This document is scheduled to be published in the Federal Register on 11/08/2022 and available online at **federalregister.gov/d/2022-24250**, and on **govinfo.gov**

6450-01-P

DEPARTMENT OF ENERGY

Accelerating Innovations in Emerging Technologies

AGENCY: Office of Science, Department of Energy.

ACTION: Request for information (RFI).

SUMMARY: The Office of Science in the Department of Energy (DOE) invites interested parties to provide input relevant to developing approaches for accelerating innovations in emerging technologies to drive scientific discovery to sustainable production of new technologies across the innovation continuum; train a science, technology, engineering, and mathematics (STEM) workforce to support 21st century industries; and meet the nation's needs for abundant clean energy, a sustainable environment, and national security.

DATES: Responses to the RFI must be received by [**INSERT DATE 45 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER***].

ADDRESSES: DOE is using the *www.regulations.gov* system for the submission and posting of public comments in this proceeding. All comments in response to this RFI are, therefore, to be submitted electronically through *www.regulations.gov* via the web form accessed by following the "Submit a Formal Comment" link.

FOR FURTHER INFORMATION CONTACT: Questions may be submitted to *accelerate@science.doe.gov* or Natalia Melcer at (301) 903-0821.

SUPPLEMENTARY INFORMATION:

Background

Research drives innovations in technologies that ensure a vibrant economy and secure the future of the nation. The United States is a global leader in research and development (R&D), with activities generally focused on two areas. Federally-funded scientific research focuses on discovery and use-inspired research, which is commonly conducted at universities and national/federal laboratories. Applied research, development, and technology demonstration

activities are funded by both federal sources and industry and are conducted in university, national laboratory, and industry settings, focusing on demonstrating the application of an innovation to yield a product that can be prototyped, scaled up, and deployed in the marketplace. The gap between these two areas of R&D is often referred to as the "valley of death" because science-driven research often does not consider the factors required to drive innovations to sustainable production, and applied R&D and industry often find it difficult to transform early-stage discoveries to mature, deployable technologies. As a result, transitioning fundamental discoveries to new technologies in the marketplace has traditionally been challenging. Further, the innovation process is not linear, and technical bottlenecks arising on the technology demonstration side often require fundamental science breakthroughs ("technology pull"); conversely, fundamental science breakthroughs can drive new technologies ("science push"). Closely coupling these research, development, demonstration, and deployment (RDD&D) processes in a more circular manner will optimize and expedite the development and deployment of next generation technologies.

Bridging these gaps requires a holistic, "end to end" approach that closely integrates basic scientific and engineering research across multiple disciplines with applied and industrial activities to ensure that innovations reach the marketplace. Long-term success in driving the innovation continuum of research, development, demonstration, and deployment (RDD&D) will also require STEM workers who are trained broadly across the spectrum of science and engineering to propel discovery, innovation, scale-up, and production of new technologies for the future.

Beyond accelerating innovations in emerging technologies, these research activities have the potential to contribute to local and regional ecosystems to catalyze more innovation, workforce development, entrepreneurship, and economic growth in these regions. This "place-based

innovation" will leverage partnerships with local or regional private and public organizations that can further lead to a vibrant culture to support innovation and industries of the future.

The DOE Office of Science (SC) seeks input on research approaches that have the potential to push the discovery and creation of innovations towards the production/commercialization of future technologies that will have important public and commercial impact. These approaches would necessarily bring together trans-disciplinary teams of scientists and engineers in diverse fields, taking advantage of talent from national laboratories, regional universities, and industry. These teams will combine key technology focus areas (described later) to achieve the overarching goal of accelerating place-based innovation with an "end to end" approach that fully integrates "science push" and "technology pull" processes to guide the S&T research. Further, to emphasize place-based research growth, approaches should be considered that draw on regional resources and expertise to support the innovation process and allow wholly new concepts and processes to thrive.

Breakthrough scientific discoveries and technological innovation are needed in areas vital to building an innovation economy for the 21st century. As the nation's lead federal agency supporting fundamental scientific research related to energy, SC seeks to drive scientific discovery in ten key areas to yield sustainable production of new technologies and meet the nation's needs for abundant clean energy, a sustainable environment, and national security. These ten key technology focus areas include:

- Artificial intelligence, machine learning, autonomy, and related advances;
- High performance computing, microelectronics, and advanced computer hardware and software;
- Quantum information science and technology;
- Advanced manufacturing and automation;

- Biopreparedness;
- Advanced communications technology and immersive technology;
- Biotechnology, medical technology, genomics, and synthetic biology;
- Data storage, data management, distributed ledger technologies, and cybersecurity, including biometrics;
- Advanced energy and industrial efficiency technologies, such as batteries and advanced nuclear technologies, including but not limited to for the purposes of electric generation; and
- Advanced materials science, including composites, 2D materials, other next-generation materials, and related manufacturing technologies.

The SC mission is to deliver scientific discoveries and major scientific tools to transform our understanding of nature and advance the energy, economic, and national security of the United States. Within this mission, SC supports fundamental research in applied mathematics, biology, chemistry, computer science, engineering, isotope R&D, materials science, and physics that catalyze technical breakthroughs and innovations across these ten key technology focus areas. For example, fundamental advances in materials and chemical processes are required to achieve goals for clean, affordable, and abundant energy generation, storage, and use. Breakthroughs in 2D materials and new electrolytes could enhance ion transport in next-generation batteries to achieve fast-charging, high-power, and high-energy-density requirements needed to power the nation's transportation fleet. Similarly, new materials that can withstand extremes of radiation and temperature could support the development of future fission and fusion reactors with high efficiencies and long lifetimes. To minimize energy costs and wastes and meet demanding design requirements, new approaches will be needed for the manufacturing of next-generation energy technologies, requiring control of materials and chemical processes from the atomic and molecular levels. Revealing the rules of nature could produce breakthroughs in biotechnology,

medical technology, and biopreparedness by tailoring biological processes to produce new chemicals, materials, or medical therapeutics. To enable continued advances in computing and power technologies, a fundamental rethinking is needed of the science behind the materials and chemistry, physics, synthesis and fabrication technologies, architectures, algorithms, and software for microelectronics. Computational modeling could enable the design of highly selective separation media to increase the efficiency of isotope production approaches. Finally, to realize a next-generation technology may require advances in multiple key technology areas, such as combining advances in new manufacturing, materials, artificial intelligence, and machine learning to produce next-generation batteries.

Questions for Input

This RFI is an initial step in improving SC's understanding of the challenges and opportunities associated with transitioning new discoveries to high-value technologies to drive the economy of the future. The RFI is a solicitation for public input to help identify approaches that can accelerate the process from scientific discovery to sustainable production of new technologies across the innovation continuum. Responses should be limited to the SC mission areas, as described in the Background section. (Note: Responses submitted to the request for information on advanced computing ecosystems do not need to be submitted again: *https://sam.gov/opp/8c35a6cc1692492e94c337ba645ecce5/view*).

Responses are requested for the questions listed. Respondents may provide input regarding any or all of these questions. Each response should be numbered to match the specific question listed.

1) What are the barriers or challenges that need to be addressed to transition basic scientific discoveries to applied technologies?

2) What opportunities are there to build research teams that bridge the discovery to production spectrum, providing an "end to end" approach that fully integrates "science push" and "technology pull" processes to guide research to realize new technologies?

3) What new opportunities could be realized by combining two or more of the ten key technologies to accelerate the development of innovative products?

4) What specific metrics should be used to measure the success of new approaches for accelerating technology development?

5) To prepare for future industries, what opportunities are there for ensuring a robust workforce related to the ten key technologies? What skills are needed for students preparing for a career, and which of these skills are not commonly available in educational institutions?

6) What specialized facilities or capabilities are needed to support research activities related to the ten key technology areas? Are there new capabilities needed that could be provided through the scientific user facilities at the DOE National Laboratories, such as the light and neutron sources, particle accelerators, nanoscience centers, and high-performance computing facilities (*https://science.osti.gov/User-Facilities*)?

7) What new mechanisms will help a region, especially those centered on underserved communities, establish a vibrant innovation ecosystem to foster training, recruitment, and retention of technical personnel, support spinoffs, and growth of existing companies, develop entrepreneurs, and catalyze future industries in the key technologies?

Comments containing references, studies, research, and other empirical data that are not widely published should include copies of the referenced materials. Note that comments will be made publicly available as submitted.

Signing Authority

This document of the Department of Energy was signed on November 2, 2022, by Asmeret

Asefaw Berhe, Director, Office of Science, pursuant to delegated authority from the Secretary of Energy. The document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the *Federal Register*.

Signed in Washington, DC, on November 2, 2022.

Treena V. Garrett,
Federal Register Liaison Officer,
U.S. Department of Energy.

[FR Doc. 2022-24250 Filed: 11/7/2022 8:45 am; Publication Date: 11/8/2022]