Provide the previous contest goals and describe the actual outcomes. Define goals for the next 90, 180, and 365 days (**see special instructions below**). • Describe the discrete improvements to and functionality of the prototype you plan to implement over the next 90 to 180 days. • Provide a high-level budget plan to meet your goals for the next 180 days, including how you will leverage program resources—members of the American-Made Network, and/or other entities. • Describe risks to the development plan and mitigation strategies (e.g., certification timelines or dependence on third parties). • Discuss all regulatory and permitting requirements, responsible regulatory and permitting authorities, current status, and remaining issues. • Provide plans for the next scale of integrated system testing, describe why this scale of	• The team has successfully met prior goals and is demonstrating continued critical progress toward testing and validating the functionality and market demand of this innovation. • The stated 90- and 180-day goals are ambitious and reduce risk, and they show a commitment to an accelerated solution development cycle. • The approach to completing the planned testing and advancing the innovation beyond this contest is well-reasoned and feasible. • The team's approach to completing their proposed plan is well-reasoned and makes good use of the program resources available to them (such as national laboratories and the American-Made Network). • Risks to the development plan have been identified and reasonable risk mitigation strategies have been described.

testing is appropriate for technology maturation, and deliver, at a minimum, a conceptual design for the scaled system. • Submit a long-term plan for the ongoing success of the effort—specifically, a compelling case that there is, or will soon be, sufficient funding in place to keep the effort going beyond this prize contest. • Describe your business model, cost model, and potential price points. Describe your innovation's unique value propositions and how these will lead to a sustainable business. Discuss any technology licensing or other agreements, as well as compliance with carbon registries. • Show a pathway to achieving DOE's Carbon Negative Shot, which is a pathway-neutral "Energy Earthshot" that aims to develop <$100/tonne CO_2e removal by 2032, with costs including ongoing MRV.	• The team's plans for the next scale of integrated system testing are logical, and their conceptual design for the scaled system is complete and thoroughly described. The scaled system design should be inclusive of the entire carbon management value chain, including transport, secure storage, and/or conversion to value-added products. • The team's long-term plan beyond this prize contest is logical and well-reasoned. The team's plan details deployment opportunities (e.g., potential integration into a hub), • The team is pursuing an innovative and compelling solution that will lead to a sustainable business. The assumptions around the business model and pricing are reasonable, achievable, and competitive. • The team's solution is a breakthrough DAC technology that will move the industry beyond its current state and has a reasonable pathway toward DOE's Carbon Negative Shot.

Special instructions

- Use only specific, measurable, achievable, relevant, and timely (SMART) outcome-based goals, not activity-based goals, so that a neutral third party can validate them (if possible).
    - For example: Demonstrate a definitive achievement of progress (e.g., "X letters of interest signed" or "achieved Y% efficiency"); do **not** describe how you spent your time (e.g., "provide a report," "talk to customers," or "perform experiments").
- SMART goals for the next 90 and 180 days should include demonstrating continued prototype refinement and an increasing number of customers.
- In defining your SMART goals, include quantified, risk-reducing, meaningful, practical, and testable interim milestones.
- SMART goals should include assessment and feedback from many relevant stakeholders (e.g., possible investors, customers, experts in the solution space, labor groups such as unions in relevant fields, and entities that would be the eventual customers or end users of the product.).
- Members of the American-Made Network may be able to help you to formulate your SMART goals.

Submission Summary Slide (a PowerPoint slide as a PDF will be made public)

Make your own public-facing, one-slide submission summary that contains technically specific details but can be understood by most people. There is no template, so feel free to present the information as you see fit. Please make any text readable in a standard printout and conference room projection.

Letters of Partnership (as a PDF)

A committed partnership that demonstrates the commercial viability of the innovation is required and must be part of the submission package. A committed partnership could be a signed contract, purchase order, signed letter from a pilot partner with a guaranteed commitment to pilot test without contingencies, or evidence of credible customers in the form of executed customer agreements or payment receipts. The committed partnership must be from an entity that is not represented by a team member on the submission package or anyone that has personal, familial, or social ties to the competitor. Competitors should submit the strongest possible documentation to meet this requirement. DOE will not provide a preliminary review. A team will not be eligible to win the prize competition if this requirement is deemed unfulfilled.

Operating Data

Submit integrated, bench-scale proof of concept system operating data to NETL's Energy Data eXchange (EDX) Platform to confirm performance. See Appendix 7 for additional information on NETL's EDX Platform. The data must represent at least 500 hours of integrated, bench-scale proof of concept system operation at relevant environmental conditions. A summary of the data produced must be included in the narrative.

State-Point Data Tables

Submit updated data tables based on the ideally optimized, integrated, bench-scale proof of concept system testing of the breakthrough DAC technology. See Appendix 3 for guidance.

Techno-Economic Analysis (TEA) and Life Cycle Analysis (LCA)

Provide results of a TEA and LCA covering both the DAC system and balance-of-plant for a reference DAC plant that captures at least 50,000 net tonnes of CO_2e/year from air based on cradle-to-gate LCA. A TEA must be prepared (in the format provided in Appendix 4) to update and refine the preliminary TEA submitted with the application. An LCA must be prepared (in the format provided in Appendix 5) to demonstrate robust accounting of full life cycle emissions.

Technology Maturation Plan (TMP)
Submit a refined TMP (in the format provided in an Appendix 8) that describes the current technology readiness level (TRL) of the selected DAC technology, relates the proposed project work to maturation of the proposed technology, describes the expected TRL at the end of the project, and describes any known post-project research and development necessary to further mature the technology. Competitors will deliver a TMP that provides plans for the next scale of integrated system testing and includes, at a minimum, a conceptual design for the scaled DAC system, as well as a long-term plan for the ongoing success of the effort—specifically, a compelling case that there is, or will soon be, sufficient funding in place to keep the effort going beyond this prize contest. The plan should show a pathway to achieving DOE's Carbon Negative Shot, which is a pathway-neutral "Energy Earthshot" that aims to develop <$100/tonne CO_2e removal by 2032, with costs including ongoing MRV. The plan should also discuss all regulatory and permitting requirements, responsible regulatory and permitting authorities, current status, and remaining issues. The TMP should also include a mass manufacturing plan covering DAC technology maturation and mass manufacturing capabilities. A TMP summary should be provided in the business plan section of the narrative.

Community Benefits Plan (CBP)
Submit an improved CBP from the Design Phase submission. See "Community Benefits Plan Guidance" in Appendix 10.

Please read and comply with the additional requirements about your submission in Appendix 1.

COMPETITORS WHO DO NOT COMPLY WITH THESE REQUIREMENTS MAY BE DISQUALIFIED.

4.7 How We Score

Reviewers and the selection committee will evaluate your submissions on a scale of 1 (nonresponsive) to 5 (very thorough response) using their subject-matter expertise and the guidance provided for each component.

The scoring of submissions will proceed as follows:

- Submissions must be complete and contain all the requested components (i.e., summary slide, operating data, letters of support) to be eligible for scoring.
- A panel of expert reviewers reads, scores, and comments on each submission. The video submission and each section of the narrative questions receive a weighted score, based on the bulleted list of statements.
- Additional components are evaluated based on the requirements detailed in this Official Rules document and the respective Appendix (i.e., Appendix 3 for state-point data tables).
- The final score from an individual reviewer for a submission package equals the weighted sum of the scores for all the components. Individual reviewers also provide written comments on the

overall strengths and weaknesses of the competitor, which are informed by a holistic perspective of the application.

Application Component	Weight
Narrative Question 1	20%
Narrative Question 2	10%
Narrative Question 3	15%
Summary of TEA and LCA	15%
Video Assessment	5%
State-Point Data Tables	10%
Technology Maturation Plan	15%
Community Benefits Plan	10%

- All reviewers' scores are then averaged for a final reviewer score for the submission package. The selection committee considers reviewer scores and overall comments when deciding the winners.
    - Reviewers may not have personal or financial interests in, or be an employee, officer, director, or agent of any entity that is a registered participant in this contest or have a familial or financial relationship with an individual who is a registered competitor.

Note: Expert reviewers will also provide comments on the submissions they review. The Prize Administrator intends to provide comments to competitors after the winners are announced. These comments are intended to help competitors continue to improve and iterate on their submissions. The comments are the opinions of the expert reviewers and do not represent the opinions of DOE.

- Interviews: The Prize Administrator, at its sole discretion, may decide to hold a short interview with a subset of the Deliver Phase competitors. Interviews would be held prior to the announcement of winners and would serve to help clarify questions the selection committee may have. Attending interviews is not required, and interviews are not an indication of winning.

The selection committee's final determination of winners will take reviewer scores, reviewer deliberation, interview findings (if applicable), and the program policy factors listed in Appendix 1 into account. DOE is the judge and final decision maker and may elect to award all, none, or some of the submissions accepted at each submission deadline.

4.8 Find Help

Visit https://americanmadechallenges.org/network.html to review and contact the members of the American-Made Network who have signed up to help you succeed.

4.9 Additional Requirements

Please read and comply with the additional requirements in Appendix 1.

COMPETITORS WHO DO NOT COMPLY WITH THESE REQUIREMENTS MAY BE DISQUALIFIED.

Appendix 1: Additional Terms and Conditions

A.1 Universal Contest Requirements

Your submission for the Develop, Design, and Deliver Phases is subject to following terms and conditions:

- If any team member is actively receiving funding from DOE at the Develop Phase submission deadline, DOE will review any potential prize awards, as well as other DOE funding, and make a decision as to whether awarding a prize to individuals or entities already receiving funding is in line with the program policy factors stated later in these rules (Section A.14).
- You must post the final content of your submission or upload the submission form online at https://www.herox.com/DAC-pre-commercial-tech before the Develop, Design, and Deliver Phases close. Late submissions or any other form of submission do not qualify.
- The video submission, summary slide, and technical assistance request may be made public.
- The cover page, narrative, and letters of commitment/support are not intended to be made public; however, see Section A.11 regarding the Freedom of Information Act (FOIA).
- You agree to release your submission video under a Creative Commons Attribution 4.0 International License (see http://creativecommons.org/licenses/by/4.0/).
- You must include all the required submission elements. The Prize Administrator may disqualify your submission after an initial screening if you fail to provide all required submission elements. Competitors may be given an opportunity to rectify submission errors due to technical challenges.
- Your submission must be in English and in a readable and searchable PDF format. Scanned handwritten submissions will be disqualified.
- Competitors will be disqualified if any engagement with the DAC Pre-Commercial Technology Prize, including but not limited to the submission, the online forum, emails to the Prize Administrator, or other forms of communication, contains any matter that, in the discretion of DOE, is indecent, lacking in professionalism, or demonstrates a lack of respect for people or life on this planet.
- If you click "Accept" on the HeroX platform and proceed to register for any of the contests described in this document, these rules will form a valid and binding agreement between you and DOE, in addition to the existing HeroX Terms of Use, for all purposes relating to these contests. You should print and keep a copy of these rules. These provisions only apply to the contests described here and no other contests on the HeroX platform or anywhere else.
- The Prize Administrator, when feasible, may give competitors an opportunity to fix non-substantive mistakes or errors in their submission packages.

A.2 Voucher Pairing System

The Prize Administrator will coordinate with the other DOE national laboratories and cultivate relationships with private fabrication facilities that are willing to work with competitors. Develop and Design Contest winners will then include their planned use of voucher funds as part of the Design and Deliver Contest submissions. Winners of the Design and Deliver Contests will then be able to negotiate specifics with either their laboratory partner or a private facility and quickly begin voucher work.

Although winners can choose where they spend their voucher funding, two-thirds of voucher funds must be spent at a national laboratory, and the remaining third may be spent at a national laboratory or a private facility of the winner's choice. In the case of a national laboratory, the funds will be provided directly to the laboratory on behalf of the winners to conduct a mutually agreed-upon scope of work between the laboratory and the winners. When vouchers are used at a non-national-laboratory facility, the winners will be reimbursed after the voucher work is complete. Voucher funds may not be redeemed for cash or transferred.

Further details about the voucher process are provided on the vouchers website: https://www.herox.com/DAC-pre-commercial-tech/resources

A.3 Verification for Payments

The Prize Administrator will verify the identity and the role of a participant potentially qualified to receive the prizes. Receiving a prize payment is contingent upon fulfilling all requirements contained herein. The Prize Administrator will notify winning competitors using provided email contact information after the date that the results are announced. Each competitor (or parent/guardian if under 18 years of age) will be required to sign and return to the Prize Administrator, within 30 days of the date the notice is sent, a completed National Renewable Energy Laboratory Request for ACH Banking Information form and a completed W-9 form (https://www.irs.gov/pub/irs-pdf/fw9.pdf). At the sole discretion of the Prize Administrator, a winning competitor will be disqualified from the competition and receive no prize funds if: (i) the person/entity cannot be contacted; (ii) the person/entity fails to sign and return the required documentation within the required time period; (iii) the notification is returned as undeliverable; or (iv) the submission or person/entity is disqualified for any other reason.

A.4 Teams and Single-Entity Awards

The Prize Administrator will award a single dollar amount to the designated primary submitter, whether the submitter consists of a single entity or multiple entities. The primary submitter is solely responsible for allocating any prize funds among its member competitors as they deem appropriate.

A.5 Submission Rights

The public videos in this contest must be submitted and released to the public under a Creative Commons Attribution 4.0 International License (see http://creativecommons.org/licenses/by/4.0/).

By making a submission and consenting to the rules of the contest, a competitor is granting to DOE, the Prize Administrator, and any other third parties supporting DOE in the contest, a license to display publicly and use the parts of the submission that are designated as "public" for government purposes. This license includes posting or linking to the public portions of the submission on the Prize Administrator's or HeroX's applications, on the contest website, on DOE websites, and on partner websites, and the inclusion of the submission in any other media worldwide. The submission may be viewed by DOE, the Prize Administrator, and the selection committee for purposes of the contests, including but not limited to screening and evaluation purposes. The Prize Administrator and any third parties acting on their behalf will also have the right to publicize the competitors' names and, as applicable, the names of competitors' team members and organizations that participated in the submission, on the contest website indefinitely.

By entering, Competitor represents and warrants that:

The competitor is the sole, original author and copyright owner of the submission or that the competitor has acquired sufficient rights to use and to authorize others, including DOE, to use the submission as specified throughout the rules; that the submission does not infringe upon any copyright, trade secret,

trademark, nondisclosure agreement, patent, or any other third-party rights; and that the submission is free of malware.

A.6 Copyright

Each competitor represents and warrants that the competitor is the sole author and copyright owner of the submission; that the submission is an original work of the competitor, or that the competitor has acquired sufficient rights to use and to authorize others, including DOE, to use the submission, as specified throughout the rules; that the submission does not infringe upon any copyright or any other third-party rights of which the competitor is aware; and that the submission is free of malware.

A.7 Contest Subject to Applicable Law

All contests are subject to all applicable federal laws and regulations. Participation constitutes each participant's full and unconditional agreement to these Official Contest Rules and administrative decisions, which are final and binding in all matters related to the contest. This notice is not an obligation of funds; the final awards are contingent upon the availability of appropriations.

A.8 Resolution of Disputes

DOE is solely responsible for administrative decisions, which are final and binding in all matters related to the contest.

In the event of a dispute, the authorized account holder of the email address used to register will be deemed to be the competitor. The “authorized account holder” is the natural person or legal entity assigned an email address by an internet access provider, online service provider, or other organization responsible for assigning email addresses for the domain associated with the submitted address. Competitors and potential winners may be required to show proof of being the authorized account holder.

The Prize Administrator will not arbitrate, intervene, advise on, or resolve any matters between team members or any disputes between teams.

A.9 Publicity

The winners of these prizes (collectively, “winners”) will be featured on DOE and NREL websites.

Except where prohibited, participation in the contest constitutes each winner’s consent to DOE’s and its agents’ use of each winner’s name, likeness, photograph, voice, opinions, and/or hometown and state information for promotional purposes through any form of media worldwide, without further permission, payment, or consideration.

A.10 Liability

Upon registration, all participants agree to assume and, thereby, have assumed any and all risks of injury or loss in connection with or in any way arising from participation in this contest or development of any submission. Upon registration, except in the case of willful misconduct, all participants agree to and, thereby, do waive and release any and all claims or causes of action against the federal government and its officers, employees, and agents for any and all injury and damage of any nature whatsoever (whether existing or thereafter arising; whether direct, indirect, or consequential; and whether foreseeable or not) arising from their participation in the contest, whether the claim or cause of action arises under contract or tort.

In accordance with the delegation of authority to run this contest delegated to the Assistant Secretary for Fossil Energy and Carbon Management, the Assistant Secretary has determined that no liability insurance will be required of competitors to compete in this competition, per 15 USC 3719(i)(2).

A.11 Records of Retention and Freedom of Information Act (FOIA)

All materials submitted to DOE as part of a submission become DOE records. Any confidential commercial information contained in a submission should be designated at the time of submission.

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

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

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

- The header and footer of every page that contains trade secrets or privileged commercial or financial information must be marked as follows: "May contain trade secrets or commercial or financial information that is privileged or confidential and exempt from public disclosure."
- In addition, each line or paragraph containing trade secrets or commercial or financial information that is privileged or confidential must be enclosed in brackets.

Competitors will be notified of any FOIA requests for their submissions in accordance with 29 C.F.R. § 70.26. Competitors may then have the opportunity to review materials and work with a FOIA representative prior to the release of materials.

A.12 Privacy

If you choose to provide HeroX with personal information by registering or completing the submission package through the contest website, you understand that such information will be transmitted to DOE and may be kept in a system of records. Such information will be used only to respond to you in matters regarding your submission and/or the contest, unless you choose to receive updates or notifications about other contests or programs from DOE on an opt-in basis. DOE is not collecting any information for commercial marketing.

A.13 General Conditions

DOE reserves the right to cancel, suspend, and/or modify the contest, or any part of it, at any time. If any fraud, technical failures, or any other factors beyond DOE's reasonable control impair the integrity or proper functioning of the contests, as determined by DOE in its sole discretion, DOE may cancel the contest.

Although DOE indicates in the Develop, Design, and Deliver Phases that it will select up to several winners for each contest, DOE reserves the right to only select competitors that are likely to achieve the goals of the program. If, in DOE's determination, no competitors are likely to achieve the goals of the program, DOE will select no competitors to be winners and will award no prize money.

ALL DECISIONS BY DOE ARE FINAL AND BINDING IN ALL MATTERS RELATED TO THE CONTEST.

A.14 Program Policy Factors

Although the scores of the expert reviewers will be carefully considered, it is the role of the Prize Administrator to maximize the impact of contest funds. Some factors outside the control of competitors and beyond the independent expert reviewer scope of review may need to be considered to accomplish this goal. The following is a list of such factors. In addition to the reviewers' scores, the below program policy factors may be considered in determining winners:

- Geographic diversity and potential economic impact of projects
- Whether the use of additional DOE funds and provided resources continues to be nonduplicative and compatible with the stated goals of this program and DOE's mission generally
- The degree to which the submission is likely to lead to advancements that increase environmental co-benefits or decrease negative environmental impacts
- The degree to which the submission exhibits technological or programmatic diversity when compared to the existing DOE project portfolio and other competitors
- The level of industry involvement and demonstrated ability to accelerate commercialization and overcome key market barriers
- The degree to which the submission is likely to lead to increased employment and manufacturing in the United States or provide other economic benefit to U.S. taxpayers
- The degree to which the submission will accelerate transformational technological, financial, or workforce advances in areas that industry by itself is not likely to undertake because of technical or financial uncertainty
- The degree to which the submission supports complementary DOE efforts or projects, which, when taken together, will best achieve the research goals and objectives
- The degree to which the submission expands DOE's funding to new competitors and recipients that have not been supported by DOE in the past
- The degree to which the submission exhibits team member diversity and the inclusion of underrepresented groups, with participants including but not limited to graduates and students of Historically Black Colleges and Universities (HBCUs), Tribal Colleges and Universities (TCUs), and other minority-serving institutions (MSIs) or members operating within Qualified Opportunity Zones or other underserved communities
- The degree to which the submission enables new and expanding market segments
- Whether the project promotes increased coordination with nongovernmental entities for the demonstration of technologies and research applications to facilitate technology transfer.

A.15 Definitions

Prize Administrator – DOE has partnered with NREL to administer the DAC Pre-Commercial Technology Prize. NREL, as the administrator, helps competitors locate and leverage the vast array of national

laboratory resources. NREL also connects elements of the network with the competitors, as described below. Ultimate decision-making authority regarding contest matters rests with the Office of Fossil Energy and Carbon Management.

Voucher Funding – Vouchers are part of the prizes for the Develop and Design Phases. In the case of a national laboratory, the funds will be provided directly to the laboratory on behalf of the winner to conduct a mutually agreed-upon scope of work between the laboratory and the winner. When vouchers are used at a non-national-laboratory facility, the winners will be reimbursed after the voucher work is complete. For further information, please see: https://www.herox.com/DAC-pre-commercial-tech/resources.

Appendix 2: Waiver Requests and Approval Processes

A2.1 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 U.S. national and economic security.[18] For projects participating in this prize, all members of the competitors' team 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, a competitor must submit an explicit waiver request.

Waiver Criteria

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

a. Its participation is in the best interest of the U.S. industry and U.S. economic development
b. The 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 U.S. 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. The 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. Manufacturing Plan
e. The foreign entity will satisfy other conditions that may be deemed necessary by DOE to protect U.S. government interests.

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 with the prize competition.
b. Country of incorporation, the extent of the ownership/level 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 individuals
c. The rationale for proposing a foreign entity participate (must address criteria above)
d. A description of the project's anticipated contributions to the U.S. economy
    - How the project will benefit U.S. research, development, and manufacturing, including contributions to employment in the United States and growth in new markets and jobs in the United States
    - How the project will promote domestic American manufacturing of products and/or services.
e. A description of how the foreign entity's participation is essential to the project

[18] See Critical and Emerging Technologies List Update (whitehouse.gov).

f. A description of the likelihood of intellectual property (IP) being created from the work and the treatment of any such IP
g. Countries where the work will be performed (note: if any work is proposed to be conducted outside the United States, the competitor must also complete a separate request foreign work waiver).

DOE may also require:

- A risk assessment with respect to 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, 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 be added to any agreement or subagreement to protect IP, mitigate risk, or achieve other related purposes.

DOE may require additional information before considering the waiver request.

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

A2.2 Waiver for Performance of Work in the United States (Foreign Work Waiver)

At least 100% of the work under this prize must be performed in the United States. To seek a waiver of the Performance of Work in the United States requirement, the competitor must submit an explicit waiver request in their submission. 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 prize and is otherwise in the economic interests of the United States to perform work outside of the United States. A request to waive the Performance of Work in the United States requirement must include the following:

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

DOE may require additional information before considering the waiver request.

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

Appendix 3: State-Point Data Tables

Instructions for Completing Data Tables

The tables that follow in this attachment shall be populated with data developed by the prize competitor. Competitors shall complete the appropriate combinations of Table 1 (required for all prize competitors) and Tables 2–7 that relate to their proposed process concept. *Merit scoring will correspond to the completeness of the data table and supporting information.*

At the time that the Design Phase application is submitted, the competitor should have achieved optimal performance for the solvent, sorbent, or membrane material system proposed. Competitors are required to provide the demonstrated performance data for their solvent, sorbent, or membrane material.

Key data or estimates provided in the table(s) shall be supported with short narratives in bullet form within the narrative. These bullets shall describe the sources for the individual data provided. This may be measurements made directly by the competitor and shall identify the apparatus and methodology used in the measurement(s). Due to page limitations, citations may be utilized to describe the sources for the individual data provided by the competitor or others, or by example calculations for noncritical data. Other acceptable sources of data are the open literature (with a citation and description), or estimated or extrapolated data (with a description of the method/model used for the estimate, or the procedure used for extrapolation). Arguments supported by theory/mechanisms shall be provided for projected performance for new, advanced solvent, sorbent or membrane materials.

State-of-the-Art DAC Reference Cases

For the purposes of this prize, comparisons to state-of-the-art DAC technologies should be based on one of the following reference documents. These reference cases should be utilized to justify all claims of cost and performance improvement that would lead to breakthrough technology development. Overall DAC systems proposed should be compared with one of the cases in these reports to illustrate how the technology achieves a breakthrough improvement. Individual DAC system components proposed should be incorporated into one of the cases in these reports in order to illustrate the potential breakthrough improvements in terms of cost and performance.

Mission Innovation. 2022. Carbon Dioxide Removal Technology Roadmap: Innovation Gaps and Landscape Analysis. http://mission-innovation.net/wp-content/uploads/2022/09/Attachment-1-CDR-Mission-Roadmap-Sept-22.pdf

Solvent-Based DAC:

Keith, D.W., Holmes, G., St. Angelo, D., and Heidel, K. 2018. "A Process for Capturing CO_2 from the Atmosphere." *Joule* 2, 1573-1594. https://www.cell.com/joule/pdf/S2542-4351(18)30225-3.pdf.

Valentine, J. and Zoelle, A. 2022. "Direct Air Capture Case Studies: Solvent System." National Energy Technology Laboratory, Pittsburgh, PA, August 31, 2022. https://netl.doe.gov/projects/files/DirectAirCaptureCaseStudiesSolventSystem_083122.pdf.

Sorbent-Based DAC:

McQueen, N., Vaz Gomes, K., McCormick, C., Blumanthal, K., Pisciotta, M., and Wilcox, J. 2021. "A Review of Direct Air Capture (DAC): Scaling Up Commercial Technologies and Innovating for the Future." *Prog. Energy* **3** 032001. https://iopscience.iop.org/article/10.1088/2516-1083/abf1ce/meta.

Valentine, J. and Zoelle, A. 2022. "Direct Air Capture Case Studies: Sorbent System." National Energy Technology Laboratory, Pittsburgh, PA, July 8, 2022. https://netl.doe.gov/projects/files/DirectAirCaptureCaseStudiesSorbentSystem_070822.pdf.

Table 1. Data Table for Individual DAC Technologies

	Units	Current Performance	Projected Performance
DAC Technology			
DAC Technology and TRL	-		
Scale (net CO_2 captured from the atmosphere)	Net tonnes CO_2/yr.		
Scale (gross CO_2 captured from the atmosphere)	Gross tonnes CO_2/yr.		
Total Energy Requirements[1]	GJ/tonne CO_2 removed from atmosphere		
Total Thermal Energy Requirements	GJ/tonne CO_2 removed from atmosphere		
Required Temperature of Thermal Energy	°C		
Total Electricity Energy Requirements	GJ/tonne CO_2 removed from atmosphere		
Volumetric Productivity	gmol CO_2/m^3 capture media/ time		
CO_2 Capture Percentage From air	%		
System Pressure Drop	Pa		
Energy Source	-		
Emissions Related to Energy Source	CO_2e tonne/yr.		

[1] Total thermal and electricity requirements encompass the entire process, including pretreatment, process operation, capture media conditioning/regeneration/drying, etc.

Table 2. State-Point Data for Solvent Based Systems

	Units	Measured/ Estimated Performance	Projected Performance
Pure Solvent			
Molecular Weight	mol-1		
Standard Boiling Point	°C		
Standard Freezing Point	°C		
Vapor Pressure @ 15°C	bar		
Working Solution			
Concentration	kg/kg		
Specific Gravity (15°C/15°C)	-		
Specific Heat Capacity @ STP	kJ/kg·K		
Viscosity @ STP	cP		
Surface Tension @ STP	dyne/cm		
CO_2 Mass Transfer Rate [K_L]	m/s		
CO_2 Reaction Rate	-		
Thermal Conductivity	W/(m·K)		
Absorption			
Pressure	bar		
Temperature	°C		
Equilibrium CO_2 Loading	gmol CO_2/kg		
Heat of Absorption	kJ/kg CO_2		
Solution Viscosity	cP		
Desorption			
Pressure	bar		
Temperature	°C		
Equilibrium CO_2 Loading	gmol CO_2/kg		
Heat of Desorption	kJ/kg CO_2		
Testing Data			
Cumulative Total of Captured CO_2	Kg CO_2		
Location			
The following information should be provided for the longest steady-state duration test performed			
Scale	tCO_2/year		
Duration of Long-Term Test (consecutive hours)	hr.		
CO_2 Concentration in the Feed Stream (e.g., flue gas, process stream)	mol %		

Carbon Capture Efficiency	%	
Solvent Make-Up Rate	%/yr.	
Reboiler Duty	kJ/kg CO_2	
Details on Solvent Reclamation or Refreshing		
CO_2 Product Purity	mol % dry	
CO_2 Product Oxygen Concentration	mol% (or ppm)	
Environmental Conditions (temperature, humidity, elevation/partial pressure, air flow rates)		

Definitions for Table 2:

- STP – Standard temperature and pressure (15°C, 1 atm).
- Pure Solvent – Agent(s), working alone or as a component of a working solution, responsible for enhanced CO_2 absorption. For example: the amine monoethanolamine (MEA) in an aqueous solution.
- Working Solution – The solute-free (i.e., CO_2-free) liquid solution used as the working solvent in the absorption/desorption process. For example: the liquid mixture of MEA and water.
- Absorption – The conditions of interest for absorption are those that prevail at maximum solvent loading, which typically occurs at the bottom of the absorption column. Measured data are preferable to estimated data.
- Desorption – The conditions of interest for desorption are those that prevail at minimum solvent loading, which typically occurs at the bottom of the desorption column. Operating pressure and temperature for the desorber/stripper are process-dependent. Measured data are preferable to estimated data.
- Pressure – The pressure of CO_2 in equilibrium with the solution. If the vapor phase is pure CO_2, this is the total pressure, and if it is a mixture of gases, this is the partial pressure of CO_2.
- Concentration – Mass fraction of pure solvent in working solution.
- Loading – The basis for CO_2 loading is moles of pure solvent.
- Mass Transfer Rate – Overall liquid phase mass transfer coefficient.
- CO_2 Reaction Rate – A characterization of the CO_2 absorption trend with respect to time, as complete in the range of time as possible.
- Details on Solvent Reclamation or Refreshing – Include information about reclamation rates or solvent replacement/refreshing during the long-term test.
- CO_2 Product Purity – Average purity of the CO_2 product from the capture system during the long-term testing.
- CO_2 Product Oxygen Concentration – Oxygen content of the CO_2 produced during the long-term testing.

Table 3. State-Point Data for Sorbent Based Systems

	Units	Current Performance (powder form)	Projected or Measured Performance (structured material system)
Sorbent			
True Density @ STP	kg/m^3		
Bulk Density	kg/m^3		
Average Particle Diameter	mm		
Particle Void Fraction	m^3/m^3		
Packing Density	m^2/m^3		
Solid Heat Capacity @ STP	kJ/kg·K		
Crush Strength	kgf		
Attrition Index	-		
Thermal Conductivity	W/(m·K)		
Adsorption			
Pressure	bar		
Temperature	°C		
Equilibrium Loading	gmol CO_2/kg		
Heat of Adsorption	kJ/gmol CO_2		
CO_2 Adsorption Kinetics	gmol/time		
Desorption			
Pressure	bar		
Temperature	°C		
Equilibrium Loading	gmol CO_2/kg		
Heat of Desorption	kJ/gmol CO_2		
CO_2 Desorption Kinetics	gmol/time		
Testing Data			
Cumulative Total of Captured CO_2	Kg CO_2		
Location			
The following information should be provided for the longest steady-state duration test performed.			
Scale	tCO_2/year		
Duration of Long-Term Test (consecutive hours)	hrs.		
CO_2 Concentration in Feed Stream (e.g., flue gas, process stream)	%		
Carbon Capture Efficiency	%		
Cycle Time	Hr.		

Sorbent Make-Up Rate	%/yr.	
Details on Sorbent Reactivation or Refreshing		
Heat Duty	kJ/kg CO_2	
CO_2 Product Purity	mol % dry	
CO_2 Product Oxygen Concentration	mol% (or ppm)	
Environmental Conditions (temperature, humidity, elevation/partial pressure, air flow rates)		

Definitions for Table 3:

- Attrition Index – For circulating sorbents, the attrition index includes the percentage and size of the fines generated.
- STP – Standard temperature and pressure (15°C, 1 atm).
- Sorbent – Adsorbate-free (i.e., CO_2-free) and dry material as used in adsorption/desorption cycle.
- Adsorption – The conditions of interest for adsorption are those that prevail at maximum sorbent loading. Measured data are preferable to estimated data.
- Desorption – The conditions of interest for desorption are those that prevail at minimum sorbent loading. Operating pressure and temperature for the desorber/stripper are process-dependent. Measured data are preferable to estimated data.
- Pressure – The pressure of CO_2 in equilibrium with the sorbent. If the vapor phase is pure CO_2, this is the total pressure, and if it is a mixture of gases, this is the partial pressure of CO_2.
- Packing Density – Ratio of the active sorbent area to the bulk sorbent volume.
- Loading – The basis for CO_2 loading is mass of dry sorbent.
- Kinetics – A characterization of the CO_2 adsorption/desorption trend with respect to time, as complete in the range of time as possible.
- Cycle Time – Time for entire absorption and regeneration cycle utilized during long-term testing.
- Details on Sorbent Reactivation or Refreshing – Include information about reactivation process and rates or sorbent replacement during the long-term test.
- CO_2 Product Purity – Average purity of the CO_2 product from the capture system during the long-term testing.
- CO_2 Product Oxygen Concentration – Oxygen content of the CO_2 produced during the long-term testing.

Table 4. State-Point Data for Membrane Based Systems

	Units	Current/ Estimated Performance	Projected Performance
Materials Properties			
Materials of Fabrication for Selective Layer			
Materials of Fabrication for Support Layer (if applicable)			
Nominal Thickness of Selective Layer (mm)			
Membrane Geometry			
Max Trans-Membrane Pressure	bar		
Hours Tested Without Significant Degradation			
Membrane Performance			
Temperature	°C		
Pressure Standardized Flux for Permeate (CO_2)	GPU or equivalent		
CO_2/H_2O Selectivity	-		
CO_2/N_2 Selectivity	-		
Type of Measurement (ideal or mixed gas)	-		
Proposed Module Design			
Flow Arrangement	-		
Packing Density	m^2/m^3		
Shell-Side Fluid	-		
Testing Data			
Cumulative Total of Captured CO_2	Kg CO_2		
Location			
The following information should be provided for the longest steady-state duration test performed .			
Scale	$tCO_2/yr.$		
CO_2 Concentration in Feed Stream (e.g., flue gas, process stream)	%		
Duration of Long-Term Test (consecutive hours)	hrs.		
Average CO_2 Capture Efficiency	%		
Starting CO_2 Capture Efficiency	%		
Ending CO_2 Capture Efficiency	%		
Membrane Performance Degradation	%/year		
CO_2 Product Purity	mol % dry		

CO_2 Product Oxygen Concentration	mol% (or ppm)	
Membrane Feed Pressure*	psia	
Permeate Pressure*	psia	
Environmental Conditions (temperature, humidity, elevation/partial pressure, air flowrates)		

Definitions for Table 4:

- Membrane Geometry – Flat discs or sheets, hollow fibers, tubes, etc.
- Pressure Standardized Flux – For materials that display a linear dependence of flux on partial pressure differential, this is equivalent to the membrane's permeance.
- GPU – Gas permeation unit, which is equivalent to 10^{-6} $cm^3/(cm^2 \cdot s \cdot cmHg)$ at 1 atm and 0°C. For nonlinear materials, the dimensional units reported shall be based on flux measured in $cm^3/(cm^2 \cdot s)$ (at 1 atm and 0°C) with pressures measured in cm Hg. Note: 1 GPU = 3.3464×10^{-6} $kgmol/(m^2 \cdot s \cdot kPa)$ [SI units].
- Type of Measurement – Either mixed or pure gas measurements; projected permeance and selectivities shall be for the mixture of gases found in de-sulfurized flue gas.
- Flow Arrangement – Typical gas-separation module designs include spiral-wound sheets, hollow-fiber bundles, shell and tube, and plate and frame, which result in either co-current, counter-current, or cross-flow arrangements, or some complex combination of these.
- Packing Density – Ratio of the active surface area of the membrane to the volume of the module.
- Shell-Side Fluid – Either the permeate or retentate stream.
- Details on Membrane Reactivation or Replacement – Include information about reactivation process and rates or membrane replacement during the long-term test.
- Starting CO_2 Capture Efficiency – Capture efficiency achieved in the first hour of long-term testing.
- Ending CO_2 Capture Efficiency – Capture efficiency achieved in the last hour of long-term testing.
- CO_2 Product Purity – Average purity of the CO_2 product from the capture system during the long-term testing.
- CO_2 Product Oxygen Concentration – Oxygen content of the CO_2 produced during the long-term testing.
- Membrane Feed Pressure – Pressure of gas fed to the membrane for separation during the long-term test. *Repeat this parameter for each stage of membrane used during the long-term test.
- Permeate Pressure – Pressure of the corresponding permeate of the membrane that accounts for the trans-membrane pressure drop and any vacuum used. *Repeat this parameter for each stage of membrane used during the long-term test

Appendix 4: Techno-Economic Analysis (TEA) Guidance

The TEA shall follow the analysis procedures documented in NETL's "Quality Guidelines for Energy System Studies: Performing a Techno-Economic Analysis for Power Generation Plants"[19] to the greatest extent possible. TEA requirements for each phase are shown in the table below:

Phase 2 (Design) Submission	Phase 3 (Deliver) Submission
Preliminary TEA	TEA

Adjustments to the guidelines can be made due to the nature of the direct air capture (DAC) technology being modeled. DAC technologies that include power and heat production integrated with the DAC system should include it in their TEA according to the guidelines. It is highly recommended that the TEA present both the gross CO_2 removed from flue gas for the system configuration presented (relevant to equipment sizing), as well as the net CO_2 removed when accounting for other on-site emission point sources within the total plant boundary (informative for system efficiency relating to CO_2 captured).

As outlined in the document, the required elements of a complete TEA include:

- General block flow diagram identifying all major process equipment for the carbon capture technology and accompanying stream tables
- Materials and energy balances of the complete process, including electric power requirements, heating and/or cooling requirements, etc.
- System performance summary
- Complete stream tables showing operating pressures, temperatures, compositions, and enthalpies for all streams entering or leaving major process equipment
- Economic analysis, including capital cost estimation and operation and maintenance costs
    - Include a list of equipment used to develop the capital cost estimate, including
        - Key parameters and their value for equipment costing (i.e., height, diameter, heat duty, delta temperature, power, etc.)
        - Individual component cost (i.e., absorber, regenerator, air contactor, etc.)
- Final summary report.

For your reference, the NETL Quality Guidelines document includes additional pertinent information, including, but not limited to:

- Description of common missteps and omissions
- Guidance on system boundaries
- Example performance summary and cost tables.

Sensitivity analysis identifying critical CO_2 capture technology and operating parameters and their impact on overall plant performance and economics should be performed. This analysis shall include the sensitivity of cost of electricity and the cost of CO_2 capture to the capital cost of the capture and

[19] National Energy Technology Laboratory. 2015. "Quality Guidelines for Energy System Studies: Performing a Techno-Economic Analysis for Power Generation Plants." National Energy Technology Laboratory, DOE/NETL-2015/1726, July 2015. https://netl.doe.gov/energy-analysis/details?id=711.

compression system, as well as the carbon capture cost as a function of the carbon capture efficiency and other process parameters of interest.

Involvement of a variety of stakeholders is seen as an important facet to developing an effective carbon capture technology. It is considered critical that a qualified organization with professional experience in performing this type of work conduct the TEA. *This activity shall not be viewed as a training exercise for inexperienced personnel.*

Appendix 5: Life Cycle Analysis (LCA) Guidance

Life cycle analysis (LCA) is an existing framework that is well-suited to evaluate carbon dioxide removal (CDR) such as DAC systems. By design, LCA provides a holistic perspective of the potential environmental impacts of a product or process throughout its entire lifetime. This includes the extraction of raw materials through end of life. Emissions to the environment (air, water, and land) are translated to a variety of potential impacts ranging from climate change to human health. Two International Organization for Standardization (ISO) standards provide the principles and framework (14040) and requirements and guidelines (14044) for conducting LCA. LCA requirements for each phase are shown in the table below:

Phase 2 (Design) Submission	Phase 3 (Deliver) Submission
Preliminary LCA	LCA

Preliminary LCA (Pre-LCA) Discussion:

The pre-LCA is intended to provide a high-level description of life cycle considerations for the DAC technology. If quantitative data are not available, the competitor should provide a qualitative discussion and highlight any major uncertainties and missing information.

LCA:

This effort should result in an LCA that is in conformance with the ISO 14040/14044 standards for the DAC technology. Given the stage of the project, it is expected that there will be significant uncertainty in some portions of the LCA. These should be addressed through evaluation of multiple scenarios and sensitivity analyses, as provided in the technology-specific guidance below.

Refined LCA:

The refined LCA is intended to be a revision of the LCA that reflects any changes as the project design progresses toward completion. At this stage, the competitor should be prepared to assess specific regionalized inputs and scale-up considerations.

Life Cycle Analysis Requirements for DAC Technologies

Pre-LCA

The following information should be provided or discussed qualitatively for the pre-LCA:

- Process
  - High-level carbon balance of the proposed approach
  - Disposition of the captured CO_2–will it be stored underground or utilized in a long-lasting product?
  - Define any co-products that might be produced as part of the DAC operation.
- Energy and Material Inputs
  - Planned sources of energy (electricity and heat)
  - Ranges of energy and material requirements per kg CO_2 captured.
- Impacts
  - Discuss potential co-benefits, including the reduction in criteria air pollutants (CAPs).

LCA

The approach and boundaries for the LCA depend on the ultimate fate of the captured CO_2 based on one of the two following options:

Option 1: In this option, the captured CO_2 from the DAC facility is sent to saline storage for permanent geologic storage. The majority of the necessary inputs for the LCA should be leveraged from the techno-economic analysis (TEA) (e.g., materials and energy balances, block flow diagrams). The LCA shall be conducted in accordance with the "FECM Best Practices for LCA of Direct Air Capture With Storage (DACS)." Table 5 of the Best Practices document summarizes the requirements.

The following provides additional clarity and specificity for some items in the Best Practices:

- Required data:
    i. Separately report and account for any captured fossil CO_2 (e.g., from on-site fossil fuel combustion) from the captured atmospheric CO_2 for consistency with the functional unit.
    ii. Include technical/physical flow amounts (e.g., kWh of electricity, MJ of heat) as key outputs in addition to the LCA impacts.
    iii. Energy inputs to the facility, including fuels and electricity.
        1. For electricity inputs, a minimum of six scenarios should be modeled corresponding to different grid mix carbon intensities, available in the NETL CO2U OpenLCA LCI Database and the NETL CO2U LCA Documentation Spreadsheet as:
            a. Regional grid consumption mix (modeled as the balancing authority) based on proposed location of hub
            b. Current U.S. grid mix
            c. 100% renewables
            d. 100% grid average coal
            e. 100% natural gas combined cycle (NGCC) with carbon capture
            f. 2050 U.S. grid mix.
        2. For heat inputs, the following scenarios shall be assessed using the data provided by NETL:
            a. Regional source of natural gas
            b. National average natural gas
            c. If external low-grade/waste heat is utilized for the DAC process, describe the source and availability.
    iv. CO_2 transport and saline aquifer storage life cycle inventory values (gate-to-grave emissions data to be used for all projects using saline storage) are available in the NETL CO2U OpenLCA LCI Database and the NETL CO2U LCA Documentation Spreadsheet as "Saline aquifer transport and storage."

- LCA results:
    i. Shall be normalized to 1 kg of CO_2 removed from the atmosphere and permanently stored.
    ii. A contribution analysis shall be provided so that impacts can be differentiated by major operation/input.

- Emissions scope:
    i. The scope of environmental impacts shall include all the impact categories listed in Section 4 of the Best Practices for LCA of DAC. To accomplish this, the environmental inventory will need to include data beyond GHG emissions. Some examples of emissions to include are NO_X and SO_2 emissions to air for acidification and particulate matter of 2.5 microns or less to air for human health particulate, and heavy metals emissions to water for ecotoxicity, A complete list can be found by referring to the US EPA website for TRACI 2.1 (https://www.epa.gov/sites/default/files/2015-12/traci_2_1_2014_dec_10_0.xlsx).

ii. For GHG emissions, the global warming potential shall be reported using the 100-year global warming potential (GWP) characterization factors as the default values from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) and Sixth Assessment Report (AR6), sensitivity cases using the 20-year GWP values is required:

GHG	AR5 (IPCC 2013)[20]		AR6 (IPCC 2021)[21]	
	100-Year (Default)	20-Year	100-Year (Default)	20-Year
CO_2	1	1	1	1
CH_4	36	85	29.8	82.5
N_2O	298	264	273	273
SF_6	23,500	17,500	25,200	18,300

Note: These GWP characterization factors may be updated by NETL to reflect the latest science.

- Additional Resources – NETL has tools that may be helpful in completing the LCA requirement. These tools are not exhaustive but can be used to provide some life cycle inventory data for some energy and material inputs. The version of tools used for the life cycle analysis should be clearly specified in the report. The following resources are recommended:
  i. FECM Best Practices – Best Practices for LCA of DAC With Storage
  ii. Additional General LCA guidance – CO2U LCA Guidance Document
  iii. NETL Life Cycle Inventory Data – NETL CO2U OpenLCA LCI Database
  iv. Electricity Consumption LCI Data – NETL Grid Mix Explorer.

- LCA submission requirements for phase deliverables:
  i. LCA Report – See CO2U LCA Guidance Document, Chapter 6: "Completing the NETL CO2U LCA Report Template."
  ii. LCA Model with Life Cycle Inventory Data – See the CO2U LCA Guidance Document for modeling guidance (no specific LCA software type is required).
  iii. List of all licensed LCA data used within the model (DOE will confirm or obtain license to access licensed data within the LCA model).

Option 2: If the CO_2 captured from the modeled DAC technology will be utilized to make a product, the LCA shall follow the guidelines set forth in the NETL report "Carbon Dioxide Utilization Life Cycle Analysis Guidance for the U.S. DOE Office of Fossil Energy," known as the CO2U LCA Guidance Document, or simply the guidance document. The guidance document is part of the NETL LCA CO2U Guidance Toolkit, which provides additional support for the creation of the required LCA. The guidance document outlines the analysis requirements and how to use the supporting data and tools. As outlined in the guidance document, the LCA must compare a proposed product system- the supply chain of the proposed CO_2 utilization project- to an appropriate comparison product system using a multiproduct functional unit and system expansion. All materials in the toolkit, including the guidance document, can be accessed at www.netl.doe.gov/LCA/CO2U. In addition to the LCA requirements outlined for Option 1, the following shall also be accounted for:

[20] IPCC. 2013. *Climate Change 2013: The Physical Science Basis*. New York: Cambridge University Press: Intergovernmental Panel on Climate Change Retrieved December 12, 2013. https://www.ipcc.ch/report/ar5/wg1/.
[21] IPCC. 2021. *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. New York: Cambridge University Press: Intergovernmental Panel on Climate Change Retrieved May 18, 2022. https://www.ipcc.ch/report/ar6/wg1/.

- Development of a Comparison Product System LCA – The GHG benefits of capture and utilization technologies require a comparison to the current commercial process for developing the same product or service as derived from the carbon utilization product proposed in the project. Guidance on how to develop the comparison product system is contained within the CO2U LCA Guidance Document.

Refined LCA

The refined LCA is intended to reflect any changes in design since the original LCA. All of the steps for modeling and reporting should be consistent with the LCA description above. A qualitative discussion should also be provided to describe a summary of the changes from the LCA. The refined LCA should include:

- Scale-up considerations—economies of scale impacts
- Representation of regionalized sources of energy inputs, including contractual procurements for dedicated sources (e.g., power purchase agreement [PPA])
- Representation of regionalized storage or utilization site.

Appendix 6: Basis for Technology EH&S Risk Assessment

Phase 2 (Design) submissions must include an environmental, health and safety (EH&S) risk assessment.

The purpose of the EH&S activity is to assess the environmental friendliness and safety of any future process based on the materials and process being proposed under the subject DOE prize. This is the major concern for solvents in use today. Exposure to nanoparticles is also coming under increasing scrutiny by the U.S. Environmental Protection Agency (EPA), National Institute for Occupational Safety and Health (NIOSH) and others. The EH&S risk assessments shall be conducted by qualified and experienced organizations and professionals (e.g., environmental scientists, industrial hygienists, safety engineers). *Unanticipated or uncontrolled EH&S risks will impede commercialization of CO_2 capture technologies, and the EH&S assessment is a critical element of the development project.*

Required elements for the EH&S Assessment are:

1. All potential ancillary or incidental air and water emissions and solid wastes produced from the proposed technology shall be identified and their magnitude estimated. In addition to solvents or sorbents used, researchers shall consider possible byproducts of side reactions that might also occur in the system, accumulated waste products, and the fate of contaminants from the feed gas stream. Environmental degradation products shall be addressed. Bioaccumulation, soil mobility, and degradability shall be considered. Conditions at the point of discharge shall be examined.
2. If possible, a concise but complete and comprehensible description of the various toxicological effects of the substances identified in (1) above shall be provided. A thorough literature search shall be conducted to examine potential human health effects and ecotoxicity. Where information is lacking for a particular material, it shall be compared to similar substances or classes of substances.
3. Properties related to volatility, flammability, explosivity, other chemical reactivity, and corrosivity shall also be collected from existing databases or if necessary, through direct measurement in cases where the substance is not in common use.
4. The compliance and regulatory implications of the proposed technology shall be addressed with reference to applicable U.S. EH&S laws and associated standards, including the Comprehensive Environmental Response and Liability Act of 1980 (CERCLA), Toxic Substances Control Act (TSCA), Clean Water Act (CWA), Clean Air Act (CAA), Superfund Amendments and Reauthorization Act (SARA) Title III, and the Occupational Safety and Health Act (OSHA).
5. An engineering analysis shall be conducted for any potentially hazardous materials identified to look for ways their use can be eliminated or minimized. Less-hazardous materials should be substituted where possible. For any new materials being proposed, synthetic options shall be examined that may lead to similar, less-hazardous compounds with the required functionality. Possible engineering controls and other mitigation strategies shall be described as appropriate.
6. Precautions for safe handling and conditions for safe storage shall be identified, including any incompatibilities with other materials that may be used in the process. Waste treatment and off-site disposal options shall be examined. Accidental release measures shall also be discussed.

Appendix 7: Energy Data eXchange (EDX) Requirements

DOE is required to improve access to federally funded research results, proper archiving of digital data, and expanded discovery and reuse of research datasets per DOE and executive orders. The Energy Data eXchange (EDX) is a data laboratory developed and maintained by NETL to find, connect, curate, use, and reuse data to advance fossil energy and environmental research and development (R&D).

Data products generated under the resulting award will be required to be submitted in the EDX at https://edx.netl.doe.gov/. Data products include but are not limited to software code, tools, applications, webpages, portfolios, images, videos, and datasets.

EDX uses federation and web services to elevate visibility for publicly approved assets in the system, including connections with DOE's Office of Scientific and Technical Information (OSTI) systems, Data.gov, and Re3Data. This ensures compliance with federal requirements, while raising visibility for researcher's published data products to promote discoverability and reuse.

EDX supports a wide variety of file types and formats including: (1) data, (2) metadata, (3) software/tools, and (4) articles (provided that there is an accompanying Government use license). A partial list of file formats accepted by EDX is provided below, however, EDX is designed for flexibility and accepts all types of file formats.

- Common data product submission formats: ASC, AmiraMesh, AVI, CAD, CSV, DAT, DBF, DOC, DSV, DWG, GIF, HDF, HTML, JPEG2000, JPG, MOV, MPEG4, MSH/CAS/DAT, NetCDF, PDF, PNG, PostScript, PPT, RTF, Surface, TAB, TIFF, TIFF Stacks, TXT, XLS, XML, ,Xradio, ZIP, and others.
- Geographic formats: APR, DBF, DEM, DLG, DRG, DXF, E00, ECW, GDB, GeoPDF, GeoTIFF, GML, GPX, GRID, IMG, KML, KMZ, MDB, MrSID, SHP, and others.

Information provided to EDX will be made publicly available, unless authorized under the resulting award. Additional information on EDX is available at https://edx.netl.doe.gov/about.

When data products are submitted to EDX, the data product will need to be registered with a digital object identifier (DOI) through OSTI to ensure more visibility in other search repositories (i.e., osti.gov, data.gov, Google Scholar, etc.). The OSTI DOI can be established through an application programming interface (API) by completing just a few additional fields.

The recipient or subrecipient should coordinate with the project manager on an annual basis to assess if there is data that should be submitted to EDX and identify the proper file formats prior to submission. All final data products shall be submitted to EDX by the recipient prior to the completion of the project.

Appendix 8: Technology Maturation Plan (TMP) Template

TECHNOLOGY MATURATION PLAN

for *{insert project title}*

{Date Prepared}

SUBMITTED BY

{Organization Name}

{Organization Address}

{City, State, Zip Code}

TEAM CAPTAIN

{Name}

{Phone Number}

{E-mail}

SUBMITTED TO

U.S. Department of Energy

This plan should be formatted to include the following sections, with each section to include the information described below:

A. TECHNOLOGY READINESS LEVEL

- Using the technology readiness levels (TRLs) in Appendix 9, specify the current TRL of the proposed technology. Note that to be at a certain TRL, all of the descriptions must be met. The application must provide a clear technical write-up describing the state of the proposed technology and use TRL description-based activities to justify the TRL score assigned.
- Provide a one-paragraph description of the target commercial application(s).

B. PROPOSED WORK

- Relate the proposed project work to the maturation of the proposed technology.
- List known performance attributes and their performance requirements to the extent possible. Explain how the performance requirements were determined (i.e., from FOAs; program plans; technology road maps; need to surpass the current state of the art). Be as specific as practical on any supporting technical/economic assessments.
- Define the TRL that is anticipated at the end of the project and describe how the project objectives will meet the TRL description if the project is successful.

C. POST-PROJECT PLANS

- Describe known post-project work needed to attain the next TRL. Explain why that work is not part of the proposed project, and why the project end point sets the best foundation practical for the next phase of work. To the extent practical, include market assessments and deployment strategies.

Appendix 9: Definition of Technology Readiness Levels (TRLs)

The following is a description of the DOE technology readiness levels.

Relative Level of Technology Development	TRL	TRL Definition	Description
System Operations	9	Actual system operated over the full range of expected mission conditions.	The technology is in its final form and operated under the full range of operating mission conditions. Examples include using the actual system with the full range of wastes in hot operations.
System Commissioning	8	Actual system completed and qualified through testing and demonstration.	The technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include developmental testing and evaluation of the system with actual waste in hot commissioning. Supporting information includes operational procedures that are virtually complete. An Operational Readiness Review (ORR) has been successfully completed prior to the start of hot testing.
	7	Full-scale, similar (prototypical) system demonstrated in relevant environment.	This represents a major step up from TRL 6, requiring demonstration of an actual system prototype in a relevant environment. Examples include testing full-scale prototype in the field with a range of simulants in cold commissioning (1). Supporting information includes results from the full-scale testing and analysis of the differences between the test environment, and analysis of what the experimental results mean for the eventual operating system/environment. Final design is virtually complete.
Technology Demonstration	6	Engineering/pilot-scale, similar (prototypical) system validation in relevant environment.	Engineering-scale models or prototypes are tested in a relevant environment. This represents a major step up in a technology's demonstrated readiness. Examples include testing an engineering scale prototypical system with a range of simulants. Supporting information includes results from the engineering-scale testing and analysis of the differences between the engineering scale, prototypical system/environment, and analysis of what the experimental results mean for the eventual operating system/environment. TRL 6 begins true engineering development of the technology as an operational system. The major difference between TRL 5 and 6 is the step up from laboratory scale to engineering scale and the determination of scaling factors that will enable design of the operating system. The prototype should be capable of performing all the functions that will be required of the operational system. The operating environment for the testing should closely represent the actual operating environment.

Relative Level of Technology Development	TRL	TRL Definition	Description
Technology Development	5	Laboratory scale, similar system validation in relevant environment.	The basic technological components are integrated so that the system configuration is similar to (matches) the final application in almost all respects. Examples include testing a high-fidelity, laboratory-scale system in a simulated environment with a range of simulants (1) and actual waste (2). Supporting information includes results from the laboratory scale testing, analysis of the differences between the laboratory and eventual operating system/environment, and analysis of what the experimental results mean for the eventual operating system/environment. The major difference between TRL 4 and 5 is the increase in the fidelity of the system and environment to the actual application. The system tested is almost prototypical.
Technology Development	4	Component and/or system validation in laboratory environment.	The basic technological components are integrated to establish that the pieces will work together. This is relatively "low fidelity" compared with the eventual system. Examples include integration of ad hoc hardware in a laboratory and testing with a range of simulants and small scale tests on actual waste. Supporting information includes the results of the integrated experiments and estimates of how the experimental components and experimental test results differ from the expected system performance goals. TRL 4–6 represent the bridge from scientific research to engineering. TRL 4 is the first step in determining whether the individual components will work together as a system. The laboratory system will probably be a mix of on-hand equipment and a few special purpose components that may require special handling, calibration, or alignment to get them to function.
Research to Prove Feasibility	3	Analytical and experimental critical function and/or characteristic proof of concept.	Active research and development (R&D) is initiated. This includes analytical studies and laboratory-scale studies to physically validate the analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative tested with simulants. Supporting information includes results of laboratory tests performed to measure parameters of interest and comparison to analytical predictions for critical subsystems. At TRL 3, the work has moved beyond the paper phase to experimental work that verifies that the concept works as expected on simulants. Components of the technology are validated, but there is no attempt to integrate the components into a complete system. Modeling and simulation may be used to complement physical experiments.
	2	Technology concept and/or application formulated.	Once basic principles are observed, practical applications can be invented. Applications are speculative, and there may be no proof or detailed analysis to support the assumptions. Examples are still limited to analytic studies. Supporting information includes publications or other references that outline the application being considered and that provide analysis to support the concept. The

Relative Level of Technology Development	TRL	TRL Definition	Description
Basic Technology Research			step up from TRL 1 to TRL 2 moves the ideas from pure to applied research. Most of the work is analytical or paper studies with the emphasis on understanding the science better. Experimental work is designed to corroborate the basic scientific observations made during TRL 1 work.
	1	Basic principles observed and reported.	This is the lowest level of technology readiness. Scientific research begins to be translated into applied R&D. Examples might include paper studies of a technology's basic properties or experimental work that consists mainly of observations of the physical world. Supporting information includes published research or other references that identify the principles that underlie the technology.

[1] Simulants should match relevant chemical and physical properties.
[2] Testing with as wide a range of actual waste as practicable and consistent with waste availability, safety, ALARA, cost, and project risk is highly desirable.

Source: U.S. Department of Energy. 2011. "Technology Readiness Assessment Guide." Office of Management.

Appendix 10: Community Benefits Plan (CBP) Guidance

Prize competitors will be required to develop a CBP to ensure that federal investments advance the following two goals: (1) investing in the American workforce, and (2) advancing diversity, equity, inclusion, and accessibility (DEIA). The below sections set forth the CBP requirements for each of these goals. Typically, CBP contains elements for community and labor engagement and contributions to the Justice40 Initiative; however, given the lower TRL range of this prize, competitors are asked to focus on the subsequent two goals in the Design Phase submission.

Investing in the American Workforce (IAW)

Quality jobs are the key to attracting and retaining the appropriately skilled, trained, or credentialed workforce required to meet the DAC Pre-Commercial Technology Prize objectives. New jobs should be supported by workforce development activities to build a stable skilled and trained workforce that will meet project labor needs at all stages of maturation.

The purpose of this section is to lay the groundwork for developing a robust IAW section as part of a CBP. This section includes a preliminary IAW assessment, which outlines workforce needs and relevant labor unions, job creation, and any negative workforce impacts of the project. This section also includes descriptions of research, partners, timeline, personnel, and resources required to develop the IAW section of a full CBP.

Elements of the IAW section include:

1. A **preliminary IAW assessment** that includes:
    a. An assessment of **workforce needs and labor unions** representing workers or trades that will be needed for technology development, prototyping, testing, business development, and commercialization.
    b. An assessment of the **jobs that will be created**, the occupational distribution, and skills or knowledge gaps that will need to be filled, and, if applicable, the training programs with whom the competitor could work to fill those gaps. Project teams should outline recruitment strategies and projected hires by occupation and assess job growth and workforce development opportunities associated with the proposal. A collective bargaining agreement, labor-management partnership, or other similar agreement would provide evidence of such a plan. Alternatively, competitors may describe:
        i. wages, benefits, and other worker supports to be provided benchmarking against prevailing wages for construction and local median wages for other occupations;
        ii. commitments to invest in workforce education and training, including measures to reduce attrition, increase productivity from a committed and engaged workforce, and support the development of a resilient, skilled, and stable workforce for the project; and
        iii. efforts to engage employees in the design and execution of workplace safety and health plans.
    c. A description of employees' ability to organize, bargain collectively, and participate, through labor organizations of their choosing, in decisions that affect them contributes to the effective conduct of business and facilitates amicable settlements of any potential disputes between employees and employers, providing assurances of project efficiency, continuity, and multiple public benefits. In the description, explain whether workers can

form and join unions of their choosing, and how they will have the opportunity to organize with the purposes of exercising collective voice in the workplace.

d. If applicable, an assessment of **any anticipated negative impacts on the workforce**, such as worker displacement resulting from this project, disruption to existing collective bargaining agreements, reduction in wages and benefits, etc.

2. A **description of research** that will need to be done to develop a detailed plan, including resources and data sets needed to successfully recruit and retain skilled labor within the project team.

3. A **description of any labor partners** who may be interested in collaborating on or learning about the plan.

4. A **timeline** for developing the plan, including appropriate milestones.

5. A **description of personnel** who will work on the plan, including trainings or qualifications that may need to be acquired.

6. An **estimate of financial resources** required for developing the plan.

Diversity, Equity, Inclusion, and Accessibility (DEIA)

Competitors should submit a DEIA section within the CBP that describes the actions the competitor will take, if selected for the award, to foster a welcoming and inclusive environment, support people from groups underrepresented in science, technology, engineering, and mathematics (STEM) and/or applicable workforces, advance equity, and encourage the inclusion of individuals from these groups in all phases of the project. The section should detail how the competitor 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 are encouraged to participate on the application team.

Elements of the DEIA plan should include the following:

1. **Background**. Describe prior and ongoing efforts by the project team relevant to DEIA, based on findings from an initial assessment that examines the context of DEIA in organizations related to the project team.

2. **Strategies, Milestones, and Timelines**. Describe targeted DEIA outcomes and implementation strategies, including milestones; include a DEIA schedule for execution; and address accountability measures. Milestones and work descriptions should be included within the schedule and workplan. Competitors are encouraged to use SMART (specific, measurable, achievable, relevant, and timely) milestones whenever possible.

3. **Resource Summary**. Describe project resources dedicated to implementing DEIA activities, including staff, facilities, capabilities, and budget. To fill open positions for the DOE-funded project, 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; In addition, competitor should consider providing comprehensive support services to increase representation and access in project's construction and operations jobs.

For the Deliver Phase submission, teams should aim to progress their technology out of the lab and consider deployment locations. Hence, teams should include contributions to the Justice40 Initiative and are encouraged to consider community and labor engagement as well.

Justice40 Initiative

Executive Order 14008 created the Justice40 Initiative, which established a goal that 40% of the overall benefits of certain federal investments flow to disadvantaged communities. Recipients of DOE funds should ensure that performance of project tasks within disadvantaged communities meaningfully benefits disadvantaged communities and does not result in increased burden to the disadvantaged community.

The purpose of this section is to lay the groundwork for developing a robust Justice40 section as part of a CBP. This section includes a preliminary Energy and Environmental Justice Assessment, which outlines groups and communities affected by the project and project impacts (benefits and negative impacts). This section also includes descriptions of research, partners, timeline, personnel, and resources required to develop the Justice40 Section of a full CBP.

Elements of the Justice40 Initiative section include:

1. A **preliminary Energy and Environmental Justice Assessment** that includes:
    - An analysis of **communities, including disadvantaged communities**, that will be affected by the project. This can be accomplished by using environmental justice screening tools and DOE's working definition of disadvantaged communities.[22] Specify what tools were used.
    - An overview of analyses needed to assess the likely **benefits and negative impacts** that can be anticipated based on project design, prior experience, or readily available data. Specify what methodology/data sources were used.
        - Benefits include (but are not limited to) measurable direct or indirect investments or positive project outcomes that achieve or contribute to the following in disadvantaged communities: (1) a decrease in energy burden; (2) a decrease in environmental exposure and burdens; (3) an increase in access to low-cost capital; (4) an increase in high-quality 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) an increase in energy resilience.
    - A discussion of anticipated negative and cumulative environmental impacts on disadvantaged communities. Are there anticipated negative or positive environmental impacts associated with the project, and how will the competitor mitigate any negative impacts? Within the context of cumulative impacts created by the project, competitors should use Environmental Protection Agency EJSCREEN tool to quantitatively discuss existing environmental impacts in the project area. See EJScreen: Environmental Justice Screening and Mapping Tool | US EPA.

[22] For additional information, please reference: https://www.whitehouse.gov/wp-content/uploads/2023/01/M-23-09_Signed_CEQ_CPO.pdf

2. A **description of research** that will need to be done to develop a detailed plan, including scoping data sources for incorporation into the plan (existing data sources as well as data sets that need to be developed).

3. A **description of any partners serving disadvantaged communities** who may be interested in collaborating on or learning about the plan.

4. A **timeline** for developing the plan, including appropriate milestones. A description of how and when anticipated benefits are expected to flow to disadvantaged communities. For example, will the benefits be provided directly within the disadvantaged community(ies) identified in the Justice40 Initiative section, or are the benefits expected to flow in another way? Further, will the benefits flow during project development or after project completion, and how will competitor track benefits delivered?

5. A **description of personnel** who will work on the plan, including trainings or qualifications that may need to be acquired.

6. An **estimate of financial resources** required for developing the plan.

Community and Labor Engagement

Community and labor engagement relates to the competitor's plans and actions to engage with community stakeholders, including community-based organizations representing residents and businesses, labor unions and worker organizations, local government, emergency responders, communities with environmental justice concerns, and relevant Tribes/Alaska Native Corporations (ANCs). Communities involve both local communities—towns, cities, or counties in geographic proximity to a project and Tribes/ANCs in close proximity to a project—and potentially broader groups that experience common conditions, which will need to be identified and scoped as part of the engagement plan. Successful competitors will demonstrate the ability to develop a plan that would meet the intent of meaningful community and labor engagement.

Community and labor engagement should ideally lay the groundwork for the 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. Registered apprenticeship programs, labor-management training partnerships, quality pre-apprenticeship programs, card check neutrality, and local and targeted hiring goals are all examples of provisions that Workforce and Community Agreements could cover that would increase the success of a DOE-funded project.

Competitors should also provide Community and Labor Partnership Documentation from representative organizations reflecting substantive engagement and feedback on competitor's approach to community benefits including job quality and workforce continuity; diversity, equity, inclusion, and accessibility; and the Justice40 Initiative detailed below.

Elements of the Community and Labor Engagement Section include:

1. A preliminary Engagement Assessment that includes:

    a. A description of prior engagement efforts by the project team to engage communities, Tribes, and labor stakeholders. If applicable, provide an assessment of and evidence of (e.g., letters of support, memorandums of understanding (MOUs), etc.) existing labor and

community support for and/or concerns with the project, including a description of steps taken to gather this information.

   b. A description of what project or technical aspects of the proposed project could be modified based on future engagement, including a discussion of whether there is a pathway for the project to consider changing target site(s) based on social considerations.

   c. A description of plans for any novel governance or financing structures, oversight mechanisms, or other mechanisms to maximize localized benefits.

2. A description of research that will need to be done to develop a detailed plan, including scoping data sources for incorporation into the plan (existing data sources, as well as data sets that need to be developed).

3. A description of resources, references, or community partners that will be useful in developing the plan.

4. A timeline for developing the plan, including appropriate milestones.

5. A description of personnel who will work on the plan, including training or qualifications that may need to be acquired.

6. An estimate of financial resources required for developing the plan.

This is the end of the Rules Document. Thank you for reading.