Fast Track

A Breakthrough Energy Proposal to Accelerate Innovation

Acknowledgements

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Executive Summary

Fast Track is a proposal for the U.S. Department of Energy (DOE) that would

1. Bridge gaps between agency programs at different stages along the innovation pathway and

2. Accelerate the development of the next generation of breakthrough technologies needed to reach global decarbonization goals and drive economic competitiveness.

As proposed in this paper, a DOE Fast Track would

- Help promising, yet unconventional innovations get access to DOE funds and support.
- Speed up access to funding and support.
- Bridge gaps where no support currently exists.
- Move innovations more quickly to the next stage of maturity.

THE CHALLENGE

Barriers to innovation at DOE

Innovative clean energy technologies encounter multiple roadblocks on the journey from initial discovery to real-world solutions. These barriers to progress arise in different ways at every stage of innovation - from discovery, to development, and to deployment. At best, they slow down the transformation of groundbreaking ideas into game-changing technologies, and at worst, they stall promising innovations indefinitely before they ever reach the market.

Public resources can help startups move their innovations through these valleys of death. However, even with a growing set of relevant tools and programs at DOE, they often fall short of achieving commercialization. The traditional mechanisms for making federal funding awards, constraints on technologies that can apply, uncoordinated timing, and a lack of integration between different programs at DOE can often leave innovative solutions stranded on their way to commercial scale.

Far from accelerating the progress of early-stage critical innovations, DOE's current standard operating practices can hinder progress and exclude or discourage startups from engaging with the government. For example, contracting can take months, or DOE may require startups to pay for prohibitively expensive equipment or efforts up front before receiving a reimbursement; additional support may be difficult to access as a new DOE funding recipient or may otherwise be inaccessible.

THE SOLUTION

Fast Track – bridging gaps and accelerating progress

DOE should holistically address agency elements that hinder innovation through a program designed to do two things: bridge gaps in existing federal support and accelerate startup progress.

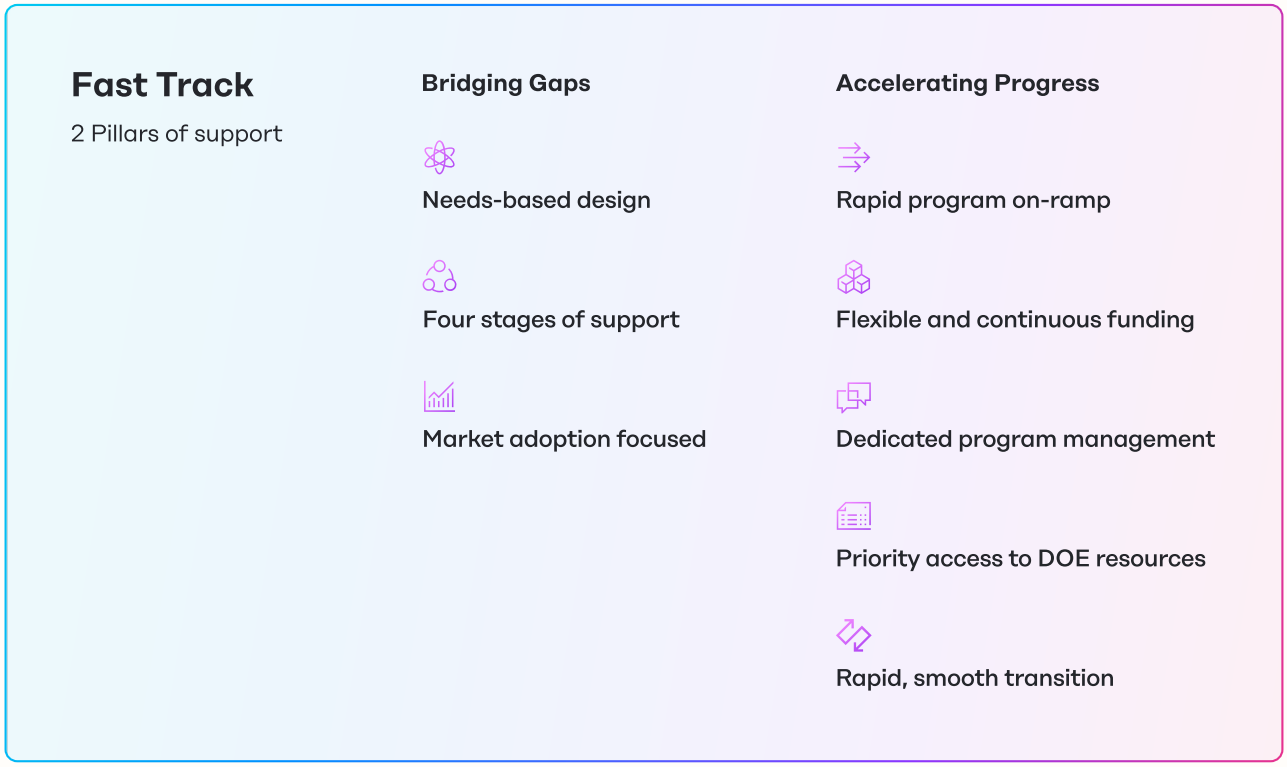


Figure 1: Fast Track Pillars – criteria that would enable startups and entrepreneurs to mature high-impact energy innovations rapidly

PILLAR 1

Bridging gaps

Fast Track would fill the gaps in DOE's support for innovation in three ways. First, it is designed to meet the unique needs of innovators and startups, and to focus on and address decarbonization challenges instead of focusing on specific technologies. Second, Fast Track would have four stages to provide support for the unique challenges that arise during the discovery and development processes of innovation.

The four stages of Fast Track are coordinated with one another to create a continuous bridge of public support that helps startups to move from any point in the innovation process on to the next stage. Third, in recognition of how critical adoption readiness is, the Fast Track would prioritize and provide market adoption support to startups in the program, while also providing support to help mature the technology itself.[1]

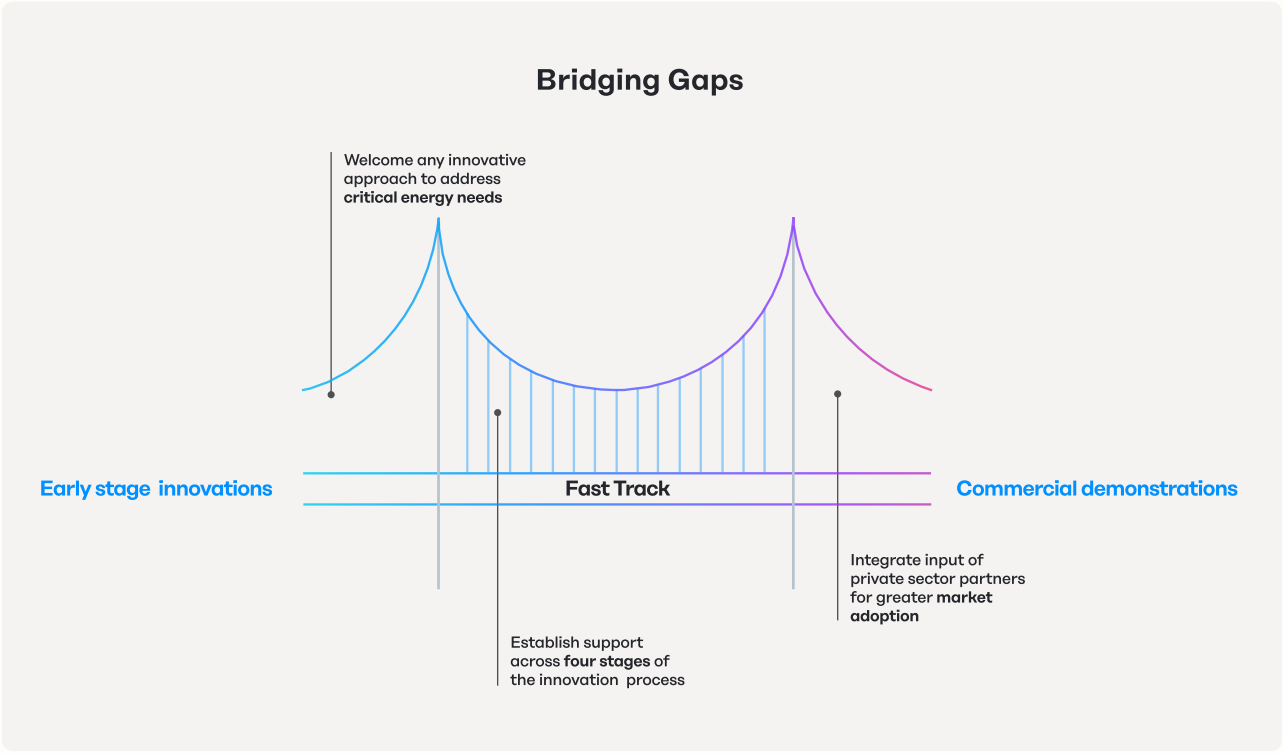


Figure 2: Fast Track bridges gaps between support for early-stage innovations and commercial demonstrations

[1] Adoption Readiness Levels (ARL): A Complement to TRL | Department of Energy

Pillar 1

Needs-based design

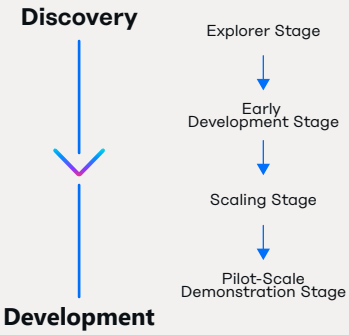
Consider any innovative startup with an approach to addressing the critical decarbonization needs DOE prioritizes.

Market adoption focused

Ensure that participants efficiently carve a pathway to market in parallel with technology development, tracking their progress on both measures carefully.

Four stages of support

Establish robust support across four stages of discovery and development, stopping before commercial demonstration.



BEV portfolio company 44.01's CO2 storage site

PILLAR 2

Accelerating progress

In addition to acting as a bridge for early-stage innovations to move towards market liftoff, Fast Track would act as an innovation accelerator. It would move startups through the "front door" by quickly vetting and selecting awardees rapidly and responsibly. It would also provide participants with access to flexible and adaptable funding — including wraparound and follow-on support to mitigate risk — and priority access to the existing impactful tools and resources housed across the DOE ecosystem and private sector partner network. Finally, when merited, Fast Track could quickly and non-competitively move participants to the next stage of the program to continue their progress.

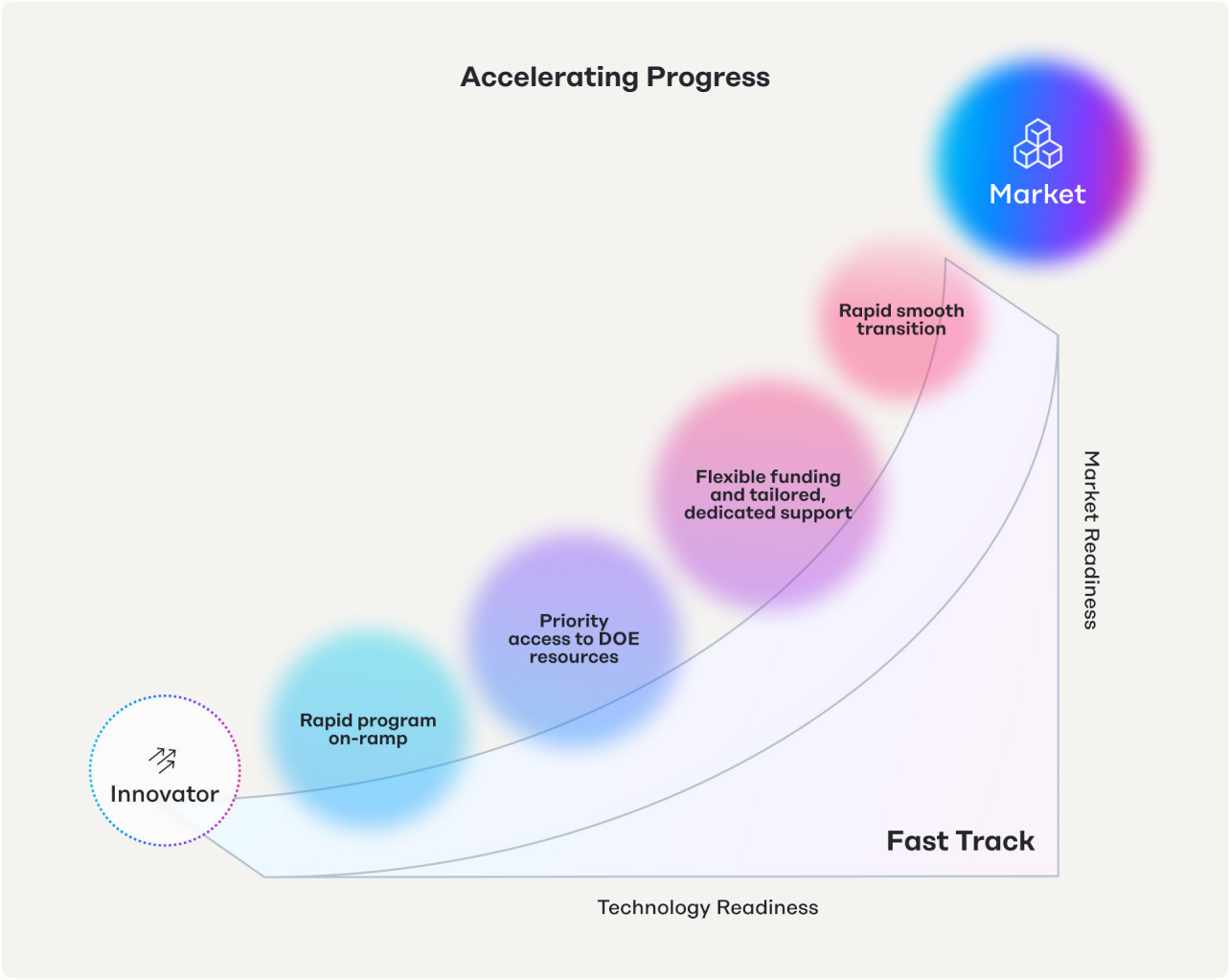


Figure 3: Fast Track accelerating innovators to market

Pillar 2

Rapid program on-ramp

Vet and select applicants quickly, within a 60–90-day period. Make grant funds available up-front to ensure access to funding does not limit progress.

Rapid, smooth transition to next stage

When merited, quickly provide participants with follow-on funding to continue their progress in a non-competitive manner.

Dedicated program management

Provide participants with access to wraparound support to mitigate the risks of developing a breakthrough technology.

Flexible funding

Provide participants with access to funding that is flexible and adaptable as they make progress and their needs change.

Priority access

Provide expedited access to the robust portfolio of existing tools and resources across the DOE ecosystem, including those at national labs, regional energy innovation partners, and other private sector partners to help overcome development challenges.

Other key elements of a successful Fast Track

To stay oriented toward market needs, Fast Track would need to make use of private sector input and expertise. Given the level of flexibility and agility this program design would create, Fast Track would also need to have a high, yet clear bar for entry based on the potential and merit of the technology in question and the team attempting to move it forward on the path to liftoff.

Specifically, such a program would:

- Assess prospects for technical merit and strong market potential, while also considering a wide range of applicants sourced from regions, including and outside of traditional hubs of technology investment.

- Integrate the input of private sector partners into the development and implementation of the program to address the most urgent energy needs faced by the market. This includes partners from industry, venture capital, incubators and accelerators, and others.

In this white paper, we describe in greater detail why a Fast Track is needed to unlock early-stage energy innovations, how DOE must build such a program with both bridge and accelerant functions, and the lifecycle of the program.

To fully realize the Fast Track described, at scale, we estimate an annual cost of $208 million in federal funding, to be matched with a private sector cost-share requirement of up to 50% per participant, depending on the innovation stage. This can be accomplished by leveraging existing programs at the Department along with additional funding and flexibility from Congress.

Table 1: Estimated annual cost of Fast Track program at full scale over four program stages

Fast Track Stage	Max Number of Projects	Federal Cost per Project	Federal Cost Share	Flexible Reserve Fund	Total Federal Program Cost
Explorer	40	$250,000	100%	$500,000	$10,500,000
Early Development	20	$1,000,000	90%	$1,000,000	$21,000,000
Scaling	15	$4,000,000	75%	$6,000,000	$66,000,000
Pilot-Scale Demonstration	10	$10,000,000	50%	$10,000,000	$110,000,000
Annual Program Total					**$207,500,000**
Annual Private Sector Match					**$122,000,000+**

There is a pressing need to speed up the creation and use of clean energy technologies to tackle the global climate crisis and other major energy-related challenges. By leveraging DOE's existing tools in a new way and building on current momentum across the government, a DOE Fast Track could become the innovation engine that realizes the promise of DOE's early-stage energy innovation efforts efficiently and effectively.

Rationale for a Fast Track Program

$9 Billion

in current DOE investment

$460 Billion

has been made available over the next 5-10 years to invest in research, development, demonstration, and early deployment activities in particular technology areas including advanced nuclear, clean hydrogen, and direct air capture.

Current Momentum at DOE

Since its creation in 1977, the U.S. Department of Energy (DOE) has been a driving force for energy innovation. Every year, DOE's programs, with support from its 17 national laboratories, channel $9B in investment toward transformative energy innovations, catalyzing new industries and contributing to economic growth in the process.[2] Recent investments from the Bipartisan Infrastructure Law (BIL) and Inflation Reduction Act (IRA) have provided an unprecedented and much-needed additional injection of federal funding into energy innovation. From these bills, over $460B has been made available over the next 5-10 years to invest in research, development, demonstration, and early deployment activities in particular technology areas including advanced nuclear, clean hydrogen, and direct air capture.[3]

In response to this funding surge, additional tools and programs were created to aid implementation including creative contracting mechanisms, an evergreen series of roadmaps outlining pathways to commercial liftoff for critical emerging energy technologies, and new major programs devoted to demonstration and deployment at scale. [4] The challenge at hand now is to better ensure that research and development efforts are translated, through the **innovation process**, into market-oriented technologies ready for demonstration.

[2] US Energy Department RD&D Budget: Interactive Dataviz | ITIF
[3] Congress's Climate Triple Whammy: Innovation, Investment, and Industrial Policy - RMI
[4] Pathways to Commercial Liftoff - Pathways to Commercial Liftoff (energy.gov)

The Energy Innovation Process

The innovation process described is how a technology with the potential to meet a need in society **(typically a market need)** evolves from an idea explored in the laboratory into a technology-based component, product, process, or system deployed in the real world. The process is often fraught with uncertainty, and those developing these innovative technologies **(the innovators)** encounter numerous obstacles during the discovery, development, and deployment stages of innovation that create a series of "valleys of death," causing an otherwise promising technology to fail to reach the scale required for commercialization and widespread adoption. The innovation process is also an iterative one, and can result in new ideas and findings that dramatically change the path to market for the new technology along the way.

Finally, to be successful, the innovation process cannot happen in a vacuum; instead, the innovator must continually analyze the market need for their idea, identify potential customers, develop a business model to carry the technology to market, and find a way to finance the process. These adoption readiness challenges can be the reason an innovative technology pivots, succeeds, stalls, or fails.

At this stage of the clean energy transition, at least half of the technologies needed to achieve the goal of net-zero emissions by 2050 are still under development, and are somewhere at the early stages of the innovation process. [5] **These technologies, and additional breakthrough approaches not yet discovered, are critical innovations that must move through the process faster to enable the clean energy transition with technologies that are affordable worldwide.**

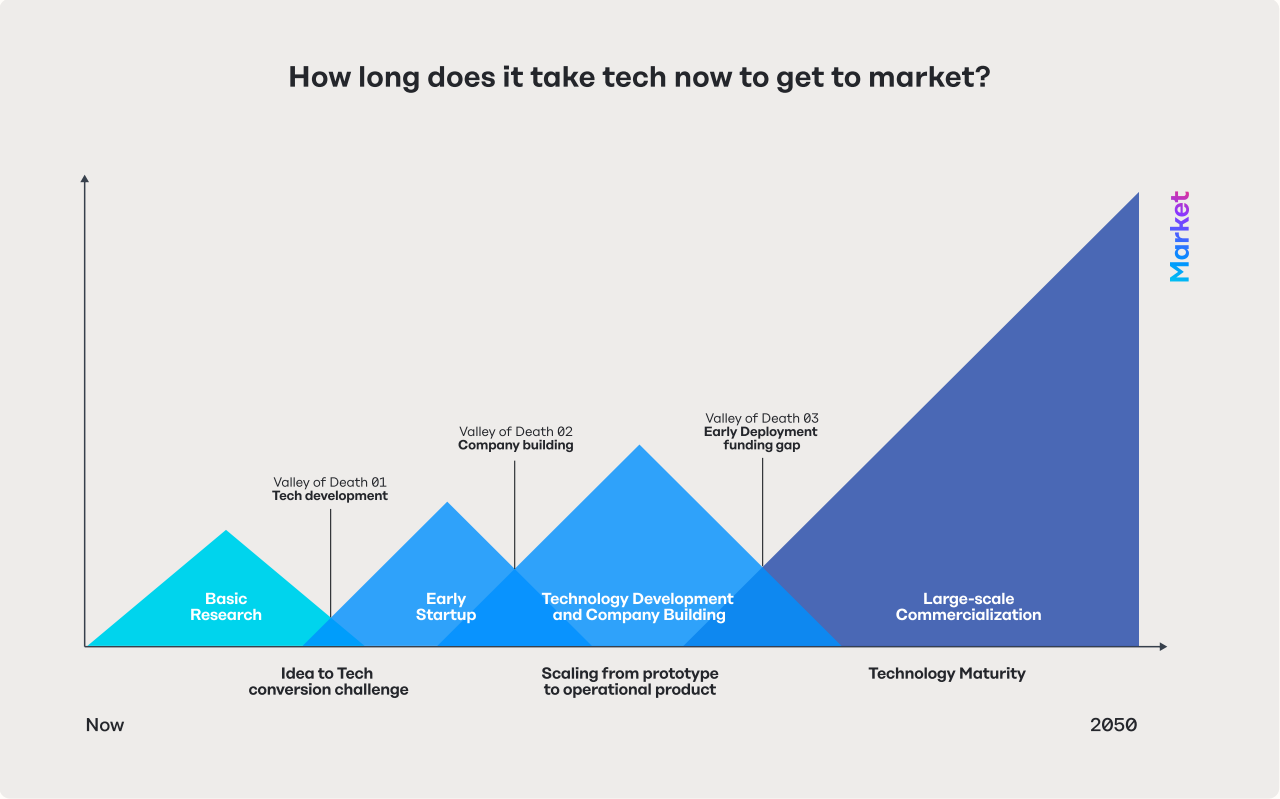


Figure 4: Showing the innovation process for moving technologies from research discovery to market-ready technology and the valleys of death that act as barriers to progress. Triangles show the evolution in an innovator's focus, and represent the scale of the support required to advance to the next stage.

[5] Net Zero by 2050 - A Roadmap for the Global Energy Sector (windows.net)

Barriers to Innovation

There is a robust set of programs at DOE to support technology development across the **discovery, development, and deployment** stages of innovation. However, these programs are not formally administered in coordination with one another to efficiently accelerate critical innovations, especially innovations necessary for decarbonization. Moreover, each program has its own distinct application and selection process and is constrained to supporting various types of technologies in specific ways. This often means emerging innovative approaches face discontinuous support or are overlooked entirely. As a result, current programs may leave critical technologies stranded while waiting for the right type of support to be available.

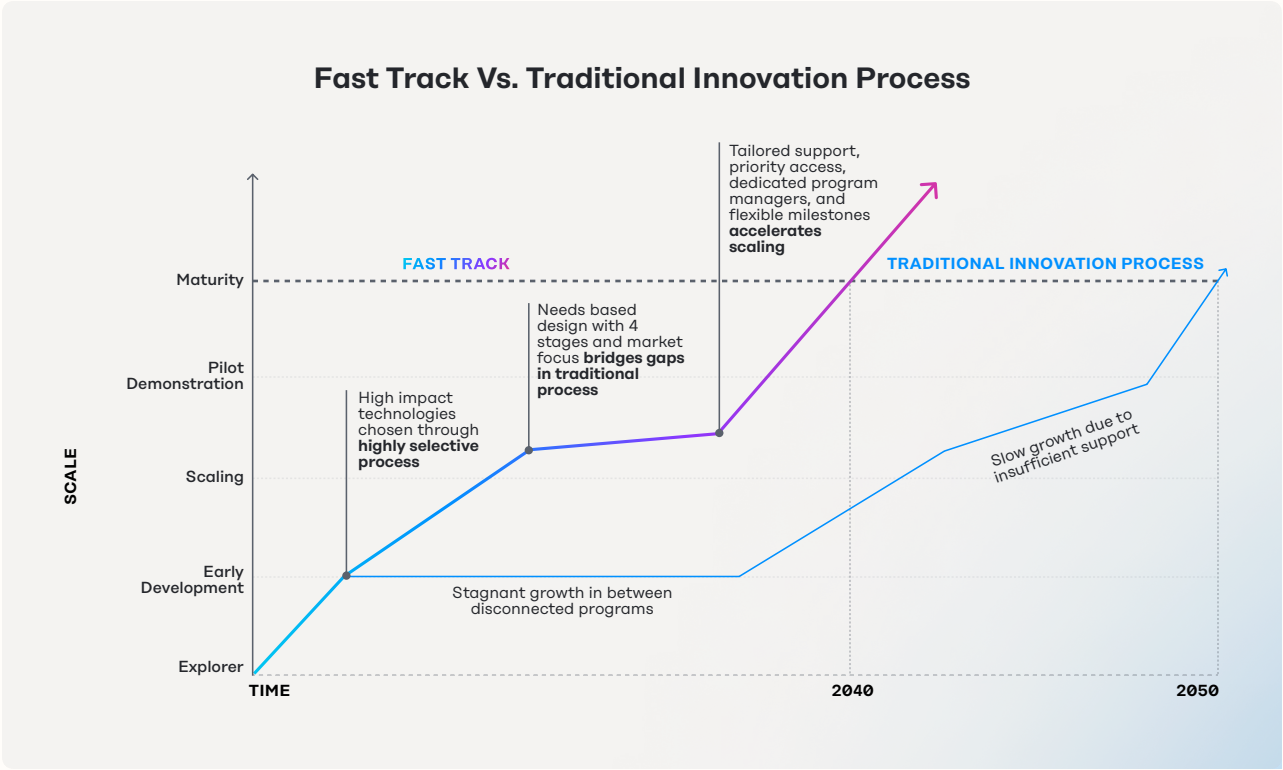
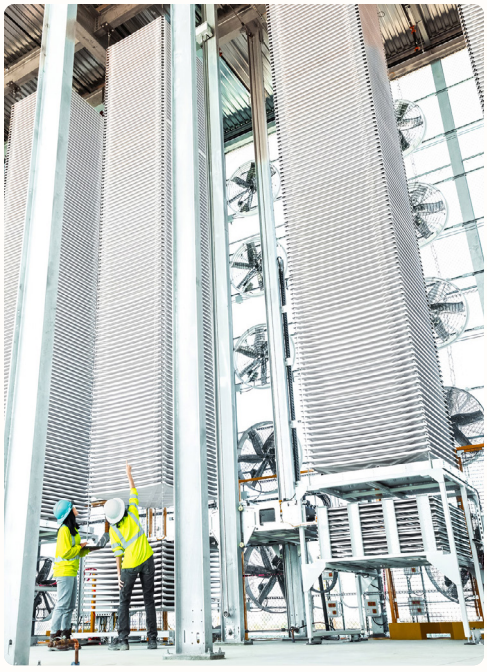


Figure 5: A representative comparison of the trajectory of an innovation supported by Fast Track and one seeking support through traditionally administered federal programs. Figure shows stages of the innovation process as a function of time.

A recent Request for Information (RFI) issued by DOE's Office of Clean Energy Demonstrations (OCED) elicited feedback on current DOE processes and the gaps in current support for clean energy innovations ready for demonstration at pilot scale (the last stage in the innovation process before demonstration, as shown in Figure 5). The feedback collected from respondents included a request for a streamlined application process more aligned with private sector practices, non-monetary assistance with activities like stakeholder outreach, flexibility in the project scope, and support navigating other government programs to receive their full benefit.[6] The responses to this RFI provide a clear example of the barriers to innovation faced by startups, and insight into how DOE could help overcome them. The Fast Track would create an avenue to speed up public support to awardees, fill remaining gaps in support across innovation stages, coordinate and streamline access to elements of DOE's energy programs, and broaden eligibility for support to all technologies of merit, and in doing would help eliminate issues raised in the RFI.



BEV portfolio company Heirloom's Direct Air Capture facility

Furthermore, newly implemented tools at DOE, like the use of Other Transaction Authority (OTA) and Partnership Intermediary Agreements (PIA), offer an opportunity to address other major, unintentional bureaucratic challenges start-ups and innovators face in taking advantage of government support. Their availability makes it possible to streamline and tailor federal support in a new and impactful way.

In short, though major barriers to innovation still exist, DOE has the capability to address them now and have a catalytic impact in advancing much needed solutions. Fast Track would intentionally leverage and organize the successful programmatic models and tools DOE already has to do so. Establishing Fast Track as an independent program with its own dedicated funding would allow DOE to be selective about which technologies merit receiving this level of flexible support, enabling the startups in the program to move quickly to scale.

[6] *REQUEST FOR INFORMATION SUMMARY (energy.gov)

Recommendations that Build on Best Practices

Successful innovation programs throughout the federal government and elsewhere have provided a rich understanding of best practices and important characteristics for any federal innovation program (see the Appendix for more detail). We recommend the following aspects form the foundation for Fast Track program development and have incorporated them in our proposed design:

- The Fast Track portfolio should prioritize innovations that solve for needs in key economic sectors including but not limited to industry, transportation, power, agriculture, buildings, carbon removal, and related enabling technologies. Priorities should be based on a current analysis of decarbonization needs that is updated regularly.
- Fast Track leadership should establish evaluation criteria to measure the impact of the program and its ability to effectively accelerate innovations towards commercial demonstration.
- The private sector should be supportive of Fast Track and their insight must be incorporated into priority setting and progress evaluation through project management.
- Solicitations should be open, maintaining flexibility on technological approach while ensuring awardees address high priority critical energy needs.
- Selection processes should be rapid and competitive, and open multiple times a year (quarterly or on a rolling basis). Existing contracting tools like Other Transaction Authority (OTAs) can enable selection within 60-90 days, a time period more aligned with the needs of startups.
- Funding available to awardees should be easily accessed by participants and flexible in what it may be used for, with guidance from DOE program managers informing the use of funds. Flexibility should be paired with clear milestones and a funding cap, and funded participant activities should be clearly tracked.
- Maximum funding levels should be tiered according to innovation stage. DOE should work with participants to develop tailored milestones, to mitigate risk and allow for termination of support if projects do not show appropriate progress (while allowing for the iteration and pivots that are inherent in the innovation process).
- Each participant entering the Fast Track after the Explorer stage must have an additional private sector partner engaged in the project, reflected through private sector cost share. For early development and scaling, projects must provide a 10-25% cost share, and later stage projects engaged in pilot scale activities must provide a 50% cost share.

Pillars of the Fast Track

The proposed Fast Track here is designed to help startups and innovators rapidly advance technologies along a viable commercialization pathway to market by:

1. Bridging gaps in support for technology development and scaling.

2. Accelerating progress by reducing unnecessary barriers and delays that occur when startups and innovators engage with traditional DOE programs not designed for startup progress.

PILLAR 1

Bridging gaps

Needs Based Design: Balancing Flexibility with Selectivity

Fast Track is designed to meet the unique needs of innovators and startups, and address decarbonization challenges instead of being technology specific. DOE's recent Energy Earthshots[7] and Pathways to Commercial Liftoff reports[8] focus on accelerating innovation, driving down costs, and streamlining deployment for a set of high priority technologies. These reports, alongside others like the National Innovation Pathway for the United States[9], could help establish a list of critical energy needs for Fast Track. Fast Track is designed to meet the unique needs of innovators and startups, and address decarbonization challenges instead of being technology specific.

Even with a primary focus on decarbonization needs, Fast Track must also be selective and deliberate about which innovations and startups receive specialized support. Here, "selective" means starting with a clear understanding of market challenges and ensuring all Fast Track innovations, no matter how novel, have the potential to address those challenges at scale. It does not mean picking technology winners at the outset. In fact, because impactful innovations often utilize unexpected technological approaches to address challenges, **we recommend DOE does not specify an exclusive list of priority technologies for meeting these critical energy needs**.

In practice, novel innovations that make use of unexpected technologies or scientific approaches to solve problems in a new way should be explicitly included in the Fast Track.

In sum, the project must:

- Address a critical energy and climate need
- Support significant greenhouse gas emissions reductions
- Have a path to market adoption and evidence of scalability
- Beyond the earliest Explorer stage (see below), include at least one commercialization partner

[7] Energy Earthshots Initiative | Department of Energy
[8] Pathways to Commercial Liftoff - Pathways to Commercial Liftoff (energy.gov)
[9] US-National-Innovation-Pathway.pdf (whitehouse.gov)

The Four Stages of Fast Track

To be ambitious, the Fast Track must accelerate progress of innovators starting from any stage of discovery or development and should go as far as preparing technologies for demonstration at scale. In practice, DOE could create four stages to cover this range of innovation activities.

With an eye toward building a full program, DOE could start by building Fast Track stages to address the biggest current gaps in support and then expand the program. To this end, we recommend DOE launch a pilot-stage Fast Track; the last section of this report provides additional discussion on this recommendation.

Fast Track should be designed to support efforts at the following stages:

Explorer stage

Validating potential and translating from research to viable technology.

Early development stage

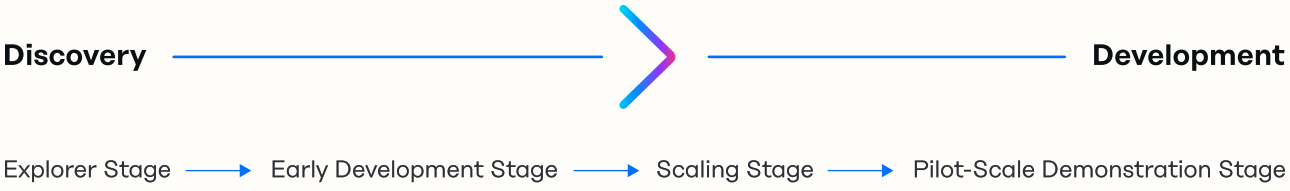
Developing prototype, market fit, and a go-to-market strategy.

Scaling stage

Validating technology performance, scaling and integrating into relevant systems, establishing manufacturing capabilities, and continuing market development.

Pilot-scale demonstration stage

First pilot-scale demonstration of the technology.



Market adoption focus

Fast Track focuses on how to move new innovations into the real world by requiring participants to carve a pathway to market in parallel with technology development, and providing a type of catalytic support that is often lacking but critical. Criteria for assessing the merit of projects should be clear to the public, reflect private sector needs, and enable DOE to place selected projects in the stage.

DOE should assess both the technology and adoption readiness stages of each potential Fast Track participant using existing Technology Readiness Level (TRL) and Adoption Readiness Level (ARL) methodologies or a similar approach. This assessment should be the basis for tailoring a project plan, making resources available, crafting milestones, and assessing project progress.

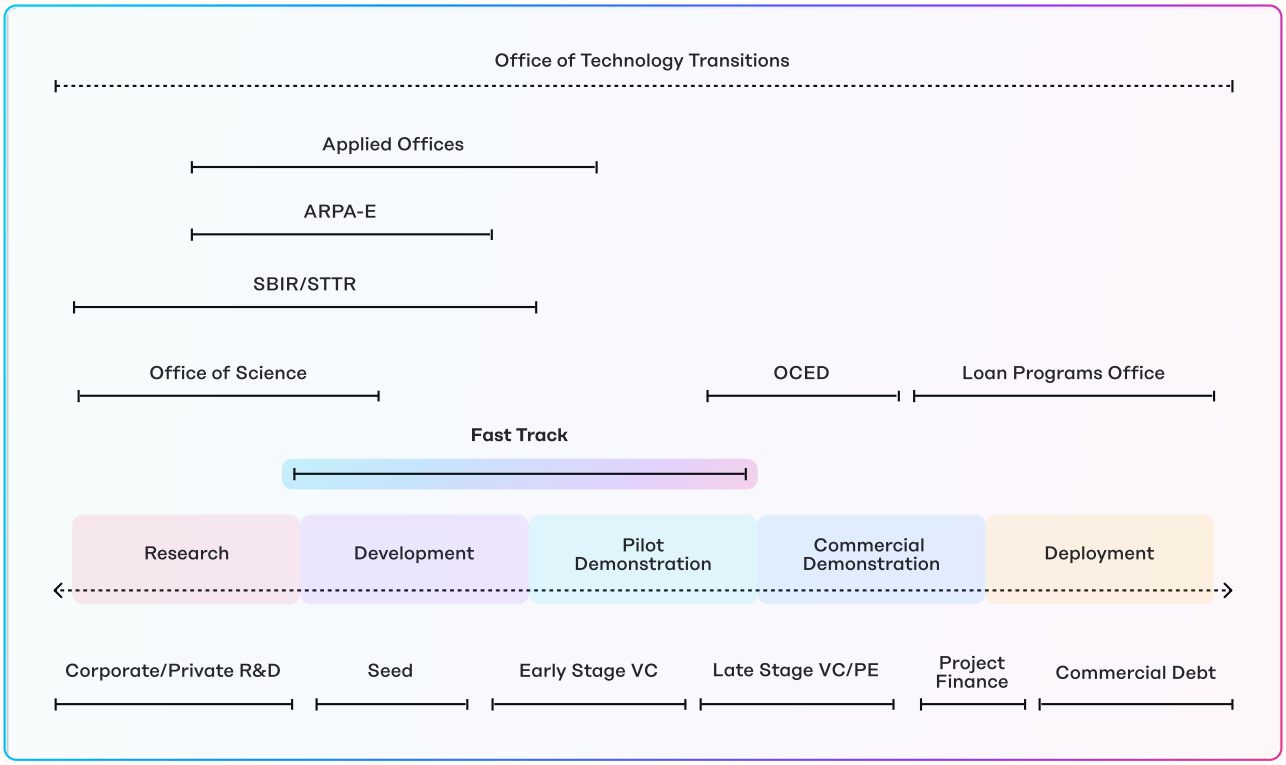


Figure 6: Where Fast Track sits along the innovation process, as compared with other DOE energy programs

PILLAR 2

Accelerating progress

In addition to filling gaps on the path for early-stage innovations to move towards market liftoff, Fast Track is an innovation accelerator. It would move startups through the "front door" of the program quickly by vetting and selecting awardees rapidly and responsibly. It would also provide participants with access to flexible and adaptable funding — wraparound support that mitigates risk — and priority access to other existing tools and programs across the DOE ecosystem and private sector. Finally, when merited, Fast Track could quickly and non-competitively move participants to the next stage of the program to continue their progress.

This section can be read as a blueprint for the Fast Track lifecycle and details how DOE could use existing programs and authorities to support Fast Track, and describes project selection, management, and evaluation in greater detail.

Rapid Program On-Ramp: Soliciting and Selecting Participants

DOE should shape the award process for Fast Track as an efficient pathway for accepting innovations developed within DOE's existing programs, and an accessible pathway for new participants previously excluded from federal innovation support. This process must meet the needs of participants applying at differing stages of maturity, and aim to strike a balance between rapid application processes that are appropriate for the four different stages, while ensuring a selective and competitive process.

Program officers from the energy programs across DOE should be empowered to direct projects with innovative merit to apply for Fast Track from the Under Secretary of Science and Innovation (S4), the Under Secretary of Infrastructure (S3), and ARPA-E. Applicants directed to the Fast Track from S3 would use the program to address specific challenges that prevent them from being ready to receive an award from that office. Applicants to OCED's existing programs that do not receive an award, for instance, but which are promising could be steered to the Fast Track for this purpose.

To take full advantage of the accelerated innovation pathway across the federal system, recipients of federal funding from other innovation-oriented agencies like NSF and DOD should also have clear access to Fast Track solicitations.

Fast Track is intended to solicit and accept innovations from anywhere in the U.S. In addition to supporting former federal funding recipients, Fast Track must also have an open and accessible platform for innovators from universities and other areas of the private sector, including accelerators, incubators, and independent entrepreneurs, to apply.

Priority Access to Existing DOE Programs and Efforts

Fast Track should support awardees by making available to participants the valuable services and capabilities already provided through other DOE programs. Providing central access to these tools through Fast Track overcomes the barriers to innovation described in the Rationale section and is a critical piece of the program. DOE should decide the best way to create priority access to these; however, **we recommend that Fast Track have dedicated funding to fill gaps between programs and enable timely access to DOE resources.** Many existing DOE activities and programs could provide support to Fast Track participants, including but not limited to:

- **The Small Business Voucher Program**
- **The American-Made program**
- **The Energy Program for Innovation Clusters**
- **The Small Business Innovation Research (SBIR) program**
- **The Lab Embedded Entrepreneurship Program**

DOE should leverage these existing programs, collaborate with other agencies, and/or develop new mechanisms where necessary to ensure Fast Track participants can access the following modes of support (note this paper does not account for the cost associated with developing new tools):

- **Catalytic technical support for commercialization**
- **Prototyping and manufacturing support**
- **Technology validation support**
- **Entrepreneurial support and innovator pipeline development**
- **Technology-to-market pathways analytical support**
- **Wrap around support for innovators**

Finally, the nascent Foundation for Energy and Security Innovation (FESI), which will support DOE in its efforts to commercialize energy technologies, could host an external complement to Fast Track. FESI could make flexible private and philanthropic support available to participants to enable activities for which government funding is not a good fit. DOE also recently announced its partnership intermediary, Energywerx, which was established using a type of Other Transaction known as a Partnership Intermediary Agreement (PIA). PIAs[10] are agreements between the federal government and external partners that are designed to increase outreach and engagement with small businesses, academic institutions, and non-traditional partners. [11]Working with Energy werx or another PI, DOE could extend the reach of the Fast Track and increase the number of non-traditional partners who benefit from it.

Flexible and Adaptable Funding

Fast Track aims to speed up government execution to support startups and innovations. Executing agreements quickly, moving funds to recipients efficiently, and making funding available up front without a reimbursement requirement are critical attributes for the program. To enable speed and flexibility, once high-potential applicants are identified, we recommend access to reserve funding not require re-competition for support. We also recommend participants seeking to move to the next Fast Track stage re-compete alongside new entrants, but that Fast Track utilizes a streamlined process to ensure participants can do so with little to no lapse in funding. See below for additional information on existing mechanisms at DOE that would enable Fast Track to operate in this way.

[10] DOE Partnership Intermediary Agreement | Department of Energy
[11] U.S. DEPARTMENT OF ENERGY PARTNERSHIP INTERMEDIARY INTERIM PILOT GUIDE

DOE's Innovative Partnership Mechanisms

Creative hiring and contracting mechanisms are being used in 2024 for the first time to establish new programs within DOE's Under Secretary of Infrastructure. DOE is making these available for wider use across its energy programs.

Other Transaction Authority (OTA) is a contracting tool that DOE could use to provide flexible and accessible support through Fast Track. OTAs have several benefits making them an attractive tool for Fast Track. They allow for negotiable terms and conditions, making it easier for startups and smaller companies to participate, and would enable DOE to attract a broader range of innovative solutions. Additionally, OTAs can be executed faster than traditional contracts. As an example of this, the DOD's Defense Innovation Unit (DIU) leverages that agency's OTA to go from problem definition to contract award in as little as 60-90 days.

Furthermore, OTAs often permit incremental funding and project milestones, which would allow Fast Track to invest in each clean energy technology in stages, based on its performance and adaptability, rather than making a significant commitment upfront. Depending upon the readiness level of the technology, OTAs can have other benefits in providing support for rapid prototyping and field testing and validating technologies.

Finally, OTAs can allow DOE to tailor the evaluation process to reflect the unique goals of each Fast Track applicant and the ARL/TRL stage of the innovation. The DIU, for example, uses OTAs to prioritize different criteria in agreements, including speed of delivery, technological innovation, and the ability to meet specific defense needs, which can be different from traditional procurement evaluation criteria.

DOE's Prize Authority could also be used as a complement to OTAs. Prize authority allows DOE to competitively award cash prizes to stimulate innovative approaches to challenges for efforts at the research, development, and prototyping stages. In the context of Fast Track, this authority could be used to cast a wide net for innovative technologies and ideas that could benefit from support, provide multi-tiered access to funding, and accelerate access to funding.

These mechanisms offer more flexible and rapid deployment and should be prioritized over traditional contracting routes. Matching the mechanism to the needs of the awardee is crucial to getting technologies through Fast Track successfully.

Dedicated Program Management: Managing and Supporting Participants

Fast Track should have dedicated, term-limited DOE program managers who have private sector experience and work closely with the startups and innovators as they progress through the stages of Fast Track. Program managers should have the authority to be involved in the direction and redirection of the technical development, design, and execution aspects of each project. Program managers and awardees should work together to establish a schedule with quantitative ARL/TRL-associated milestones and deliverables appropriate to the stage of the participant. If a project does not hit its milestones, its program manager should have discretion to renegotiate the project objectives, schedule, or deliverables and/or to terminate Fast Track support, similar to the management of ARPA-E projects.[12]

Fast Track may also access experts from across DOE, as well as representatives from national laboratories, regional innovation programs, investment firms, and other private sector stakeholders to support challenges encountered during the program.

As noted in Best Practices, beyond financial and technical guidance, Fast Track should provide aid in other areas like customer discovery, hiring, technical assistance, business strategy, manufacturing support, project design, and access to financing.

The type of support would be project specific, recognizing needs differ greatly across TRL/ARL levels, market sector, business model, and technical approach. This support could come directly through program managers, or in the form of funds (either federal or cost-shared funds from the private sector) made available to engage third party organizations, national laboratories, or other private sector entities. Other mechanisms such as the recently established Foundation for Energy Security and Innovation (FESI) could also provide support for these activities.

A rapid, smooth transition to the next stage

Fast Track is designed to move breakthrough innovations through successive stages of the innovation process with minimal bureaucratic barriers. To continue progress without delay, projects that are on track should be able to quickly and non-competitively move to the next stage of the Fast Track and other subsequent DOE programs. This would ensure projects do not run out of funding while applying for additional support. We recommend that DOE utilizes its existing noncompete tools for this support.

Fast Track Process

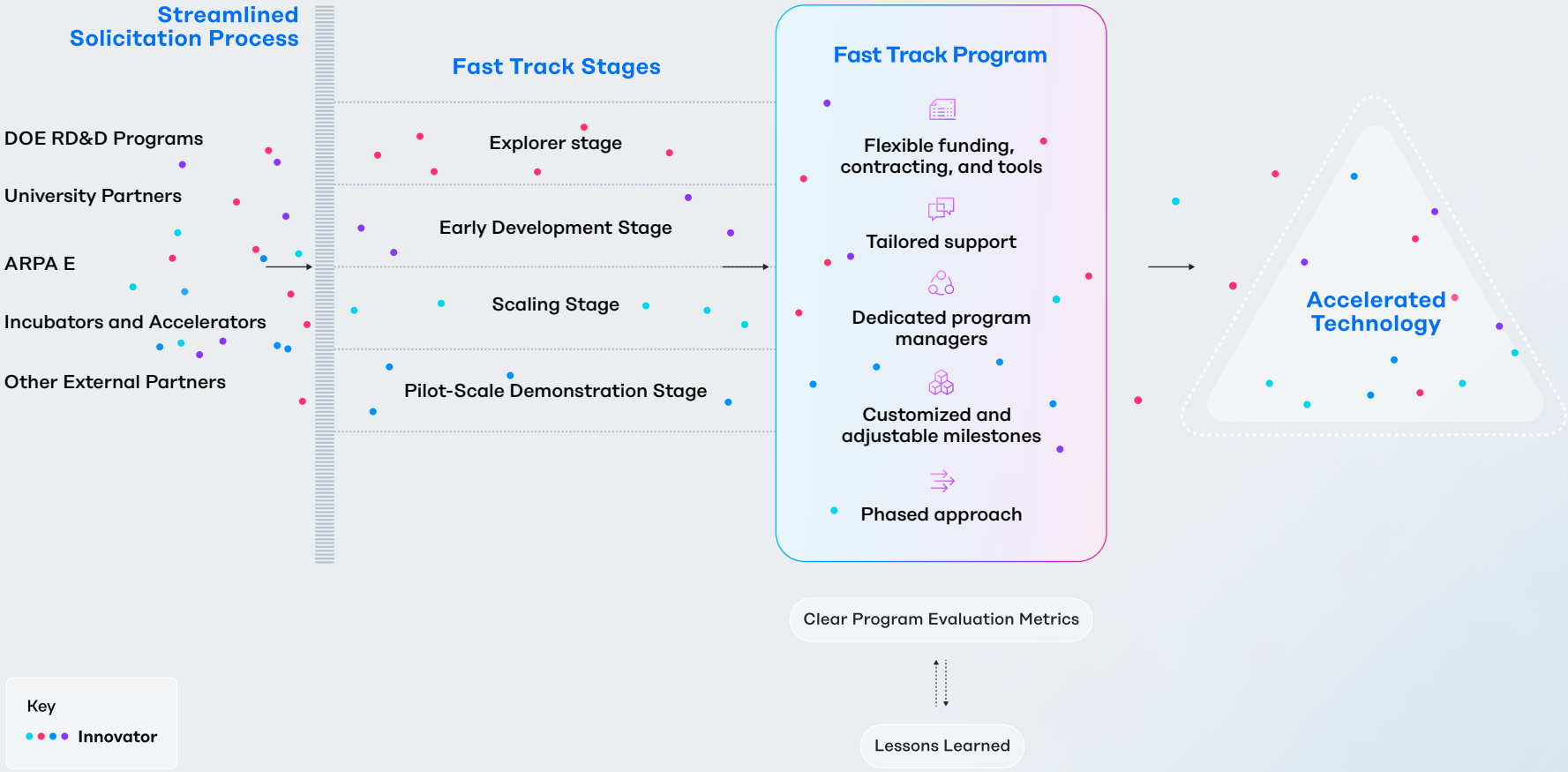


Figure 7: Fast Track process

Implementing Fast Track

Fast Track Program Estimated Cost

To operate Fast Track, we project an estimated $208 million annually in federal funding, to be matched with up to 50% private sector cost share supporting the progress of its participants. In the table below we provide annual estimates of the number of projects that could be admitted to the program at each stage, the federal cap on funding per project, the level of federal cost share, and an amount of federal funding to be held in reserve, to provide additional support to all projects at each stage when merited.

This Flexible Reserve Fund is a pool of federal resources to support modest, unforeseen project needs and pivots. It is modeled after ARPA-E's Technology-to-Market (T2M) plus up tool that can provide up to $500,000 in funding to promising ARPA-E projects that have gaps in their commercialization plan and could benefit from rapid, flexible funding to achieve the next innovation stage (i.e., SCALEUP)[13]. DOE's SBIR and Voucher programs provide similar support for project recipients as well. Our reserve fund estimates reflect 5-10% of the total amount of federal funding provided for grants made at each stage each year.

Fast Track Stage	Max Number of Projects	Federal Cost per Project	Federal Cost Share	Flexible Reserve Fund	Total Federal Program Cost
Explorer	40	$250,000	100%	$500,000	$10,500,000
Early Development	20	$1,000,000	90%	$1,000,000	$21,000,000
Scaling	15	$4,000,000	75%	$6,000,000	$66,000,000
Pilot-Scale Demonstration	10	$10,000,000	50%	$10,000,000	$110,000,000
Annual Program Total					**$207,500,000**
Annual Private Sector Match					**$122,000,000+**

[13] Technology Commercialization | arpa-e.energy.gov

Launching Fast Track at Pilot-Stage

As previously mentioned, a pilot-stage demonstration Fast Track program "segment" would address a clear gap that exists in DOE's current structure.

An ambitious program is needed to create a full Fast Track program that accelerates innovations at all technology and adoption readiness stages to demonstration stage quickly. However, if built in phases, DOE could design and implement "seed segments" of the Fast Track program that match its four stages, that could eventually extend into a full-coverage Fast Track. This pilot-stage program could be one such seed program.

The Need for Pilot-Stage Support

As noted, prior to BIL, IRA, and DOE's latest reorganization, DOE mainly functioned as an early-stage research organization for basic science and incremental applied energy advancements. While new programs created by BIL and IRA provide significant support for later-stage technologies at TRL stages of 6 and above, there is a significant gap in federal support for technologies trying to progress through the mid-stages of the TRL scale and beyond the low end of the ARL scale.

Projects that fall within this gap have promising technologies that require additional testing, development, and validation to prove they will work at larger scales; technologies at this stage may also have high adoption readiness risk (a low ARL score). Because adoption risk is still high, private investment is often inaccessible to these companies until questions about market relevance, competitiveness with incumbents, and others are answered. Additionally, the innovator developing the technology may have further business development challenges to overcome.

Pilot-scale demonstrations typically cost around $25 million or less; however, while there is pilot support sprinkled across applied energy programs, there is not a coordinated program to explicitly support this innovation stage, except for one ARPA-E program.[13] In 2019, ARPA-E launched the Seeding Critical Advances for Leading Energy technologies with Untapped Potential (SCALEUP) program to help high-risk and potentially transformative new energy technologies bridge the pilot-stage valley of death by providing funding and support for their scale up. This program aims to transition ARPA-E funded technologies from proof-of-concept prototypes to deployable technologies ready for private investment.[14] Unfortunately, this program is only available to prior ARPA-E awardees; other DOE awardees and clean energy startups hoping for federal support at this stage struggle to find equivalent support.

[13] bipartisanpolicy.org/download/?file=/wp-content/uploads/2023/03/BPC-Energy-White-Paper_R04.pdf
[14] The SCALEUP Program | arpa-e.energy.gov

Without significant support to overcome the adoption risks mentioned above, technologies stuck at this valley of death will not reach large-scale demonstration phase. The pilot-stage demonstration segment of the Fast Track would overcome this valley and help assess a technology's opportunity for impact, articulate its technology and adoption readiness needs, shape a path forward with federal support, and more broadly ensure a robust pipeline of projects ready for support from DOE's late-stage programs like OCED and LPO.

A Blueprint for a Pilot-Stage Fast Track

Selection criteria

Minimum TRL5 to enter; ARL must be sufficiently high to indicate the technology has market potential and that the innovative technology meets a critical energy need.

Funding and support

There should be a standard funding maximum that is developed in the program design phase of the Fast Track. For pilot-scale projects, this federal funding cap could be as high as $10M. This funding could support activities such as:

- Funding for first of a kind pilot stage demonstration
- Technical assistance for customer discovery, business strategy development, etc.
- Vouchers for National Lab access

End Goal

Specific ARL goals to be developed based on DOE's Commercial Adoption Readiness Assessment Tool (CARAT) assessment; TRL 7 by end of project.

Recommended supplemental DOE Programs:

- ARPA-E SCALEUP and its program directors could help OTT and OCED understand challenges with the SCALEUP approach and the aspects of the design that work well, in helping shape the Fast Track program.
- The Small Business Voucher program could act as a model for creating a voucher program within Fast Track that provides access to national laboratories who could support technology validation at pilot scale.
- FESI could provide an avenue to connect pilot-phase Fast Track participants with access to resources outside of DOE programs that enable progress at this stage.

Conclusion

The proposed DOE Fast Track represents a strategic program to accelerate the pace of clean energy innovation. A Fast Track would ensure that early-stage clean energy technologies with a viable path to market and substantial emissions reduction potential are provided with the necessary tools to succeed. The program's emphasis on dedicated hands-on support, flexible capital, and collaboration with the energy innovation network catalyze innovation and create new industries. Fast Track embodies a transformative and cohesive approach to spur clean energy innovation, fostering a stronger clean energy future.

Rendering of BEV portfolio company Malta's thermo-electric energy storage facility

Appendix

Fast Track FAQs

What DOE programs would be involved in a Fast Track?

DOE's energy programs, including those in S3 and S4, ARPA-e, and the Office of Technology Transitions would be involved in the Fast Track program.

FESI would provide an avenue for coordination with external partners.

How would the Fast Track work with DOE programs like EERE and OCED? Is it adjacent to them?

Ideally, the Fast Track would be situated adjacent to technology-specific DOE programs like EERE and OCED, acting as a connective conveyor between them.

It would operate separately from these programs, and could also support innovations from outside of the DOE universe.

Who would oversee the Fast Track program and be responsible for it?

Departmental leadership should decide who should manage the Fast Track program. One possible option would be to appoint a term-limited official who reports directly to the Secretary of Energy (similar to NIH Institute and Center Directors).

One of the highest priorities of the director of the Fast Track should be to ensure that the program is agile and adapts to changing critical energy needs over time.

What would funding from Fast Track do?

The amount of funding and the activities it enables vary based on the maturity level of the recipient's innovation. This funding is deliberately intended to be flexible in its use. See Table 1 for more information.

Some examples of ways Fast Track funding could be used are additional technology development and data gathering, prototyping, performance validation and technical assistance, staffing, business development support, pilot demonstrations, and dedicated support from DOE and the labs and partners.

How would Fast Track involve the private sector?

To ensure that the Fast Track is solving for market-relevant needs, the private sector must be deeply involved in the execution of the program. It should also share the costs of projects on the Fast Track as a vote of confidence. Earlier stage efforts could require 10-25% cost-share and later stage participants should bring 50% cost-share to match DOE funding.

Would the Fast Track need Congressional authorization?

At first, no — DOE could use existing authorities and funding to establish and test a Fast Track. Eventually, Congressional authorization would be needed to realize the full potential of the program and to provide it with long-term sustainability.

How would the Fast Track rely on the resources at the National Labs and across all regions of the US?

Fast Track makes use of the expertise at our national labs and the diverse resources available throughout the country to speed innovation. Fast Track funding would be provided to institutions and partners to aid participants in their efforts.

National Labs: Access to the labs should be made available to Fast Track participants as a resource that accelerates project progress.

State Resources: Fast Track is meant to crowd in participation from innovators and their supporters, extending DOE's network beyond those already in the agency's ecosystem. Universities, accelerators, and other regional resources could receive funding to support Fast Track projects, and innovators would be provided with funding to participate.

The Role of FESI in Supporting Fast Track

FESI is ideally suited to be an external hub of DOE's Fast Track. The foundation is congressionally chartered to advance DOE's mission and has the potential to provide an agile forum for identifying target technologies, mobilizing non-federal resources, and coordinating activities between DOE, external sponsors, and innovators to accelerate progress. FESI should provide complementary support to Fast Track with autonomy to be creative and risk tolerant. FESI would offer an avenue for engaging the philanthropic and financial communities as well as potential early adopters of critical innovations, which may include federal agencies and facilities, all of whom have significant roles to play in accelerating innovation.

Learning from Other Federal Innovation Programs

Agencies throughout the federal government complex have designed and executed innovation programs focused on spurring disruptive solutions across a diverse array of industries. They differ in their functions and structures, which are a reflection of their own goals and technology areas of focus — but one can find key themes and characteristics that can be applied to advance clean energy innovations. In this section, we provide an overview of principles extracted from other government efforts that should be integrated into Fast Track to ensure thorough, appropriate support for energy technologies.

Key Features to Incorporate Into Fast Track

Innovation programs vary widely across the federal government, each adapted to address unique sectors, technologies, and goals. While there is no perfect federal innovation program, there are characteristics that are shared across many of the programs that lead to greater success and impact and can be adopted to accelerate the development of clean energy innovations. Research has been conducted to capture these characteristics. For example, a 2019 report by Partnership for Public Service surveyed federal employees across 16 federal agencies to determine the attributes that will help agencies foster innovation. The report details 10 characteristics of federal programs that allow innovation to thrive including leadership support, use of expertise from outside industries, and adapting to change. A report from Professor Sandford Borins from the University of Toronto sampled over 300 federal, state, and local government reformers who have won awards for innovation.[15] This report similarly found that characteristics of successful innovations involve a systems approach and process improvement, the involvement of the private sector, and empowerment of communities and staff.[16]

The characteristics below are found frequently in standout innovation programs, and have been cited more broadly throughout the innovation management research mentioned above. These characteristics are also a means to address challenges that have been identified in the past for DOE programs. While these features are important attributes of successful innovation programs, how they are implemented matters. This list is not all encompassing of every important feature needed to successfully address gaps. Finally, in order to stay impactful over time, all innovation programs must be open to change and adapt to both the customer and the evolving goals of the broader organization.

[15] Risk-and-Reward-Report.pdf (ourpublicservice.org)
[16] BorinsInnovatingInGov.pdf (businessofgovernment.org)

Characteristics of Impactful Innovation Programs

1. **Creative Contracting Mechanisms**

- Program must be designed or authorized to tolerate different contracting mechanisms and designs
- Program officers can use traditional grants, contracts, and cooperative agreements, as well as Other Transaction Authority in circumstances where traditional grants do not adequately support the needs of the innovator
- Contracting officers are incentivized to think outside the box to create agreements that fit the project, not the other way around

2. **Dedicated Program Managers**

- Empowered program managers have the capacity and technical ability to address the unique needs of every awardee
- Individual successes of program managers and awardees are incentivized and rewarded, and program managers are insulated from the failures of the awardees

3. **Flexible Milestones**

- Milestones that are responsive to the rapidly changing needs of startups
- Milestones must account for higher failure rates, allowing for quick exits to "fail fast" and allow companies to step away and potentially return to continue the support if the issues are resolved
- Evaluations must be accessible for both the grantee and program managers to allow for quick learning and pivots

4. **Designed to Support Creative Approaches to Solving Big Challenges**

- Awards target high growth potential startups and stay away from both pure basic research of science that has no clear end use, and pure applied research for established technologies

5. **Tolerance for Risk and Failure**

- Both culture and practices support higher risk technologies with the understanding that it is guaranteed that some will fail
- Practices include incentives for creative management, recognition for successes, or managerial support and backing when projects fail
- The program has the support of senior leadership for risk tolerance to permeate through the program

6. **Program Independence**

- Program has autonomy to select and run the projects that it wants without being boxed in by existing external program goals
- Can include a direct line to executive leadership that supports and defends the boundary-pushing program

7. **External Collaboration**

- Programs bring in employees from varying backgrounds in the private sector, allowing for rotational programs or short details to bring in new ideas
- Use of external advisory boards to evaluate projects on merit
- Programs work with the private sector to be responsive and aware of market conditions, consumer needs, and cutting edge advances