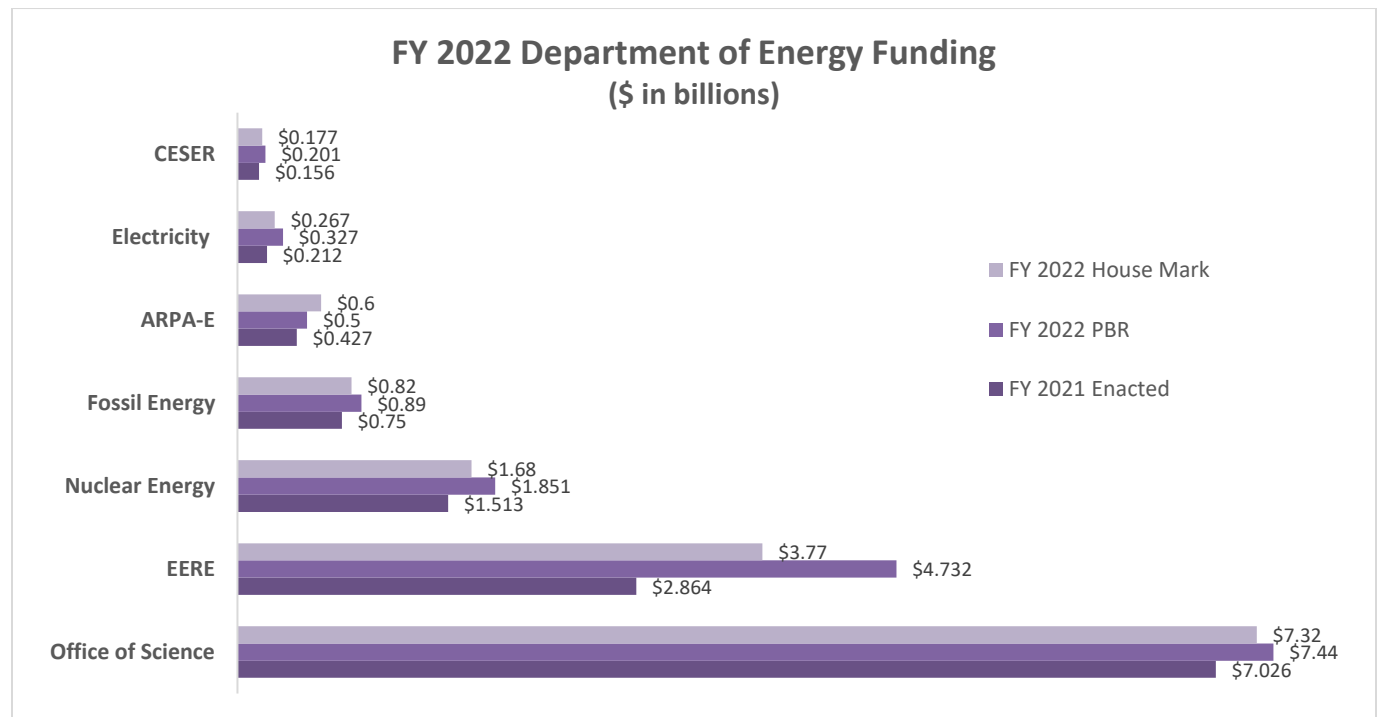


## Appropriations Update: House Appropriations Committee Favorably Reports FY 2022 Energy and Water Development Appropriations Bill

Lewis-Burke Associates LLC – July 20, 2021

The House Appropriations Committee approved the fiscal year (FY) 2022 Energy and Water Development appropriations bill with a vote of 33-24 on July 16. The bill's jurisdiction includes civilian and defense-related programs of the Department of Energy (DOE), civil works projects of the Army Corps of Engineers, the Department of the Interior's Bureau of Reclamation, and related independent agencies. The full House plans to vote on the Energy and Water bill along with six other appropriations bills the week of July 26. The Senate has not yet started consideration of FY 2022 appropriations bills.

The House Energy and Water bill would provide \$45.1 billion for DOE, which is \$3.2 billion, or 8 percent, above the FY 2021 enacted level, but \$1.1 billion below the President's budget request. The bill would increase funding for all major DOE programs (see graphic below). However, the Committee prioritized research, development, and demonstration of applied energy programs to decarbonize the electricity sector and help meet the President's goal of net zero emissions economy-wide by 2050. The largest proposed increase—\$906 million or 32 percent—is for renewable energy and energy efficiency projects. The Committee provided no funding to establish a new Advanced Research Projects Agency-Climate (ARPA-C) but significantly increased funding to support Advanced Research Projects Agency-Energy (ARPA-E) and supported the creation of a new Office of Clean Energy Demonstrations. Overall, the majority of new funding would be primarily focused on grants for industry as well as assistance to state, local, and tribal governments to advance deployment of clean energy technologies and increase grid resilience and cybersecurity as opposed to early-stage research and development better suited for research universities and other research organizations.



Republicans have most heavily criticized proposed funding for the national security missions of the National Nuclear Security Administration (NNSA). While the bill proposes \$15.5 billion for nuclear weapons activities—a \$139 million increase and consistent with the President’s budget request—Republicans are concerned that the less than one percent increase is not sufficient to support nuclear weapons modernization activities, especially for the construction of new production facilities and new life extension programs for nuclear warheads. This criticism extends beyond funding for NNSA. Republicans want to negotiate higher funding levels for defense discretionary spending beyond the 1.7 percent increase proposed by the Biden Administration and House Democrats.

The Committee was aware of impacts and delays to research and construction projects caused by the COVID-19 pandemic, but provided no specific funds to address those impacts. Instead, the Committee directed DOE to include funding to address COVID-19 impacts in future budget requests. The Committee did not have reliable and comprehensive COVID-19 budget impact information and put the burden on DOE to mitigate those impacts.

Below is a summary of funding levels for relevant programs proposed in the bill, followed by a more detailed description of each program area:

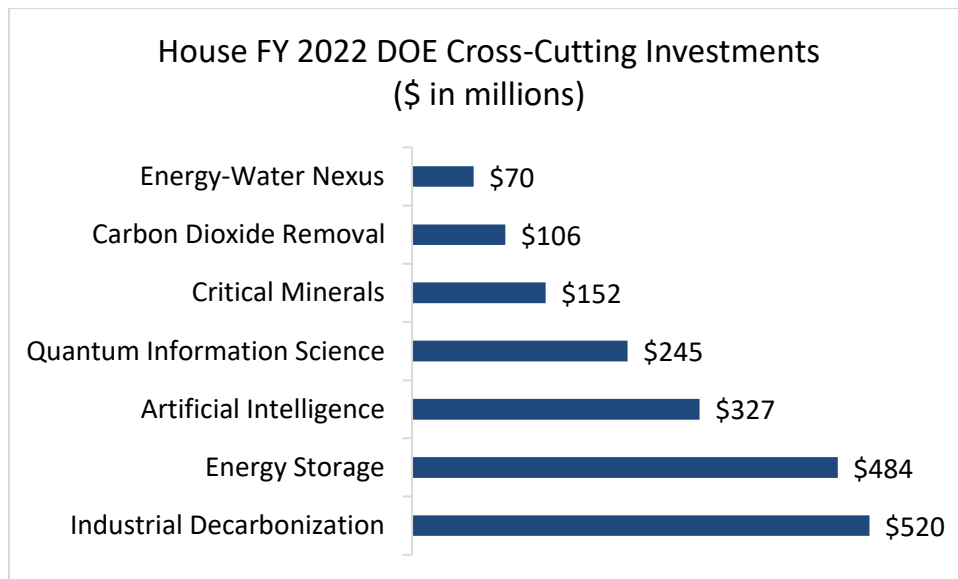
- The bill does not support the creation of a new **Advanced Research Projects Agency-Climate (ARPA-C)** and instead would provide \$600 million to fund climate and clean energy innovation through **ARPA-E**.
- The bill would provide \$200 million, half of the funds requested in the President’s budget request, to establish a new **Office of Clean Energy Demonstrations**.
- Three existing **Energy Innovation Hubs** would be fully funded that focus on energy storage, solar fuels, and desalination. The bill would allow DOE to terminate the Critical Materials Energy Innovation Hub and instead establish a new national lab consortium with research university and industry partners.
- The bill does not provide funding to establish two new **Clean Energy Manufacturing Innovation (CEMI) Institutes**, as proposed in the President’s budget request. Instead, the bill fully funds the existing CEMI Institute focused on cybersecurity for manufacturing and directs DOE to consider renewing or extending the five other DOE-funded CEMI Institutes for another five years.
- **The Office of Science** would receive a \$294 million or 4 percent increase above the FY 2021 enacted level, but \$120 million below the President’s budget request. The bill prioritizes funding for research and maximizing operations of new science facilities. Most science facility construction projects are underfunded with the Committee planning to use a future infrastructure or stimulus package to address funding shortfalls.
- The bill would provide \$130 million for **Energy Frontier Research Centers (EFRCs)**, an increase of \$14 million above the FY 2021 enacted level and the same as the President’s budget request. This would allow DOE to release a \$100 million funding call in Fall 2021 to compete EFRCs and make between 40 and 50 center-level awards.
- The four **Bioenergy Research Centers** would be fully funded at \$100 million.
- The bill would provide funding to compete new **Urban Integrated Field Labs** to improve climate observational and prediction capabilities as well a broader research effort to establish a national coastal observation network.
- For **applied energy**, the bill would increase funding for all renewable energy, energy efficiency, nuclear energy, fossil energy and carbon management, grid modernization, and cybersecurity programs. Consistent with DOE’s priorities, the bill would expand research, development, and demonstration efforts in hydrogen, carbon capture, utilization, and sequestration, and

integrated energy storage systems that leverage renewable, energy storage, nuclear, and fossil energy applications and infrastructure.

- The bill would provide \$2 million to help establish a regional network of university-based **cybersecurity centers** to address cybersecurity and critical energy infrastructure challenges unique to the energy assets of each region while also training a globally competitive workforce.
- The bill would provide \$5 million to the Office of Technology Transitions to compete another round of **regional “incubators supporting energy innovation clusters.”**
- NNSA’s **Research, Technology, and Engineering** program would see a cut of \$26 million compared to the FY 2021 enacted level but \$97 million above the President’s budget request. This would include \$107 million for **Academic Programs**, an increase of \$5 million above the FY 2021 enacted level.
- The bill would fully fund the three existing **University Consortia for Nuclear Nonproliferation Research** and provides funding to compete a fourth consortium focused on nuclear forensics, including quantum-enabled nuclear security technologies.

## Crosscutting Research and Technology

The House Appropriations Committee prioritized funding in several cross-cutting technology areas (see graphic below).



Below is additional information on each major cross-cutting technology area:

- **\$520 million for industrial decarbonization:** This is a \$7 million increase above the FY 2021 enacted level. These activities include improving energy efficiency in the industrial sector ranging from energy intensive unit operations (e.g., process heating) to facilities and systems operations including waste heat recovery and flexible combined heat & power approaches that have the potential to significantly reduce energy consumption and associated greenhouse gas emissions in the near term; developing carbon capture, utilization, and sequestration approaches; increasing electrification through increased uptake of industrial heat pumps and boilers; developing pathways for the use of low carbon fuels, feedstocks and energy sources such as renewable hydrogen, biomass, or solar thermal to reduce emissions; and innovations in advanced manufacturing including biomanufacturing, circularity for critical materials, plastics,

and water, and new pathways for carbon dioxide removal approaches such as utilization of alkaline by-products or waste.

- **\$484 million for energy storage:** This would be a \$24 million increase above the FY 2021 enacted level. The Committee directs DOE to focus on research, development, and demonstration of long duration energy storage. In particular, the Committee directs DOE to invest in different energy storage approaches, including electrochemical, chemical, thermal, and mechanical, as well as different technologies, including supercapacitors, flow batteries, low-carbon hydrogen storage, and compressed-air energy storage. This is consistent with DOE's interest in improving the commercial viability for storage across a wide range of uses including meeting load during periods of peak demand, grid preparation for fast charging of electric vehicles, and applications to ensure reliability of critical infrastructure, including communications and information technology.
- **\$327 million for Artificial Intelligence (AI) and machine learning:** This would be a \$29 million increase above the FY 2021 enacted level and \$115 million is allocated to the Office of Science. The Committee supports the use of AI and machine learning for discovery science, the improvement of facility operations, and broad applications across the applied energy offices.
- **\$245 million for quantum information science:** This would be same funding level of FY 2021. The Committee would provide \$120 million to support core research activities across all six Office of Science programs and \$125 million to fully fund the five National Quantum Information Science Research Centers. The Committee also would expand research investments to support a quantum internet and communications research program consistent with the Department's "America's Blueprint for the Quantum Internet." The Committee also directs DOE to invest in a broad array of quantum computing technologies, such as gate, annealing, topological, photonics, trapped ion, silicon, and superconducting approaches.
- **\$152 million for critical minerals:** This would be a \$7 million increase above the FY 2021 enacted level. DOE's research and development activities are focused on the energy-efficient and low-impact extraction of critical materials from a variety of conventional and unconventional feedstocks; critical mineral and material processing; critical minerals and materials manufacturing including metallization, magnet manufacturing, battery manufacturing, and catalyst manufacturing; and reuse and recycling, particularly for magnets and batteries, as well as novel second-use applications of electric vehicle batteries for grid-scale electricity storage. To help support these efforts, the Committee approves the establishment of a new Critical Materials Supply Chain Research Facility.
- **\$106 million for carbon dioxide removal:** This would be an \$11 million increase above the FY 2021 enacted level and \$75 million is allocated specifically for direct air capture. DOE's research and development activities include natural and biological systems as well as engineered technologies that remove CO<sub>2</sub> from the atmosphere or oceans and durably store it in geological, terrestrial, or ocean reservoirs, or in products. The Committee supports investments in bioenergy with carbon capture and sequestration, direct air capture with durable storage, biological methods, enhanced mineralization, soil carbon sequestration, afforestation and reforestation, direct ocean capture, enhanced ocean alkalinity, and coastal blue carbon. The Committee also supports the creation of a Carbon Dioxide Removal Task Force that can provide advice to the Secretary of Energy on how to remove barriers to advance carbon dioxide removal projects and accelerate commercialization as well as launching a direct air capture test center at the National Energy Technology Laboratory.
- **\$70 million for the energy-water nexus:** This would be a \$10 million increase above the FY 2021 enacted level. DOE's activities are focused on the energy efficient and resource efficient treatment of nontraditional water sources for beneficial end use applications including energy-efficient and low-cost desalination technologies and technical assistance for waste-water

treatment facilities. The Committee also supports new DOE efforts to reduce greenhouse gas emissions in the agricultural sector, including better understanding and predicting of water flow to design more water and energy efficient irrigation systems. To better coordinate these activities, the Committee would establish a DOE and U.S. Department of Agriculture Interagency Working Group.

The bill also emphasizes the importance of **workforce development, diversity, and environmental justice**. The bill would expand workforce development programs, such as traineeships, at the Office of Science, the applied energy offices, and DOE national laboratories in STEM fields to improve workforce readiness but also to address diversity, equity, and inclusion by broadening partnerships with minority serving institutions. In particular, the bill would prioritize funding for training and workforce development programs “that assist and support workers in trades and activities required for the continued growth of the U.S. energy efficiency and clean energy sectors, including training programs focused on building retrofit, the construction industry, and the electric vehicle industry,” especially to help displaced fossil fuel workers. The Committee directs DOE to also pay more attention to developing a national security workforce. In particular, the Committee directs DOE to work with the Department of Defense to advance education and workforce development programs related to climate change, electric infrastructure, nuclear energy, and space and help develop a broader national security education and workforce development strategy.

Regarding environmental justice, the Committee directs DOE to “consider social equity, workforce development standards, public health effects, and environmental and energy justice in conducting activities across the Department’s programs and to prioritize projects and grantees that advance equity and justice and maximize public health benefits.” The Committee would also task the National Academies of Sciences to conduct a study on the technical and non-technical barriers to and solutions for ensuring equitable distribution of the benefits associated with clean energy in environmental justice communities across all sectors of the economy.

## The Office of Science

The House bill would provide \$7.32 billion for **the Office of Science**, a \$294 million, or 4 percent, increase above the FY 2021 enacted level but \$120 million below the President’s budget request. The additional funding would not be applied proportionally across the six Office of Science program offices. Changes relative to FY 2021 would range from an increase of 7 percent for Biological and Environmental Research (BER) to a decrease of 7 percent for Nuclear Physics (NP). The increases to BER are consistent with the Biden Administration’s priorities to grow research activities in climate science and biotechnology. The House bill also supports new research and development initiatives, funded separately from the other six major Office of Science programs, in isotope production and accelerator science. Overall, the House bill prioritizes funding for research and maximizing operations of research facilities. The House bill would underfund construction of major research facilities and instruments with the House planning to use a future infrastructure or stimulus package to address funding shortfalls.

The report accompanying the bill would include support for several Office of Science-wide initiatives. The bill would provide \$245 million for **Quantum Information Science**, the same as the FY 2021 enacted funding level. This would include \$120 million to support core research activities across all six Office of Science programs and \$125 million to fully fund the five National Quantum Information Science Research Centers. The Committee also would expand research investments to support a quantum internet and communications research program consistent with the Department’s “America’s Blueprint for the Quantum Internet.” The bill would also provide \$115 million for **Artificial Intelligence** and

machine learning for science applications and improved facility operations. To grow efforts started in FY 2021, the bill also supports expanding DOE relationships with the National Institutes of Health and using unique DOE capabilities such as instrumentation, materials, modeling and simulation, and data science to advance **biomedical sciences**. The bill would provide \$2 million, an increase from \$1 million in FY 2021, for DOE to support NIH in data and computational sciences. The bill also supports a new **Reaching a New Energy Sciences Workforce (RENEW)** initiative to increase participation and retention of underrepresented groups in the Office of Science's research activities. This includes a proposed \$6 million or 21 percent increase for Office of Science workforce development programs and requires DOE to submit a plan for expanding support for high school, undergraduate, and graduate students as well as recent graduates, teachers, and faculty in STEM fields as well as an outreach strategy to more effectively advertise, recruit, and promote educational and workforce programs to community colleges, Minority Serving Institutions, and non-R1 research universities.

The bill would provide **Advanced Scientific Computing Research (ASCR)** with \$1.025 billion, an increase of \$10 million or nearly 1 percent above the FY 2021 enacted level. This includes \$250 million for **Mathematical, Computational, and Computer Sciences Research**, the same as the FY 2021 enacted funding level. The bill would increase funding to support the Leadership Computing Facilities at Argonne and Oak Ridge National Laboratories, the National Energy Research Scientific Computing Center at Lawrence Berkeley National Laboratory, and ESnet. The bill would also provide \$15 million, an increase of \$5 million or 50 percent, for the **Computational Science Graduate Fellowship program**. In addition, the Committee would give ASCR a leading role in advancing the Office of Science cross-cutting Artificial Intelligence initiative.

The bill would increase funding for **Basic Energy Sciences (BES)** by \$48 million or 2.1 percent above the FY 2021 enacted level for a total of \$2.29 billion. The bill would provide \$130 million for **Energy Frontier Research Centers (EFRCs)**, an increase of \$14 million above the FY 2021 enacted level and the same as the President's budget request. This would allow DOE to release a \$100 million funding call in Fall 2021 to compete EFRCs and make between 40 and 50 center-level awards. The bill would also provide \$25 million (the same as the FY 2021 enacted level) to continue support for the **Batteries and Energy Storage Innovation Hub**, up to \$25 million (an increase of \$5 million from the FY 2021 enacted level) for the **Fuels from Sunlight Innovation Hub**, and \$25 million for the **Experimental Program to Stimulate Competitive Research** (the same as the FY 2021 enacted level). The bill also provides an increase of \$14 million for facility operations of light sources, neutron sources, and Nanoscale Science Research Centers to support increased research demand from users from academia, industry, and other federal agencies.

**Biological and Environmental Research (BER)** would be funded at \$805 million, an increase of \$52 million or 7 percent over FY 2021. The bill would fully fund the **Bioenergy Research Centers** at \$100 million. Within biological sciences, the bill prioritizes funding for the **Designing the Bioeconomy Initiative** to improve the predictive understanding of gene functions and soil-plant-microbe interactions from molecular to ecosystem scale to apply to a climate change, environmental sustainability, and clean energy solutions. Within Atmospheric Systems Research, the bill prioritizes funding to reduce uncertainty in cloud aerosol effects. Within Earth and Environmental Systems modeling, the bill prioritizes funding to develop the Energy, Exascale, and Earth System Model to improve earth system prediction and climate risk management for state, local, and tribal decision-makers. Within Environmental Systems Science, the bill supports efforts to compete regionally diverse, university-led **Urban Integrated Field Laboratories**, especially those near coastal areas and those that can examine water scarcity issues in dry regions of the United States.

**Fusion Energy Sciences (FES)** would receive \$698 million, an increase of \$26 million or 4 percent above the FY 2021 enacted level. The bill would provide \$242 million, the same as the FY 2021 enacted level, for the U.S. contribution to the international ITER fusion project. The bill would also maintain flat funding of \$20 million for **High Energy Density Physics** research, including support for LaserNetUS while cutting construction funds for the **Matter in Extreme Conditions Petawatt Upgrade** at SLAC by 67 percent to \$5 million. Instead, the bill prioritizes funding for a new **Milestone-Based Development program** that was authorized into law in the Energy Act of 2020 and highlighted in the fusion program strategic plan, “Powering the Future: Fusion and Plasmas.” This includes up to \$45 million to support research and development of technologies and fusion designs driven by specific performance milestones to help develop a U.S.-based fusion power industry.

**High Energy Physics (HEP)** would receive \$1.078 billion, an increase of \$32 million or three percent above the FY 2021 enacted level. The bill supports funding levels requested in the President’s budget request for the construction of the Long Baseline Neutrino Facility/Deep Underground Neutrino Experiment (LBNF/DUNE) and Proton Improvement Plan II (PIP-II) accelerator upgrade although both fall short of needed funding to stay on time and on budget based on DOE-approved baselines and project profiles. The bill instead prioritizes funding for research and operations activities by providing a \$33 million increase over the FY 2021 enacted level. Within funding for research and operations, the bill would provide \$30 million to support the Sanford Underground Research Facility and \$20 million for the Cosmic Microwave Background Stage 4 experiment. The Committee also continues to urge DOE to cultivate a balanced portfolio of small- to large-scale projects and “ensure adequate funding for research performed at universities and national laboratories.”

The bill would provide \$665 million for **Nuclear Physics (NP)**, a cut of \$48 million or 7 percent below the FY 2021 enacted level. The bill provides very little guidance, other than to prioritize the operations of existing facilities to support nuclear physics research. The bill would also maintain flat funding for the Electron Ion Collider at \$5 million.

### **ARPA-E, ARPA-C, and Office of Clean Energy Demonstrations**

The House bill does not support the creation of a new **Advanced Research Projects Agency – Climate (ARPA-C)**. The Committee notes that ARPA-E already funds and has authority “to address the energy and environmental missions of the Department,” including climate-related innovations. The bill instead directs the Department to conduct any proposed activities for ARPA-C, and support any interagency effort described in ARPA-C’s proposed mission, through ARPA-E. **ARPA-E** would receive \$600 million, an increase of \$173 million or 40.5 percent compared to FY 2021, and \$100 million above the request. The increased funding would support more than 15 new funding opportunity announcements and ARPA-E plans to support research in diverse set of topics, such as materials for carbon-neutral buildings, reducing high-level nuclear waste, advanced batteries, grid flexibility, and novel fusion technologies.

The bill supports the creation of a new **Office of Clean Energy Demonstrations (OCED)** and would provide \$200 million, half of the funding requested in the President’s budget request, to launch this new effort. The purpose of OCED would be to serve as the central hub to accelerate the commercialization of more mature clean energy technologies. OCED would compete and award multi-year, cost-shared agreements for specific technology demonstrations with the private sector. In FY 2022, DOE plans to fund commercial-scale energy storage demonstration projects.

## Applied Energy Programs

The House bill provides a significant boost in funding to all applied energy programs. The biggest increase would be for renewable energy and energy efficiency projects—\$906 million or 32 percent above the FY 2021 enacted level—and the Committee supports new research directions in the fossil energy program for carbon capture, utilization, and storage. Carbon dioxide removal, hydrogen production, energy storage, and industrial decarbonization are also strongly supported across all the applied energy programs.

The **Office of Energy Efficiency and Renewable Energy (EERE)** would receive \$3.77 billion, an increase of \$906 million or 32 percent above the FY 2021 enacted level, but \$964 million or 20 percent below the budget request. The bill would increase all renewable energy and energy efficiency programs, though the level of growth would vary from 54 percent for Wind Energy Technologies to 17 percent for Water Power Technologies. The Advanced Manufacturing and the Vehicles Technologies Offices would receive the highest funding levels of \$530 million and \$500 million, respectively. The Committee prioritizes the expansion of energy efficiency and renewable energy technology access to low-income households, multi-family homes, renters, and minority communities as well as increasing reuse and recycling of critical materials and components of energy efficiency and renewable energy technologies. Additional priorities include:

- For **sustainable transportation**, the bill would advance innovative battery and alternative fuels research for vehicles, as well as hydrogen and fuel cell technologies including for heavy-duty transportation and sustainable aviation.
- For **renewable energy**, the bill would advance research and development to improve photovoltaic cell technologies, overcome grid integration challenges, as well as advance technologies for concentrated solar power, offshore wind energy, enhanced geothermal systems, hydropower, and marine energy.
- For **energy efficiency**, the bill would advance efforts for water and wastewater treatment, micro-battery technology manufacturing, and decarbonizing steel manufacturing.
- The bill would support the phase down of the **Critical Materials Energy Innovation Hub** and allow DOE to establish a new national lab consortium with research university and industry partners.
- The bill fully funds the fifth year of the **Energy-Water Desalination Hub** at \$25 million.
- The bill does not provide funding to establish two new **Clean Energy Manufacturing Innovation (CEMI) Institutes**, as proposed in the President’s budget request. Instead, the bill fully funds the existing CEMI Institute focused on cybersecurity for manufacturing and directs DOE to consider renewing or extending the five other DOE-funded CEMI Institutes for another five years.

With a new initiative in Industrial Decarbonization, the Committee directs DOE to provide a briefing to Congress on “the status of its decarbonization roadmaps in key technology areas to guide research and development” to meet greenhouse gas reduction targets as well as submit a report to Congress on how sustainable chemistry in manufacturing processes fit into DOE’s research and development portfolio. The Committee also accepted the Administration’s proposal for Build Back Better Challenge Grants to advance clean energy deployment, especially for underserved communities.

The **Office of Fossil Energy and Carbon Management** would see an increase of \$70 million above FY 2021 but also \$70 million less than the amount requested in the President’s budget request. As expected, the House would embrace the Office’s vector away from activities that promote fossil energy



extraction and toward research and technologies focused entirely on carbon capture, utilization, and sequestration, CO2 removal, and sustainable critical mineral supply chains. This includes \$105 million for research and development on solid oxide fuel cell systems for hydrogen; \$51 million for carbon dioxide removal, including \$5 million for a competitive solicitation in advancing innovative direct air capture systems; \$50 million for atmospheric carbon containment; \$10 million and \$12 million for research on carbon capture technologies at industrial sites and natural gas power systems, respectively; and \$10 million for carbon utilization via algal systems. Support for petroleum or natural gas research would be focused on methane emission mitigation and monitoring (\$13 million), reducing the environmental impact of produced water (\$5 million), and natural gas conversion technologies that support hydrogen development (\$20 million). The bill would also provide \$30 million for CarbonSAFE and \$20 million for carbon storage regional initiatives. The Committee directs DOE through the regional initiatives to explore ways to expand regional geological characterization; the collection and analyzing of data especially with big data, machine learning, and artificial intelligence tools; and address regional monitoring, permitting, and policy challenges.

The **Office of Nuclear Energy (NE)** would receive an increase of \$167 million or 11 percent above the FY 2021 enacted level. The bill highlights nuclear energy's important role in generating zero-carbon emission energy and meeting the Biden Administration's ambitious goals of net zero carbon for the electricity sector by 2035. The bill strongly supports the **Nuclear Energy University Program (NEUP)** and would set aside no less than \$40 million to support university-led research and development projects. The bill also directs DOE to set aside additional funding for NEUP since current law requires DOE to provide 20 percent of total nuclear energy research and development funding to university-led research and development and infrastructure projects. The bill would also provide \$6 million within NE and \$16 million within the Nuclear Regulatory Commission for the **Integrated University Program** to help train the nation's nuclear science and engineering workforce.

The bill would also advance other top DOE and congressional research and development priorities for nuclear energy, including:

- \$395 million, an increase of \$145 million above the FY 2021 enacted level, for the Advanced Reactor Demonstration Program, including \$245 million to continue funding of the two advanced reactor demonstration projects, \$75 million to support existing advanced reactor risk reduction projects, and \$48 million for the capital design and construction of a demonstration reactor test bed at Idaho National Laboratory to support reactor demonstration activities;
- \$145 million, an increase of \$30 million above the FY 2021 enacted level, to support light water and non-light water small modular reactors research, development, and demonstration activities, including \$15 million for advance reactor concepts industry awards and \$25 million for the development of a 1 megawatt-scale reactor.
- \$98 million to support the availability of high assay, low enriched uranium (HALEU), including \$33 million for an Advanced Nuclear Fuel Availability program to make small quantities of HALEU available to the private sector for initial advanced reactor demonstrations and \$15 million to fabricate HALEU from blended-down used fuel from the now-decommissioned Experimental Breeder Reactor-II.

The bill would also provide \$20 million in new funds for DOE to use a consent-based approach to identify a site for a federal spent nuclear fuel interim storage facility.

The bill would provide a significant funding boost to grid modernization and cybersecurity programs. The **Office of Electricity (OE)** would be funded at \$267 million, an increase of \$55 million or 26 percent compared to FY 2021 enacted levels. The bill would continue its strong support for the **Grid Modernization Initiative (GMI)** and prioritizes funding for grid resiliency, cyber protection, energy storage to improve grid flexibility, and advanced sensors and controls. The report specifically calls out efforts to continue to “support the integration of sensors into the nation’s electric distribution systems, fundamental research and field validation of microgrid controllers and systems, and transactive energy concepts, including studies and evaluations of energy usage behavior in response to price signals.” The Committee also places a high priority on “addressing the challenges facing the electric power grid by developing the innovative technologies, tools, and techniques to modernize the distribution portion of the electricity delivery system.” The bill would also provide \$9 million for “university-based research and development of scalable cyber-physical platforms for resilient and secure electric power systems that are flexible, modular, self-healing, and autonomous.”

The House bill would also boost funding for the **Office of Cybersecurity, Energy Security, and Emergency Response (CESER)** to \$201 million, an increase of \$21 million from FY 2021 enacted levels. The focus would be on efforts to develop new defenses for cyberthreats to the electrical grid by supporting industry-led projects, such as digital twinning of the grid to test defenses against attacks and cyber testing of industrial control systems. The bill also provides \$2 million to help establish a regional network of university-based **cybersecurity centers** to address cybersecurity and critical energy infrastructure challenges unique to the energy assets of each region while training a globally competitive workforce. The bill also provides \$5 million to conduct a demonstration program of innovative technologies such as for monitoring vegetation management and to improve grid resilience from wildfires. Overall, the Committee “places a high priority on ensuring the protection of the grid against cyberattacks and extreme weather events caused by climate change.”

## **National Nuclear Security Administration**

The House bill would fund **NNSA** at \$20.2 billion, \$423 million above the FY 2021 enacted level. Weapons Activities would be funded at \$15.5 billion, an increase of \$139 million above the FY 2021 enacted level and the same as the President’s budget request. While the House bill matches the budget request, Republicans do not believe the proposed level of funding is sufficient to support nuclear weapons modernization activities. Republicans are also opposed to the bill’s proposal to zero out funding to advance a new submarine-launched cruise missile or to extend the life of the B83. The bill would also cut funding for the feasibility study and design work for the new W93 warhead.

While the bill would cut funding by \$26 million compared to the FY 2021 enacted level for the **Research, Technology, and Engineering** program, it would be \$97 million above the President’s budget request. The bill would provide \$580 million for the **Inertial Confinement Fusion** program, an increase of \$5 million above the FY 2021 enacted level and \$51 million above the President’s budget request. The bill also would provide \$747 million for **Advanced Simulation and Computing**, an increase of \$15 million above the FY 2021 enacted level, and \$769 million for **Assessment Science**, rejecting an \$80 million cut proposed in the budget request. The bill would also provide \$107 million for **Academic Programs**, an increase of \$5 million above the FY 2021 enacted level. This includes \$40 million for the Minority Serving Institution Partnership program. The bill also encourages NNSA to partner with ZNetUS to advance pulsed-power high energy density research and development and requires NNSA to develop a plan to work with ZNetUS to facilitate user access to national pulsed-power facilities.

The House bill would also provide \$2.3 billion for **nonproliferation**, \$80 million above the FY 2021 enacted level. The bill includes \$15 million to fully fund the three existing **University Consortia for Nuclear Nonproliferation Research** and \$5 million to compete a fourth university consortia focused on nuclear forensics, including quantum-enabled nuclear security technologies.

### Department of Energy

As reported by the House Appropriations Committee on July 16, 2021

(In thousands of \$)

	FY 2021 Enacted	FY 2022 Request	FY 2022 House	House vs. FY 2021 Enacted	House vs. FY 2022 Request
<b>DOE, total</b>	<b>41,865,625</b>	<b>46,189,430</b>	<b>45,126,500</b>	<b>3,260,875</b> (7.8%)	<b>-1,062,930</b> (2.3%)
<b>Science</b>	<b>7,026,000</b>	<b>7,440,000</b>	<b>7,320,000</b>	<b>294,000</b> (4.2%)	<b>-120,000</b> (1.6%)
Advanced Scientific Computing Research	1,015,000	1,040,000	1,025,000	10,000 (1.0%)	-15,000 (1.4%)
Basic Energy Sciences	2,245,000	2,300,000	2,293,000	48,000 (2.1%)	-7,000 (0.3%)
Biological and Environmental Research	753,000	828,000	805,000	52,000 (6.9%)	-23,000 (2.8%)
Fusion Energy Sciences	672,000	675,000	698,000	26,000 (3.9%)	23,000 (3.4%)
High Energy Physics	1,046,000	1,061,000	1,078,000	32,000 (3.1%)	17,000 (1.6%)
Nuclear Physics	713,000	720,000	665,000	-48,000 (6.7%)	-55,000 (7.6%)
Isotope R&D and Production*		90,000	82,000	82,000 --	-8,000 (8.9%)
Accelerator R&D and Production*		24,000	18,000	18,000 --	-6,000 (25.0%)
Workforce Development for Teachers and Scientists	29,000	35,000	35,000	6,000 (20.7%)	0 --
Science Laboratories Infrastructure	240,000	295,000	249,000	9,000 (3.8%)	-46,000 (15.6%)
<b>ARPA-E</b>	<b>427,000</b>	<b>500,000</b>	<b>600,000</b>	<b>173,000</b> (40.5%)	<b>100,000</b> (20.0%)
<b>ARPA-C†</b>		<b>200,000</b>	<b>0</b>	<b>0</b> --	<b>-200,000</b> (100.0%)
<b>Office of Clean Energy Demonstrations†</b>		<b>400,000</b>	<b>200,000</b>	<b>200,000</b> --	<b>-200,000</b> --
<b>EERE</b>	<b>2,861,760</b>	<b>4,732,000</b>	<b>3,768,000</b>	<b>906,240</b> (31.7%)	<b>-964,000</b> (20.4%)
Hydrogen and Fuel Cell Technologies	150,000	197,500	195,000	45,000 (30.0%)	-2,500 (1.3%)
Bioenergy Technologies	255,000	340,000	303,000	48,000 (18.8%)	-37,000 (10.9%)
Solar Energy Technologies	280,000	386,575	350,000	70,000 (25.0%)	-36,575 (9.5%)
Wind Energy Technologies	110,000	204,870	170,000	60,000 (54.5%)	-34,870 (17.0%)
Geothermal Technologies	106,000	163,760	137,000	31,000 (29.2%)	-26,760 (16.3%)

Water Power Technologies	150,000	196,560	175,000	25,000 (16.7%)	-21,560 (11.0%)
Vehicle Technologies	400,000	595,000	530,000	130,000 (32.5%)	-65,000 (10.9%)
Building Technologies	290,000	382,000	350,000	60,000 (20.7%)	-32,000 (8.4%)
Advanced Manufacturing Technologies	396,000	550,000	500,000	104,000 (26.3%)	-50,000 (9.1%)
<b>Electricity</b>	<b>211,720</b>	<b>327,000</b>	<b>267,000</b>	<b>55,280 (26.1%)</b>	<b>-60,000 (18.3%)</b>
<b>Cybersecurity, Energy Security, and Emergency Response</b>	<b>156,000</b>	<b>201,000</b>	<b>177,000</b>	<b>21,000 (13.5%)</b>	<b>-24,000 (11.9%)</b>
<b>Nuclear Energy</b>	<b>1,507,600</b>	<b>1,850,500</b>	<b>1,675,000</b>	<b>167,400 (11.1%)</b>	<b>-175,500 (9.5%)</b>
<b>Fossil Energy and Carbon Management R&amp;D†</b>	<b>750,000</b>	<b>890,000</b>	<b>820,000</b>	<b>70,000 (9.3%)</b>	<b>-70,000 (7.9%)</b>
<b>National Nuclear Security Administration</b>	<b>19,732,200</b>	<b>19,743,000</b>	<b>20,155,000</b>	<b>422,800 (2.1%)</b>	<b>412,000 (2.1%)</b>
Weapons Activities	15,345,000	15,484,295	15,484,295	139,295 (0.9%)	0 --
Defense Nuclear Non-proliferation	2,260,000	1,934,000	2,340,000	80,000 (3.5%)	406,000 (21.0%)

\* Isotope R&D and Production and Accelerator R&D and Production are not new research efforts, but starting in FY 2022 they will be separate programs with their own funding lines.

† ARPA-C and the Office of Clean Energy Demonstration are new proposed programs in the FY 2022 President's budget request.

‡ The Office of Fossil Energy R&D has been renamed to reflect its expanded mission.

Sources: The FY 2022 Energy and Water Development Appropriations bill is available [here](#), the detailed report accompanying the bill is available [here](#), and a bill summary is available [here](#).