U.S. House Committee on Energy and Commerce
Subcommittee on Energy
May 9, 2019 Hearing: The Fiscal Year 2020 Department of Energy Budget
Questions for the Record Submitted to the Honorable Rick Perry

QUESTIONS FROM THE HONORABLE FRED UPTON (R-MI)

Q1. In this year's budget, the Department launched a "MoonShot" RD&D effort across the Department of Energy's research offices, called the "Advanced Energy Storage Initiative (AESI)." It appears to be a crosscutting initiative with aggressive and achievable goals for cost competitive grid-scale energy storage services. This is great to see, as the Department has historically tackled some of the nation's most complicated energy challenges by aligning the American innovation machine's robust resources and competencies towards an ambitious "goal." These moonshots yielded breakthroughs like hydraulic fracturing, the MRI machine, and more recently 6 cent per kilowatt-hour (kWh) solar to society.

Q1a. These types of goals can accelerate breakthroughs and ensure the efficient use of taxpayer resources. Wouldn't it be beneficial for the Department to launch similar RD&D initiatives for critical technologies like advanced nuclear and carbon capture for coal and gas as well?

A1a. The Department of Energy is well known for launching initiatives like the "MoonShot" which make highly effective use of taxpayer dollars. For example, the Office of Fossil Energy recently launched the Coal FIRST initiative—to develop the coal plant of the future needed to provide secure, stable, and reliable power. The Coal FIRST power plant of the future will have zero or near zero CO2 emissions. The Coal FIRST initiative will make coal-fired power plants in the future more adaptive to the modern electrical grid. The initiative will integrate early-stage R&D on power plant components with currently available technologies into a first-of-a-kind system. Through innovative technologies and advanced approaches to design and manufacturing, the initiative will look beyond today's utility-scale power plant concepts (e.g., base-load units) in ways that integrate with the electrical grid in the United States and internationally. Coal FIRST technologies also aims to increase U.S. exports, create domestic jobs, and support our partners' abroad—reducing energy poverty in Africa and Asia, and providing affordable electricity, and opportunities for economic prosperity, to people worldwide. Many of the technologies developed for Coal FIRST will have applicability for natural gas-fired power plants since they share many of the same technologies and processes. For example, more efficient turbine technologies that are of interest for Coal FIRST could

also have applicability for natural gas plants. Additionally, carbon capture technologies deployed as part of Coal FIRST will also help mature these technologies and could make them available for natural gas-fired facilities with some modifications to adjust for natural gas-fired conditions.

DOE envisions that the future coal fleet may be based on electricity generating units possessing many of the following traits:

- High overall plant efficiency (40%+ HHV or higher at full load, with minimal reductions in efficiency over the required generation range)
- Small (unit sizes of approximately 50 to 350 MW), maximizing the benefits of high-quality, low-cost shop fabrication to minimize field construction costs, and project cycle time
- Near-zero emissions including carbon dioxide
- Capable of high ramp rates and minimum loads commensurate with estimates of renewable market penetration by 2050
- Integration with thermal or other energy storage (e.g., chemical production) to ease intermittency inefficiencies and equipment damage
- Minimized water consumption
- Reduced design, construction, and commissioning schedules from conventional norms by leveraging techniques including but not limited to advanced process engineering and parametric design methods for modular design
- Enhanced maintenance features including technology advances with monitoring and diagnostics to reduce maintenance and minimize forced outages
- Integration with coal upgrading, or other plant value streams (e.g., co-production)
- Capable of natural gas co-firing.

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Q2. I was one of the primary authors of the American Medical Isotope Production Act (AMIPA). AMIPA was intended to help drive conversion from Highly Enriched Uranium (HEU), which the Nuclear Threat Initiative has called "one of the most dangerous materials on the planet," https://www.nti.org/newsroom/news/new-roadmap-minimize-and-eliminate-heu/ to non-HEU in the medical space. Over the last year, we have seen severe disruptions in the supply of non-HEU from overseas reactors which has adversely impacted U.S. patient care. https://www.cardiovascularbusiness.com/topics/cardiovascular-imaging/nuclear-imaging-labs-brace-tc-99m-shortage

Q2a. Would you give us a status report on AMIPA progress, and where we stand with respect to conversion to non-HEU in the medical isotope space and what more Congress and the Administration could be doing to increase use and domestic production of non-HEU?

A2a. The Department is continuing to implement a technology neutral program to support domestic projects for the production of non-HEU-based supplies of molybdenum-99 (Mo-99), as directed in the AMIPA. The program passed a key milestone in November 2018 when one of DOE/NNSA's cooperative agreement partners, NorthStar Medical Radioisotopes, began producing its non-HEU-based Mo-99 for patient use in the United States. Additionally, in Fiscal Year (FY) 2019, DOE/NNSA awarded four new cooperative agreements totaling $60 million in federal funding to NorthStar Medical Radioisotopes (to scale-up its existing project), SHINE Medical Technologies, Niowave, and Northwest Medical Isotopes to further expand non-HEU-based domestic production capacity. These awards were in response to FY 2018 congressional direction to issue a Funding Opportunity Announcement and competitively award new cooperative agreements. Globally, all major Mo-99 producers have converted to using non-HEU targets for Mo-99 production, with the exception of the Institute of Radioelements (IRE) in Belgium. IRE anticipates that they will obtain all the necessary approvals to begin selling non-HEU-based Mo-99 to its U.S. customers in the first quarter of calendar year

2020. This will initiate IRE's phased conversion process that will result in full LEU-based production by the end of 2022.

Q2b. Would you please include information concerning whether the Department met its goals/directives?

A2b. The Department will meet its goal of supporting the establishment of a reliable domestic supply of Mo-99 without the use of HEU when at least two domestic producers can supply sufficient quantities of Mo-99 to meet U.S. demand. Based upon the estimated schedules of our cooperative agreement partners, U.S. industry should be able to produce sufficient quantities of Mo-99 to meet U.S. demands in 2022/2023.

Q2c. In addition, please report on your preparations and evaluations with the Secretary of Health and Human Services to 2019 concerning joint certification about the ban on the export of highly enriched for purposes of medical isotope production, pursuant to Section 134 (f) of the Atomic Energy Act.

A2c. The Department is working with the U.S. Food & Drug Administration (FDA) to review the market supply of medical radioisotopes, including Mo-99 and iodine-131, to determine if there is a sufficient supply available to satisfy the domestic market. In consultation and coordination with the FDA and the Nuclear Regulatory Commission, the Department is assessing whether there is a sufficient supply of Mo-99 and other medical isotopes produced without the use of HEU available to meet the needs of U.S. patients. The conclusions drawn from the assessment will be used to determine whether the Department of Energy and Department of Health and Human Services will be able to make the joint certifications necessary for the ban on HEU export licenses for medical isotope production to take effect or whether the Department will propose that the period to issue such licenses will be extended for up to six years.

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QUESTIONS FROM THE HONORABLE ROBERT E. LATTA (R-OH)

Q1. I am a supporter of DOE's efficiency standards, but I think we need to be realistic about the challenges and opportunities facing the program. The law originated in the 1970's and 80's. You are doing what you can to improve the standard setting process through a new "process rule" rulemaking, but I believe it is time that Congress modernize the law to reflect the realities of today.

Q1a. What are you doing to improve transparency in the rulemaking process so consumers can be confident that the new products they purchase meet their expectations for quality, convenience, and energy efficiency?

A1a. DOE relies on robust stakeholder input to ensure that affected households and businesses will benefit from any new standards, and that new standards will not reduce product performance or utility. Stakeholders can comment on DOE proposals during the preliminary and proposed rule stage, and can participate in public meetings in person or via webinar. These opportunities to engage are made public through notices in the *Federal Register* and emails to DOE's Appliance and Equipment Standards Listserv, which members of the public can join through DOE's website. The data and expertise that stakeholders provide at these stages inform the Department's rulemaking efforts to evaluate whether a standard will save a significant amount of energy and is economically justified and technically feasible. In addition to public meetings, and open comment periods, DOE allows for ex parte communications by any stakeholder at any point in the rulemaking process. Stakeholders regularly use this process to express concerns to DOE on a variety of rulemaking topics.

To ensure transparency into the analysis it performs, the technical and analytical tools DOE uses to assess the costs and benefits of any potential standard are available for download on the Appliance Standard Program's website. Additionally, to provide further clarity for interested parties, DOE maintains a website of information services on the appliance and equipment standards program.

Because stakeholder perspectives are such a crucial component of the rulemaking process, the Department is proposing amendments to its Process Rule to enhance opportunities for stakeholder participation and to improve transparency and certainty in its rulemaking process. In looking to improve its process, DOE has requested comment on an early assessment review process of the potential energy savings, technological feasibility, and economic justification of a new or amended standard, which would help minimize the resources DOE and stakeholders spend on rulemakings that do not meet all three of these criteria.

Another proposed change to the 1996 Process Rule requires the Department to finalize test procedures 180 days before proposing a new energy conservation standard. This sequencing of rulemakings is critical to ensure certainty in the rulemaking process and allow manufacturers to gain experience with the new test procedure, evaluate engineering designs, and test products. This process improvement will better enable stakeholders to participate in the standards rulemaking phases by contributing data and helping to assess the impacts of potential standards on product design, product costs, energy use and consumer utility.

Further, DOE's proposed Process Rule would be binding on the Department, further enhancing stakeholder certainty. DOE should be held accountable for complying with its own procedures so that the public will have confidence in the transparency and fairness of DOE's regulatory process.

Q1b. As Congress considers ways to improve the standard setting process, will you commit to working with us and providing technical assistance?

A1b. Yes, the Department will provide technical assistance to Congress's efforts to further improve the department's rulemaking process.

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QUESTIONS FROM THE HONORABLE TIM WALBERG (R-MI)

Q1. As industry and the markets continue to transition to cleaner technology-based solutions, we must also think more holistically about the transition toward electric vehicles and what it means for our environment. While we want to be good stewards of our earth, we must look at the cradle-to-grave impacts of other renewable resources—just like has been done with coal and nuclear resources.

Q1a. Is the Department undertaking any initiatives or early-stage research to understand how advanced batteries—like those in electric vehicles— degrade and could be re-used or recycled?

A1a. The Department of Energy (DOE) is aware of the increasing importance of this area and is currently investigating strategies at every level of the battery material supply chain to reclaim, recycle, and reuse materials for next-generation batteries. In FY 2019, DOE obligated $10M for innovative cathode materials R&D for technology advancement through the Office of Energy Efficiency and Renewable Energy (EERE) **to Reduce, Recycle, and Recover Critical Materials in Lithium-Ion Batteries**.

These efforts focus on material and technology substitutes that reduce or eliminate the need for critical materials and cost-effective recovery of materials through recycling. For the next-generation cathode material research, EERE has made the goal to reduce cobalt, the highest long-term supply chain risk for lithium ion batteries, to less than 5% by weight of the cathode. This work will center on cobalt substitution methods and new exploratory chemistries that are completely cobalt free.

For end of life batteries, EERE has two ongoing initiatives: the Battery Recycling Prize and the ReCell Center. The Lithium Ion Battery Recycling Prize is a competitively-awarded $5.5M initiative from FY 2018 and FY 2019 appropriations, for innovative ideas to collect, store and transport discarded lithium ion batteries to recycling centers. In FY 2019, DOE obligated $5M for the ReCell Center at the National Labs focused on recovery of all materials in end-of-life batteries to decrease barriers to recycling lithium ion batteries and potentially lower the cost of next generation batteries. In addition, the ReCell Center is investigating cost-effective methods to reuse spent electric vehicle (EV) batteries for other applications such as stationary storage.

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Within the ReCell Center there are four major research focus areas: direct recycling, other material recovery, design for recycling, and modeling and analysis.

- Direct Recycling - Focuses on recovery of composite cathode materials to be used in next generation batteries to eliminate the processing of new material based on their elemental components.
- Other Material Recovery - Focuses on recovering all non-cathode components of lithium ion batteries. An expanded set of recoverable products could create a recycling infrastructure that is less reliant on the cathode economics alone and increase the profitability of recycling overall.
- Design for Recycling - Investigates battery designs capable of meeting rigorous performance standards required for EV batteries while also making recycling less onerous.
- Modeling and Analysis - Investigates the feasibility as well as the cost and energy impact of all processing efforts underway.

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QUESTIONS FROM THE HONORABLE RICHARD HUDSON (R-NC)

Q1. I have Fort Bragg in my district, the epicenter of the universe. With the largest military installation in the world in my backyard, I look for every opportunity to support our men and women in uniform both during and after their service. As you know, Congress provided DOE with new energy security authorities and responsibilities under the FAST Act, including a requirement to identify and protect defense critical infrastructure. I understand that DOE's Office of Electricity is underway with several significant new initiatives, including the development of a North American energy model, which will help us identify interdependencies and potential risks.

Q1a. What are some of the major takeaways from your work on defense critical infrastructure, and what concerns you the most about the state of our bulk power grid and electricity generation fleet generally?

A1a. DOE's Office of Electricity (OE) leads the DCEI effort by working with industry, the Department of Defense (DoD), the Department of Homeland Security, and other relevant Federal agencies. OE is currently working with the necessary electric utility stakeholders to analyze the critical transmission path that serves each critical defense facility, while also working with DoD to identify energy resilience solutions on-site. As you are aware, nearly every military installation receives its electricity from the civilian power grid, which has a high degree of reliability. However, the resilience of the grid that serves these critical locations is much more difficult to quantify given the threat landscape and numerous interdependencies on different infrastructures, equipment, and supply chains.

The bulk-power system (BPS), which is the lifeline for every critical infrastructure sector, is complex and interdependent. The damage of one piece of equipment, whether from a cyberattack, physical attack, or natural disaster, can have deleterious, cascading effects across critical infrastructure sectors. One of the major takeaways OE has identified is the lack of awareness of how the BPS has evolved over the last two decades—specifically, the transition in electric generation modalities, which has inadvertently increased both the cyber and physical threat attack surface. I would note that the 2019 World Wide Threat Assessment, authored by former Director of National

Intelligence, Dan Coats, highlights the persistent cyber threat from nation-state actors on pages 5-6.

OE staff were recently at Fort Bragg with local utility personnel, DoD staff, and Federal Energy Regulatory Commission staff, to identify opportunities for improving the resilience of the base. There are numerous opportunities to improve the overall resilience of Fort Bragg that will be replicable at various other critical defense facilities. We are presently evaluating resilience investments and attempting to identify funding sources for such investments.

Q1b. Could you supply the committee updated information you defense critical infrastructure work, and could we arrange a briefing for myself on this topic, given the Fort Bragg is in my district?

A1b. I would be happy to brief your office and the Committee regarding OE's efforts on DCEI to date, and to describe how we envision the initiative moving forward.

Q2. As the representative Fort Bragg, I am very interested in how we can improve the safety and security of our soldiers in the field and our military installations. As you know, I had an amendment included in the NDAA for DOE to develop guidelines for a pilot program for the deployment of micro reactors at critical DOE and DOD sites. It is my understanding the final report will be ready by August and I look forward to reading it.

Q2a. Can I count on you for providing this committee and myself all the necessary technical assistance we need to put future deployment plans into action?

A2a. The Department believes that microreactors have the potential to address unique energy reliability and resiliency challenges for both defense and commercial applications such as: electricity and process heat supplies for remote and off-grid communities and industrial locations or electricity supplies for disaster and emergency relief operations.

The Department's Office of Nuclear Energy (NE) is actively leveraging its decades of nuclear reactor research and development experience to enable the development of micro reactor technologies. NE remains closely engaged with the Department of Defense (DoD) Office of the Under Secretary of Defense for Acquisition and Sustainment and the

DoD Strategic Capabilities Office (SCO) to finalize the report on the requirements for a microreactor deployment pilot program as directed in the fiscal year (FY) 2019 National Defense Authorization Act (NDAA). Also, NE is actively coordinating near-term, national laboratory-led, cross-cutting technology development activities that could support future DoD microreactor demonstration and deployment efforts.

The Department continues to provide DoD and U.S. industry the technical expertise and programmatic support of its national laboratories and federal RD&D programs to facilitate the deployment of these innovative technologies.

Q3. Secretary Perry, I know my time is running out. I am a big supporter of DOE's Energy and Manufacturing workforce development initiatives. Could you please follow up with me and this committee on conducting a full audit of all DOE workforce development activities, including a description of the workforce development program or project name, target audience or program focus, funding level, statutory authority, and program status?

A3. Workforce development is a department-wide effort to cultivate a more diverse workforce that is equipped to thrive in the next generation of energy jobs.

Pursuant to Public Law 95-619, the Office of Economic Impact and Diversity (ED) is authorized to implement programs which impact underrepresented minority communities. To this extent, ED's programs are focused on ensuring that minorities can participate fully in the energy sector. For example, ED recently launched the Equity in Energy Initiative. This initiative seeks to expand the participation of underserved communities in the energy workforce such as Native Americans, women, veterans, and formerly incarcerated persons to ensure America's energy independence. In recent months ED has also organized separate Equity in Energy Discussions all around the country for Asian American and Pacific Islander, African American, and Hispanic stakeholders. ED's workforce development activities include the following:

Florida International University (FIU): ED funds the "Mission to Market for Inclusive Economic Development Program" at FIU at a funding level of $260,000/year. The target

audience is undergraduate and graduate students. Program Status: Active.

STEM Scholastic and Research Support for 21st Century Workforce at Morehouse College. Funding Level: $250,000/year. Target Audience: Undergraduate and graduate students. Status: Active.

The Cooperative Development Energy Program at Fort Valley State University: ED has been funding the STEM Careers in Energy Program since 1983. The target audience is 9th grade through graduate school. Funding: $100,000. Program Status: Active.
The Next Generation of Entrepreneurial Managers' Project at the University of Houston and Texas Southern University. Funding: $180,000/year. Target Audience: Undergraduate students. Status: Active.

Building Capacity through Partnerships at Tougaloo College. Funding: $75,000/year. Target Audience: Undergraduate. Status: Active.

Thurgood Marshall College Fund (career development program). Funding: $75,000/year. Target Audience: Undergraduate students. Status: Active.

Additionally, DOE has supported paid STEM internships for minority and female students through the Office of Fossil Energy, paid internship opportunities for community college students at DOE labs through the Office of Science, an online career map to illustrate potential career pathways to the bioeconomy through the Bioenergy Technology Office, free online accredited training courses through the Federal Energy Management Program, established pipelines between DOE labs and minority-serving institutions in STEM disciplines through the National Nuclear Security Administration's Minority Serving Institution Partnership Program (MSIPP), solar energy industry relevant training for active duty military through the Solar Energy Technologies Office's Solar Ready Vets Program, traineeships in advanced manufacturing and composites through our Office of Energy Efficiency and Renewable Energy, the VETS2TECH summit to help veterans fill critical STEM workforce shortages at national labs, and the Wounded Warrior Career

Development Program through Sandia National Lab.

DOE seeks not only to diversify and improve the nation's workforce, but its own workforce as well. DOE's Chief Human Capital Officer (CHCO) is responsible for strategically aligning the agency's workforce to its missions by recruiting, developing, training, and managing a highly skilled, productive, and diverse workforce. With a dual focus on strengthening technical competence while developing the critical leadership skills needed for career advancement, DOE has a wide-range of programs and resources available to help employees achieve their development goals. The Department's robust Learning Management System helps ensure the technical competency of DOE's workforce by providing tools to assess training needs and an expansive catalog of courses to strengthen job-related skills and support upskilling and reskilling.

As further evidence of the Department's commitment to workforce development, an advisor to the Secretary has been hired to work specifically on DOE's role in workforce development for veterans and transitioning active duty service members. A senior advisor was also hired last year to assess future workforce and skills needs of the DOE enterprise.

Moreover, cybersecurity workforce development is a national priority outlined in the President's National Cyber Strategy, and further reinforced by Executive Order 13870, "America's Cybersecurity Workforce." Through DOE's State, local, tribal, and territorial workforce development efforts through organizations like the National Association of State Energy Officials (NASEO), DOE is developing a multifaceted approach including online training, playbooks, workshops, and guidance. This builds capacity throughout the sector and guarantees the state energy officials DOE engages with regularly have the necessary skills and resources needed to prepare for, and respond to, energy disruptions of significance, including cyber emergencies.

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QUESTIONS FROM THE HONORABLE JEFF DUNCAN (R-SC)

Q1. Secretary Perry: First let me "thank you" for including budget dollars for the Advanced Manufacturing Collaborative (AMC) building to be located at the University of South Carolina-Aiken campus in South Carolina. The AMC will not only allow experts in emerging technologies to collaborate with industry, academia and government to improve manufacturing in the Nation but also will assist the DOE complex by accelerating technology development for the cleanup mission. This will be a "game changer" for the local region in my state and certainly a "win/win" for the public private sectors. Do you have a comment or two about the importance of this facility to DOE-EM?

A1. The AMC will remedy a critical portion of the outdated infrastructure of the Savannah River National Laboratory (SRNL). The construction of an approximately 60,000 square foot modern facility will include chemistry laboratories, engineering fabrication laboratories, a high bay, industrial space, and staff offices.

AMC will be a part of SRNL in a collaborative manufacturing approach with industry and academia to include key topics like process intensification, process modeling, smart manufacturing, additive manufacturing, robotics, and virtual reality.

The AMC will enable the SRNL to translate a range of proven, advanced manufacturing technologies from the commercial, chemical, and industrial manufacturing sectors into DOE processes, plans and missions to significantly improve the Office of Environmental Management's (EM) ability to manage risk, improve worker and public safety, reduce costs, and accelerate the cleanup of legacy radioactive waste. The AMC will help to develop the next generation workforce with unique skillsets in chemical processing and manufacturing critical to the successful completion of the EM cleanup mission.