DOE released new funding calls in solar, carbon utilization, hydrogen, geothermal, and particle accelerators to support research, development, and demonstration activities. DOE has also started to release more information and continues to seek stakeholder input on future funding calls related to implementing $62 billion in funding from the bipartisan infrastructure bill, especially on regional clean hydrogen hubs and hydrogen manufacturing, recycling and electrolysis research and development. This update also provides a preview of upcoming Office of Science funding opportunities over the next few months as Congress finalizes fiscal year 2022 appropriations.

**New Funding Opportunities**

- **$5 million for Small Innovative Projects in Solar:** Letters of Intent due February 28
  - DOE plans to fund innovative research and development seedling projects in photovoltaics and concentrating solar-thermal power technologies.
  - DOE streamlined the application process to encourage applications in particular from a diverse pool of researchers who have never applied or have been selected for an award by DOE’s Solar Energy Technologies Office.
  - As part of a new requirement, applicants must submit a plan to broaden the participation of underrepresented groups on their team.
  - DOE plans to make up to 23 awards each ranging between $250,000 and $400,000 over 12 to 18 months.

- **$22 million for Particle Accelerator Research and Technology Development:** Pre-applications due March 15
  - DOE will fund use-inspired basic research and development activities to advance accelerator science and technology and domestic supplier development that supports Office of Science missions.
  - DOE will fund two program activities:
    - **Accelerator Stewardship:** support cross-disciplinary teams to test new applications of accelerator technology in science, medicine, national security, and industrial applications up to Technology Readiness Level (TRL) 4.
    - **Accelerator Development:** support domestic suppliers of critical accelerator components and technologies up to TRL 6 and Manufacturing Readiness Levels between 5 and 7.
  - Awards will be one- to three-year grants ranging from $50,000 to $1 million per year.

- **$25 million for Concentrating Solar-Thermal Power Research, Development, and Demonstration:** Concept papers due March 16
  - DOE plans to fund projects in two specific areas of interest:
    - **Concentrating Solar-Thermal for Industrial Decarbonization** to advance concentrating solar thermal energy generation coupled with thermal energy storage and integrated with high-temperature process technologies to produce economically important products, like steel, cement, ammonia, chemicals, and fuels.
    - **Concentrating Solar-thermal Particle Technologies for Generation 3 CSP and Beyond (Gen3++)** to build on SETO’s Gen3 CSP to develop systems that can operate at temperatures above 700°C.
  - DOE plans to make 8 to 15 awards, each ranging between $750,000 and $6 million with an anticipated performance period of 12-36 months. A 20 percent cost share is required on research and development projects and a 50 percent cost share is required on demonstration projects.
• $19 million for **Carbon Utilization Technologies Using Algae**: Concept papers due March 18
  - The focus is on increasing the capability of algal systems to capture carbon dioxide and put it to productive use, such as biofuels for aviation and other bioproducts.
  - DOE will support projects in two specific topic areas:
    - Carbon utilization efficiency from biomass or atmospheric-based sources of carbon dioxide and
    - Algae-based technology to utilize anthropogenic CO2 from utility and industrial sources
  - DOE plans to fund three to four projects in each topic area with an award of around $2 million for each project over two to three years. A 20 percent cost share is required.

• $28 million for **Hydrogen Research and Development**: Proposals due March 23
  - DOE plans to fund research and development activities related to clean hydrogen production, storage, transportation and utilization.
  - DOE plans to fund projects in five specific areas of interest:
    - process intensification and modularization for clean hydrogen cost reductions;
    - clean hydrogen from high-volume waste materials and biomass;
    - sensors and controls for co-gasification of waste plastics in production of hydrogen with carbon capture;
    - front end engineering design (FEED) studies for carbon capture systems at domestic steam methane reforming facilities producing hydrogen from natural gas; and
    - FEED studies for carbon capture systems at domestic autothermal reforming facilities producing hydrogen from natural gas.
  - Award and funding distribution, cost share requirements, and period of performance vary by topic area.

• $20 million for the **Geothermal Drilling Technology Demonstration Campaign**: Letters of Intent due April 4
  - DOE will fund drilling demonstration projects that can significantly lower the cost of drilling geothermal wells—which can exceed 50% of a project’s total costs.
  - Of particular interest are projects that advance geothermal well construction through the development, modification, and adaptation of technologies and techniques that reduce drilling costs by at least 25 percent in a real-world geothermal field setting.
  - DOE plans to make up to five awards ranging from $500,000 to $9 million each for 24 to 48 months. There is a 20 percent cost share for research and development activities and 50 percent for demonstration activities.

**Implementation of $62 Billion of DOE Funding from the Bipartisan Infrastructure Bill**

DOE is seeking feedback from stakeholders and starting to draft funding opportunities to implement $62 billion in funding the agency received from the bipartisan infrastructure bill in November 2021. Many future opportunities are not designed for research universities, national labs, and other research organizations either because they are not eligible entities or do not have a significant research component. In some cases, research universities and other research organizations can participate as partners but not as prime institutions. In a few cases, research universities and other research organizations can apply directly to funding opportunities. Below are current and upcoming opportunities:

• **$8 Billion RegionaClassic Hydrogen Hubs Implementation Strategy Request for Information**: Responses due March 8
  - This is the last opportunity for research universities and other interested stakeholders to shape the $8 billion in funding for the Hydrogen Hubs solicitation expected by May 15, 2022
  - The RFI seeks input in four topic areas:
    - Regional clean hydrogen hub provisions and requirements,
    - The solicitation process, funding opportunity announcement structure, and implementation strategy,
    - Equity, environmental and energy justice priorities, and
    - Market adoption and sustainability of the Hubs.
$1.5 Billion **Clean Hydrogen Manufacturing, Recycling and Electrolysis Request for Information**: Responses due March 29

- This is an opportunity for research universities and other interested stakeholders to shape $1.5 billion in funding for electrolysis, manufacturing, and recycling research and development for hydrogen production and use, with the first funding solicitation expected in Summer 2022.
- DOE is interested in research and development priorities related to new program activities:
  - $1 billion over five years for clean hydrogen manufacturing and recycling research, development, and demonstration, including
    - Clean Hydrogen Manufacturing Initiative focused on growing domestic manufacturing of clean hydrogen use, storage, and related equipment and
    - Clean Hydrogen Technology Recycling RD&D Program focused on recycling of equipment for clean hydrogen processing, delivery, storage, and use, including fuel cells.
  - $500 million for the Clean Hydrogen Electrolysis Program focused on improving the efficiency, increasing the durability, and reducing capital costs of electrolyzers for clean hydrogen production.

$6 Billion **Civil Nuclear Credit Program**

- This program is designed for nuclear reactor owners and operators and will provide funding to support the continued operation of existing U.S. nuclear reactors and avoid premature retirements.

$3 Billion **Production and Recycling of Batteries for Vehicles and Energy Storage**

- The focus of this funding is to support new or project to retool, retrofit, and/or expand existing battery materials refining and production plants, battery cell and pack manufacturing facilities, and recycling facilities for advanced batteries.
- DOE plans to fund demonstration and commercial scale projects for processing lithium ion battery materials, advanced lithium ion battery component manufacturing, and recycling.
**Upcoming Office of Science Funding Opportunities:** March-May 2022

- **$17 million for Chemical and Materials Sciences to Advance Clean Energy Technologies and Transform Manufacturing**
  - This funding opportunity will support single Principal Investigators and small teams (as opposed to large, multidisciplinary teams for EFRCs) to drive basic research priorities for material and chemistry research.
  - DOE plans to fund the following topic areas (similar to EFRCs but no research in microelectronics and energy/water nexus and instead of quantum research a focus on critical materials):
    - Science for Clean Energy: carbon-neutral hydrogen, solar energy and fuel, nuclear energy, catalysis, energy storage, subsurface science, direct air capture of CO2
    - Science for Advanced Manufacturing: transformative manufacturing, chemical upcycling of polymers, synthesis science
  - Other National Priority Research Areas: critical materials
  - DOE plans to fund up to 20 awards ranging from $500,000 to $1 million per year over three years.
  - New this year: Applications led by or in partnership with Minority Serving Institutions and applications including individuals from historically underrepresented groups in STEM will be strongly encouraged and will also be part of the formal review process and program factors that determine scores for winning proposals.
  - There will likely be limited submission requirements of no more than two submissions for each lead institution.

- **$15 million for Microelectronics**
  - This funding solicitation would expand multi-disciplinary microelectronics research to accelerate the advancement of microelectronic technologies in a co-design innovation ecosystem in which materials, chemistries, devices, systems, architectures, algorithms, and software are developed in a closely integrated fashion.
  - Priorities include materials, chemistry, and fundamental device science for microelectronics.
  - DOE national labs are likely to be the leads on these efforts but with research university partners.
  - This would build on the FY 2021 funding solicitation on microelectronics co-design research and recent awards.

- **$20 million for Applied Mathematics and Computer Science**
  - This would support the science of AI, including domain-aware, interpretable, and robust machine learning systems as well as data-intensive, machine-learning enhanced modeling and simulation, and intelligent automation and decision support capabilities.
  - Targeted funding calls are likely in the following topic areas:
    - Data visualization beyond 4D;
    - Federated scientific machine learning;
    - Explainable AI (initial direction for this and the former topics can be found in the Basic Research Needs for Scientific Machine Learning report);
    - Randomized algorithms for scientific computing (based on research priorities from the December 2020 and January 2021 workshops and summary slides); and
    - Parallel discrete event simulation (based on research priorities from the September 2021 Roundtable).

- **$20 million for Math Centers**
  - The Mathematical Multifaceted Integrated Capability Centers (MMICCS) are up for recompetition.
  - DOE typically awards three centers funded at around $2.5 million a year over four years.
  - These centers allow applied mathematics researchers to work together in large, collaborative teams to develop the mathematics needed to address significant scientific computing research challenges in DOE mission areas of energy, environment, and security.
  - An example of the last funding call is here and examples of existing MMICCS are here.
$25 million for a **Quantum Internet and Communications Network**
- This would support early-stage research, including novel devices and hardware, to continue building out and testing the first dedicated.
- This includes basic research in quantum information networks that overcomes challenges in transporting and storing quantum information over interconnects and networks.
- This will likely include elements from last year’s call: [DOE ASCR Entanglement Management and Control in Transparent Optical Quantum Networks](http://example.com).

$10 million for **Operating-Systems Research**
- This includes improved storage systems and input/output (I/O) processes and exploring high-productivity environments for scientific computing.
- Initial research directions are based on the January 2021 Roundtable on Operating-Systems Research and the December 2020 [User Facilities Roundtable](http://example.com).
  - In January 2021, ASCR sponsored a Roundtable Discussion on Operating-Systems Research. This led to the publication of two whitepapers that identified future research opportunities—[Research Opportunities in Operating Systems for High-Performance Scientific Computing](http://example.com) and [Research Opportunities in Operating Systems for Scientific Edge Computing](http://example.com). The first focuses on research opportunities related to full-stack co-design for extreme heterogeneity and scalability, adaptive management and partitioning of resources, and smart supercomputer systems and facilities. The second white paper focuses on deploying large numbers of edge resources, with scalable access control mechanisms, to support much more heterogenous computing resources and more complex organizational structures as well as supporting smart systems, instruments and facilities to support science breakthroughs with autonomous experiments, “self-driving” laboratories, smart manufacturing, and AI-driven design, discovery and evaluation.

$17 million for **Urban Integrated Field Labs**
- DOE would support the launch of new urban field laboratories that would build integrated models and tools that improve understanding of the interdependence of the natural and human components of the climate system.
- Cities are seen as critical to informing future climate policy because the urban landscape is where the majority of industry operates, consumers live, and power is consumed, but there is a gap in understanding how human activity in urban areas impacts our climate system.
- Awards for these field labs would likely range from $1 million to $2 million a year over five years.
- The initial scope would target a diverse set of urban regions around the country with the purpose of developing a science framework for advancing observational and prediction capabilities.
- The initial focus would be on tackling three specific interdependent challenges: constraining climate changes and its impacts on all scales across urban regions; evaluating the mitigation-potential for emerging energy technologies in urban regions and beyond; and addressing environmental justice through neighborhood scale evaluation of climate impacts and energy needs.

$20 million for **Artificial Intelligence and Machine Learning (AI/ML) Research and Development for HEP**
- Priority topics are likely to include advancing AI/ML capabilities for more efficient processing of large data sets, modeling and mitigation of systematic uncertainties, high-throughput data selection, real-time data classification, and improved operations of particle accelerators and detectors.

$12 million for the **Nuclear Data Interagency Working Group Research Program**
- DOE plans to support research projects using nuclear data and improving databases for users supported by Nuclear Physics, the Isotope Program and the National Nuclear Security Administration Office of Defense Nuclear Nonproliferation Research and Development.
- Research opportunities usually cover nuclear physics basic science, nuclear energy applications, non-proliferation and nuclear security applications, and other associated applications in radiation protection, planetary, and space-based science.
- DOE plans to make up to 20 awards averaging $350,000 a year over three years.
• $7 million for **Quantum Information Science Research and Innovation for Nuclear Science**
  - This would support research that would have a transformative impact on the nuclear physics mission area and/or advance quantum information science development enabled by nuclear physics-supported science, technologies, and laboratory infrastructure.
  - Topics are likely to include quantum computation, quantum simulations and simulators, quantum sensing, nuclear physics detectors, nuclear many-body problem, ‘squeezed’ quantum states, entanglement at collider energies, and lattice gauge theories as well as novel areas of basic research.
• $7 million for **Research and Development of Next Generation Nuclear Physics Accelerator Facilities**
  - DOE will support research and development efforts for accelerator systems of relevance to current or next generation NP accelerator facilities.
  - Topics usually include accelerator research and development that significantly advances state-of-the-art accelerator capabilities for next generation machines for the study of nuclear physics, for improving the performance of existing facilities studying nuclear physics, or SRF technology.
  - DOE plans to make up to 10 awards typically ranging from $500,000 to $1 million for two years.
  - DOE awards are expected to be up to five years with a second five-year renewal and awards range from $1 million to $2 million.
• $5 million for **DOE Traineeships in High Energy Physics for Computation**
  - In the last two years, HEP has funded graduate traineeship programs in accelerator physics and technology and instrumentation. The focus this year is to build expertise in computational tools, data management and analytics, and simulation techniques to advance HEP programs.
  - DOE awards to a university or consortia of universities would support tuition, stipend, and travel costs for students enrolled in specific academic programs aimed at training graduate students in computational techniques needed for HEP programs, and provide some support for curriculum development and program administration.