



Bipartisan Policy Center

Innovation at Scale: Supporting Pilot-Scale Demonstrations

INTRODUCTION

The establishment of the Office of Clean Energy Demonstrations (OCED) at the Department of Energy represents an important step towards accelerating American innovation and achieving net-zero greenhouse gas (GHG) emissions by 2050. The clean energy and low-emissions solutions required to meet these goals are complex, capital intensive, and not yet deployed at scale. Promising technologies often fail to move past successful research and development (R&D) into market adoption due to the expensive and risky nature of validating technology at scale. Federal funding provided by OCED is critical to effectively demonstrate and de-risk these technologies so they may be commercially proven and deployed widely.

While OCED programs have and likely will continue to focus on very large and complex projects—those at the last step before commercial application or requiring \$25 million or more to achieve commercial scale^a—there is a lack of public and private funding for pilot-scale demonstrations which require less than \$25 million.

Projects at this stage are larger than typical venture capital investments but not yet sufficiently de-risked for project finance providers. Pilot-scale demonstrations aim to prove that larger investments are worthwhile. OCED is well-positioned to address this funding support gap by creating a Small Business Innovation Research (SBIR) program^b and a Small Business Technology Transfer (STTR) program through existing authority. By incorporating lessons learned from the longstanding DOE SBIR/STTR programs, OCED has the opportunity to develop its program in a way that supports companies at the pilot-stage and de-risks a pipeline of promising technology for larger-scale OCED awards.

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By Natalie Tham

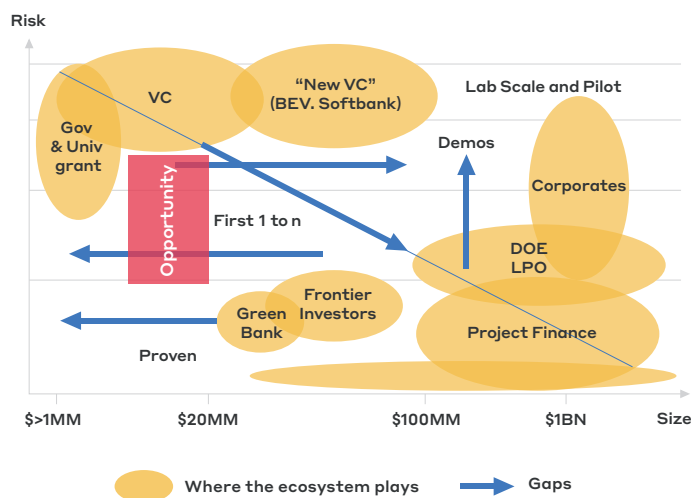
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Hart, David and Jetta Wong. [DOE OCED Recommendation Letter](#), ITIF, 2021.
[About | The SBIR and STTR Programs](#)

THE CASE FOR FUNDING PILOT-SCALE DEMONSTRATIONS

There is a funding gap in the innovation pipeline for promising technologies to secure investment for pilot-scale demonstration projects that follow lab prototypes, especially for projects requiring less than \$20 million.^c These technologies have been deemed technically feasible in an R&D setting and must now demonstrate success at incrementally larger scales. They have likely identified potential commercial applications and need additional support for further market development. Venture capital investments generally occupy a high-risk profile and have a large number of relatively small investments. Public funding from applied R&D programs at DOE and other agencies occupy a similar risk profile and many of these programs focus solely on technical merit. In contrast, project finance providers focus on low-risk projects with a smaller number of large investments and typically require an idea to have been demonstrated multiple times on a large-scale and have a repeatable business model. Shown in red in the figure below, a gap exists for projects that have moved past the venture capital or R&D funding stage but still require further demonstration (especially with respect to commercial viability) before attracting larger investment.



Note: Size axis is indicative (not a scale) and different across tech stages

Source: [Prime Coalition](#)

^c Khatcherian, Karine. [Barriers to the Timely Deployment of Climate Infrastructure](#). Prime Coalition, 2022.

A DEMONSTRATION PIPELINE AT OCED

OCED is well-positioned to fill this gap and support companies at the pilot stage by creating an SBIR/STTR program through its existing scope and authority. While primary OCED projects will likely focus on very large and very complex projects in the range of \$25 million to hundreds of millions, no program exists to support pilot-scale demonstration projects needing less than \$25 million. An OCED SBIR/STTR program could fill this gap and provide enormous impact with comparatively small investment. This would allow OCED to build a pipeline of highly innovative projects for its larger-scale programs and help to prepare the companies behind these projects to apply for larger awards. Using the SBIR/STTR program to support pilot-scale demonstrations aligns with OCED’s mission to deliver energy demonstration projects at scale while also aligning with the SBIR/STTR mission to stimulate innovation in small businesses.

The amount of funding that could be available for an OCED SBIR/STTR program is not insignificant. The Small Business Administration (SBA) defines R&D as an activity that is “a systematic application of knowledge and innovation toward the production of useful materials, devices, and systems or methods, including ... improvement of prototypes”^d OCED’s focus on demonstration and stated goal of “accelerat[ing] clean energy technologies from the lab to market”^e falls within this definition, especially with respect to the improvement of prototypes. The Infrastructure Investment and Jobs Act (IIJA) funded OCED at \$21.5 billion over five years. At the high end, assuming most of the OCED budget is considered R&D under SBA’s definition, this yields a nearly \$157 million annual budget for an OCED SBIR/STTR program. To put this into perspective, in fiscal year 2021 DOE received \$326 million across all SBIR programs for clean energy technology areas supported by each DOE program office.^f Even with a more conservative assumption about OCED’s R&D budget, the amount of funding available to support pilot-scale demonstration projects is ample.

OCED should look to the success of the SCALEUP program at DOE’s Advanced Research Project Agency – Energy (ARPA-E) as it considers this question, especially with respect to building an internal pipeline for large awards. ARPA-E realized the need to address the lack of public funding for pilots in 2019 when it announced the first cohort of its \$75 million SCALEUP program.^g Award amounts for this cohort of previously funded ARPA-E projects ranged

d [Small Business Administration SBIR/STTR Policy Directive](#)
e [About Us | Office of Clean Energy Demonstrations](#)
f [Department of Energy FY 2023 Congressional Budget Request](#)
g [ARPA-E | The SCALEUP Program](#)

from \$2.25 million to nearly \$20 million and supported demonstration and market development for projects with proven technical performance on a path to commercial viability. This model proved highly successful; ARPA-E recently announced a second cohort with \$100 million in funding for eight projects.^h Currently, eligibility for ARPA-E SCALEUP is limited to prior ARPA-E awardees. Pulling from a pipeline of past awardees, which are initially funded at \$1 to 5 million, allows ARPA-E to significantly increase the size of investment to worthwhile technologies with relatively low technical risk. Similarly, OCED could create a de-risked pipeline by funding pilot-scale demonstrations and tracking them for larger-scale OCED programs. The success of the ARPA-E SCALEUP program is evidence that this model is worth pursuing, and a similar program at OCED would expand this opportunity to companies outside of ARPA-E past awardees currently supported by SCALEUP.

AN OCED SBIR/STTR TO SUPPORT INNOVATIVE COMPANIES

The opportunity to advise on the formation of a new program in the federal government does not come around often, and investments from the Inflation Reduction Act provide unprecedented opportunity for clean energy small businesses to flourish. To make the most of this moment, the Bipartisan Policy Center consulted clean energy startups, incubators and accelerators, investors, NGOs, think tanks, and researchers to develop the recommendations presented in this white paper. Startups were asked how an OCED program focused on pilot-scale projects could address the real-world challenges of a small company on the path to commercialization. Funders were asked what OCED should do to prepare potential awardees for the post-award stages. In short, potential applicants, awardees, and supporters of an OCED pilot-scale program were asked to design their ideal program. This paper builds on BPC's previous work identifying opportunities to strengthen DOE's existing SBIR/STTR program.ⁱ

^h [U.S. Department of Energy Announces \\$100 Million to Boost Commercialization of Eight New Clean Energy Technologies](#). ARPA-E, 2022.

ⁱ [Das, Tanya. Reforming the Department of Energy's Small Business Innovation Programs](#). Bipartisan Policy Center, 2022.

RECOMMENDATIONS

In consultation with clean energy startups, incubators and accelerators, investors, NGOs, think tanks, and researchers, BPC recommends that OCED create an SBIR/STTR program to support pilot-scale demonstrations. This program should incorporate the following:

1. Make funding available for flexible purposes.
2. Considering raising the cap for awards.
3. Operate independently of the larger DOE SBIR/STTR program.
4. Offer open topic solicitations, as well as solicitations for specified topics where applicable.
5. Consider a flexible structure to simplify contracting for eligible awardees.
6. Increase the frequency of application windows.
7. Bolster support for first-time and underrepresented applicants.
8. Consider high-growth, innovative startups as well as larger, more established small businesses.

Make funding available for flexible purposes.

Potential applicants to OCED's SBIR/STTR will be at a later stage than traditional DOE SBIR/STTR applicants, and therefore their needs will be different. In addition to the need to reliably demonstrate technology, major challenges to commercial deployment include establishing consumer adoption, overcoming regulatory hurdles, and supply chain considerations. Because of these factors, awardees will be better supported if they have flexibility in how they spend their awards. Some options include permitting costs, patent applications, purchasing equipment, securing office and other workspaces, working with engineering and design partners, supporting manufacturing at scale, creating industry engagement, finding corporate partners, and identifying customers. OCED could also consider a model with matching funds to incentivize corporate partners to participate, which could spur more private sector investment and potentially lead to future offtake agreements, expand public-private partnerships, and generally increase the likelihood of successful commercialization. Awards should also be allowed to supplement other awards a company has received.

Consider raising the cap for SBIR/STTR awards.

A higher awards cap could better meet the needs of OCED SBIR/STTR projects, which are further down the commercialization pathway than projects supported by the existing DOE SBIR/STTR program and are likely more capital-intensive. Some options include a cap of \$8-10 million, offering \$5 million over five years, or incremental grant amounts over a period of time (for example, \$250,000, \$1 million, \$5 million) with reporting and milestone requirements

along the way. This increased cap could be coupled with smaller exploratory grants to be used to find partners and validate that the technology is ready for a Phase I award.

Operate independently of the larger DOE SBIR program.

The OCED SBIR/STTR program should focus on helping startups fund pilot-scale demonstration projects, a focus unlike SBIR/STTR programs in other DOE applied offices which focus primarily on earlier-stage R&D projects. In order to adopt this approach, OCED SBIR/STTR should follow the model of ARPA-E by managing its own SBIR process separate from the rest of DOE's SBIR program. ARPA-E has a unique structure that focuses on short-term topic-specific programs. The office uses SBIR grants to supplement program cohorts selected through the standard granting process, as opposed to separating SBIR awardees from other grant awardees as is done in other DOE applied offices. An SBIR program fully managed by ARPA-E has allowed the office to use their SBIR funding in a way that fits the unique needs of their program. OCED similarly has a focus distinct from that of other DOE applied offices. The flexibility of an independent SBIR/STTR program could amplify the impact of OCED in supporting demonstration projects.

Offer open topic solicitations, as well as solicitations for specified topics where applicable.

The current DOE SBIR/STTR program has been criticized for soliciting applications in narrowly defined technology-oriented topic areas to meet specific federal R&D needs.^j This approach disqualifies entrepreneurs whose innovations may be highly relevant to DOE's and OCED's mission, but whose ideas fall outside the scope of certain restrictive topics. To maximize flexibility for applicants and overall program impact, OCED should ensure a portion of solicitations are open to any technology area relevant to OCED's mission. OCED may still solicit applicants for more narrow topic areas that are paired with market-oriented or end-use outcomes, for example in a technology area where commercial interest or a decarbonization gap is known.

Consider a flexible structure to simplify contracting for eligible awardees.

Adding a flexible structure could take the form of a milestone-based approach to unlock Phase II funding instead of submitting an additional application. This would allow eligible companies to access Phase II financial resources with lower administrative burden, once milestones or requirements are met, and would eliminate the need for separate applications for companies who

^j Das, Tanya. [Reforming the Department of Energy's Small Business Innovation Programs](#). Bipartisan Policy Center, 2022.

are further along commercially. This is possible under the current SBIR/STTR program authorization, and the ARPA-E SBIR program is currently structured this way. Additionally, the innovation arm of the Department of the Air Force, AFWERX^k, awards firm fixed price contracts to small businesses, significantly decreasing the administrative burden which can be overwhelming to companies at the Phase I stage. Awardees are paid for specific milestones and deliverables, rather than reimbursed for incurred costs. ARPA-E SBIR/STTR program also uses a firm fixed price contract model for Phase I awards, even if the awards are coupled as Phase I/Phase II/Phase IIS combined awards.

Increase the frequency of application windows.

Companies face key points along the commercialization pathway that determine whether they succeed or fail. These points are often referred to as “valleys of death” because companies must navigate across them successfully in order to continue to the next stage. The most common valley of death hurdle for companies in the pilot stage is the ability to validate that a market exists for the technology.

OCED SBIR/STTR applications should be reviewed more frequently than twice per year to allow entrepreneurs to apply for funding at the most optimal time in their company growth timeline and before they fall prey to the valley of death. The National Science Foundation’s SBIR program currently operates with a rolling application window, allowing entrepreneurs to apply for funding when it is most needed, instead of only when it is available. OCED should consider offering more than two application windows.

Bolster support for first-time and underrepresented applicants.

Fostering entrepreneurship in underrepresented groups is a statutory goal of the SBIR/STTR program. As such, OCED should offer direct outreach and dedicated support to SBIR/STTR applicants from underrepresented groups and first-time SBIR/STTR applicants to fulfill this goal. OCED could utilize a variety of approaches to achieve this goal, which may include:

- Conducting strategic outreach to underrepresented groups, with particular focus on ensuring a promising company can obtain funding before they fall through the valley of death;
- Building out a Phase 0 program to provide application assistance to first time and unsuccessful applicants (similar to the existing DOE SBIR/STTR Phase 0 program);
- Developing materials and provide dedicated support to help successful applicants navigate award management processes; and
- Providing access to feedback and individualized support during the drafting

^k [U.S. Air Force | AFWERX Program](#)

process. OCED should coordinate with established DOE outreach in other program offices or within DOE's Office of Economic Impact and Diversity, as well as with local universities, university extension offices, community colleges, or national labs.

Consider high-growth, innovative startups as well as larger, more established small businesses.

The current small business definition includes companies with fewer than 500 employees, placing smaller companies in direct competition with much larger ones. A company with closer to 500 employees can compete for non-SBIR/STTR funding in a way that a smaller company is not able to. OCED should consider a more robust definition that includes both the current employee cap, as well as other indicators that demonstrate an applicant to be an innovative and high-growth startup. This will help ensure that the program focuses on startups.

CONCLUSION

The technologies needed to reach net-zero emissions by mid-century require both public and private investments to progress from idea to market. OCED has a vital role to play in accelerating these important technologies, particularly at the pilot demonstration phase.

Because existing federal programs primarily focus on applied R&D and venture capital firms rarely target companies moving into the demonstration phase, there is a funding support gap for innovative companies seeking to demonstrate technical and commercial viability. While recent federal investments, like the DAC and Hydrogen Hubs, target large-scale demonstrations requiring hundreds of millions in funding, there is no program to support those needing less than \$25 million. Through an SBIR/STTR program, OCED is well positioned to support innovative companies at the pilot demonstration stage and to diversify the overall suite of technological solutions available to meet our goals. OCED should take the lessons learned from the longstanding DOE SBIR/STTR program and the ARPA-E SCALEUP program to develop a program that supports companies at the pilot-stage, explores promising clean energy and low-emissions technology solutions, and drives American innovation.