



OCED

Office of Clean Energy Demonstrations

OCED Investment Value Proposition

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Report Disclaimer

This report, “OCED Investment Value Proposition,” outlines the Office of Clean Energy Demonstrations (OCED) general philosophy towards its investments. It is intended to provide the private sector and the American public with a clearer understanding of OCED’s approach to its investments and to facilitate a more informed dialogue concerning the commercialization of its portfolio. For the purposes of this report, risk is the effect of uncertainty on objectives.ⁱ

The content herein reflects a broad overview of OCED’s investment philosophy and should not be interpreted as either policy or procedural guidelines, or as an investment decision framework that will apply to OCED projects or operations in all instances. The insights and perspectives shared in this document aim to enhance transparency and understanding of OCED’s value proposition and are not representations of OCED’s operations or commitments.

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ⁱ [OMB Circular No. A-11 \(2024\), Section 260.30](#)

Introduction

OCED’s Mission

The Department of Energy (DOE) Office of Clean Energy Demonstrations (OCED) directly addresses the need to scale innovative technologies in the energy and industrial sectors in the United States. By partnering with the private sector to demonstrate cutting-edge technology and catalyzing significant private investment, OCED responds to growing demand for energy and energy-related infrastructure, ensuring continued American energy leadership, widespread economic growth, and domestic energy resilience.

The mission of the Office of Clean Energy Demonstrations is to deliver clean energy demonstration projects at scale in partnership with the private sector to accelerate deployment, market adoption, and the equitable transition to a decarbonized energy system.

OCED’s Scope

In support of this ambitious mission, *Figure 1* below illustrates how OCED executes its mandate:



Figure 1: OCED Mandate

OCED is a multi-technology office with an investment mandate spanning a wide range of energy and industrial technologies including advanced nuclear, hydrogen, carbon management, long-duration energy storage, industrial demonstrations, and energy projects in rural and remote areas and on current and former mine land. OCED’s private sector partners span a diverse set of sectors representing a large swath of the American economy, from traditional manufacturing and retail to both established and emerging energy companies.

In line with its mission, OCED has a long-term vision beyond the Office’s foundation in the Infrastructure Investment and Jobs Act (IIJA, commonly known as the Bipartisan Infrastructure Law (BIL)) and the Inflation Reduction Act (IRA). In Fiscal Year 2024, OCED received annual appropriations to expand its portfolio to Distributed Energy Systems and Gen3+ Advanced Nuclear. OCED will continue to expand its portfolio and partner with the private sector to invest in technologies and sectors in need of commercial-scale demonstrations, further strengthening U.S. competitiveness and global energy leadership.

OCED's Investment Instruments & Philosophy

Investment Instruments

OCED manages over \$25 billion in federal funding as one of the world's largest advanced energy investors. The Office makes investments through a range of instruments, the three largest are:

- **Demonstration Projects:** OCED invests most of its capital in first-of-a-kind (FOAK) and early-of-a-kind commercial demonstration projects. These investments typically take the form of a Cooperative Agreementⁱⁱ or an Other Transaction Agreement between DOE and a private sector partner. Under these agreements, OCED generally funds up to 50% of the total project capital expenditures. The private sector partner finances the remainder, usually representing a 50% or higher "cost share." Private sector cost share typically comes from corporate parent balance sheets (funded by cash flows or equity fundraising), corporate debt facilities, 3rd-party project investors, or some combination thereof. Following typical project financing transactions, OCED stages funding using specific milestones aligned with successive project phases: (1) Detailed Planning, (2) Project Development, (3) Installation, Integration and Construction, and (4) Ramp-Up and Operation. At each phase, OCED evaluates the project's progress and commercial potential as part of the gating criteria for further investment. OCED's contribution can be viewed as "non-dilutive project equity" ("non-dilutive" in that OCED has no requirement for repayment or financial return and thus does not dilute any ownership structure, and "project equity" in that OCED funds specific projects rather than general corporate spend). In addition to these applications, OCED uses Cooperative Agreements and grants to support projects in programs focused on place-based strategies, such as improving energy systems in rural or remote areas.
- **Financial Instrument Solutions:** OCED investments can also target market-related barriers to commercialization of energy technologies. These investments are typically pursuant to Other Transaction (OT) authority and can employ transaction structures such as Partnership Intermediary Agreements (PIA) or Other Transaction Agreements. An example application could be demand-side support for offtake agreements, where OCED or a special purpose entity runs a competitive auction (e.g., contract for difference) to help energy projects raise private sector financing.
- **Liftoff Enabling Programs:** When appropriate, OCED invests in addressing targeted value chain-related barriers to commercialization. These investments can take many forms, including grants, prizes, National Laboratory agreements, and Other Transaction Agreements. Examples include Technology Commercialization Fund (TCF) vouchers to provide technology developers with access to testbed facilities, technical assistance in siting and permitting, and prizes to support expanding U.S. manufacturing and supply chains. OCED also pursues a variety of collaborations with the National Labs like convening industry to share data and best practices in pursuit of commercial liftoff, developing and sharing contract terms with the market to support standardization, and developing analysis frameworks important for incentives and business cases.

ii A legal instrument of financial assistance between a Federal awarding agency or pass-through entity and a non-Federal entity that, consistent with [31 U.S.C. 6302-6305](#):

1. Is used to enter into a relationship the principal purpose of which is to transfer anything of value from the Federal awarding agency or pass-through entity to the non-Federal entity to carry out a public purpose authorized by a law of the United States (see [31 U.S.C. 6101\(3\)](#)); and not to acquire property or services for the Federal government or pass-through entity's direct benefit or use;
2. Is distinguished from a grant in that it provides for substantial involvement between the Federal awarding agency or pass-through entity and the non-Federal entity in carrying out the activity contemplated by the Federal award.
3. The term does not include: (1) A cooperative research and development agreement as defined in [15 U.S.C. 3710a](#); or (2) An agreement that provides only: (i) Direct United States Government cash assistance to an individual; (ii) A subsidy; (iii) A loan; (iv) A loan guarantee; or (v) Insurance.

Investment Philosophy

OCED's investment philosophy is centered on accelerating commercialization for emerging energy and industrial technologies. Beyond the success of individual projects, OCED seeks the success of the portfolio broadly, pursuing the "return" of "commercial liftoff" – i.e., the point where a technology establishes a largely self-sustaining market that can attract a wide range of capital providers with different risk appetiteⁱⁱⁱ – in each investment area (*rather than* a financial return to OCED). To achieve commercial liftoff, a technology must realize cost reductions and learning improvements achieved from continued deployments at scale.

By nature of its earlier stage mandate, OCED's investment areas and projects are characterized by a high degree of uncertainty. Some sectors are not developed (e.g., many business and product solutions exist with no clear market leader and varying paths to viability). Some project features may be uncertain at the time of investment (e.g., cost and revenue projections, technology readiness, operational track record, regulatory requirements, qualifications for tax credits, and others). These uncertainties increase the real and perceived risks of such projects, creating barriers to investment by the private sector.

To attract private capital to these projects, OCED deploys the investment instruments previously discussed. By co-investing with the private sector, OCED facilitates the development of FOAK and early-of-a-kind energy and industrial sector projects. These investments "buy down" (i.e., reduce) the real and perceived risks of emerging critical-path energy technologies through commercial demonstration, familiarizing market and community partners with these solutions. In doing so, OCED's investments act as a catalyst for follow-on private sector investment – taking on early commercialization risks that the private sector cannot or will not at sufficient pace or scale. OCED provides a bridge between high-risk, early-stage technology development and the commercial maturity required for widespread investment and broad market adoption.

To execute on this investment philosophy, OCED follows a generalized investment cycle in close collaboration with other DOE offices (*Figure 2*):

- **Identify emerging investment areas:** Through comprehensive analytical research and targeted discussions with a wide range of partners including private sector organizations, investors, market experts, non-profits, and other DOE offices, OCED identifies sectors, technologies, and business models that are uniquely ready for OCED investment based on technology and commercial readiness, development stage, and attractiveness to private capital investment.
- **Identify key barriers to commercial liftoff:** Next, OCED undertakes a thorough analysis of the obstacles to commercial viability in these investment areas. This analysis is underpinned by internal DOE and market intelligence gathering and characterizes sector-specific challenges such as technological hurdles, financial risks, offtake challenges, and regulatory constraints. These analyses often reference the [Pathways to Commercial Liftoff Reports](#).
- **Design funding programs to overcome barriers:** When appropriated funding by Congress, OCED designs programs – in close collaboration with other DOE offices in pursuit of well-aligned, impactful programming – to reduce commercialization barriers for emerging energy and industrial sector technologies.
- **Select projects and invest:** OCED selects meritorious projects through a competitive, structured review process, negotiates final agreements, and allocates program funding. Portfolio balancing is essential to each investment decision (initial and ongoing). This involves evaluating projects in the context of the portfolio from a strategic and a risk perspective to maintain a balanced portfolio throughout the investment cycle.

ⁱⁱⁱ "Liftoff" is characterized by significant improvement in technology and operating parameters, market recognition of a sector or technology's full value, and realization of industrial-scale manufacturing and deployment capacity. (<https://liftoff.energy.gov/>)

- **Oversee projects in phases:** OCED's phased approach to project implementation incorporates well-established principles familiar to the private sector. From conceptual design through construction and operations, each phase includes integrated stages and checks. With its larger and more complex projects, funding is released in tranches and projects must pass investment go/no-go decision points prior to receiving the next tranche of funding. These decision points are generally designed to align with the investment decision points of OCED's private sector partners. At the go/no-go decision points, OCED may adjust or discontinue funding for the project based on the outcome of the evaluation.^{iv}
- **Track and share insights:** The dissemination of key findings and lessons learned from the portfolio is crucial to OCED's mandate. While ensuring project data security and closely protecting any confidential business information, OCED develops important, non-attributable insights through anonymization and aggregation of portfolio data. By sharing timely on-the-ground learnings, OCED improves DOE's and the market's understanding of energy technologies, encourages future investments by the public and private sector, and accelerates commercial liftoff.
- **Make iterative improvements:** OCED's approach is inherently iterative. OCED will repeat the process of identifying barriers, securing funding, designing programs, investing in demonstrations, balancing its portfolio, providing oversight, and sharing insights to refine and enhance the impact of its investments.

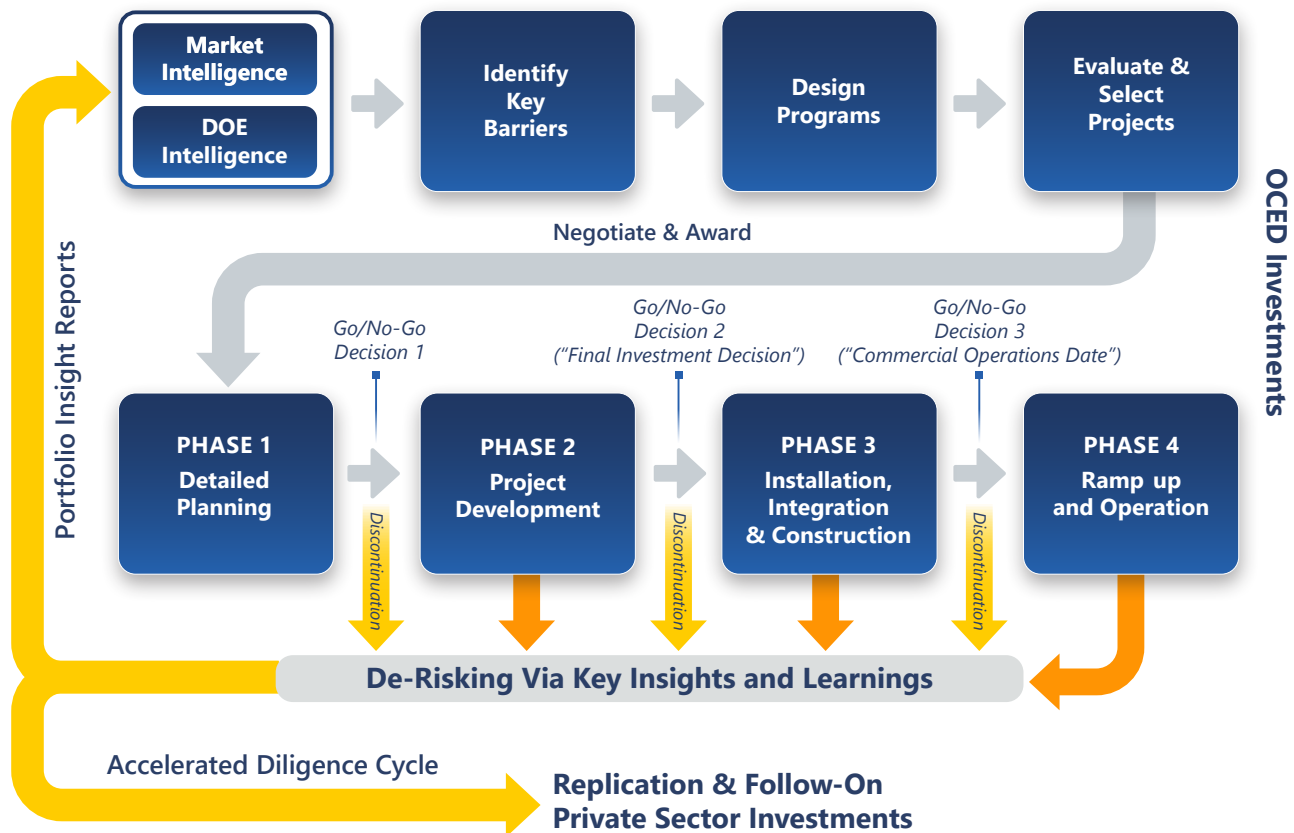


Figure 2: Illustration of OCED's investment and insights generation cycle

^{iv} <https://www.energy.gov/oced/project-management-oversight-excellence>

Market Position

As energy and industrial sector technologies move along the commercialization path from research & development (R&D) to pilot, demonstration, deployment, and steady state commercial operation, the amount of funding needed in each step of commercialization grows substantially (*Figure 3*). This progression is paralleled by a shift in the nature of the risks associated with each stage. OCED plays a unique role in this progression, both within DOE and in the private sector.

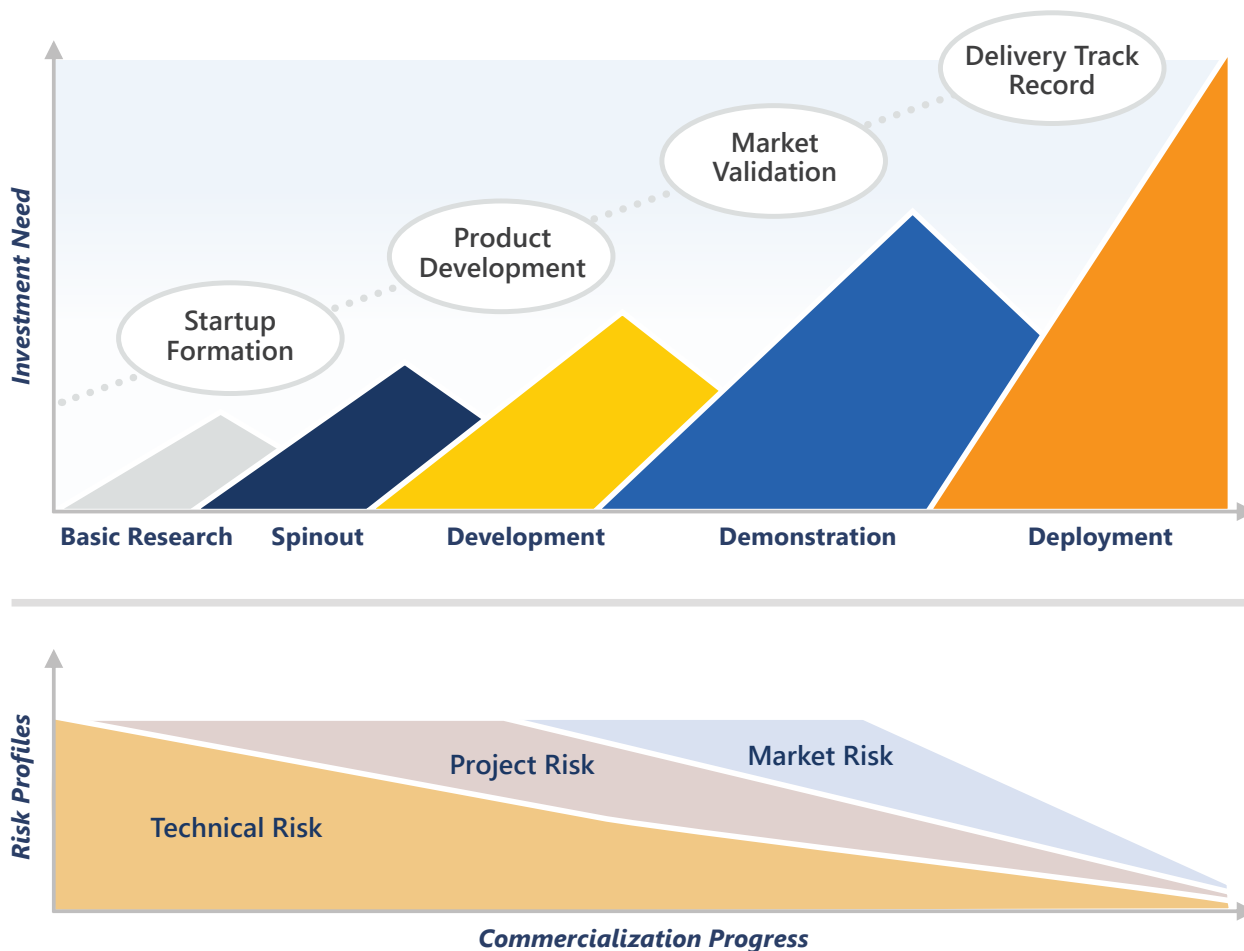


Figure 3: Commercialization Progress, Investment Size, and Risk Profile

OCED's position within DOE

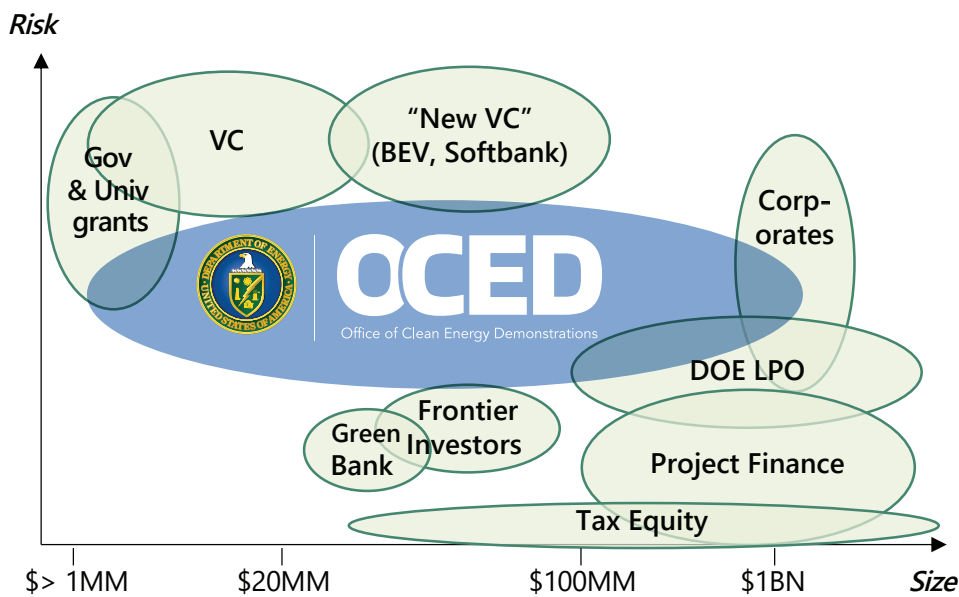
DOE offices focus on different stages of the energy and industrial technology commercialization continuum. Earlier stage offices (e.g., the Office of Science, Advanced Research Projects Agency-Energy (ARPA-E), and the Applied R&D Offices) fund activities that primarily drive down technology risks. They provide financial assistance^v to fund primarily research, development, piloting, and small-scale demonstrations for emerging technologies. At this early stage, the feasibility and potential of innovative technologies are explored and validated.

^v In this context, federal financial assistance means assistance that non-Federal entities receive or administer in forms such as grants, cooperative agreements, and other financial assistance.

OCED primarily funds FOAK and early-of-a-kind commercial-scale demonstration stage projects, focusing on the unique challenges of early commercial adoption and scaling emerging technology. OCED's involvement represents a transition from primarily technology risks to primarily project execution and market risks. The DOE Loan Programs Office (LPO) plays at a later stage in the commercialization continuum, providing loans and loan guarantees to accelerate deployment of projects that have no binary technology risk and are able to meet the requirement of a 'reasonable prospect of repayment.' In general, a project that is able to take debt from LPO should do so, as OCED funding focuses on gaps in the path to commercial scale that LPO debt cannot support.

OCED's unique position reflects its critical role in bridging the gap between pioneering research and full-scale commercial deployment within DOE's strategy for advancing energy and industrial manufacturing competitiveness in the US.

OCED's position within the energy and industrial technology investor landscape



Note: Not to scale, not comprehensive

Figure 4: OCED's role in the broader funding landscape (Source: Prime Coalition, 2022)

OCED's strategic position within the emerging energy and industrial technology investment landscape primarily focuses on bridging the funding gap for FOAK and early-of-a-kind commercial-scale demonstrations that do not yet fit the desired risk-return profile (perceived or actual) of the private sector (Figure 4). Earlier-stage equity investors typically seek corporate equity opportunities at dollar amounts unable to fund commercial-scale demonstration projects. Conversely, private infrastructure investors typically seek projects with well-defined parameters, predictable revenue streams, and proven technology performance. While project finance investors at times may be willing to invest in FOAK and early-of-a-kind demonstration projects through creative structures, a significant funding gap for such projects remains. OCED bridges this gap with non-dilutive capital.

Beyond project investments, OCED plays an important role in advancing sectors through ecosystem-enabling funding (see Lifftoff Enabling Programs above) informed by extensive industry, investor, and community engagement as well as analysis and market intelligence. This holistic approach addresses the immediate financial needs of demonstration projects, enabling these sectors to develop in a self-sustaining manner.

A note on project discontinuations

By nature of its mandate, OCED's investment areas and projects are characterized by a high degree of uncertainty. As such, some projects will not proceed to Final Investment Decision (FID) or Commercial Operation Date (COD). Project discontinuation is not seen as a failure, but rather a predictable and important result of seeking rewards by taking appropriate risks.

OCED captures and shares with industry critical, transferable learnings from successful projects as well as project discontinuations to continue to fulfill its mission of accelerating market adoption of important clean energy and industrial technologies. By sharing learnings even from projects that don't proceed, OCED's *portfolio* can still succeed in the face of individual *project* discontinuations.

Analogous DOE Office	Private Sector Financing	Typical Discontinuation / Default Rate ¹	Typical Investment Size	Typical Return Expectations
<div style="display: flex; flex-direction: column; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">Applied R&D Offices</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">OCED</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">LPO</div> </div>	Angel / Seed	50–75% ²	<\$1M	~22–27% ⁷
	Early- / Mid-Stage VC	30–65% ³	\$1M–\$50M	~15–23% ⁸
	Late-Stage VC / PE	14–30% ⁴	\$50M–\$500M	~13–20% ⁹
	Project Finance	5–11% ⁵	\$500M–\$2B	~6–11% ¹⁰
	Commercial Debt / LPO Portfolio	Commercial: 3.75–6.25% LPO: 3.1% ⁶	\$500M–\$5B	SOFR + 250–500 bps

Figure 5: Discontinuation Rate Illustration (sources in Appendix)

A *project's* success may take the form of sustained profitable operations, follow-on non-Federal financing, expansion or replication, workforce development, and early identification of critical barriers. Even if a project does not proceed to FID or COD, that project may contribute to learnings and *portfolio* success, which may take the form of:

- *Technology successes* (e.g., learnings that inform R&D and demonstration strategies, de-risked technology, increased capital flow to next-generation technologies at scale, improved performance and cost, and demonstrated technology in new environments); and
- *Commercial adoption* (e.g., improved datasets for industry modeling and investor analysis, better understood market dynamics, increased product demand, increased capital flow, improved workforce, and scaled community benefits).

Given the risk profile of projects inherent to OCED's mission, the early stage of commercial development at which OCED typically awards projects, and learnings from past demonstration programs at DOE, OCED's project discontinuation rate is expected to be relatively higher than the Loan Programs Office's default rate and relatively lower than the Applied R&D offices' discontinuation rates. For context, DOE offices and roughly analogous private sector financing categories are shown in *Figure 5*. Due to the depth and breadth of DOE's Applied R&D Offices, their Typical Discontinuation/Default Rate, Typical Investment Size, and Typical Return Expectations figures are highly imprecise.

¹ Discontinuation rate and default rate – most relevant in equity and debt contexts, respectively – are distinct measures. Discontinuation rate measures the frequency with which investors stop supporting a project or platform, sometimes resulting in wind down. Default rate measures the share of borrowers unable to repay their debt (i.e., in default).

Conclusion

The DOE has a near-term opportunity to commercialize technologies that will significantly extend the longevity of United States energy dominance. OCED enables the private sector to solidify global energy leadership by building domestic manufacturing and local, resilient energy supply; creating widespread economic growth; and driving significant private sector investment.

By nature of OCED's mandate, OCED's investment areas are characterized by both high potential impact and market challenges. The latter has been shown to inhibit private sector investment. OCED addresses these barriers by co-investing with the private sector using a variety of instruments to spur commercialization. This co-investment facilitates early-of-a-kind project development for energy and industrial technologies and buys down the real and perceived risks of future deployments. In this way, OCED **catalyzes progress from high-risk, early-stage development toward the commercial maturity required for widespread investment and broad market adoption.**

Appendix

Figure 5 Footnotes

- 2 Angel Resource Institute. (2016). [Angel Returns Report 2016](#). 70% of the 20 angel funds surveyed exited with less than a 1x cash on cash multiple, which Angel Resource Institute considered as a threshold for failure.; Forbes. (2018). [How Angel Investors And Angel Groups Work](#). Although there is a lack of publicly available data on typical angel investment failure rates, Forbes has estimated that less than 50% of investors expect a positive return. Harvard Business School. (2016). [The Globalization of Angel Investments: Evidence Across Countries](#).
- 3 Industry Ventures. (2017). [The Venture Capital Risk and Return Matrix - Industry Ventures](#). Industry Ventures analysis of Pitchbook data estimates that loss rates, which this source defines as the likelihood of a return that is less than 1x invested capital, for early-mid stage VC can range from 30 to 65%.; Forbes. (2012). [Data Insight: Venture Capital returns and loss rates](#). Analysis from Adams Street Partners suggests that "over both 10- and 30-year periods, share of dollars invested that go to losing deals has been roughly 55%. The capital-weighted loss rate has been 45-46% over these periods."
- 4 Industry Ventures. (2017). The Venture Capital Risk and Return Matrix. "Private equity-backed companies defaulted at a rate of 17%" from January 2022 to August 2023 per an analysis completed by Moody's. The default rate on corporate debt was used as a proxy to illustrate private equity portfolio company failure rate. Analysis of data from Dow Jones VentureSource, Correlation Ventures, Union Square Ventures, and Industry Ventures; Bloomberg. (2024). [PE-Backed Firms Suffering Higher Default Rates, Moody's Says](#).
- 5 S&P Global Market Intelligence. (2016). [S&P Annual Global Project Finance Default and Recovery Study](#), 1980-2014 .10-year cumulative default rate ~7% (comparable to BBB-). Relevant Sectors: Power 7.32%, Infra 6.61%, Metals & Mining 11.44%, Manufacturing 11.12%, Chemicals 11.15%, Oil & Gas 5.26%.
- 6 S&P Global Market Intelligence. (2024). [Default, Transition, and Recovery: The U.S. Speculative-Grade Corporate Default Rate Will Continue Its Descent, Reaching 3.75% By June 2025](#). S&P Global Ratings Credit Research & Insights projects a "June 2025 default rate of 3.75%" in the base case and 6.25% in the "pessimistic" scenario; DOE Loan Programs Office (2023). [Accelerating Portfolio Growth, Annual Portfolio Status Report, 2023](#). LPO reports 3.1% of actual losses as a percentage of disbursement.
- 7 Issue Lab. (2007). [Returns of Angel Investors in Groups](#). Nesta. (2009). Analysis of exits from 539 angel investments found an approximate 27% internal rate of return.; [Siding with the Angels](#); Forbes. (2019). [How Angel Investors And Angel Groups Work](#). Although comprehensive public data is not available covering typical angel investment returns, Forbes notes that angel investors often see a 27% internal rate of return and 2.5x their investment upon exit.
- 8 Cambridge Associates. (2023). [US Venture Capital, Index and Selected Benchmark Statistics](#); Pitchbook. Cambridge Associates LLC US Venture Capital Index reported to have a 10-year horizon ~15% return and 25-year horizon ~23% return compared to CA Modified Public Market Equivalent.
- 9 Cambridge Associates. (2023). [US Private Equity, Index and Selected Benchmarks](#). Cambridge Associates LLC US Private Equity Index reported to have a 25-year horizon ~13% return.; McKinsey & Company. (2022). [McKinsey Global Private Markets Review 2022](#), Private markets rally to new heights. McKinsey reported that the calculated median net IRR for private equity funds through September 30, 2021 (2008-2018) vintages was ~20%.
- 10 CBRE. (2024). [Infrastructure Outlook H1 2024](#). CBRE analysis indicates a that infrastructure returns over 10 years ranges from 6.8%-10.9%, citing data from Refinitiv, Factset, MSCI, Cambridge Associates, and FTSE.