

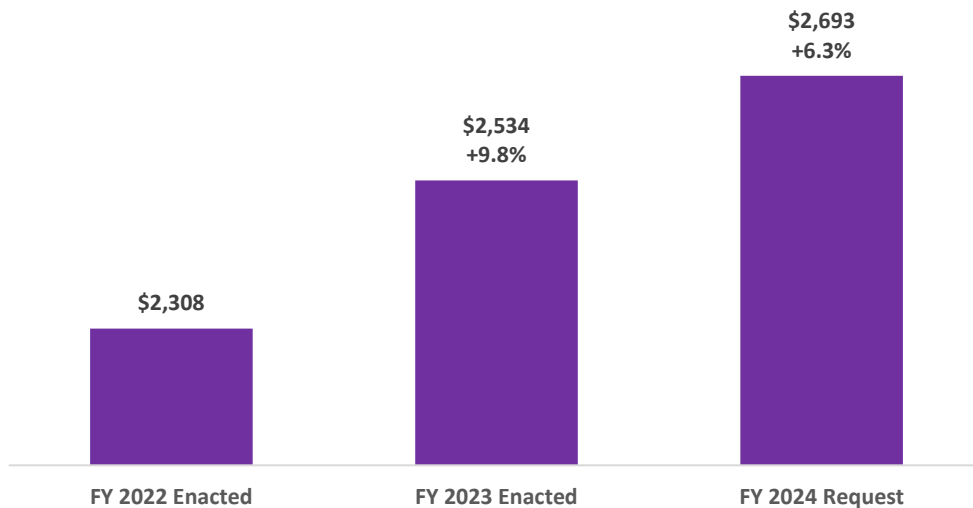
DOE Research and Funding Priorities for Materials and Chemistry Research

This provides an update and advance intelligence on recent activities, emerging priorities, and future opportunities within the Department of Energy (DOE) Basic Energy Science (BES) program. BES primarily funds materials and chemical sciences, along with some support for geosciences and biosciences. BES also builds and operates the government's largest collection of world-class scientific user facilities. This analysis is based on information from the virtual BES Advisory Committee (BESAC) meeting held on [April 25, 2023](#), final fiscal year (FY) 2023 appropriations, the FY 2024 President's budget request, the release of new workshop reports, and discussions with DOE program managers.

Funding Outlook

BES saw a 9.8 percent increase in FY 2023 compared to FY 2022 levels (see graphic). DOE has since requested a \$159 million, or 6 percent increase compared to FY 2023 enacted levels, for BES in the FY 2024 President's budget request. Congress has not yet started to advance the FY 2024 Energy and Water bill, which funds the DOE Office of Science, and the funding outlook on major federal programs is tied to debt ceiling negotiations. If Congress and the White House can reach a budget deal by the end of May 2023, both the House and Senate plan to advance the FY 2024 Energy and Water bill in June 2023.

BES Funding (\$ in Millions)



In FY 2024, funding increases are requested primarily for:

- new Microelectronics Science Research Centers (+\$25 million for BES' contribution);
- additional Energy Earthshot Research Centers and Foundations awards (+\$35 million for BES' contribution);
- the Reaching a New Energy Sciences Workforce and Funding to Accelerate Inclusive Research programs (+\$12 million for BES's contribution); and
- increasing operations of BES's 12 scientific user facilities (+\$166 million).

FY 2024 Funding Opportunities

Below are planned FY 2024 funding opportunities relevant to materials and chemistry research as well as other BES-supported research areas. Actual funding and timing is contingent on final FY 2024 congressional appropriations, but the information below is based on best available information.

- **\$100 million for Energy Frontier Research Centers (November/December 2023):** DOE plans to fund up to 12 new or renewed centers. [EFRCs](#) are one of DOE's leading center-level competitions and well-suited for research universities. These centers are funded from \$2 million to \$4 million each per year over four years and there are no cost share requirements. These multi-investigator, multi-disciplinary, multi-institutional centers accelerate scientific discovery and tackle transformative energy grand challenges. The three planned topic areas for the next competition include: quantum information science, microelectronics, and transformative manufacturing. However, DOE may add another high priority topic area. See the most recent [FY 2022 funding solicitation](#) as an example.
- **\$24 million for Computational Materials Sciences Centers (November/December 2023):** DOE plans to re compete computational materials sciences centers [awards](#). Awards are \$4 million per year over four years. This program supports integrated, multidisciplinary teams to perform research and develop open-source codes and databases for predictive design of functional materials. The focus is on new approaches to enhance the use of large data sets derived from advanced characterization of materials, materials synthesis, processing, properties assessments, and the data generated by large-scale computational efforts that model materials phenomena. Teams are expected to develop open-source, robust, validated, user-friendly software (and the associated experimental and computational databases) that captures the essential physics and chemistry of relevant systems and can be used by the broader research community and by industry to accelerate the design of new functional materials.
- **\$25 million for the Established Program to Stimulate Competitive Research (EPSCoR) (November/December 2023):** DOE plans to release a solicitation for [EPSCoR](#) that will focus on State-National Laboratory Partnership awards in climate and clean energy to promote single principal investigator and small group research with DOE national labs, including support of early career awards. Early-career faculty are strongly encouraged to apply. Participation by undergraduate and graduate students as well as postdoctoral fellows is required. Topics evolve, but examples from the [last call](#) include Energy Storage, Carbon Dioxide Removal, Hydrogen, Solar Energy Conversion, and Low-carbon Manufacturing. Average awards are \$250,000 per year over two or three years.
- **\$47 million for Reaching a New Energy Sciences Workforce (RENEW) (January/February 2024):** DOE plans to release a third solicitation, similar to [prior years](#), to provide undergraduate and graduate training and research opportunities for students and academic institutions currently underrepresented in the Office of Science portfolio. This opportunity is primarily for non-R1 institutions of higher education and Minority Serving Institutions (MSIs) in partnership with DOE National Laboratories to access unique user facilities and science infrastructure. R1 institutions can be partners on multi-institutional collaborations. DOE views this initiative as part of a broader effort to advance a diverse, equitable, and inclusive research community. Each DOE Office of Science program office releases its own solicitation with a slightly different focus. New in FY 2024 will be a graduate fellowship program. Average award size is around \$500,000 per year over three years.
- **\$40 million for Funding to Accelerate Inclusive Research (FAIR) (January/February 2024):** DOE plans release a second funding solicitation to build on [FY 2023](#) to support research and infrastructure on clean energy, climate, and related topics at Minority Serving Institutions (MSIs), including underserved and environmental justice regions. DOE would provide support to single Principal Investigators or small groups as well as for equipment and other infrastructure improvements. The majority of funds would directly support MSIs, but a portion would fund partnering institutions, such as research universities and national laboratories. This would complement the workforce development activities of the Reaching a New Energy Sciences Workforce (RENEW) initiative. Average award size will be \$500,000 per year over three years.
- **\$200 million for Energy Earthshot Research Centers Lab Call (Spring 2024):** DOE plans to release a second funding solicitation for new multi-investigator, multi-disciplinary centers to address the basic research challenges of the six existing Energy Earthshots in long duration storage, hydrogen, carbon negative technologies, geothermal, floating offshore wind, and industrial heat along with one or two more Earthshots that may be announced before the end of the year. The National Lab-led teams with research university collaborators would focus on energy-relevant research

with a scope and complexity beyond what is possible in standard single investigator or small group awards. Each center would be funded at \$3 million to \$5 million per year over four years. The most recent example is available [here](#).

- **\$75 million for Energy Earthshot Research Foundations (Spring 2024):** DOE plans to release a second solicitation, similar to the FY 2023 [solicitation](#), to support small teams from research universities and national labs to advance key fundamental research challenges facing the [six Energy Earthshots](#). This solicitation is designed for research universities since DOE national labs are not eligible to lead applications. Awards will range from \$500,000 to \$2 million each per year over three years.
- **\$60 million for Microelectronics Science Research Centers (Spring 2024):** Authorized in the *CHIPS and Science Act*, DOE plans to launch four Microelectronics Science Research Centers in this new \$400 million program. Modeled after the DOE National QIS Centers, each would be funded at \$25 million per year over five years, with the option for a 5-year renewal. These will likely be DOE National Lab-led with university and industry partners. BES specific areas of interest include:
 - accelerated discovery and development of new microelectronics science and technology;
 - advanced experimental and computational capabilities, including materials science, chemistry, plasma science, artificial intelligence, and multiscale codesign;
 - innovative methods for circuits, architectures, systems, modeling, and synthesis;
 - sustainable and energy-efficient microelectronics devices, including logic, memory, and sensors/detectors
 - testbeds for prototyping platforms for validation/verification of new concepts;
 - prototyping of novel devices to facilitate lab-to-fab transition; and
 - development of advanced cybersecurity capabilities for computing architectures.

Research Priorities

BES sponsors Basic Research Needs workshops and Roundtable reports to define research priorities and make future investment decisions. The graphic below shows the current set of BES topics that will be funded, including topics for Energy Frontier Research Centers.

Defining Research Priorities: Basic Research Needs Strategic Planning Workshops and Roundtables

Quantum Science

- Quantum Materials for Energy Relevant Technology
- Neuromorphic Computing: From Materials to Systems Architecture
- Opportunities for Quantum Computing in Chemical and Materials Sciences

Theory, Modeling & Computation

- Producing and Managing Large Scientific Data with Artificial Intelligence and Machine Learning
- ESnet: Basic Energy Sciences Network Requirements Review

Characterization

- Experimental Tools for Basic Research at the Frontiers of High-Voltage Science
- Wide-Field-of-View for Nanoscale and Discovery of Transformative Experimental Tools
- Research Opportunities in the Physical Sciences Enabled by Cryogenic Electron Microscopy

Synthesis

- Synthesis Science
- Chemical Upcycling of Polymers
- Transformative Manufacturing

Cross-Cutting Energy

- Energy and Water
- Basic Research Needs for Catalysis Science
- Future Nuclear Energy
- Next Generation Electrical Energy Storage
- Microelectronics
- Liquid Solar Fuels
- Fundamental Science for Carbon-Nuclear Hybrid Technologies
- Fundamental Science for Carbon Dioxide Removal Technologies
- Fundamental Science to Accelerate Nuclear Energy Innovation

BES Advisory Committee: International Benchmarking

SC Biopreparedness & Response

CAN THE U.S. COMPETE in Basic Energy Sciences?

Source: DOE Office of Science.