

## FY 2022 DOE Fossil Energy and Carbon Management Research and Development Priorities

The Department of Energy (DOE) has proposed a \$140 million or 19 percent increase in fiscal year (FY) 2022 for fossil energy and carbon management research, development, deployment, and demonstration activities. If funded, the budget for these activities would grow to \$890 million in FY 2022. While congressional appropriations will determine final funding levels, DOE still plans to advance new program priorities. The most significant shift is new investments focused on decarbonizing the power and industrial sectors primarily through carbon capture, utilization, and storage while reducing research and development activities for more traditional fossil combustion efforts. DOE notes that it will no longer fund any research and development activities that support fossil combustion, traditional fossil-fueled power generation, or increased production of fossil fuels.

New initiatives and funding opportunities proposed for FY 2022 include:

- **\$69 million to reduce methane emissions:** DOE plans to fund the development and deployment of new technologies to monitor and reduce methane emissions primarily for natural gas production, but also includes coal and oil fuel production. DOE proposes an additional \$16 million to support research that addresses the environmental impacts of oil and natural gas development including wellbore integrity, oil spill prevention, and produced water treatment and reuse technologies; \$41 million to mitigate emissions throughout the natural gas supply chain, from reducing flaring in production fields to detecting and mitigating legacy infrastructure, including the development of advanced materials, data management tools, in-pipe inspection and repair technologies, dynamic compressor research and development, new advanced remote detection technologies, and the development of modular remediation materials and solutions; and \$12 million for the development of direct and remote measurement sensor technologies for the collection, dissemination, and analysis of emissions data, including from orphan wells.
- **\$30 million to accelerate carbon-neutral hydrogen using natural gas infrastructure:** DOE proposes a new natural gas hydrogen research program to offer an emissions-free fuel for power generation, industrial applications, and the transportation sector. The focus is on developing technologies that leverage natural gas infrastructure for hydrogen production, transportation, storage, and use coupled to carbon management. Specifically, DOE plans to support technologies for carbon-neutral hydrogen production as well as hydrogen (and ammonia) transportation, and geologic storage technologies that leverage existing natural gas infrastructure. Hydrogen research would focus on improving carbon neutral natural gas steam methane reforming, blending hydrogen with natural gas, and leveraging existing transportation and storage infrastructure. DOE also plans to support the development of new analytical tools and models that can evaluate potential advanced technologies, technology performance metrics, technoeconomic and lifecycle analyses, and resource evaluations.
- **\$23 million for carbon dioxide removal (CDR):** CDR refers to approaches that remove carbon dioxide from the atmosphere and store it in geologic formations, products, terrestrial sinks, or in the ocean. DOE's three research and development priorities include direct air capture, bioenergy with carbon capture and storage, and mineralization. DOE plans to prioritize research and development in carbon mineralization which has the potential to use reactive rocks and minerals, including materials such as mine tailings and wastes, to react with carbon dioxide and permanently store it as a solid material. DOE also plans to field test bioenergy with carbon capture and storage for both gasification and combustion.

- **\$16 million for Big Data and Artificial Intelligence (AI):** DOE plans to fund research university and national lab projects that use AI and machine learning applications to improve plant operations, technology testing, systems analysis, and technology transfer to industry. DOE is focused on using AI, machine learning, and data analysis to create learning algorithms within large datasets to help discover new materials, optimize processes, and run autonomous systems. Priority areas include passive sensor platforms, data management and systems, and tools that employ AI to help adapt varying pipeline conditions and additional fluids, optimize dedicated carbon dioxide storage, and apply remediation technologies to detect and fix methane leakage from legacy fossil infrastructure.
- **\$15 million for carbon utilization:** DOE will continue to fund novel approaches to recycle carbon oxide emissions, principally carbon dioxide, into value-added products. Potential feedstocks include flue gas from power generation, industrial point sources, captured/concentrated carbon dioxide, mixed gas streams, or the atmosphere. These carbon sources could then be converted through a bio-mediated, catalytic, mineralization, or hybrid pathway. DOE's priority areas include the catalytic conversion to higher value products such as fuels, chemicals, polymers, and nutraceuticals; mineralization to building products; generation of solid carbon products; and algal systems designed to integrate carbon dioxide. Most new funding proposed in FY 2022 would support research into catalysts made from low-cost materials and improved reactor designs to lower the cost of the conversion process. New funding would also support the development of at least one, fully integrated carbon dioxide utilization field-test system.
- **\$10 million for critical minerals:** DOE is focused on the extraction of critical minerals and rare-earth elements from coal to meet demand for magnets, catalysts, and batteries for clean energy applications. New funding in FY 2022 would expand research and development in support of pre-front end engineering and design studies for large-scale pilot projects to produce large quantities of high purity, commercial grade rare earth elements and other critical minerals. In particular, research and development would expand current efforts to include extraction of alkaline minerals from coal waste to serve as a feedstock to react with and permanently store carbon dioxide to form a synthetic aggregate for mine land reclamation or a feedstock for roads and concrete.