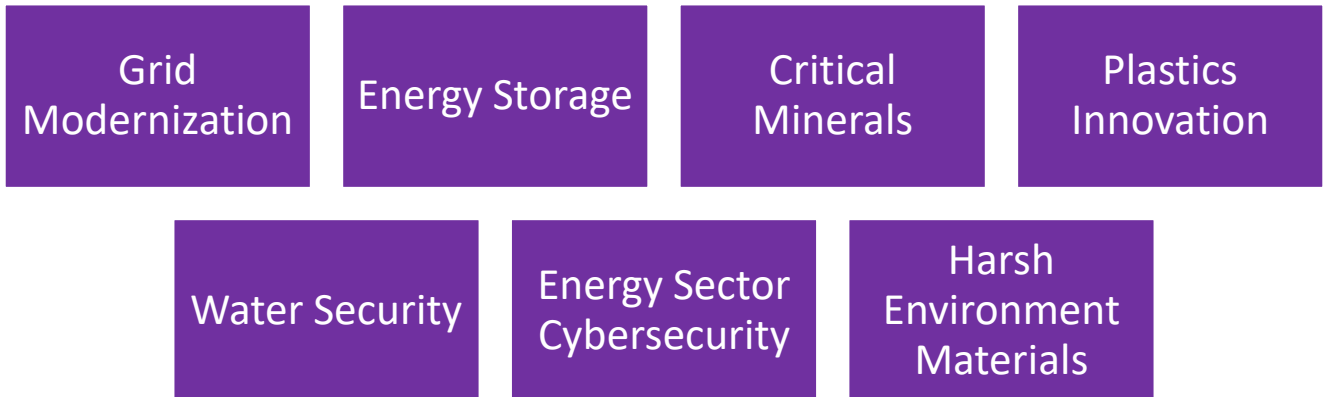


## Agency Update: Outlook on Major Department of Energy Applied Energy Research and Funding Initiatives

Lewis-Burke Associates LLC – March 9, 2020

In addition to the Department of Energy (DOE) Office of Science, DOE’s applied energy programs are also making major investments in new research initiatives. These research initiatives are focused on meeting DOE missions such as grid modernization, materials for harsh environments, and finding alternatives to critical materials for energy technologies. This analysis provides advance intelligence on future funding and research priorities for each major research initiative across the applied energy offices. The focus is on extramural, competitive funding opportunities and does not include funding through National Lab consortia and research university partnership opportunities through National Lab-only funding calls.

The DOE applied energy offices currently have seven major research initiatives. One—critical minerals—is a new initiative in fiscal year (FY) 2021, while the rest were launched in prior fiscal years. While Congress will ultimately decide final funding levels for these major initiatives through the FY 2021 appropriations process, which started in February 2020, DOE will prioritize funding for the following major initiatives:



### Grid Modernization Initiative

The main goal of this initiative is to develop new concepts, tools, and technologies to better measure, analyze, predict, protect, and control the grid of the future. Major research interests include leveled cost of energy, electricity affordability, generation and hybrid systems, resilience modeling, cyber-physical security, advanced sensing, energy storage and system flexibility. No major funding call is expected in FY 2021 as DOE recently made \$80 million of awards to 88 projects managed by the DOE national laboratories.



## Energy Storage Grand Challenge

DOE is taking a more holistic approach to accelerate the development, commercialization, and utilization of next-generation energy storage technologies. The Energy Storage Grand Challenge incorporates and better integrates existing but disparate research and development efforts from the Office of Science, Grid Modernization Initiative, and Advanced Energy Storage Initiative. The goal is to create and sustain global leadership in energy storage utilization and exports by 2030, with a secure domestic manufacturing supply chain that is independent of foreign sources of critical materials. In FY 2020, Congress appropriated \$368 million toward this effort. While the FY 2021 President’s budget request proposes less funding than FY 2020, primarily in the Office of Energy Efficiency and Renewable Energy, Congress is likely to reject those cuts and maintain stable funding.

**Energy Storage Grand Challenge  
(Formerly Advanced Energy Storage Initiative)  
(\$ thousands)**

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request
Electricity	46,000	56,000	83,500
Energy Efficiency and Renewable Energy	217,837	282,636	97,000
Fossil Energy	-	4,500	5,000
Nuclear Energy	-	-	4,000
Science	24,088	24,088	24,088
<b>Total, Energy Storage Grand Challenge</b>	<b>287,925</b>	<b>367,224</b>	<b>213,588</b>

*Source: Department of Energy.*

The following major funding opportunities are expected in FY 2021:

- \$35 million for vehicle batteries: focus on new battery chemistries and technologies to reduce costs, improve energy density, and durability;
- \$15 million for hydrogen applications: Through the H2@Scale program and funding call, the focus would be on integrating renewables, nuclear, and other resources with hydrogen production, storage, and use across applications; and
- \$14 million for buildings: focus on using thermal energy storage and controllable building loads to enhance grid reliability by making building loads more flexible while meeting the needs of building occupants and maintaining the performance of labor-saving devices, appliances, and equipment.



## Critical Minerals Initiative

The goal of this new initiative is to diversify supply, develop substitutes, and improve recycling of critical minerals, especially rare earths, needed for energy applications. DOE has three main research and development priorities:

- Understanding the fundamentals of rare earth properties, including novel synthesis techniques that control composition and incorporate unique capabilities for the preparation, purification, processing, and fabrication of well-characterized materials;

- Reducing use and discovering substitutes, especially through experimentally validated computational models in materials science and chemistry for predictive design of alternatives to rare earth materials; and
- Enhancing separations and chemical processing for rare earths, especially understanding the interactions of aqueous solutions with mineral interfaces.

The following major funding opportunities are expected in FY 2021:

- \$31 million for critical and rare-earth materials separations and processing: DOE plans to release a funding solicitation to fund up to 10 research and development projects focused on foundational knowledge related to critical and rare earth materials separations and processing. The FY 2021 President’s budget request proposes dissolving the Critical Materials Institute currently under the Advanced Manufacturing Office and replacing it with a National Lab-led consortium modeled after the Grid Modernization Lab Consortium. Congress is likely to reject prematurely terminating the Critical Materials Institute—one of DOE’s Energy Innovation Hubs—but will support early investments and a consortium model.
- \$25 million for basic research under the Office of Science: Within the Office of Science, the Basic Energy Sciences program would release a funding call for research that would improve understanding of synthesis approaches and materials discovery to enable rare earth substitution and reduced use of critical materials, such as utilizing synthetic advances in related fields and predictive theory, modeling, and data mining/artificial intelligence to accelerate progress. Research efforts may also include chemistry of rare earths, such as selective separations from solutions, and dynamics and reactivity at mineral-water interfaces during extraction and recovery.



## Plastics Innovation Challenge

To address the growing global challenge of plastic waste, DOE launched a research initiative that would explore novel technologies and approaches to economically deconstruct existing plastics, increase opportunities for upcycling, and develop recyclable polymers. Specifically, the goals of this research grand challenge are to reduce the energy costs associated with the current lifecycle of plastics; develop new polymers that are recyclable-by-design; and develop biological and chemical methods to deconstruct plastic waste, including from rivers and oceans, into useful chemical feedstock streams.

The following major funding opportunities are expected in FY 2021:

- \$8 million for biobased plastics designed for recyclability: The Bioenergy Technologies Office, through the new national lab consortium for innovative technologies for plastics recycling and up-cycling (BOTTLE), would compete projects with industry and academia for biobased plastics that could be co-produced with fuels in an integrated biorefinery.
- \$10 million for chemical upcycling: The Office of Science Basic Energy Sciences program plans to support research in chemistry and biology for chemical conversion and upcycling of polymers, design of next generation polymers and polymeric materials, and next generation tools for determining chemical and biochemical mechanisms with potential benefit for polymer upcycling.



## Water Security Grand Challenge

To help meet the long-term needs for safe, secure, and affordable water, DOE is focusing research efforts on desalination technologies, resource recovery from municipal wastewater, and small modular energy-water systems. No major funding calls are expected in FY 2021, except for a few prize competitions in targeted areas, with most efforts and funding dedicated to the new Desalination Energy Innovation Hub.



## Energy Sector Cybersecurity

DOE is the lead federal agency to enhance the preparedness, resiliency, and recovery of U.S. energy infrastructure from all threats and hazards. Most increases in funding proposed by DOE for these activities are to assist industry and state and local governments to improve energy infrastructure security and recover from different hazards. Specifically, in FY 2021, an additional \$22 million is requested to improve emergency response and recovery, provide near-real-time situational awareness and information sharing about the status of the energy systems to improve risk management, and analyze evolving threats and hazards to energy infrastructure.

The one major research and development funding call proposed for FY 2021 would provide \$10 million for several projects to focus on developing new AI techniques to automatically adapt energy-delivery infrastructure operations and survive a cyber-attack that would otherwise disrupt energy delivery.



## Harsh Environment Materials Initiative

The goal of this initiative is to develop new materials that can operate in harsh environments. The focus is on novel materials, integrated sensors, and manufacturing processes for the development of advanced thermoelectric power plants and nuclear energy systems. The majority of funds in FY 2021 will be focused on advancing activities related to the fueled operational test of a micro-reactor fabricated using additive manufacturing techniques at Oak Ridge National Laboratory, called the Transformational Challenge Reactor. No major new funding calls are expected in FY 2021.