Department of Energy
Washington, DC 20585

December 21, 2021

Kevin Bogardus
E&E News
122 C Street N.W., Suite 722
Washington, DC 20001

Via email: kbogardus@eenews.net

Re: HQ-2022-00216-F

Dear Mr. Bogardus:

This is the final response to the request for information that you sent to the Department of Energy (DOE) under the Freedom of Information Act (FOIA), 5 U.S.C. § 552. You requested the following:

> Records of all responses to Questions for the Record provided to Congress from the Department of Energy from November 1 to November 30, 2021.

Your request has been assigned to DOE's Office of Congressional and Intergovernmental Affairs (CI) to conduct a search of its files for responsive records. CI started its search on December 16, 2021, which is the cut-off date for responsive records. CI has completed its search and identified two (2) documents responsive to your request. The documents are being released in their entirety, as described in the accompanying index.

The adequacy of the search may be appealed within 90 calendar days from your receipt of this letter pursuant to 10 C.F.R. § 1004.8. Appeals should be addressed to Director, Office of Hearings and Appeals, HG-1, L'Enfant Plaza, U.S. Department of Energy, 1000 Independence Avenue, S.W., Washington, D.C. 20585-1615. The written appeal, including the envelope, must clearly indicate that a FOIA appeal is being made. You may also submit your appeal to OHA.filings@hq.doe.gov, including the phrase "Freedom of Information Appeal" in the subject line (this is the preferred method by the Office of Hearings and Appeals). The appeal must contain all of the elements required by 10 C.F.R. § 1004.8, including a copy of the determination letter. Thereafter, judicial review will be available to you in the Federal District Court either: 1) in the district where you reside; 2) where you have your principal place of business; 3) where DOE's records are situated; or 4) in the District of Columbia.

You may contact DOE's FOIA Public Liaison, Alexander Morris, FOIA Officer, Office of Public Information, at 202-586-5955, or by mail at MA-46/Forrestal Building, 1000 Independence Avenue, S.W., Washington, D.C. 20585, for any further assistance and to discuss any aspect of your request. Additionally, you may contact the Office of

Government Information Services (OGIS) at the National Archives and Records Administration to inquire about the FOIA mediation services they offer. The contact information for OGIS is as follows: Office of Government Information Services, National Archives and Records Administration, 8601 Adelphi Road-OGIS, College Park, Maryland 20740-6001, e-mail at ogis@nara.gov; telephone at 202-741-5770; toll free at 1-877-684-6448; or facsimile at 202-741-5769.

The FOIA provides for the assessment of fees for the processing of requests. *See* 5 U.S.C. § 552(a)(4)(A)(i); *see also* 10 C.F.R. § 1004.9(a). In our December 15, 2021 letter, you were advised that your request was placed in the "news media" category for fee purposes. Requesters in this category are charged fees for duplication only and are provided 100 pages at no cost. DOE's processing costs did not exceed $15.00, the minimum amount at which DOE assesses fees. Thus, no fees will be charged for processing your request.

If you have any questions about the processing of the request or this letter, you may contact Anh-Chi Nguyen or me at:

MA-46/ Forrestal Building
1000 Independence Avenue, S.W.
Washington, D.C. 20585
(202) 586-5955.

I appreciate the opportunity to assist you with this matter.

Sincerely,

Alexander C. Morris

Digitally signed by Alexander C. Morris
Date: 2021.12.21 08:32:50 -05'00'

Alexander C. Morris
FOIA Officer
Office of Public Information

Enclosures

INDEX

Request #: HQ-2022-00216-F

Final response for Mr. Kevin Bogardus:

> **Records of all responses to Questions for the Record provided to Congress from the Department of Energy from November 1 to November 30, 2021**.

DOE's Office of Congressional and Intergovernmental Affairs (CI) has completed its search and has identified two (2) documents responsive to your request.

- Two (2) documents *are being released in their entirety*.

Testimony of Secretary Jennifer M. Granholm

U.S. Department of Energy

Before the

U.S. House Committee on Science, Space, and Technology

May 27, 2021

Chairwoman Johnson, Ranking Member Lucas, and Members of the committee, it is an honor to appear before you today to discuss the President's FY 2022 discretionary request for the Department of Energy ("the Department" or "DOE").

As you know, I was confirmed on February 25, 2021. It is a privilege to serve as the 16th Secretary of Energy and have the responsibility of leading the Department in delivering technological advancements and scientific discoveries, and advancing the energy, economic, and national security of the United States.

I am proud to say we have accomplished a lot in my first few months at DOE.

In addition, of course, to continuing to advance our core science and security missions, we have jump-started efforts to create jobs and build the clean energy economy of the future, an economy that works better for American families and an economy that works for all kinds of communities with jobs for all kinds of workers. We declared to the world that America is back at the table for climate action, and followed it up with new funding opportunities for technologies ranging from carbon capture to geothermal energy to extracting critical minerals from coal waste. And we set ambitious new goals to cut solar costs by more than half and add 30 gigawatts of offshore wind capacity by 2030. We will deliver these goals while prioritizing addressing long-standing and persistent racial and environmental injustice and targeting benefits to disadvantaged communities

We announced over $1 billion in new funding opportunities, grants, and awards for projects with the potential to punch through obstacles in our way to a net-zero carbon future by 2050. These new funding opportunities, grants, and awards for projects include developing cutting-edge solar technology, improving vehicle efficiency, modernizing water infrastructure, and researching everything from microelectronics that can launch the next digital revolution, to powerful particle accelerators that can help us answer some of our biggest questions about the universe.

In April 2021, DOE announced multiple funding opportunities that provided demonstration and deployment support to the sustainable transportation sector, totaling $224M. This includes funding for bioenergy pre-pilot technologies to pilot scale and/or demonstration scale projects that support sustainable aviation and marine fuels, CO_2 conversion, waste and underutilized carbon feedstocks. Additionally, this funding will demonstrate efficiency improvement and

emission reduction opportunities in medium- and heavy- duty trucks and their associated freight systems.

We have had a number of achievements. We set an ambitious new target to cut the cost of solar energy by 60% within the next ten years, and announced nearly $128 million in funding to lower costs, improve performance, and speed the deployment of solar energy technologies. We developed a national offshore wind goal to support 77,000 jobs, power 10 million homes, and cut 78 million metric tons in carbon emissions. We also announced $109.5 million in funding for carbon capture, critical mineral recovery, and geothermal energy projects that directly support job creation in coal communities impacted by changes in the energy economy. We kicked off a 100-day plan to address cybersecurity risks to the U.S. electric system. And we witnessed Perseverance roving around the surface of Mars, powered by tech produced in our National Labs.

Internally, we held our very first Jobs & Justice town hall, spelling out what it means to center job creation and equity in all of our work.

We have kept our country safe by supporting a safe, secure, and effective nuclear stockpile, and a continued modernization program. And all the while, our labs continued working toward groundbreaking discoveries, including in the fight against COVID-19.

But these investments are really just a down payment on what we need to do as a nation. To really build an economy that positions American families and American communities to thrive, we need the resources the American Jobs Plan and the FY 2022 discretionary request will provide to take us further.

The American Jobs Plan

In March, President Biden released the American Jobs Plan. This represents the biggest investment in America since World War II, and is a once-in-a-generation investment in our nation's economy, and especially in our energy infrastructure and our ability to win the global energy market. This plan will put millions of people to work and lay the foundation for economic growth for decades to come.

Globally, there is a $23 trillion market for clean energy products and for products that will reduce carbon pollution. This is a massive opportunity for this country. Other countries are seeing that opportunity as well, and our economic competitors are working to corner the market on those opportunities. The question is: Where are those products going to be built, and who will build them?

Through the American Jobs Plan, our country is going to corner the market on a number of these products to put our people to work. It's going to take a lot of work, literally. We need millions of people in the United States working to build energy technologies and energy products and energy infrastructure. And we all know that, in the 21st Century, making sure that we have the

right infrastructure is critical.

Infrastructure is roads and bridges, it is the electrical grid that keeps the lights on, it is ports, airports, and trains, it is pipes that pump water into our homes, and it is the broadband that both brings the world and learning to our children and brings opportunity to our businesses. Infrastructure is so broad that it creates jobs in all pockets of America.

I want to work with you to make these investments so that together we deploy the energy infrastructure that our economy needs now, at the same time that we advance cutting-edge clean energy technologies, creating millions of good-paying union clean energy jobs, and building an equitable clean energy future.

FY 2022 President's Discretionary Funding Request

President Biden's proposed FY 2022 discretionary funding request for the Department of Energy invests $46.2 billion to advance key priorities including creating jobs through clean energy projects, bringing America to the forefront of clean energy innovation, tackling the climate crisis with the urgency that science demands, investing in communities that have been left behind, and ensuring the safety and security of the nuclear stockpile.

Creating Jobs through Clean Energy Projects and Energy Efficiency Retrofits
The discretionary request supports the President's vision of achieving carbon pollution-free electricity by 2035 while creating good-paying jobs by investing $1.9 billion in a Building Clean Energy Projects and Workforce Initiative at DOE. This Investment will support programmatic infrastructure for a new energy efficiency and clean electricity standard, a new Build Back Better Challenge Grant competition to support novel State-, local-, and tribal-level approaches to clean energy deployment that provides benefits to marginalized and overburdened communities, and streamlined transmission investment. These investments will develop and deploy technologies that will deliver a clean energy revolution resulting in cheap, abundant clean power delivered on a modern energy grid that is resilient and reliable.

Spurring Innovation in Clean Energy Technologies
Within DOE, the discretionary request invests more than $8 billion in clean energy and climate innovation. From investing in advanced nuclear, electric vehicles, and green hydrogen, to funding innovative approaches to air conditioning and refrigeration, the FY 2022 discretionary request puts the Nation on a path to quadruple clean energy research in four years, emphasizing U.S. pre-eminence in innovating the technologies needed to tackle the climate crisis.

These investments will leverage the tremendous innovation capacity of our 17 National Laboratories, America's universities, and entrepreneurs to transform our power, transportation, buildings, and industrial sectors to clean, emissions-free power sources and help achieve a net-zero emissions economy by 2050. The discretionary request advances us towards these goals by building on the basic science breakthroughs at our National Laboratories; and employing the resources that turn those science breakthroughs in energy and deployable technologies like those supported by the Advanced Research Projects Agency-Energy. Meanwhile, the Department's energy programs, which run the gamut from renewables to efficiency, carbon capture to

hydrogen, and grid technology to storage are going to make it their mission to bring clean energy solutions to life. Building on ARPA-E's success, the discretionary request also includes funding to establish the Advanced Research Projects Agency for Climate, to develop transformative solutions for the climate crisis through R&D support for high-impact innovative technologies to address adaptation and resilience challenges, as well as non-energy emissions mitigation. ARPA-C will work with other Agencies to lay the foundation for future climate change solutions across the Federal Government.

Revitalizing the Office of Fossil Energy and Carbon Management while Supporting Coal and Power Plant Communities
The discretionary request supports increased funding for a revitalized Office of Fossil Energy and Carbon Management that will advance carbon reduction and mitigation in sectors and applications that are difficult to decarbonize, including the industrial sector, with technologies and methods such as carbon capture and storage, hydrogen, and direct air capture – all while ensuring that overburdened communities are protected from increases in cumulative pollution.

The discretionary request also helps DOE build the energy economy back better in a way that lifts up communities who haven't yet seen a future for themselves in the energy transition and those who have just been left behind for far too long. This includes funding DOE's role in supporting the newly established Interagency Working Group on Coal and Power Plan Communities and Economic Revitalization. By supporting the POWER+ Initiative, DOE will help communities impacted by the energy transition and ensure their success. DOE programs can support fossil fuels workers translating their skills to new positions in various areas, from extracting critical minerals from coal mine sites and upgrading pipelines to reduce methane to building carbon capture and hydrogen systems on existing industrial and power plant facilities; from building zero-emissions buses and upgrading the power grid to drilling for geothermal energy. Their predecessors built the U.S. economy of the 20th Century; they will power the economy of the 21st Century.

The Department will also support communities of color living with the toxic legacy of air pollution, those who are still paying too much for their energy, and who are often the first and worst impacted by the climate emergency. With targeted investments, DOE will help communities impacted by the energy sector and advance environmental justice and equity.

Expanding Foundational Research, Emphasizing Climate and Clean Energy Science
The discretionary request invests $7.4 billion, an increase of more than $400 million over 2021 levels, in the Office of Science to better understand our changing climate, identify and develop novel materials and concepts for clean energy technologies of the future, advance artificial intelligence and quantum science, as well as the world's most advanced computing to enhance prediction and decision-making across numerous environmental and scientific challenges, and of course to support the national research community with cutting-edge scientific facilities. This investment in foundational research will support America's first-rate scientists, engineers, and entrepreneurs, who develop and deploy technologies that improve our lives and jumpstart new industries.

Investing in Historically Black Colleges and Universities and Minority Serving Institutions
The FY 2022 discretionary request creates and enhances research funding opportunities and invests in infrastructure such as laboratory facilities and information technology upgrades for Historically Black Colleges and Universities (HBCUs) and Minority-Serving Institutions (MSIs). It also increases resources for workforce development programs to augment pathways to good-paying Science, Technology, Engineering, and Math (STEM) careers for students attending these schools. New grant awards, including a research center focused on climate, will expand research capacity and create new opportunities at HBCUs and other MSIs. The FY 2022 discretionary request will build on the Department's existing relationships with HBCUs and MSIs, establish new partnerships with these institutions, and include them in our efforts to target disadvantaged communities for new clean energy investments, jobs, and businesses, while doubling down on our commitments to racial justice.

Strengthening the Nation's Nuclear Security
The President's FY 2022 discretionary request for the Department supports a safe, secure, and effective nuclear stockpile, and a continued modernization program. This includes the recapitalization of the National Nuclear Security Administration's (NNSA's) physical infrastructure and essential facilities to ensure our deterrent remains viable. The discretionary request ensures continued, robust investments in the Department's nuclear security mission, including safeguarding and ensuring the reliability of America's nuclear weapons stockpile. The request also funds key nuclear nonproliferation and counterterrorism programs and increases funding for the Naval Nuclear Propulsion Program, which designs, builds, operates, maintains, and manages the reactor systems of the Naval nuclear fleet, and increases the number of highly skilled staff to carry out the mission. Additionally, the discretionary request sustains our investment in the Environmental Management mission to clean up World War II and Cold War nuclear sites.

Conclusion

In conclusion, I am humbled to reaffirm my commitment to lead the Department of Energy. I look forward to our continued partnership to achieve these ambitious yet necessary goals.

Thank you for the opportunity to be here today. I am happy to answer your questions.

U.S. Senate Committee on Energy and Natural Resources
June 15, 2021 Hearing: *The President's Budget Request for the Department of Energy for Fiscal Year 2022*
Questions for the Record Submitted to the Honorable Jennifer Granholm

QUESTIONS FROM CHAIRMAN JOE MANCHIN III

Q1. The Title XVII solicitation for advanced fossil energy projects has $8.5 billion of loan authority available and has not awarded any loan guarantees to date. The Fiscal Year 2022 budget request states that, "the program will avoid directly subsidizing fossil fuels by excluding traditional fossil projects from consideration for a loan guarantee."

Q1a. Given that Congress explicitly made eligible advanced fossil energy technologies and carbon capture and storage, what is the impact of this new policy for these technologies and how would this effect projects currently pending?

A1a. Under the Title XVII Innovative Energy Loan Guarantee Program, the Department of Energy continues to make its loan guarantee authority available to finance advanced fossil energy projects that (a) avoid, reduce or sequester air pollutants or anthropogenic emissions of greenhouse gases, and (b) employ new or significantly improved technology as compared to commercial technology in service in the United States. Projects eligible for using the Title XVII loan guarantee authority are not "traditional" by necessity of the statutory requirements and should therefore not be affected by the language in the President's Fiscal Year 2022 Budget Request.

Q2. While it is critical that we address our nation's nuclear waste problem, I strongly believe that we must maintain our current nuclear fleet, particularly if we want to reach any climate goals. The Department of Energy's Fiscal Year 2022 budget requests $60 million for the light water sustainability program, which is critical for ensuring the continued safe and economic operation of the domestic fleet. While this program is important we must do more at the federal level to protect these infrastructure assets by either allocating credits or figuring out a means to value nuclear power plants' zero emission qualities.

Q2a. Do you agree we need to maintain our domestic nuclear power plants in order to meet our emission reduction goals?

A2a. Yes, I agree domestic nuclear power plants are needed in order to meet emission reduction goals. Existing U.S. nuclear power reactors currently generate 20 percent of our electricity, and more than half of our carbon-free power. To reach our ambitious goals of a 50 to 52 percent reduction in our carbon emissions by the end of the decade, 100 percent clean electricity by 2035, and a net-zero economy by 2050, we will need to use every single clean energy tool available, and our existing nuclear power plants, as well as new advanced nuclear plants, will play crucial roles in meeting these goals.

Q2b. Do you support a nuclear production tax credit or the concept of a reverse auction to ensure that economically pressured nuclear power plants do not shutdown prematurely?

A2b. The Administration understands the importance of keeping existing nuclear power plants operating to meet our aggressive climate goals. The American Jobs Plan recommends an allocated production credit for electricity generation from eligible existing nuclear power facilities, which would help avoid future premature shutdowns.

Q3. As you know, hydrogen has the potential to decarbonize virtually all carbon intensive sectors of our economy, including transportation, power, and industry. With innovation in technologies, like CCUS and electrolyzers, we'll be able to produce it cleanly by using all of our abundant, domestic energy resources – natural gas, renewables and nuclear – and will not require us to rely on overseas supply chains.

Q3a. Do you agree that we need to invest more heavily in hydrogen research, development and demonstration, including for hydrogen hubs, to get the U.S. to a clean hydrogen economy?

A3a. Absolutely. Industries are beginning to announce projects involving clean hydrogen to reduce emissions, but many hurdles remain for deploying it at scale. Key sectors of the economy that hydrogen can de-carbonize are steel production, ammonia production, medium- and heavy-duty transportation, and grid-scale energy storage. In addition, clean hydrogen can be used as a feedstock along with carbon dioxide (CO_2) to produce synthetic fuels and chemicals. The Hydrogen Energy EarthShot establishes a framework and foundation for clean hydrogen production from all pathways including electrolysis from renewable and nuclear energy from the gasification of solid materials such as byproducts from coal, agriculture residues, and plastics. Near-term research, development, and demonstration (RD&D) actions are required to overcome barriers and reduce costs to jump-start hydrogen infrastructure and increase the uptake of clean hydrogen. The Department is also working on efforts to support the safe and wide-scale deployment of hydrogen across the industrial sectors and accelerating that deployment through the American Jobs Plan, which includes support for demonstration projects.

Q3b. Given the breadth of production sources and end-uses of hydrogen, what changes are needed, if any, to the current structure of the Hydrogen program at DOE to make sure we can expeditiously and efficiently advance a clean hydrogen economy?

A3b. Several applied offices are supporting the production of clean hydrogen from renewables and nuclear

energy using electrolysis and the conversion of natural gas, coal waste, sustainable biomass residues, and waste plastics to hydrogen using gasification and pyrolysis technologies. All the offices coordinate hydrogen activities, as described in the comprehensive DOE-wide Hydrogen Program Plan, published in November 2020. Since then, DOE's Office of the Under Secretary for Science and Energy established a Hydrogen Science and Energy Technology Team (SETT) which members across multiple offices, which enhances collaboration and coordination. The EERE Hydrogen and Fuel Cell Technologies Office (HFTO), which has been leading hydrogen and fuel cell coordination over the last two decades, includes efforts on hydrogen from renewables, delivery, storage, and end use applications in transportation (trucks, marine, rail, etc.), industry (e.g., steel, ammonia), and energy storage to enable renewables. In addition to hydrogen, HFTO also includes fuel cells for transportation and stationary applications, systems integration, and safety, codes, and standards. Key subprograms include Hydrogen Technologies, Fuel Cell Technologies, Systems Development and Integration, and Data, Modeling, and Analysis, with emphasis on the H2@Scale initiative to enable large scale production and end use of hydrogen. HFTO also works closely with the nuclear office to demonstrate production of hydrogen using electrolyzers and nuclear electricity; and with the Office of Fossil Energy and Carbon Management (FECM) on high temperature electrolyzers and reversible fuel cells. FECM has several programs that are involved with clean hydrogen production, transport, storage, and use. This includes the Gasification Program to produce clean hydrogen from solid waste feedstocks; the Reversible Solid Oxide Fuel Cell Program to produce clean hydrogen through conversion of water using excess electricity during off-peak time and to produce electricity through conversion of hydrogen back during peak time; the Advanced Turbines Program to utilize clean hydrogen for power production; and the Carbon Capture, Utilization and Storage Program to capture CO_2 emissions associated with hydrogen production to enable clean hydrogen production from fossil and waste fuels; the energy storage program is evaluating the storage of bulk hydrogen storage both above and below ground for power plants; and bulk transport of hydrogen in pipelines networks.

Q4. The President's budget request calls for increases to both the Office of Electricity and the Office of Cybersecurity, Energy Security, and Emergency Response (CESER). The increases of 54% and 29%, respectively, are requested to modernize and enhance the resilience of the grid against increasing threats and risks.

Q4a. How will the increase in funds support existing and new efforts to accomplish this critical mission?

A4a. The Office of Electricity (OE) leads the Department's efforts to strengthen, transform, and improve energy infrastructure so consumers have access to resilient, secure, and clean sources of electricity. The requested funding increase is focused in several key areas:

- The new Energy Delivery Grid Operations Technology program will focus on developing large, networked energy transmission, distribution, communication, and data infrastructures across multiple utility boundaries in support of reliable and resilient energy delivery systems. The EDGOT technology portfolio will enable risk and uncertainty assessments, evaluation and identification of effective mitigation strategies, and support of more informed infrastructure planning and investment decisions by both public and private sectors, thereby enhancing U.S. energy and economic security.

- Energy Storage R&D enhances support for innovative, late-stage, long-duration energy storage technologies to provide a pathway for demonstration and deployment of novel, mature storage technologies that provide substantial benefit to the electric grid, equitably serve communities, and encourage U.S. manufacturing innovation.

- Full funding is requested to complete construction and commissioning of the Grid Storage Launchpad (GSL) project, which will enhance critical research capabilities for the development and testing of new grid energy storage materials that are more cost effective, safer, and durable.

- Transformer Resilience and Advanced Components R&D increases accelerate the timeline for field validation of innovative, flexible, and adaptable prototypes for large power transformers (LPTs), which will promote greater standardization to increase grid resilience, and support evaluation of technologies that maintain grid reliability and safety under extreme weather and climate conditions.

CESER leads the Department's role as the Sector Risk Management Agency (SRMA) to prepare for, mitigate, and respond to risk and threats to the U.S. energy sector. The increase in funding will be focused on key activities such as:

- Increasing cyber visibility of threats in the operational technology environments of critical energy systems;
- Expanding CESER's Cyber Testing for Resilient Industrial Control Systems (CyTRICS) program to conduct vulnerability testing in partnership with key manufacturers and suppliers to address supply chain threats;
- Supporting energy security planning efforts at the state, local, tribal, and territorial (SLTT) levels;
- Strengthening cybersecurity workforce initiatives; and
- Supporting sector risk management through the development of tools and technologies to identify, protect, detect, and mitigate to cyber and non-cyber risks (such as physical, electromagnetic pulse, and geomagnetic disturbance threats).

The request also strengthens CESER's Emergency Support Function–Energy (ESF-12) role to conduct situational assessments and modeling before, during, and after supply disruptions, as well as respond quickly to those emergencies from all hazards in partnership with the industry, SLTT community, and interagency partners such as the Federal Emergency Management Agency (FEMA), Cybersecurity and Infrastructure Security Agency, and Federal Bureau of Investigation.

Q4b. In particular, given the significant impact of the Colonial Pipeline shutdown following a ransomware attack, how will DOE help counter the threat of cyber-crime on energy systems?

A4b. DOE's FY 22 Budget Request proposes to invest $201M in CESER. As the office responsible for executing DOE's SRMA and ESF #12 responsibilities, CESER works closely with energy sector partners and across all levels of government to prepare for and respond to growing and evolving cyber threats and attacks to U.S. energy infrastructure, which may include cyber-crime threats. The FY 22 Budget Request will enable CESER to strengthen DOE's ability to execute its energy and national security mission by enhancing the office's risk management, situational awareness, and emergency response capabilities.

Specifically, the FY 22 Budget Request will allow CESER to advance policies, technologies, and initiatives to increase the visibility of physical and cyber threats in the operational technology environment, mature the cybersecurity supply chain, and support exercises and partnerships with states and other public and private sector organizations that will bolster the Nation's energy security and resilience. Additionally, CESER will lead crosscutting energy sector cybersecurity research and development (R&D) and ensure that cybersecurity is integrated into the research and development activities of all of DOE's science and applied energy program offices.

These activities are critical to deter cyber threats from both criminal and nation-state actors.

Q5. The State Energy Program provides funding and technical assistance to states, territories, and tribes to improve energy security and energy efficiency. The President's budget request includes an additional $300 million to launch a new Build Back Better Challenge that would provide grants on a competitive basis to support the deployment of novel clean energy technologies at the state and local level.

Q5a. How will states be competing with each other for grants under this new program, and how will DOE ensure that states with smaller state energy offices, like West Virginia, are being given an equal opportunity to participate?

A5a. DOE intends to design the program to provide all states a fair opportunity to compete for the Build Back Better Challenge. One option under consideration is to create three to four eligibility groupings that will allow states of similar size and characteristics to compete with each other rather than across all states. Also recognizing that states and localities have different resources and different starting points, the program would be designed to maximize participation by allowing flexibility on the types of policies or other measures that qualify and taking into account a state's progress from its starting point not just the ambition of its end point. Finally, DOE plans to conduct listening sessions with states and local government organizations or conduct other outreach efforts to identify existing priorities and challenges facing potential applicants.

Q5b. Will these grants support solutions across the entire spectrum of clean energy technologies, including those like CCUS and hydrogen?

A5b. The grants funded by the Build Back Better Challenge would be subject to DOE regulations, specifically 10 CFR 420, which outlines the parameters for spending State Energy Program funds. CCUS and

hydrogen are not explicitly prohibited program activities per 10 CFR 420. States seeking funding will have to demonstrate in their applications how they will use these commercially available technologies in proposals that fit within the goals of the program, which are to incentivize state energy officials and their partners to incubate novel approaches to clean energy technology deployment, prioritizing investments that meet energy needs at the local level, and are inclusive in improving the economic well-being of impoverished and disenfranchised communities, and/or communities that have been marginalized or overburdened.

Q6. While I was pleased to see that this year's budget request includes support for the U.S Energy Employment Report, I want to make sure the report with the employment data from 2020 doesn't fall through the cracks and that we are on track to have the 2021 data released on time next year.

Q6a. Can you provide a timeline for when the 2020 data will be released?

A6a. The 2021 U.S Energy Employment Report (USEER) that includes 2020 data was released on July 19, 2021.

Q6b. Has work begun on the report with this year's data?

A6b. Yes, we have already begun working on next year's USEER, including drafting the survey template, which will help ensure that next year's USEER is released in a timely manner.

Q7. I understand that much of our transmission infrastructure is 40-50 years old. The Energy Information Administration estimates that overall transmission and distribution losses are about 5%.

Q7a. As we modernize the grid and make it more resilient, how will DOE support efforts to enhance the efficiency of the grid to reduce these line losses?

A7a. DOE supports the development and deployment of technologies to improve grid efficiency and reduce line losses. On the transmission system, converting alternating current (AC) lines to high-voltage direct current (HVDC) or upgrading to higher voltage AC (uprating) can work to reduce losses, as can new installations of technologies such as HVDC systems and power flow devices. DOE's Office of Electricity (OE) has sponsored research and development (R&D) in areas such as flexible AC transmission system, power flow controllers, dynamic topology configurations, advanced power

transformers, and high temperature superconductors, all of which provide improvements that reduce losses in the system. On the distribution system, enhanced efficiency and reduced losses can be addressed with proper conductor sizing, more efficient transformers, capacitor banks to improve power factor, as well as smart meters and analytical tools to address non-technical losses and inefficiencies. DOE supports the R&D of more efficient distribution transformers, advanced distribution management system applications, and sensors to monitor real-time system conditions.

The conductivity-enhanced materials for Affordable Breakthrough Leapfrog Electric and thermal applications initiative is a cross-office DOE effort aimed at developing advanced conductors for numerous power systems applications. Advanced conductors can provide significant benefit to the efficiency of the bulk power system, and OE and the Office of Energy Efficiency and Renewable Energy's Advanced Manufacturing Office are collaborating in sponsoring projects to develop conductors for electric grid applications.

QUESTIONS FROM SENATOR JOHN BARRASSO

Q1. You stated that DOE would soon be issuing a request for information (RFI) for the uranium reserve. Thank you for the update. I am glad to hear DOE is making progress.

Q1a. What additional steps does DOE plan to take prior to initiating purchases of uranium?

A1a. Pursuant to the National Environmental Policy Act (NEPA), the National Nuclear Security Administration (NNSA) will be preparing an analysis of the potential environmental impacts associated with the establishment of a uranium reserve.

NNSA will also consider responses to a request for information (RFI).

Q1b. What is the timeline for these actions?

A1b. NNSA is currently working through the NEPA process and the timeline will depend on the level of analyses are required.

When an RFI is issued, it will be open for input for at least 30 days. At the end of this period, NNSA will review the information received, and develop and issue one or more requests for proposals (RFPs).

Q1c. Will you begin purchasing uranium by the end of calendar year 2021? If not, when will you begin purchasing uranium?

A1c. We are planning to be ready to start purchasing uranium by the end of calendar year 2021. However, NNSA cannot commit to a firm date until NEPA and other evaluations are complete.

Q2. DOE requested $150 million for fiscal year 2021 to support the ten year uranium reserve program recommended by the federal interagency Nuclear Fuel Working Group. Congress only appropriated half of that in fiscal year 2021.

Q2a. Why didn't DOE request additional funding for fiscal year 2022?

Q2b. Does DOE believe additional funding will be required to support this multiyear program once the initial $75 million has been used to purchase uranium? If not, why not?

A2. Due to the complex nature of the activities and the coordination needed, DOE requires time to prepare and finalize the requested plan for the Uranium Reserve (UR) program. DOE plans to issue a Request for Information (RFI) to gain a better understanding of stakeholder and Tribal views related to the development of a UR program. The Department will also evaluate what, if any, further review is required under the National Environmental Policy Act (NEPA) and the National Historic Preservation Act prior to procuring uranium and conversion services for a reserve. DOE cannot commit to a firm date in the absence of a completed NEPA analysis.

Q3. High-assay, low-enriched uranium, or HA-LEU, is vital to the advanced reactor community, with nine of the ten awardees under DOE's Advanced Reactor Demonstration Program relying on HA-LEU-based fuels. Today, Russia is the only commercial supplier of HA-LEU. While I'm glad to see that DOE is requesting funding to continue operation of the HA-LEU demonstration program, domestic enrichment capability needs to be expanded quickly in order to prevent our foreign adversaries from capturing this market. At the same time, DOE needs to be working to provide our companies with the HA-LEU they need in the near-term. I greatly appreciate your agreement on this issue and commitment to make DOE produced HA-LEU available.

Q3a. How much HA-LEU, from what sources and on what timeline, will DOE make available with the funds requested for fiscal year 2022?

A3a. The funds requested in the FY 2022 Budget Request represents the first year of funding for the high-assay, low-enriched uranium (HALEU) Availability Program. The FY 2022 Budget Request would staff and operate the HALEU enrichment demonstration facility in a cost share agreement with industry, as well as initiate the critical HALEU support elements outlined in the Consolidated Appropriations Act of 2021 (Public Law No. 116-260). These support elements include assessing criticality benchmark data needs to support licensing, transportation package development, and the first year of funding required to re-establish material processing and handling capabilities to enable the recovery and down-blending of Highly Enriched Uranium (HEU) and scrap/excess HALEU at critical DOE facilities. The reestablishment of these processing and handling capabilities would enable DOE to recover and make available limited amounts of HALEU to support the Advanced Reactor Demonstration Program (ARDP).

Q3b. DOE has sources of HA-LEU that could be made available to support the needs of our advanced reactor developers, but some of this material is expensive to process or reserved for other needs. What additional sources of HA-LEU, including material declared excess to defense needs, and processes could

be considered if additional funding was available? Please include in your response material considered to be unavailable to meet our HA-LEU needs and explain why it is unavailable.

A3b. DOE is assessing its inventories to determine what material (in the form of spent fuel and/or scrap) might be recoverable for use as HALEU fuel feedstock and is in the process of conducting cost estimates to recover limited amounts of such materials. The enriched uranium declared excess to defense needs (such as that in the 1994 and 2005 Excess Material Declarations) is not HALEU material that sits on a shelf ready for use, but rather exists in various forms and locations throughout the DOE complex and is processed annually on a fixed schedule. Additional funding will not adjust the amount of processing that is able to occur each year. DOE and the National Nuclear Security Administration (NNSA) plan to fulfill the commitments of the Excess Material Declarations, with most of the recovered enriched uranium being designated for critical programs such as Naval Nuclear Propulsion and fueling research reactors and medical isotope production facilities.

In recognition of the Department's need for HALEU for commercial reactor development, NNSA will lead an effort, in coordination with the Office of Nuclear Energy (NE), to identify a fixed amount of material that can be provided as HALEU for advanced reactor demonstrations from HEU material set aside in the 1994 excess material declaration for research reactors and medical isotope production without impacting existing NNSA nonproliferation and nuclear security programs prior to the establishment of an enrichment capability in the United States. NNSA will also evaluate whether that material can be made available in the timeframe needed. NE and NNSA will develop an independent government cost estimate on HALEU supply actions to establish planning expectations.

Q3c. What is DOE doing to ensure we have full scale HA-LEU enrichment capacity in the United States to ultimately meet the needs of our advanced reactor developers?

A3c. The timely demonstration of advanced reactor concepts is critical to American leadership in nuclear energy and to establishing a reliable demand signal that will encourage industry to establish HALEU production capability within the Unites States. In order to support the establishment of a full-scale HALEU enrichment capability, DOE will consider options for acquiring or providing HALEU to advanced reactor developers to help sustain strategic supply infrastructure, work to make available HALEU to ARDP awardees on their required schedules to ensure their successful and timely

demonstrations and ensure a strong demand signal by using all available DOE resources (recovered uranium and enriched uranium), and help develop supply chain capabilities on the necessary timelines and to incentivize existing participants toward a diverse, market-driven supply chain in the 2030s.

Q4. American innovators are developing radioisotope power systems for unique energy applications. Much like advanced nuclear fission reactors that require high-assay, low-enriched uranium for their fuel, these radioisotope power systems will require fuel that is not readily available in the commercial market. The fuel for these systems can be obtained from nuclear waste currently being processed and stored by DOE. Will you work with these companies to provide them with the fuel they need?

A4. The Department recognizes the potential of radioisotope power sources to serve unique energy commercial applications. The Office of Nuclear Energy's (NE) Gateway for Accelerated Innovation in Nuclear (GAIN) provides the nuclear developer community with access to the technical, regulatory, and financial support necessary to move innovative nuclear energy technologies toward commercialization. NE also performs research on approaches to recover useful products from used nuclear fuel. In addition, the Isotope Program in the Office of Science produces critical radioactive and stable isotopes in short supply for the nation or that no domestic entity has the infrastructure or core competency to produce and engages with industry for the sale and distribution of isotopes.

Q5. Do you agree that discoveries in physical sciences such as chemistry and physics are more necessary now than ever before, given DOE's mission and its legal and contractual obligations (e.g. for clean-up and environmental remediation)? If so, please provide details for the Office of Science Budget, especially with respect to Basic Energy Sciences and your views about the importance of basic research in the physical sciences? If not, why not?

A5. As one of the principal sponsors of U.S. basic research in the Federal government, the Department of Energy's (DOE) Office of Science delivers the scientific discoveries, capabilities, and major scientific tools that advance the scientific and technology foundations necessary to accomplish the DOE mission areas. The FY 2022 Budget Request continues to provide support for chemistry, materials sciences, biology, and physics research as well as operation of world-leading user facilities required to create the knowledge foundation to spur discoveries and innovations that will advance the Department's missions in energy and environment. Subject to Congressional Appropriations, in FY 2022 the Basic Energy Sciences (BES) program plans to expand investments that advance DOE's missions, such as providing the understanding and foundations for clean energy, that cross the entire BES portfolio. Areas of focus

will include the design of chemical mechanisms and materials to capture carbon dioxide directly from air; conversion of solar energy efficiently to useful power and fuels; generation, storage, and use of hydrogen as a fuel, energy storage medium, and chemical in carbon-neutral cycles; and creation of approaches for next-generation electrical and thermal energy storage. In addition, BES will continue to provide scientific foundations for DOE's environmental mission, including research on heavy element chemistries and radiation effects in materials, and understanding the fundamental mechanisms resulting from extreme environments involving radiation and severe chemistries critical for long-term waste form performance.

Q6. I believe that one of the benefits of basic energy science and experiments in chemistry and physics in particular is the value of experimental findings to inform modeling. Do you agree? What is DOE doing to ensure models are properly verified and validated with experimental data?

A6. The integration of theory and modeling with experiments is a long-established practice in research supported by the Department of Energy's (DOE) Office of Science (SC), including the activities in Basic Energy Sciences (BES) and Biological and Environmental Research (BER). Experiments are essential for the development, verification, and validation of models, while theory and modeling provide important contributions to interpreting experimental findings. In FY 2021, for example, BES solicited proposals for new research to advance integration of data science approaches such as Artificial Intelligence and Machine Learning (AI/ML) with experiment, theory, and simulation to develop reliable and predictive models that accelerate scientific discovery and overcome difficult fundamental research challenges for energy. Similarly, BER solicited proposals to advance the atmospheric sciences where observations from the Atmospheric Radiation Measurement User Facility will be combined with machine learning to develop more accurate climate model predictions. Notable in these areas are BES' Computational Chemistry and Materials Sciences program and BER's investments in the Environmental Molecular Sciences Laboratory (EMSL) that explicitly require experimental validation of computational codes developed for current and future exascale computing platforms, with both the data and open-source software publicly available. In addition, AI/ML techniques are also being applied for more efficient user facility operations and interpretation of massive experimental data sets. Subject to Congressional Appropriations, in FY 2022 BES and BER plan continued investments in the use of

experimentally validated computational tools and data science to accelerate fundamental research for the discovery of new chemical mechanisms and material systems with exceptional properties and functions.

Q7. DOE's Budget in Brief lists the five programmatic priorities areas for the Office of Energy Efficiency and Renewable Energy (EERE), including "Decarbonizing agriculture." What is the statutory authority for EERE to pursue this priority?

A7. EERE agriculture-related proposals span a number of Offices within DOE. DOE also coordinates with the USDA on a number of our agriculture-related proposals. Bioenergy activities that include biomass crop production, landscape design, and soil carbon science are funded within DOE's Bioenergy Technology Office. That office is authorized by 42 U.S.C. § 16232.

DOE's Hydrogen Fuel Cells Technologies Office is authorized under Title VIII of Energy Policy Act of 2005 for agriculture-related projects. The goal of the program is to demonstrate and commercialize the use of hydrogen for transportation (in light-duty vehicles and heavy-duty vehicles), utility, industrial, commercial, and residential applications. DOE considers certain agriculture-related industrial and commercial applications, such as the production and use of hydrogen from renewable fuels for use in ammonia/fertilizer production, as applicable to decarbonizing agriculture.

DOE's Solar Energy Technologies Office is authorized under Section 3004(b)(2)(B)(iii)(III) of the Energy Act of 2020 to carry out research, development, demonstration, and commercialization activities involving the integration of solar energy technologies with "other applications, such as in the agriculture, transportation, buildings, industrial, and fuels sectors."

DOE's Advanced Manufacturing Office is authorized, in part, under § 911 (a)(2)(C) of EPAct 2005. This section authorizes DOE to conduct RD&D on "advanced technologies to improve the energy efficiency, environmental performance, and process efficiency of energy-intensive and waste-intensive industries." DOE considers agriculture as such an industry.

DOE's Water Power Technologies Office programs are authorized, in part, under Division Z, Section 3001 of the Energy Act of 2020. This includes a hydropower focus on existing waterways for development of small hydropower and/or hybrid systems to support power for irrigation districts, and a

marine energy focus on the development of marine-powered desalination systems, which could provide either direct water benefits for agriculture or nutrient cycling systems for aquaculture.

Title V of the Energy Act of 2020 states that interagency coordination for carbon mitigation activities, including in agriculture, shall be coordinated among the Office of Energy Efficiency and Renewable Energy, the Office of Science, and the Office of Fossil Energy.

Q8. DOE's Budget in Brief states that the Office of Fossil Energy (FE) conducts research to "retain and create good paying jobs with a free and fair chance to join a union and collectively bargain." What is the statutory authority for DOE to research "a free and fair chance to join a union and collectively bargain?"

A8. The Department of Energy (DOE) and the Office of Fossil Energy and Carbon Management (FECM) are committed to ensuring that energy technologies we research, develop, and demonstrate (RD&D) take into consideration the quality of job creation and equity. FECM is not researching "a free and fair chance to join a union," rather FECM is striving towards equitable outcomes of the RD&D investments of the Department, including the jobs these investments will create. There is a commitment toward inclusion to ensure all workers have equitable workplaces, and that includes all workers earning the equitable wages and having the opportunity to collectively bargain with their employer to offset the disadvantages of an individual trying to negotiate their own wage with their employer. An opportunity to join a union is important as collectively bargaining ensures that all workers, regardless of race, gender, and sexual orientation make the same wages. Unions and collectively bargaining are some of many tools we would like to consider in our attempt to ensure access, inclusion, and equity in our work.

Q9. DOE's Budget in Brief mentions funding within FE that will help meet "our climate goals." Which specific climate goals is this document referring to?

A9. The Biden Administration's mission is to achieve net-zero carbon emissions in the power sector by 2035 and net-zero economy-wide by 2050. Avoiding, reducing, and removing greenhouse gas emissions are indispensable to meeting that challenge. That applies not just to the ways we develop, deliver, and use energy, but also to our industrial sectors that we depend on every day to build and run modern society. Research, development, demonstration, and deployment (RDD&D) of decarbonization technologies including carbon capture, utilization and storage and carbon dioxide removal are critical to achieving those goals. In addition to advancing carbon capture and storage (CCS), research on

sustainably-sourced waste biomass and plastic co-firing coupled with CCS will further enable industry to reach net-zero goals. In addition, research on recovering critical minerals from sustainable mining, coal waste and other mining waste materials supports a U.S. domestic supply chain for manufacturing clean energy technologies in the United States.

Q10. DOE's Budget in Brief states that "the Office of Electricity (OE)…lead[s] the Department's efforts to strengthen, transform, and improve energy infrastructure so consumers have equitable access to resilient, secure, and clean sources of electricity."

Q10a. How does DOE define "equitable access"?

A10a. Equitable access to energy means that energy is available and affordable for all U.S. consumers.

Q10b. How does DOE define "clean"?

A10b. Clean technologies include those that avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases.

Q10c. What is the statutory authority for OE to pursue these efforts?

A10c. Examples of statutory authority to pursue these efforts include:

The Energy Act of 2020 Section 3202(d)(1), which states: "The Secretary may award grants to eligible entities for identifying, evaluating, designing, and demonstrating energy storage technology and microgrid projects that utilize energy from renewable energy sources."

The Energy Independence and Security Act of 2007, which states:

- Section 1301: "It is the policy of the United States to support the modernization of the Nation's electricity transmission and distribution system to maintain a reliable and secure electricity infrastructure that can meet future demand growth and to achieve each of the following, which together characterize a Smart Grid: ... Deployment and integration of distributed resources and generation, including renewable resources."

- Section 1304A: "In supporting the development of model grid architectures, the Secretary shall...analyze the effects of the increasing proliferation of renewable and other zero emissions energy generation sources, increasing use of distributed resources owned by non-utility entities, and the use of digital and automated controls not managed by grid operators".

Q11. DOE's Budget in Brief states that the Loan Programs Office "will avoid directly subsidizing fossil fuels by excluding traditional fossil projects from consideration for a loan guarantee." Is a carbon capture, utilization, and sequestration (CCUS) project for a coal- or natural gas-fired electric generation or industrial facility considered a "traditional fossil project?"

A11. Every project is unique, and a blanket statement cannot be issued on what may or may not qualify for a loan under the Advanced Fossil Energy Projects provision of the Title XVII Innovative Energy Loan Guarantee Program. The Department of Energy is interested in funding new or retrofit Carbon Capture, Utilization and Storage (CCUS) projects that meet the statutory requirements of the Title XVII program, which are any projects that (a) avoid, reduce or sequester air pollutants or anthropogenic emissions of greenhouse gases, and (b) employ new or significantly improved technology as compared to commercial technology in service in the United States. Projects satisfying these requirements would not be considered "traditional."

Q12. DOE's budget leads with "Advancing clean energy innovation, tackling the climate crisis." Where has Congress specifically authorized DOE to "tackle the climate crisis?"

A12. In the Department of Energy Organization Act, Congress stated that among the Department's intended purposes is to "assure incorporation of national environmental protection goals in the formulation and implementation of energy programs . . . to advance the goals of restoring, protecting, and enhancing environmental quality, and assuring public health and safety." 42 U.S.C. § 7122. Congress has subsequently directed the Department to take on climate change initiates through various legislative actions. *See, e.g.,* 42 U.S.C. § 13382(a), 42 U.S.C. § 13389(c)-(d), 42 U.S.C. § 17353, and 50 U.S.C. § 3060.

Q13. DOE's Budget in Brief states that "CESER programs work in an integrated manner… to enhance the resilience and security of the U.S. energy infrastructure for all consumers, in line with energy justice principles."

Q13a. What are "energy justice principles"?

A13a. Communities of color and low-income communities have borne the brunt of air, water, and soil pollution. The clean energy revolution must support these communities and make sure they reap the associated benefits. The Department of Energy's (DOE) Office of Economic Impact and Diversity will lead this effort through a new role committed to implementing President Biden's Justice40 Initiative —a plan to deliver 40% of the overall benefits of climate investments to disadvantaged communities and inform equitable research, development, and deployment within DOE.

Q13b. Can "energy justice principles" supersede the resilience and security of energy infrastructure?

A13b. DOE is confident that energy justice priorities can be advanced in tandem with energy infrastructure resilience and security.

Q14. DOE's Budget in Brief moves the Strategic Petroleum Reserve from FE to CESER. The justification for this realignment is "to align the Department's non-nuclear emergency management and national security functions." EERE conducts cybersecurity R&D for renewable technologies. Does DOE plan to better align cybersecurity R&D by moving it all under OE?

A14. The Request does not move all cybersecurity R&D under OE. Rather, it moves energy sector cybersecurity R&D associated with electricity delivery systems under OE so it can be better coordinated with other related electricity delivery system R&D. Cybersecurity R&D associated with specific forms of energy generation (such as nuclear, fossil fuel, and renewables) is located in the corresponding DOE applied energy programs.

DOE's Budget Request will ensure that "security by design" is a core principle embedded in all research, development, and deployment (RD&D) conducted by DOE's applied energy and science offices.

CESER has lead responsibility for coordinating energy sector cybersecurity across all DOE applied energy and science offices, as well as conducting cross-cutting cybersecurity R&D to strengthen energy sector cybersecurity more broadly. This includes developing tools and technologies to detect and

mitigate cyber threats and working with the industry and State, local, Tribal, and territorial (SLTT) communities on cyber preparedness and response.

Q15. Secretary of State Blinken has called the treatment of Uyghur Muslims in China "genocide." China supplies 80 percent of the world's polysilicon in Xinjiang, where China uses the Uyghur population as slaves.

Q15a. How will you ensure DOE does not procure or fund the purchase of solar panels made with products of slave labor?

A15a. DOE is deeply concerned about these allegations of forced labor in Xinjiang and is working with other federal agencies on the implications for the solar supply chain. This is one reason why it is so important that we build up our domestic industry and supply chains to ensure safe labor standards.

Q15b. How will the administration make sure other entities within the United States are not importing the products of slave labor?

A15b. The Administration is taking a "whole of government approach" to show strong action against forced labor. On June 24, Secretary of Homeland Security Alejandro N. Mayorkas announced that The Department of Homeland Security's (DHS) U.S. Customs and Border Protection (CBP) issued a Withhold Release Order against Hoshine Silicon Industry Co. Ltd., a company located in China's Xinjiang Uyghur Autonomous Region. The Withhold Release Order instructs personnel at all U.S. ports of entry to immediately begin to detain shipments containing silica-based products made by Hoshine and its subsidiaries. The ban will be enforced by CBP, and incoming shipments from identified firms will only be released if the importer can verify that the materials are not made with slave labor.

Q16. On appliance standards, DOE performed an analysis and found that 60 percent of standards resulted in 96 percent of savings. In other words, 40 percent of appliance standards accounted for only 4 percent of total energy savings. Is it unreasonable for DOE to focus its efforts on rules that will save the most energy?

A16. DOE is statutorily obligated to periodically review the potential for energy savings for all products under its authority pursuant to 42 U.S.C. 6295(m), 42 U.S.C. 6313(a)(6)(C), and 42 U.S.C. 6316(a). The Energy Policy and Conservation Act, as amended, already includes seven factors for determining

whether a new or amended standard is significant and should be adopted by the Department. These seven statutory factors include:

1. The economic impact of the standard on manufacturers and consumers of the products subject to the standard;
2. The savings in operating costs throughout the estimated average life of the covered products in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses for the covered products that are likely to result from the standard;
3. The total projected amount of energy (or as applicable, water) savings likely to result directly from the standard;
4. Any lessening of the utility or the performance of the covered products likely to result from the standard;
5. The impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from the standard;
6. The need for national energy and water conservation; and
7. Other factors the Secretary of Energy considers relevant.

DOE's analysis includes an evaluation of potential costs, benefits, and technological feasibility and there are historical examples where the Department determined that amended standards were not justified or feasible. DOE already has the capacity and obligation to evaluate the significance of its potential actions and determine not to amend early in the process if warranted.

In some cases, relatively small energy savings can be achieved at a very small cost and still reduce consumer's energy bills, which is consistent with the Department's statutory mission. Additionally, some appliance standards have a greater impact on reducing peak energy demand and improving grid resiliency, which is not necessarily reflected in a total energy savings estimate but is nevertheless an important goal for the Department.

An evaluation of the total energy savings of previous rules must also include the historical context of the appliance standards program and the implementation of energy conservation standard regulations over

time. For some products, the initial rulemaking(s) capture lower-hanging fruit in terms of efficiency improvement and yield much higher savings. However, future rulemakings for the same product may be more incremental in terms of their energy efficiency gains and energy savings benefits as the product moves along its cost-efficiency curve. A significant fraction of the historical energy savings originate from such initial rulemakings for several products. It may not be practical to expect such a large fraction of savings to come from a small number of rules in the future.

Furthermore, DOE has historically welcomed a variety of approaches for establishing new or amended energy conservation standards, including consensus agreements and negotiated rulemakings with direct final rules. Such approaches provided transparency, flexibility, and certainty to all parties involved. In some cases, the negotiated rulemakings achieved record energy savings and probably produced results greater than might have occurred in a traditional notice-and-comment rulemaking. The input and collaboration of multiple stakeholders during such consensus and negotiated rulemakings reduced the burden on the Department. In some cases, such negotiations were directly between stakeholders without DOE involvement, the results of which were presented to DOE for codification. As such, not all rulemakings required the same effort on the part of the Department.

Q17. Appliance standards are generally established in a two-step process. First, DOE establishes a test procedure and then it sets an energy conservation standard. However, there are times, in which DOE works on the conservation standards before establishing test procedures. Do you agree that it is important for transparency and predictability to understand how to test a product before setting the conservation standard?

A17. DOE agrees that it is important to understand how to test a product before adopting an energy conservation standard. To optimize the timing sequence of these activities, it is DOE's practice to finalize test procedure revisions before the energy conservation standard notice of proposed rulemaking (NOPR) issuance date. In this sequence, DOE identifies any necessary modifications to established test procedures before initiating the standards proposal process. In so doing, it considers all stakeholder comments for needed test procedure modifications. DOE believes that preliminary standards-related work and data gathering can commence in concert with the test procedure proceeding, as long as any

anticipated test procedure changes are identified and evaluated in time for them to be factored into the energy conservation standards proposal.

Q18. DOE is the federal agency tasked with R&D on mineral extraction and mineral processing. China dominates mineral processing for the minerals needed for renewable energy facilities, electric vehicles, and battery technology. Why has DOE failed to request money for R&D on mineral processing?

A18. DOE's request includes funding for several activities focused on the separation and processing of critical minerals from both primary mining ores and secondary sources such as recycled materials and mine wastes. Within DOE's Advanced Manufacturing Office, the request includes funding to support validation and verification of improved upstream extraction and midstream separation and processing technologies of critical materials. In response to FY21 Congressional direction, AMO funded a Lithium Research Center focused on converting lithium chloride to lithium hydroxide and lithium-ion (Li-ion) extraction from unconventional sources, and the tenth of ten years of funding for the Critical Materials Institute (CMI), which funds multiple projects devoted to separation and processing of critical minerals. The requested FY22 funding will also enable DOE to leverage the efforts of the CMI and other DOE programs to develop a Critical Minerals Consortium of government, industry, and academic stakeholders, per the Energy Act of 2020. Additionally, DOE's Geothermal Technologies Office (GTO) will build on the FY21 Geothermal Lithium Extraction Prize through planned activities for additional research and technologies that separate lithium or other critical minerals from geothermal brines. The focus of this effort will be a better understanding of the resources, environment, and operations of geothermal power generation sites with potential mineral coproduction. DOE's Vehicle Technologies Office (VTO) supports battery R&D with activities that address nearly every stage of the lithium-ion battery supply chain, to support a resilient domestic market for EV batteries in the coming decade. R&D is focused on reducing the use of cobalt and other non-abundant, non-secure critical minerals; developing silicon-based and lithium-metal batteries which both promise to deliver higher energies and lower costs in smaller formats that use fewer materials; and establishing a battery recycling ecosystem for end of life lithium batteries, including consumer electronic batteries, to recover and re-use critical battery materials.

Q19. In DOE's budget, affordability is defined as "more optimal deployment of assets to meet system needs and minimize costs." I would argue that affordability simply means lower costs.

Q19a. An increasingly distributed grid like we have today is more complex than the electric grid was initially designed. Do you agree?

A19a. The electricity grid was built to handle predominantly centralized generation and one-way power flows. The grid of today now emphasizes resilience in the wake of unpredictable weather events, security breaches, and transitions, such as a changing generation mix, electrification, and more distributed generation. These transitions are not uniform across the country: some regions are transforming in different ways than others, and thus the grid of the future may be more distributed in one region than in another. For regions transitioning to a more distributed grid architecture, more variable power output, fluctuating load patterns, and bi-directional power flow may be drivers that lead to increased system complexity. However, the complexity of today's grid is due to a variety of other trends as well, often in response to customer and operator demands.

The shift to a highly distributed grid can provide significant consumer benefit, including power quality, lower costs, and reliability. Advanced technologies can manage system complexity to provide maximum customer benefits.

Q19b. Do you agree that this complex, distributed nature has resulted in higher total system costs and, therefore, higher costs for consumers?

A19b. Even as grid complexity may increase in some regions due to transitions including emphasis on security and resilience, changing generation mix, and more distributed generation, there are many options that leverage the benefits of grid transitions to support operators and customers. Features such as transactive energy and demand response, advanced options requiring the technologies of a modern grid, may reduce customer costs through economic efficiency and customer participation. Furthermore, advanced technologies work to manage complexity while maintaining or increasing reliability, resilience, and affordability in the evolving system. These technologies include power electronics to manage power flow, energy management systems to optimize performance, sensing and communication technologies to improve observability, modeling and simulation to assist with optimal planning, and cyber technologies to enhance cybersecurity. Utilized together with distribution technologies, these advanced technologies reduce system operator costs and thus have the potential to reduce customer costs, increase customer benefits, or both.

QUESTIONS FROM SENATOR JAMES E. RISCH

Q1. The Advanced Reactor Demonstration Program, within the Office of Nuclear Energy, funds the demonstration of two advanced reactors through a cost-share with the industry partners. It also funds the Nuclear Reactor Innovation Center, NRIC, (located at INL) and other important programs. ARDP supports programs that give these private sector developers access to our national laboratories, user facilities, and expertise. It is an exciting time for nuclear energy to be on the cusp of seeing these new reactors built. Please share your thoughts on the importance of nuclear and advanced reactors to the administration's clean energy goals? Why do you think public-private partnerships are a good model for these reactors?

A1. Nuclear energy can play an important role in the transition to a clean energy economy. Nuclear is the largest source of clean power in the United States (U.S.) and it generates nearly 800 billion kilowatt hours of electricity each year and produces more than half of the nation's emissions-free electricity. The thermal energy from nuclear reactors may also be used to decarbonize other energy-intensive sectors such as transportation – the largest contributor to carbon pollution. In particular, advanced nuclear reactor concepts offer significant potential benefits versus existing technologies, including possible lower costs, enhanced safety and security, greater resource utilization, and simpler operating regimes. Because of these unique attributes and advantages, advanced reactors could allow nuclear energy to increase its contribution to the overall U.S. power generation portfolio as a clean and resilient energy source and will be critical to the U.S. achieving net-zero emissions by 2050.

The Office of Nuclear Energy is supporting the development and demonstration of advanced nuclear reactors by entering into public-private partnerships with the domestic nuclear industry that feature robust non-government cost shares. Based on the tremendous potential value of improved nuclear energy technology, private-sector investment in nuclear innovation has increased significantly in recent years. However, due to the unique technical, regulatory and financial risks associated with the nuclear power industry, the private sector is hesitant to demonstrate these technologies on their own. The U.S. government has an important role to play in reducing risk for developers and in reducing the time required to develop these new technologies. If these advanced nuclear technologies are not developed on an accelerated schedule, the ongoing shift of nuclear technology primacy to other international states (*e.g.*, China, the Russian Federation) will continue, the opportunity may be missed to re-energize the U.S. nuclear industrial sector, and our U.S. vendors may lose a potentially lucrative export market.

NNSA is also working with domestic nuclear reactor vendors in public-private partnerships with NE to help prepare the industry for future international markets and ensure designs meet international safeguards, security, and nonproliferation requirements in line with our export control regulations. Public-private partnerships leverage the strengths of the government and the private sector to enable demonstration of advanced reactors on a timeline that maximizes the impact of advanced reactors on future energy markets.

Q2. Last week, you announced the first of this administration's Energy Earthshots – Hydrogen Shot – with the goal of reducing the cost of clean hydrogen by 80 percent. Chairman Manchin and I authored legislation to accelerate the development of hybrid energy systems last year. Can you discuss how the DOE budget request will support this hydrogen Earthshot? What will you be doing to leverage DOE assets, like the national laboratories to achieve this goal?

A2. The DOE budget request provides a coordinated strategy across multiple offices including the Office of Energy Efficiency and Renewable Energy (EERE), Fossil Energy and Carbon Management (FECM), and Nuclear Energy (NE), and will support both the hybrid energy systems concept and the Hydrogen Energy Earthshot (or Hydrogen Shot). Activities include hydrogen production through electrolysis, thermal conversion (such as fossil and waste with carbon capture and sequestration (CCS)), and advanced pathways such as thermochemical or direct photoelectrochemical conversion, which are all included under Hydrogen Shot. In addition, the budget request includes R&D for hydrogen delivery, storage, fuel cells, turbines, and enabling end-use applications such as in heavy-duty trucks, industrial applications (e.g., ammonia and steel production), power generation, and energy storage (e.g., with offshore wind). National labs are a cornerstone of our efforts and DOE has launched several consortia (e.g., H2NEW for electrolysis) that bring together national labs, industry, universities, and other stakeholders to address the most pressing challenges to reducing the cost of hydrogen and meeting durability and efficiency goals. In addition, DOE has issued a call for proposals for the private sector to work with national labs through Cooperative Research and Development Agreements (CRADAs). Examples include the HyBlend initiative which includes labs and over 20 industry partners to address the challenges of blending hydrogen with natural gas and the use of lab assets to de-risk and validate integrated and hybrid energy systems such as using nuclear and other high-temperature heat sources for hydrogen production.

Q3. There have been a number of high profile cyberattacks on our nation's critical infrastructure or their parent companies in recent years, most recently the Colonial Pipeline was hit with a ransomware attack that led to panic and gas shortages in parts of the United States. During the last administration, the CESER office was created to try and put a focus on the cybersecurity of energy critical infrastructure. This year the President's budget implements a number of changes to CESER and the Office of Electricity. Can you describe why these changes were made, and how they will increase the cybersecurity of our energy critical infrastructure?

A3. The Request moves energy sector cybersecurity R&D associated with electricity delivery systems under OE so it can be better coordinated with other related electricity delivery system R&D. CESER focuses on expanding efforts on risk management tools and technology, emergency response, and information sharing partnerships to enhance preparedness, resilience, and recovery of the U.S. energy infrastructure from all threats and hazards. These changes will also enable CESER to better partner with the Applied Energy and Office of Science programs across the Department and to establish a formal mechanism to ensure that "security by design" is a core principle embedded in all research, development, and deployment (RD&D) conducted by DOE's applied energy and science offices.

CESER has lead responsibility for coordinating energy sector cybersecurity across all DOE applied energy and science offices, as well as conducting cross-cutting cybersecurity R&D to strengthen energy sector cybersecurity more broadly. This includes developing tools and technologies to detect and mitigate cyber threats and working with the industry and State, local, Tribal, and territorial (SLTT) communities on cyber preparedness and response.

Q4. What entity at DOE will coordinate the cybersecurity R&D efforts across the applied energy and science offices, and how will the leadership roles be defined for these efforts?

A4. CESER will coordinate energy delivery systems cybersecurity research and development (R&D) across the applied energy and science offices within DOE. CESER kicked-off an effort in May 2021 to work with the applied offices to collaboratively develop a formal coordination mechanism. CESER expects this effort will ensure that "security by design" is a core principle in all research, development, and deployment (RD&D) conducted by DOE, which will strengthen energy sector cybersecurity broadly.

Q5. Thank you for your response to the letter Senator King and I led in support of CESER and for maintaining its leadership at the Assistant Secretary level. My understanding is that the Department is

considering moving away from having a senate confirmed leader for CESER. The Department's budget proposes "that the Office of Petroleum Reserves report to the Assistant Secretary for CESER" to better align various functions – can you please explain if the Department plans to nominate an individual for the CESER Assistant Secretary Position?

A5. CESER plays a vital role in the DOE's efforts to secure and protect the Nation's critical energy infrastructure from all threats and hazards. As the office responsible for executing DOE's risk management, preparedness, and emergency response capabilities for the U.S energy sector, it is critical that CESER have consistent, professional, nonpartisan leadership at the helm. To ensure the long-term success of the office, DOE is committed to hiring strong career staff who have both the subject matter expertise and relationships with the sector that can span multiple Administrations. While I do not yet know whether the President will nominate as Assistant Secretary for this position, the Department has not waited to fill critical senior roles with experienced professionals who will lead this office to best perform for the Nation when called upon.

Q6. The Energy Organization Act states that there shall be eight Assistant Secretaries at the Department. There will be one Assistant Secretary vacancy at the Department if an individual is not nominated to lead CESER. Does the Department plan on nominating an Assistant Secretary to lead a different office if the leadership at CESER is moved to the career level. If so, what office?

A6. The Department continues to fill critical vacancies, including Under Secretary and Assistant Secretary positions. I do not yet know whether the President will nominate an Assistant Secretary for this position. Regardless, the Department will ensure that CESER is led by professional career staff who are committed to the important mission the organization plays to enhance the security of the U.S. energy sector.

Q7. Many countries are pursuing nuclear energy as a source of clean, reliable, and safe baseload power. A new reactor is a 60+ year investment and relationship, and it is critical American companies have a seat at the table to compete for and win these opportunities. Otherwise, we will see China and Russia continue to build their market share. US international leadership in nuclear energy technology is critical to diplomacy and has implications for international standards for nuclear safety and continued US leadership in nonproliferation. How are you supporting American developed technologies to expand our leadership on the world stage as we compete with the likes of China and Russia?

A7. One of the top priorities of the Department of Energy's (DOE) Office of Nuclear Energy (NE) is to support industry in expanding the footprint of U.S. technology exports. Our goal for U.S. innovative

nuclear technologies should be to innovate here, build here, and deploy everywhere. We recognize the critical role that government plays in leveraging bilateral relationships to develop robust civil nuclear cooperation, strong cooperation agreements to include intergovernmental agreements and technical expertise collaboration, in order to underpin and bolster commercial opportunities and provide direct support to our U.S. companies. We have found that leveraging the strategic partnership which overlays the commercial engagement from the outset, as is the case with Poland and Romania, have helped to facilitate the policy, financial and technical discussions needed to move these projects forward.

As mandated by the FY 2021 Omnibus Appropriations legislation, NNSA is working with the NRC and NE to help prepare the U.S. advanced reactor industry for future global markets by assisting with the integration of international safeguards, security, and other nonproliferation features early in the design process. This will help U.S. designers meet international requirements and be in compliance with our own export control regulations, thereby increasing the marketability of U.S. designs globally.

NE continues to work closely with our U.S. industry partners to review desired market opportunities, focus specific country engagement; build in-country regional leaders which support technology expansion opportunities; and deploy resources that target the human resource development, other infrastructure development, energy analysis and technical reviews needed to advance the countries' market readiness. We have long recognized the need to formalize discussions on industry's priority countries and are pleased to be leading efforts in coordination with DOE's Office of International Affairs to have working-level discussions with industry associations to better understand how we might move our efforts forward in a coordinated manner.

As we look to further support American companies and position them as viable competitors to China and Russia, we have to continue to work on addressing the challenge of financing. To that end, NE has expanded our capability to utilize internationally recognized financial consultants and extended that service to our industry partners and their international commercial partners so that we are able to best inform the structuring of the deals and the policies that govern them. We have also worked with the other departments and agencies to find creative solutions to contribute to funding the front-end engineering work to facilitate our industry's ability to advance a project. We have also continued

dialogue with our colleagues at the U.S. International Development Finance Corporation and the Export-Import Bank of the United States on the nuances of specific countries that are of near-term interest to our industry partners.

The Department's support for demonstrating advanced reactor designs like the Advanced Reactor Demonstration Program will support these technologies in becoming a reality that can be exported globally. Not only will this lead to jobs in the United States but will also allow the United States to have a key voice in shaping the global safety and security norms for these next generation technologies.

Q8. It is important that Office of Electricity and CESER each have their own Assistant Secretary to ensure that their crucial missions are getting the full attention of a capable professional. How many career cyber and energy crisis management professionals have been hired in CESER since an acting Assistant Secretary was named in January, 2020?

A8. CESER currently consists of 23 federal employees, of whom 17 are focused on various energy security and emergency response activities. Hiring and recruiting cyber and emergency response talent is a priority focus area of CESER leadership to ensure DOE accomplishes its national security mission in support of the U.S. energy sector.

Q9. During the last Administration, DOE and the State of Idaho added a supplement agreement to the 1995 Settlement Agreement that would allow the INL to continue to do important nuclear research and development while ensuring that there is accountability for the Department to dispose of the wastes stored on-site. Specifically, it provides a path forward for additional research at Lab once the Integrated Waste Treatment Unit begins operating and processing sodium-bearing waste. Can you please explain what steps the Department is taking to process the sodium bearing waste on site, including timelines and milestone for the operation of the IWTU?

A9. The Idaho Site Treatment Plan (STP) contains milestones for operation of the Integrated Waste Treatment Unit (IWTU). The first of these milestones will be missed due to impacts caused by the COVID-19 worldwide pandemic. The missed STP milestone states: "DOE will commence operation of the IWTU and fill one canister by 3Q FY 2021 in accordance with the milestone in Table 5-1." Due to these pandemic impacts, DOE transmitted a letter to the Idaho Department of Environmental Quality on June 28, 2021 requesting a fifteen-month extension to the IWTU STP operational milestones and is awaiting their formal response to the request. The IWTU project is currently completing final facility modifications and system testing prior to a "Confirmatory Run", that consists of operating the facility

for approximately 50 days using non-radioactive waste simulant to ensure all facility systems are operating as designed. Once this Confirmatory Run is completed, the facility will shut down and conduct final facility inspections. The Confirmatory Run and inspections are not part of the STP but will ensure the IWTU facility is operating as designed and is ready to begin processing the sodium bearing liquid radioactive waste. Once these confirmatory activities are complete, facility operations will resume using waste simulant and transition to radioactive waste processing. DOE estimates that, if no additional pandemic-related delays and no additional operational issues are encountered, the facility will begin radioactive waste treatment operations in 2022.

Q10. The near term transition of the Idaho Cleanup Project to a new contractor offers an opportunity to address how EM works collaboratively with NE to address environmental legacies and wastes from ongoing operations. What is the Department doing to establish a long-term strategy to disposition legacy spent nuclear fuel and that from ongoing operations of reactors to meet Idaho Settlement Agreement commitments and support the laboratories enduring mission? What steps is the Department taking to ensure that the cleanup work at the Lab does not lose momentum during the transition?

A10. DOE has recently approved the mission need for a spent nuclear fuel (SNF) staging capability at the INL. This capability will support a potential future SNF packaging demonstration project to explore the capability to package SNF safely. The current and future contracts contain requirements for both contractor organizations to minimize transition impacts to operations. These requirements, along with close federal oversight of transition activities, will ensure any disruptions caused by contract transition activities are addressed/resolved in a timely manner.

Q11. The budget request "continues efforts to develop technologies to ensure safe and effective fish passage for migratory species by partnering with the National Laboratories and the private sector with an eye toward field demonstration and deployment." Can you please outline what research and technologies are being developed by DOE related to fish passage, including partnering DOE institutions and other federal agencies?

A11. DOE's Water Power Technologies Office (WPTO) supports monitoring and mitigation technologies R&D at the national laboratories for fish passage, and basic and applied science to understand the effects of hydropower on fish. The Pacific Northwest National Lab (PNNL) and Oak Ridge National Lab (ORNL) HydroPASSAGE project has led to the development of low impact hydropower turbines – including some with over 99% fish passage survival predicted. Under HydroPASSAGE, PNNL

developed the Biological Performance Assessment (BioPA) Tool, commercialized the Sensor Fish, and developed the Hydropower Biological Toolkit. With support from WPTO and the U.S. Army Corps of Engineers, PNNL also developed the Juvenile Salmon Acoustic Telemetry System (JSATS) and a miniature version of Juvenile Eel/ Lamprey Tag to enable monitoring of fish passage and fishways.

WPTO provides a variety of funding the private sector, including small businesses, for fish passage engineering, design, and biological evaluations and facilitates partnering with the national labs to utilize facilities and expertise. WPTO's Funding Opportunity Announcement (FOA) Innovative Solutions for Fish Passage at Hydropower Dams delivered evaluations of two novel fishways and a new tool to detect migrating fish. The University of Massachusetts with partners at the U.S. Geological Survey, U.S. Fish and Wildlife Service, and the National Oceanic and Atmospheric Administration (NOAA) completed a laboratory evaluation of the Entrance Palisade, for lower cost upstream passage of multiple species of concern. Alden Research Labs evaluated a Modular and Scalable Downstream Passage design for American eel and field-tested a prototype with an owner/operator partner in New Hampshire. The Electric Power Research Institute leveraged existing sonar data from industry partners on the St. Lawrence River and collaborated with PNNL to develop an Artificial Intelligence method to detect and accurately classify American eels in a high flow river system.

WPTO utilized PNNL in the Small Business Voucher pilot program to support the evaluation of Whooshh Innovations' innovative upstream fish passage device, known as the "salmon cannon." WPTO is utilizing PNNL voucher support to advance three solutions awarded in the Fish Protection Prize, in partnership with the Bureau of Reclamation under the Federal Hydropower Memorandum of Understanding (MOU), awardees include 1) Benjamin Mater of Alden Research Laboratory and Charles Coutant's, Making a Deal with the Devilfish: Biometric-Informed Screening Technology; 2) Prometheus Innovations, LLC's Fish Diversion Material & Inspection Improvements; and 3) Natel Energy's The Center Sender. WPTO is also utilizing ORNL's technical and advanced/additive manufacturing capabilities for FOA Topic Modular Technologies for Low-Head Hydropower Applications, to develop "Fish Passage Modules." Awards include 1) Percheron Power's helical module based on the Archimedes Screw Turbine for bidirectional multispecies passage; 2) Natel Energy's fish-friendly, low-head

generation module; and 3) Littoral Power Systems' concept for a multispecies module that integrates into Littoral's Standard Modular Hydropower System.

Q12. I appreciate your understanding and support of the need for a secure and domestic supply chain for critical minerals and their importance for clean energy technologies. What specific steps are you taking to coordinate with the Secretary of Interior and the Secretary of Agriculture to ensure they are permitting projects to source these minerals domestically in a streamlined and efficient manner to ensure we are not reliant on China and others?

A12. While DOE does not have a direct role in the permitting process for mineral extraction, DOE coordinates closely with resources management and science agencies within the Departments of the Interior and Agriculture as part of a whole-of-government approach to ensuring resilient and secure supply chains for rare earth elements and other critical minerals used in clean energy technologies. DOE and the Department of the Interior (U.S. Geological Survey) co-chair of the National Science and Technology Council (NSTC) Critical Minerals Subcommittee (CMS). In this capacity, DOE helps lead interagency efforts to improve processes for critical mineral extraction, separation, purification, and alloying, as well as efforts to reduce the need for primary mineral extraction, such as developing critical minerals recycling and reprocessing technologies, and technological alternatives to critical minerals. In furtherance of these efforts, the DOE budget request supports a portfolio of new early-stage projects to address emerging critical materials needs for the Nation based on an updated materials criticality assessment, which will be conducted in coordination with the Department of the Interior.

Q13. The use of High Assay Low Enriched Uranium (HALEU) in coated particles, like TRISO fuel, has applications for space power and propulsion. This is very exciting and provides a much safer launch environment for nuclear reactors that are critical to both developing a sustained presence on the lunar surface and as a propulsion system to Mars. Could you talk to your view of the DOE/NASA/DOD relationships and what DOE is doing to support these missions? Can you talk to the role that INL is playing in these programs?

A13. Coated particle fuels, such as TRi-structural ISOtropic (TRISO) fuel, may be more resistant to neutron irradiation, corrosion, oxidation, and high temperatures than traditional reactor fuels. These fuels include uranium fuel kernels covered by layers of material that protect the fuel from damage during high-temperature operation and exposure to hydrogen propellent. The potential use of High-Assay, Low-Enriched Uranium (HALEU) in coated particle fuels has numerous potential applications in both

terrestrial and space applications, including nuclear thermal propulsion (NTP) and mobile nuclear reactor modules. The development of space reactors and mobile terrestrial reactors can benefit by leveraging the ongoing commercial and U.S. Government work on advanced nuclear energy systems.

The Department of Energy (DOE), the Department of Defense (DOD), and the National Aeronautics and Space Administration (NASA) share a mutual interest in advancing nuclear fuel production technologies in furtherance of ongoing research, development, and deployment efforts to support their respective missions. In support of these efforts, DOE has partnered with DOD and NASA through a Memorandum of Agreement to establish a commercial capability to produce coated particle fuels. This work scope is being executed by BWX Technologies (BWXT) at their Lynchburg, Tennessee, facility through a contract with the Idaho National Laboratory (INL). Under this joint effort, BWXT has successfully completed the restart of their TRISO fuel line and is actively producing fuel.

DOE's National Laboratory infrastructure is a key component of NASA and DOD nuclear reactor technology development and testing strategies. Specifically, at INL transient irradiation testing of NTP fuel and reactor components is occurring at the Transient Reactor Test (TREAT) facility and long-duration irradiation testing and post-irradiation examination of TRISO fuels is occurring at INL's Advanced Test Reactor and the Irradiated Materials Characterization Laboratory. INL is also providing significant additional support to the reactor development and demonstration activities funded by NASA and DOD. This support covers a broad range of activities, such as leading the procurement efforts for commercial industry designs of NTP and fission surface power systems, developing advanced modeling and simulation of space nuclear fuels and reactor operations, and evaluating siting options for testing and demonstrating space nuclear power and propulsion technologies.

U.S. Senate Committee on Energy and Natural Resources
June 15, 2021 Hearing: *The President's Budget Request for the Department of Energy for Fiscal Year 2022*
Questions for the Record Submitted to the Honorable Jennifer Granholm

QUESTIONS FROM SENATOR STEVE DAINES

Q1. Secretary Granholm, I would like to follow up to our discussion on the implementation of the EFFECT Act (Section 4002 of P.L. 116-260) and how Montanans are able to participate in that specific program that was already enacted into law. What specific steps should I tell interested Montanans that they should take in order for DOE to consider them for the location of the large-scale CCUS pilot project detailed in the bipartisan EFFECT Act?

A1. The Department of Energy (DOE) issues competitive funding opportunity announcements (FOAs) when implementing its appropriated budget. The Office of Fossil Energy and Carbon Management is responsible for implementing DOE's carbon capture, utilization, and storage research and development programs. These programs typically issue FOAs through the National Energy Technology Laboratory. Information on upcoming and current FOAs, and how to do business with DOE can be found at the following website: https://netl.doe.gov/business/solicitations.

Q2. Secretary Granholm, can you detail the normal process that interested parties must follow to participate in a DOE funded pilot project?

A2. The normal process for new Department of Energy (DOE) funded pilot projects typically starts with DOE issuing a competitive funding solicitation (usually a Funding Opportunity Announcement (FOA) for financial assistance awards). Once the solicitation is posted, interested parties submit applications to that solicitation. All applications that are responsive to the objectives and requirements of the solicitation are reviewed by a Merit Review Panel in accordance with 2 CFR 200.205 and the DOE Merit Review Guide for Financial Assistance. If the applicant is selected for award, DOE will negotiate the terms of the resultant financial assistance award, including scope, schedule, and budget. Once the project begins, DOE will continue to be substantially engaged in the project, and award Recipients are expected to regularly communicate project progress. Most DOE projects are financial assistance awards with a minimum Recipient cost share required — at least 20 percent for research and development programs (including pilot scale projects) or 50 percent for demonstration or commercial application programs. Information on upcoming and current FOAs, and how to do business with DOE can be found at the following website: https://netl.doe.gov/business/solicitations.

Q3. Secretary Granholm, of the provisions included in the Energy Policy Act that was signed into law as part of the Consolidated Appropriations of 2021 (P.L. 116-260) what was specifically included in your budget request?

A3. The authorizations for research and development and demonstration and deployment are so critical to providing the department with a great starting foundation. We continue to move forward on several the provisions, including, but not limited to geothermal ($163M), grid modernization ($1.1B), energy storage ($1.1B), and carbon capture, utilization, and storage ($305M). In addition to our FY22 request, the Bipartisan Infrastructure Framework and Build Back Better agenda would fully fund much of the Energy Act of 2020 implementation.

Q4. Secretary Granholm, your budget request was $6.6B more than FY21 enacted levels. How much of that additional request is directed to the new authorities enacted in the Energy Policy Act?

A4. I look forward to working with Congress to see that the authorizations in the Energy Act of 2020 are funded. The Bipartisan Infrastructure Framework and Build Back Better agenda would fully fund much of the Energy Act of 2020 implementation.

Q5. Secretary Granholm, your budget request was $6.6B more than FY21 enacted levels. How much of that additional request comes from programs that have not been directly authorized by congress?

A5. The President's FY22 Request is an investment to advance key priorities including creating jobs through clean energy projects, bringing America to the forefront of clean energy innovation, tackling the climate crisis with the urgency that science demands, investing in communities that have been left behind, and ensuring the safety and security of the nuclear stockpile.

Q6. Secretary Granholm, I would like to follow up to our discussion on critical minerals. In the discussion with Chairman Manchin and myself you mentioned the recycling of certain critical minerals as part of DOE's goal to reduce dependence on foreign countries for our supply of critical minerals. By your estimate, how much of a percentage impact will recycling have on U.S. import dependence on the Department of the Interior's list of critical minerals?

A6. It is difficult to quantify the percentage impact of recycling on U.S. net import reliance for all critical minerals because of the unique nature of the supply chain for each critical mineral. However, recycling has the potential to help reduce net import reliance for critical and other important minerals as part of a strategy that also includes reducing demand through manufacturing improvements and substitution and

increasing supply through environmentally sound domestic primary production and trade ties with reliable partners.

Projections of the impact of recycling on primary demand for minerals can depend very strongly on the assumptions made, however, there is a consensus among many studies that a significant portion of primary demand could be met. The 100-day review conducted by DOE under Section 3 of Executive Order 14017, America's Supply Chains (Feb. 24, 2021), estimates that about 20 percent of nickel demand could be met by 2030, while the cobalt contribution could peak at just under 80 percent in that year, but then decline as advanced low-cobalt, or cobalt-free batteries enter the processing stream.[1] The International Energy Agency's May 2021 report "The Role of Critical Minerals in Clean Energy Transitions" estimated that with policy support to boost collection rates and promote product design to streamline recycling processes, secondary supplies could contribute 12 percent of the total demand for cobalt, seven percent for nickel, and five percent for lithium, worldwide, by 2040.[2] The World Bank Group, in its report "Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition," estimates that recycling could reduce global primary demand for cobalt, nickel, and lithium by 15, 23, 26 percent, respectively, by 2050.[3]

Q7. Secretary Granholm, you mentioned brine extraction as a way to produced lithium. According to USGS, the United States is currently 50% import reliant on Argentina, Chile, China, and Russia for our lithium supply. Will this new method of extraction have a significant impact on our import reliance and if so by what percentage?

A7. The budget request includes funding for continued research on improving technologies for extracting lithium from geothermal brines as well as lithium clays. While it is difficult to estimate how much domestic lithium production will increase due to new extraction technologies, the development of new and improved methods for extracting lithium will enable U.S. mining companies to better utilize substantial domestic lithium resources. According to the U.S. Geological Survey, domestic lithium consumption in 2020 was approximately 2,000 metric tons, compared with estimated domestic

[1] "Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth", 100-day review under Executive Order 14017.
[2] The Role of Critical Minerals in Clean Energy Transitions – Analysis - IEA
[3] Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition

resources—from brines, clays, and hard rock lithium—of approximately 7.9 million tons. Domestic U.S. resources make up almost 10% of the 86 million tons of estimated resources worldwide. Identified lithium resources have increased worldwide in recent years due to continuing exploration. In the Salton Sea region of California, where DOE is currently funding technology developments and demonstrations to extract, separate, and process lithium from geothermal brines, the annual lithium resource potential is estimated by the California Energy Commission to be 600,000 tons, which currently exceeds the annual U.S. demand for lithium and could transform the United States from a net lithium importer to a net exporter. The DOE budget request includes continued funding for improved lithium extraction and processing methods as well as other complementary research and development efforts that support the Federal Consortium for Advanced Batteries' National Blueprint for Lithium Batteries 2021-2030. The Blueprint also calls for research and development to develop alternatives to critical minerals such as cobalt in battery applications and enable end-of-life reuse and recycling of battery critical materials.

Q8. Secretary Granholm, DOE is the agency tasked with mineral R&D. Specifically in P.L. 104-134 with "technological investigations and research concerning the extraction, processing, use and disposal of mineral substances." Outside of the lithium example given during the hearing, what other efforts is DOE undertaking or were included in your budget request to increase domestic mineral extraction?

A8. The budget request includes funding that will support environmentally sound domestic extraction of mineral substances, including rare earth elements, tellurium, and other minerals used in the production of batteries, magnets, and other components of clean energy technologies. This includes the continuation of projects funded by DOE's Advanced Manufacturing Office (AMO) focusing on improved separation and processing of rare earth elements from primary mining as well as from secondary sources such as recycled materials and mine wastes. The request will also support the establishment of a new lab-industry consortium and other DOE programs to de-risk and validate successful technology innovations for critical minerals, including separation and processing technologies, per the Energy Act of 2020. DOE's Vehicle Technologies Office (VTO) supports battery R&D with ongoing activities focused on significantly reducing or eliminating the use of cobalt and other, non-abundant, non-secure, critical minerals in lithium-based batteries; significantly reducing or eliminating the use of heavy rare earth minerals in electric drive motor magnets, and reducing platinum group metals in internal combustion engine emissions control systems. VTO also supports R&D to establish a lithium battery recycling chain

for end-of-life batteries and the recovery and re-use of critical materials battery to support a domestic battery materials supply chain.

Q9. Secretary Granholm, Montana just passed a number of laws that help make way for the next generation of nuclear energy. Nuclear energy can provide clean, safe, baseload power and just like CCUS, it should play a major role in any discussion of a clean energy future. How does the Department of Energy's budget reflect research and development of advanced nuclear energy?

A9. The Department of Energy's (DOE) Office of Nuclear Energy (NE) fiscal year (FY) 2022 Budget Request clearly recognizes the important role that advanced nuclear energy will play in combating the climate crisis, creating clean energy jobs with the free and fair choice to join a union, and growing America's economy through innovative science and technology. The FY 2022 request includes nearly $700 million (M) to help drive innovative United States (U.S.) advanced reactor technologies to market within the decade, including $305M to support the maturation of emergent advanced reactor designs.

Specifically, NE requested $65M for the Advanced Reactor Technologies (ART) program that supports innovative reactor concepts including fast reactors, molten salt reactors (MSR), high temperature gas-cooled reactors (HTGR), and microreactors. In FY 2022, the ART program will address the highest priority, industry-identified challenges associated with advanced reactor technologies and systems and will continue to support industry-led, innovative, cost-shared research and development (R&D) activities through competitive awards to help reduce long-term technical barriers for innovative reactor concepts. TRi-structural ISOtropic (TRISO) fuel qualification activities will also continue in FY 2022, to qualify this robust fuel form for use in multiple advanced reactor designs.

Further, the FY 2022 Budget requests $50M to support five Advanced Reactor Demonstration Program (ARDP) Risk Reduction projects to aid advanced reactor developers in resolving technical, operational, and regulatory challenges to development of a diverse set of designs that could have significant impact on the energy market in the next 10 to 14 years. Additionally, in support of Small Modular Reactors (SMR), the NE request includes $115M to support continued investment in ongoing and new projects to advance multiple U.S. SMR technologies.

In FY 2022, NE will make investments to support Advanced Reactor Regulatory Development activities by performing targeted R&D to address and resolve key regulatory framework issues that directly impact the critical path to advanced reactor demonstration and deployment. In addition, the National Reactor Innovation Center (NRIC) seeks to accelerate the development and demonstration of advanced reactors by enabling access to the research and demonstration infrastructure needed to take these reactors from blueprints to reality.

The NE FY 2022 Budget also requests $145M to help build the nation's first fast test reactor in more than two decades. The Versatile Test Reactor will be capable of performing irradiation testing at higher neutron fluxes than what is currently available today and is needed to accelerate the testing of advanced nuclear fuels, materials, instrumentation and sensors required by new designs and the existing fleet. Finally, the NE FY 2022 Budget requests $124M to conduct crosscutting R&D in topical areas such as modeling and simulation tools, advanced sensors and instrumentation, nuclear cybersecurity, advanced materials and manufacturing technologies, and integrated energy systems, and to support industry, university, and national laboratory access to unique, world-class nuclear energy research capabilities through the Nuclear Science User Facilities (NSUF) program.

Q10. Secretary Granholm, what steps should Montana leaders and communities take and how can they work with DOE to be the next location for an advanced nuclear project?

A10. The Office of Nuclear Energy is supporting the development of a diverse set of advanced reactor designs. States such as Montana and the utilities servicing their citizens are encouraged to work directly with United States advanced reactor developers to determine whether these advanced designs fit within their integrated resource planning processes and potentially provide alternatives to replace aging and retiring fossil energy plants. States should also consider whether legislative actions such as tax credits for clean nuclear energy production provide appropriate incentives for utilities to deploy advanced nuclear generation. While preparing for future nuclear operations, states may also want to consider providing support for nuclear workforce-focused curricula at local community colleges and vocational schools.

QUESTIONS FROM SENATOR LISA MURKOWSKI

Q1. Please provide an update to me on what the Department has done, continues to do, and plans to do to implement the Energy Act of 2020, which so many of us on this committee worked so hard to develop. Where do you and the Department rank this implementation on your list of priorities? Is this prioritization reflected in the Department's budget? Can you point to specific accounts or programs as an example?

A1. **Title I – Efficiency**

DOE is undertaking the following actions to implement section 1011 of the Energy Act of 2020 related to the Weatherization Assistance Program (WAP):

- DOE plans to issue a funding opportunity announcement in the fall of 2021 to implement section 414D, Financial Assistance for Enhancement and Innovation. DOE has set aside $18.6 million for this opportunity from FY21 funds.

- DOE plans to propose regulations in FY22 to implement the statutory changes enacted in section 1011, including the provisions to modernize the definition of "weatherization" as provided in section 1101(b), to include the consideration of weatherization's non-energy benefits as provided in section 1101(c) and to amend the reweatherization date as provided in section 1101(h).

DOE is undertaking the following actions to implement other sections of the Act including:

- The President's FY22 Budget request calls for additional funding to help improve efficiency and lower energy costs for schools (Section 1001) via the EERE Building Technologies Office (BTO).

- DOE's is prioritizing activities related to R&D program focused on building-to-grid integration and grid-interactive efficient buildings.

- DOE's BTO published an early assessment request for information (RFI) undertaking an early assessment review for amended energy conservation standards for ceiling fans to determine whether to amend applicable energy conservation standards for this product.

- DOE'S BTO is developing a report to Congress on the benefits of electrochromic glass on energy consumption and occupant comfort in buildings.

Title II - Nuclear
The Department of Energy has been implementing many of the Title II - Nuclear programs called out in the Energy Act of 2020 and views its implementation as important to ensure nuclear energy is a key element in meeting our aggressive climate goals. The Department has followed through on the direction under this title including continuing with the Advanced Reactor Demonstration Program, continuing planning for the Versatile Test Reactor, and implementing the Integrated Energy System subprogram within the Office of Nuclear Energy. In addition, the Department worked to implement to the maximum extent possible, the 20% nuclear energy research and development funding for the Nuclear Energy University Program. The President's budget for fiscal year 2022 requests funding to start new programs, such as the High-Assay, Low Enriched Uranium (HALEU) Availability subprogram (section 2001), and International Nuclear Energy Cooperation has been restored as a standalone program. The Department is working to implement other aspects of Title II and we look forward to continuing this process.

Title III - Renewable Energy and Storage.
The Department's FY22 budget request and recent activities are aligned with the Energy Act of 2020. The FY22 budget request proposes strong growth in funding across the Department's renewable power offices, with significant increases for solar, wind, geothermal and waterpower R&D directly in line with sections 3001-3004 of the Energy Act. There is an enhanced emphasis on supporting all elements of the technology development cycle, from concept design to demonstration and deployment, as well as ensuring renewable generation is integrated into the grid in a way that maintains or increases overall reliability and resilience. This includes increased support to state and local governments and communities to plan and operate clean, reliable power systems, as well as support to ensure secure supply chains and well-paid, stable jobs in communities across the U.S.

These efforts are closely aligned with the Energy Act of 2020. Examples of specific programs include:

- EERE's Solar Energy Technologies Office (SETO) requested $100M to grow domestic solar manufacturing through the solar Manufacturing and Competitiveness subprogram (Section 3004).

- EERE's Wind Energy Technologies Office (WETO) and SETO are demonstrating the ability and robustness wind and solar energy in providing critical grid services, such as frequency regulation, load following, and contingency reserves (Section 3003 and Section 3004).
- EERE's Water Power Technologies Office (WPTO) requested additional funding for HydroWIRES to increase the flexibility of hydropower through operational improvements, supporting development and testing of innovative pumped storage hydropower technologies, and investing in the environmental systems to keep the fleet online (Section 3001).
- EERE's Geothermal Technologies Office (GTO) request includes prioritization of the successful Frontier Observatory in Research in Geothermal Energy (FORGE) program (Section 3002).
- EERE is developing a grid integration research and development (Section 8004) plan to coordinate RD&D activities on integrating renewable energy and electric vehicles onto the grid.
- The Department's Grid Modernization Initiative has been and will continue to coordinate (Section 8006) grid modernization effort with a variety of relevant entities including utilities, states, national laboratories, vendors, etc. through activities such as workshops and a project peer reviews.
- EERE (SETO) requested $15M to apply concentrating solar-thermal technologies to the industrial sector for production of solar-derived industrial products, chemicals, and fuels (Section 3004).
- EERE (SETO) requested $20M to increase participation of underrepresented groups in the solar industry through a national career accelerator to train and diversify the solar and clean energy workforce and build pathways for career placement and advancement in both solar installation and manufacturing (Section 3004).
- EERE (WETO) is exploring the potential for, and technical viability of, airborne wind energy technologies, which convert wind energy into electricity using tethered flying devices (Section 3003).
- EERE (WETO and SETO) has established a project team and obligated funding to support the development of a Wind and Solar Energy Technology Materials Physical Property Database, which will identify the type, quantity, country of origin, source, significant uses, projected

availability, and physical properties of materials used in wind and solar (Section 3003 and Section 3004).

- EERE (WETO) has made investments in projects already underway to focus on blade recycling, including technology development efforts to recycle fiberglass for use by the automotive industry. WETO also plans to focus future endeavors on recycling critical materials as they become more predominant in the growing offshore wind industry (Section 3003).
- EERE (GTO) through the FY21 and planned FY22 Amplify initiative invested in a portfolio of enhanced geothermal systems (EGS) demonstration projects located at the margins of existing geothermal production fields where teams will add new, low-cost, clean EGS power to the grid from wells that would otherwise sit idle (Section 3002).
- EERE's (GTO) planned FY22 effort "Community Geothermal Heating & Cooling Technical Assistance & Deployment" will provide technical assistance funds to competitively selected geographic coalitions to demonstrate and deploy community-scale geothermal systems. The effort will target urban centers, rural areas, energy communities, and remote communities where geothermal has high technical and economic potential and can reduce dependence on fossil fuels (such as natural gas and heating oil) (Section 3002).
- EERE (GTO) has proposed and started scoping a new effort, GEODE (Geothermal Energy from Oil and gas Demonstrated Engineering), that will be designed to leverage oil & gas subsurface assets, transfer technologies, and expertise to help address geothermal challenges while providing clean energy employment opportunities for communities adversely impacted by the fossil energy sector decline (Section 3002).
- In FY21, EERE (GTO) is partnering with the Federal Energy Management Program to conduct suitability screenings for the installation of geothermal heating and cooling systems at Department of Defense, National Park Service, and DOE National Lab facilities. This screening will inform proposed FY22 field validation work at one or more promising Federal sites (Section 3002).
- EERE (WPTO) is evaluating how best to implement the amended language on including entities that serve inadequate electric service to expand the eligibility for the EPAct 2005 Section 242

Hydro Incentive Program (Section 3005) and is conducting a technical analysis of the terms to determine metrics. WPTO also plans to request inputs from stakeholders through an RFI.

- EERE (WPTO) is developing technical assistance to support hydropower developers to consider microgrids and storage, and through the Energy Transition Initiative Partnership Project to support remote and isolated communities to develop technology-neutral approaches in microgrids and includes system configurations with storage (Section 3202).
- EERE (WPTO) is examining opportunities for research and development in advanced technologies for non-power sector applications, including applications with respect to the maritime transportation and associated maritime energy infrastructure needs, as well as in enabling missions at sea in the Arctic. The report is being developed in coordination with other EERE offices and will coordinate with other respective agencies on identifying gaps and opportunities in R&D (Section 3001).
- Building on the Powering the Blue Economy effort, with new authorization explicitly providing for expanded microgrid, desalination, and ocean observing work, EERE (WPTO) is increasing its activities to support how marine energy can meet the power needs in the blue economy, including in hybrid energy configurations (Section 3001).

These examples serve to highlight the alignment of the Department's FY22 budget request and ongoing activities with the Energy Act of 2020. The Energy Act of 2020 also specified a number of requested studies. The Department is developing these studies expeditiously.

The Department continues to ramp its efforts on energy storage. The Energy Storage Grand Challenge, for example, has already led to numerous funding opportunities and awards (here). The Department's FY22 budget request also includes significant new funding for storage. Consistent with the Energy Act of 2020, and among other areas, this funding will support: the Energy Storage Grand Challenge to evaluate, validate, and demonstrate a wide range of new storage technologies; full construction of the Grid Storage Launchpad to consolidate existing materials research and new characterization and testing capabilities focused on grid-scale energy storage; and technical support to a diversity of external stakeholders.

Title IV – Carbon Management; Title V – Carbon Removal.

Titles IV and V, Carbon Management and Carbon Removal authorizes RD&D programs for a suite of initiatives to commercialize Carbon Capture, Utilization and Storage, carbon removal from the atmosphere, and hydrogen technologies. The Office of Fossil Energy and Carbon Management (FECM) FY22 budget request would provide funding to enable near-term work to develop and deploy technologies for the power and industrial sectors. These investments will be critical to meet our climate goals of 50% emissions reductions by 2030, 100% clean electricity by 2035, and net zero carbon emissions by 2050. Carbon dioxide removal will be an important tool to achieve economy-wide net zero emissions by 2050. The goal is to enable the commercialization of clean energy innovations that will activate job creation, benefit climate vulnerable communities, and yield a more geographically diverse and impactful research portfolio. Major priorities of the FECM budget request include:

- Accelerate Carbon-Neutral Hydrogen (H2): Develop technologies that leverage the natural gas infrastructure for H2 production, transportation, storage, and use coupled to carbon management. Hydrogen offers an emissions free fuel for power generation, industrial applications, and the transportation sector.
- Develop Low-Carbon Supply Chains for Industries: Develop novel approaches to recycle carbon oxide emissions, principally carbon dioxide (CO2), into value-added products such as cement, concrete, steel, chemicals, and fuels using systems-based carbon management approaches.
- Advance Carbon Dioxide Removal: Research, develop, and demonstrate CDR technologies and approaches by investing in Direct Air Capture (DAC) and mineral carbonation projects.
- Demonstrate and Deploy Point Source Carbon Capture and Storage: RDD&D for CCS in the power and industrial sectors to enable wider, strategic commercial deployment to meet net-zero emissions goals by 2050.

FY22 objectives and planned activities for carbon removal approaches across DOE offices include:

<u>Crosscut Objectives:</u>

- ***Capturing Carbon Emissions Directly from the Air and Ocean:*** Conduct RDD&D on CDR technologies and systems. These approaches include, but are not limited to BECCS, DAC,

biological approaches, geologic/enhanced mineralization, soil carbon sequestration, afforestation/re-forestation, DOC, enhanced ocean alkalinity, and coastal blue carbon.

- ***Remove Carbon Emissions Directly from the Air and Ocean:*** Conduct RDD&D on CDR technologies and systems.
- ***Enable Low-Cost and Scalable CDR Infrastructure:*** Identify and address critical barriers to reducing the costs and energy requirements for CDR systems through targeted research investments. Promote and demonstrate the strategic deployment of diverse CDR systems and strategies.
- ***Address Resource and Sustainability Requirements:*** Assess availability of primary energy, water, and other inputs to ensure holistic, sustainable, low and negative-life-cycle emissions pathways, and ensure the stewardship of our communities, natural resources, and the environment. For demonstration and deployment projects, coupling carbon accounting through life cycle and techno-economic analyses are critical to assessing the net amount and timescale of carbon removal alongside associated costs.

Program 'Action Areas': The Department of Energy (DOE) Program offices Energy Efficiency and Renewable Energy (EERE), Fossil Energy and Carbon Management (FECM), Science (SC), and Advanced Research Projects Agency-Energy (ARPA-E) will:

1. ***Strengthen Cross-DOE Coordination and Collaboration:*** Ensure an integrated approach including clearly defined "swim lanes" and "relay points," integrated systems analysis, workshops and Principal Investigator meetings, community/stakeholder engagement, and data/information sharing.
2. ***Support Fundamental and Applied R&D and Technology Transfer:*** Establish the foundational scientific infrastructure, knowledge base, innovation, and technology transfer to enable DOE to meet program goals.
3. ***Conduct Systems Analysis:*** Conduct life cycle, resource, regional, and techno-economic analyses to guide the portfolio and strategy.
4. ***Promote Safety Sharing:*** Share best practices and resources and make safety a priority in our activities and projects.

5. ***Coordinate on Workforce/STEM and Diversity, Equity, and Inclusion:*** Collaborate on best practices and accelerate progress towards common goals.

In addition, the Energy Act authorized a number of demonstration projects across a variety of technology areas. The FY22 budget requests funding for a new Office of Clean Energy Demonstrations (OCED), which would initiate and manage a multi-year series of competitive solicitations. It would work to accelerate the maturation of near- and mid-term clean energy technologies and systems to achieve rapid commercial adoption and increased availability. OCED's approach would be informed by existing clean energy innovation initiatives across DOE's diverse program and functional offices, sites and associated National Laboratories. OCED would issue initial competitive solicitations for commercial-scale energy storage demonstrations, and issue at least one technology neutral commercial-scale demonstration solicitation per year focused on a crosscutting energy challenge.

FY22 Request:

- Continue development of transformational DAC materials and components, and feasibility studies of current DAC systems.
- Continue National Laboratory RDD&D on mineralization and enhanced weathering concepts.
- Continue evaluation of coal-waste biomass co-feeding concepts with CCUS at existing facilities.

Title VI – Industrial and Manufacturing Technologies. Title VI of the Energy Act of 2020 encourages the development and commercialization of technologies that increase the technological and economic competitiveness of U.S. industry and manufacturing and decrease the emissions of non-power industrial sectors.

In the FY22 budget, DOE has created a new **Decarbonizing Industry Crosscut** that will engage multiple offices across DOE to foster innovations and enable scale up of cost-competitive, low-emissions technologies, consistent with Energy Act direction. The Crosscut leverages research, development, demonstration, and deployment across the pillars of industrial decarbonization: energy efficiency; electrification; low-carbon fuels, feedstocks, and energy sources; and carbon capture, utilization, and storage (CCUS). Given the technologies and systems interdependencies across the

decarbonization pillars, crosscut activities will be an enabling piece of DOE's portfolio of solutions to address Congressional direction. Aggregated funding for decarbonizing industry across ARPA-E, EERE, FECM, LPO, and Science totaled $565 million in FY211. The FY22 budget requests $1,386.7 million for the decarbonizing industry crosscut.[4]

In the FY22 budget, the Advanced Manufacturing Office (AMO) has adopted a new budget structure to better align with Congressional direction. The historical subprogram structure through FY21 had been based on operational categories—R&D Project, R&D Consortia, and Technical Partnerships. The FY22 Budget includes a new structure across four technical subprograms: Materials, Manufacturing Innovations, Energy Systems, and Manufacturing Enterprise. Through the new budget structure, AMO is addressing both industrial decarbonization and manufacturing innovation need to decarbonize other sectors. AMO is also providing technical assistance for manufacturers to reduce their energy use intensity, adopt smart energy management programs, incorporate resilience into their operating systems, and provide targets for energy efficiency, productivity, waste reduction, and water use reduction practices.[5]

Title VII – Critical Minerals. Title VII of the Energy Act directs DOE to carry out an R&D program to develop advanced separation technologies for the extraction and recovery of rare earth elements (REEs) and other critical materials from coal and coal byproducts. It also directs DOE to conduct an RDD&CA program on the development of alternatives to, recycling of, and efficient production and use of critical materials, and directs DOE and EIA to develop analytical and forecasting tools to evaluate critical minerals markets.

The FY22 budget creates a **Critical Minerals and Materials** crosscut to elevate, coordinate, and augment DOE's activities across the three pillars that ground DOE's strategy for bolstering the critical minerals and materials supply chain: diversify supply in a safe, sustainable, and environmentally just way, develop substitutes, and improve reuse and recycling. Current DOE investments in SC, EERE, and FECM support these three pillars across the full lifecycle of critical minerals and materials, from

[4] Congressional Budget Justification, Volume 2, p 245
[5] Congressional Budget Justification, Volume 3 Part 1, p 379-382.

extraction to processing and manufacturing to recycling and reuse. Funding the critical minerals and materials crosscut totaled $146.4 million in FY21. The FY22 budget requests $233.25 million.

The Office of Fossil Energy and Carbon Management (FECM) has created a new Mineral Sustainability subprogram to coordinate FECM critical minerals and materials activities and implement the Energy Act provisions related to recovery of REEs and critical materials from coal waste and industrial by-products.

Title VIII – Grid Modernization

Key priorities and changes within the proposed FY22 budget for DOE's Office of Electricity (OE) are aligned with the Energy Act of 2020, including:

- Expanding Transmission Capacity and Advanced Grid Architectures: pursue electricity-related policy issues by carrying out statutory and executive requirements, while also providing policy design and analysis expertise to Federal, State, Tribal, territorial, and regional entities.
- Transmission Reliability and Resilience - ensuring the reliability and resilience of the U.S. electric grid through R&D on measurement and control of the electricity system, assessing evolving system needs, identifying pathways to achieve an equitable transition to decarbonization and electrification, and risk assessment to address challenges across integrated energy systems.
- Resilient Distribution Systems - develops transformative technologies, tools, and techniques to enable industry to modernize the distribution portion of the electric delivery system. The FY22 request supports a competitive award process to harness emerging sources of energy for balance, reliability, and control: EVs, connected homes and buildings, increasing distributed solar, and energy storage.
- Energy Delivery Grid Operations Technology - a new program in OE in FY22 that will support a public–private partnership to develop national-scale energy planning and real-time situational awareness capabilities by focusing on developing large, networked communication and data infrastructures across multiple utility boundaries. The EDGOT technology portfolio will enable assessment of risks and uncertainty, evaluation and identification of effective mitigation strategies, and support of more informed infrastructure planning and investment decisions by both public and private sectors, thereby enhancing U.S. energy and economic security.

- The department has identified the steering committee and begun development of draft voluntary pathways for grid modernization (Section 8008).
- Office of Electricity is working with EERE to develop a statement of work with the national academies for studying and evaluating net metering (Section 8015).

Title IX – DOE Innovation. Title IX of the Energy Act contains a number of provisions aimed at supporting innovation at DOE.

The Act authorizes the Office of Technology Transitions and establishes a Chief Commercialization Officer to focus on commercializing technologies that advance the missions of DOE. The mission of OTT is to expand the commercial and public impact of the research investments of DOE. OTT enhances the public return on investment from DOE's technology portfolio, including the National Laboratories, through a suite of outcome-oriented activities that will enable climate change mitigation, job creation, and commercialization of DOE technology. Internally, OTT works to fill gaps in the RDD&D continuum, providing specialized tools, training, analysis, and programs to improve the successful transition of technology from proof of concept to prototype to demonstration. Externally, OTT supports development of a robust ecosystem for energy entrepreneurs and technology start-ups and seeds public-private partnerships with a diverse set of actors. OTT also supports Lab Partnering Service to encourage partnerships between the national laboratories and public and private sector entities, as authorized under the Energy Act.[6] The FY22 budget request $19.47 million for OTT, an increase of $1.831 million above FY21 enacted levels.[7]

Title IX of the Act also authorizes the Established Program to Stimulate Competitive Research (EPSCoR) program to broaden support and provide grants for science and engineering research in applied energy, environmental management, and basic science. The EPSCoR program funds research in states and territories with historically lower levels of Federal academic research funding. The FY22 budget request includes $25 million in EPSCoR funding from the Office of Basic Energy Sciences. The request also initiates a new activity, Reaching a New Energy Sciences Workforce (RENEW), for

[6] https://www.energy.gov/technologytransitions/lab-partnering-service
[7] Congressional Budget Justification, Volume 2, p 199.

targeted efforts to increase participation and retention of underrepresented groups in research activities. RENEW leverages DOE's national laboratories, user facilities, and other research infrastructure to provide undergraduate and graduate training opportunities for students and academic institutions not currently well represented in the U.S. science and technology ecosystem, including students in EPSCoR jurisdictions. The FY22 budget request includes $30 million for RENEW across DOE programs.

Q2. The Energy Act authorized geothermal demonstration projects. How do you and the Department plan to implement these demonstrations? Will Alaska be included under this initiative?

A2. DOE's Geothermal Technologies Office (GTO) has several initiatives included in our FY22 Budget Request that supports geothermal energy demonstrations across our technology portfolio:

- **Frontier Observatory in Research in Geothermal Energy (FORGE):** FORGE is GTO's flagship initiative for demonstrating Enhanced Geothermal System (EGS) research and technologies. In FY22, GTO will significantly increase its support for the next R&D solicitation to take advantage of the momentum at the FORGE site and provide additional technological progress toward ensuring EGS viability in the commercial space.
- **Wells of Opportunity – Amplify:** GTO will make a major investment for the third year in a row in near-field EGS demonstration projects. Because these projects are at the margins of existing geothermal production fields, teams can leverage existing infrastructure and add new, low-cost, clean power to the grid from wells that would otherwise sit idle.
- **Drilling Technology Demonstration Campaign:** R&D on drilling technologies over the past decade has resulted in numerous technologies and methods that are now ready for field demonstration, can reduce the costs and risks of drilling, and lead to increased deployment of geothermal. DOE-sponsored field development is needed because thinly capitalized geothermal developers will not accept risks associated with the implementation of new, higher-risk technology. This drilling technology demonstration campaign will enable field demonstration of innovative well construction technologies, including those adapted from the oil and gas (O&G) industry, to prove their utility and efficacy in geothermal environments and attract future private investment.

- **Community Geothermal Heating & Cooling Technical Assistance & Deployment:** This initiative funds technical assistance to demonstrate and deploy community-scale (also described as district-scale) geothermal systems that directly heat community homes and infrastructure. The initiative will provide funds to competitively selected geographic coalitions and will target urban centers, rural areas, energy communities, and remote communities where geothermal has high technical and economic potential and can reduce dependence on fossil fuels (such as natural gas and heating oil).
- **Federal Partnerships for Geothermal Installations:** Through this initiative, GTO is partnering with DOE's Federal Energy Management Program (FEMP) to support geothermal energy development at Federal facilities to heat, cool, and potentially power their installations. In FY22, GTO support will fund advanced feasibility studies on shovel-ready sites and then develop on-site geothermal projects on Federal sites via FEMP performance contracting mechanisms.

These planned FY22 initiatives will be open to a variety of stakeholders across the United States, including in Alaska. As stated above, the Community Geothermal Heating & Cooling Technical Assistance & Deployment specifically includes remote and rural communities, such as those in Alaska. In addition, Federal installations all over the country are eligible for the Federal Partnerships for Geothermal Installations, including sites in Alaska. The technology and processes developed by these demonstrations will further geothermal exploration and development in Alaska and across the United States.

Q3. In your testimony to the committee, you described internal deliberations, including with the Department's General Counsel, regarding the status of Loan Program Office reforms, and the eligibility of domestic mining projects meeting the definition of "advanced technologies". Specifically, you suggested that further statutory changes may be necessary to address this. Could you please provide an overview of the deliberations, what the legal question at hand is, and an idea of what statutory changes you believe may be required to make domestic mining projects eligible? What progress is being made generally on the reforms implemented for LPO under the Energy Act of 2020.

A3. As part of the increased interest and applications that the Department of Energy (DOE) is receiving across all of its loan programs, the Loan Program Office (LPO) has received project proposals that do not expressly fall within technology categories eligible under the original program authorization of the Energy Policy Act of 2005 or the expanded eligible technologies included in the Energy Act of 2020.

Therefore, LPO and the Office of General Counsel have been conducting legal research and analysis to determine what types of projects may be eligible under the existing Title XVII Innovative Energy Loan Guarantee Program authority. Consistent with DOE's advanced nuclear energy projects solicitation, the Energy Act of 2020 clarified that advanced nuclear energy facilities include supply chain components; however, the clarification was limited to manufacturing. Additional legal analysis by the Department is necessary to determine eligibility of mining projects in the advanced nuclear energy facilities category and other categories.

Through prior legal analysis, it has been determined that mining does not qualify as an eligible project cost under the Advanced Technology Vehicles Manufacturing Direct Loan Program (ATVM) authority as established in the Energy Independence and Security Act of 2007. It would require the action of Congress to expand the authority of ATVM to allow for mining activities that would support automotive manufacturing to be deemed eligible. Similarly, it is not explicit in the Title XVII statutory language, as amended, that mining is an eligible technology category.

LPO is in the process of evaluating whether the Title XVII regulations are required to be amended to reflect the reforms to Title XVII that were included in the Energy Act of 2020.

Q4. The Bipartisan Budget Act of 2015 authorized sales from the Strategic Petroleum Reserve (SPR) in FY2017 through FY2020, to fund modernization efforts. Sales occurred in FY2017, 2018 and 2019, but the FY2020 sale was cancelled due to the collapse in oil prices catalyzed by the COVID pandemic. Can you provide an update on the status of SPR modernization efforts? Further, can you provide an update as to how the COVID pandemic impacted these efforts, with specific detail to the impact that the cancelled SPR sale has had, and potential avenues that can mitigate any adverse impact thereof?

A4. The last Energy Security and Infrastructure Modernization (ESIM) sale was originally scheduled for FY 2020, to support modernization of the Strategic Petroleum Reserve (SPR) and is now currently scheduled to be complete by the end of June 2021. *The timing of this final sale supports current construction contract award schedules and there were no impacts from the sale being delayed from FY 2020 to FY 2021.*

Currently, the SPR modernization effort, referred to as Life Extension 2 (LE2) has received approval for Critical Decision (CD)-2 (Establish Project Baseline) and CD-3 (Approve Start of Construction) for

three of the four SPR sites in June 2021. Contract awards have begun at the Bryan Mound site. Contract awards are scheduled to continue for the Bayou Choctaw, Big Hill, and Bryan Mound sites through FY2022. Approval for CD-2 and CD-3 for the West Hackberry site are delayed until fall of FY2022 due to efforts to descope the project to stay within the $1.42B funding raised over the four SPR Modernization sales. The project to complete drilling secondary wells into the single well caverns at the West Hackberry site has been removed from LE2 scope, to stay within the $1.42B funding, and required significant re-engineering prior to requesting CD-2/3 approval.

The design schedule was delayed approximately 3 months due to productivity losses in the early days of the pandemic. Transitioning from an in-person collaboration model for the engineering design to a completely online collaboration model required tweaking the design process. Those changes have been implemented and currently there is no ongoing impact to the productivity of the design process. Changes have also been made to the procurement process to maximize the use of remote meetings with vendors. Quality inspections of government furnished equipment have been transitioned to a remote process with no identified loss of productivity and no negative impacts to quality of inspections.

At this time, all process changes to address COVID-19 impacts of maximum telework have been implemented. There are no other changes that have been identified that could increase productivity of the SPR LE2 due to COVID-19.

Q5. The budget request incorporates a plus-up for the Office of Policy, in part to facilitate merging the Arctic Energy Office (AEO) into it. Can you commit to me that you will support the AEO retaining its cross-cutting portfolio and mission, regardless of where a reorganization may place it? What is the actual funding for the Arctic Energy Office that you are requesting, and how does it compare to last year's (FY2021) request?

A5. The Department of Energy continues to strongly support the Arctic Energy Office in Fairbanks, Alaska with the same structure as the previous administration. The Office of Policy has been tasked to provide administrative and logistic support for AEO's headquarters functions, and the AEO budget was submitted within the Office of Policy's budget request for FY22. The actual funding for the AEO we are requesting is $1.996 M ($1.796 M was allocated internally as part of last year's (FY2021) funding). The Director of AEO remains a direct report to the Secretariat equivalent to the other DOE functional offices

and continues to carry out their function of coordinating DOE's Arctic activities, both in Alaska and internationally.

Q6. Do you still believe that the Arctic is increasingly a key geostrategic and geopolitical arena that the United States should look to compete in? What do you believe the Department's role in the Arctic should be, and how is that reflected in the FY2022 Budget request?

A6. The Arctic is an increasingly key geostrategic and geopolitical arena that the United States must compete and lead in. The Department's role in the Arctic should cover the breadth of the Department's mission space of Energy, Science, and Security. In addition to support of the AEO to lead coordination across the Department and engage in broader interagency coordination on Arctic matters on behalf of the Department, the budget request prioritizes tribal engagement, energy justice, climate change effects, and technology transition/deployment - all key areas for DOE in the Arctic.

Q7. How does the Department's budget request support reducing and ending American reliance on foreign imports of materials necessary for energy independence and a low-carbon future, be it critical minerals, oil and gas, or other strategic materials?

A7. The FY22 budget creates a **Critical Minerals and Materials** crosscut to elevate, coordinate, and augment DOE's activities across the three pillars that ground DOE's strategy for bolstering the critical minerals and materials supply chain: diversify supply in a safe, sustainable, and environmentally just way, develop substitutes, and improve reuse and recycling. Current DOE investments in SC, EERE, and FECM support these three pillars across the full lifecycle of critical minerals and materials, from extraction to processing and manufacturing to recycling and reuse. Funding for the critical minerals and materials crosscut totaled $146.4 million in FY21. The FY22 budget requests $233.25 million.[8]

Examples of current applied RD&D activities across the supply chain include:

- **Extraction**: EERE and FECM support extraction efforts both through the identification of geographically-distributed domestic critical minerals resources (such as geothermal brines or coal byproducts and wastes) and the energy-efficient and low-impact extraction of critical

[8] FY 22 Congressional Budget Justification, Volume 2, p 313

materials from a variety of conventional and unconventional feedstocks (including clays, brines, produced water, coal byproducts and wastes, and mine tailings).

- **Processing:** EERE and FECM support critical mineral and material processing through RD&D on innovative separation and refining that range in technology and scale from localized mobile modular systems that process roughly 1 ton/day of material to more centralized facilities that produce tens of thousands of tons of material per year.
- **Manufacturing:** EERE supports critical minerals and materials manufacturing through RD&D on metallization, magnet manufacturing, battery manufacturing, and catalyst manufacturing to grow capabilities that support a manufacturing ecosystem that is innovative and resilient.
- **Reuse & Recycling:** EERE supports recycling RD&D, particularly for magnets and batteries, as well as novel second-use applications of electric vehicle batteries for grid-scale electricity storage.

Critical Minerals & Materials
Funding by Appropriation and Program Control
($ Thousands)

Appropriation and Program Control	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY 2021 ($ Change)
Advanced Research Program Agency-Energy	**8,922**	**1,000**	**TBD***	**TBD***
Advanced Research Program Agency-Energy	8,922	1,000	TBD*	TBD*
Energy Efficiency and Renewable Energy	**74,200**	**104,300**	**160,150**	**+55,850**
Advanced Manufacturing	55,000	45,000	70,000	+25,000
Geothermal Technologies	200	4,300	2,150	-2,150
Hydrogen & Fuel Cell Technologies	19,000	25,000	31,000	+6,000
Vehicle Technologies	0	30,000	57,000	+27,000
Fossil Energy and Carbon Management	**23,000**	**23,000**	**48,000**	**25,000**
Fossil Energy and Carbon Management Research, Development, Demonstration and Deployment	23,000	23,000	48,000	25,000
Nuclear Energy	**0**	**1,000**	**0**	**-1,000**
Crosscutting Technology Development	0	1,000	0	-1,000
Office of Technology Transitions	**0**	**100**	**100**	**0**
Science	**0**	**17,000**	**25,000**	**+8,000**
Basic Energy Sciences	0	17,000	25,000	+8,000
Grand Total	**106,122**	**146,400**	**233,250***	**87,850***

* ARPA-E funding is determined annually based on programs developed through office and stakeholder priorities. Therefore, funding for FY 2022 is not available at this time.

Q8. Do you believe American liquefied natural gas (LNG) exports remain and will remain into the foreseeable future, an important geostrategic resource and commodity? If yes, how does the Department's budget request support this philosophy? If no, please explain why?

A8. The United States is among the top global exporters of liquified natural gas (LNG) and our exports are, and will continue to be, an important tool in promoting global energy security. LNG also frequently has a comparatively beneficial emissions profile against the fuels it displaces. In order to meet the climate goals of net-zero carbon dioxide (CO_2) emissions by 2050, these benefits need to be paired with careful management of the carbon and other greenhouse gas emissions associated with producing, liquefying, transporting, and combusting natural gas. Through the research and development (R&D) program in the Office of Fossil Energy and Carbon Management, we are working to do everything we can to ensure that U.S. natural gas, including LNG, comes from a leak-tight system and that its emissions are quantifiable, verifiable, and improve over time.

Q9. Do you believe that the Department should expand the High Assay Low-Enriched Uranium (HALEU) production capacity of the HALEU enrichment demonstration program already underway in order to meet the needs of the reactors being developed under the Advanced Reactor Demonstration Program? If so, do you believe that the budget request includes sufficient funding for this purpose?

A9. The FY 2022 Budget Request seeks to make available small quantities of high-assay, low-enriched uranium (HALEU) from limited DOE uranium inventories. Further, the Administration requests funding to continue to staff and operate the HALEU enrichment demonstration facility in a cost share agreement with industry at the planned demonstration production levels. It is understood that these production levels are not sufficient to meet the initial core requirements for the demonstration reactors selected under the Department's Advanced Reactor Demonstration Program. While we believe the budget request sustains the HALEU demonstration in the short term, we are evaluating alternatives to avoid having to rely on foreign sources of HALEU for future fuel supply for these reactors, and their successors. A request for information on incentivizing a sustainable commercial HALEU supply for the long term is planned to be issued by the end of the calendar year.

Q10. The Department's budget request mentions the potential expansion of support from the Energy Transition Initiative (ETI) to additional Alaskan communities, and expanding the budget for the ETI. How much, in total, do you envision the expansion of ETI to be? Will these additional resources go to communities already within the existing partnership?

A10. DOE is committed to continuing and expanding its support for energy efficiency, renewable energy and energy storage technologies in Alaska and other islanded and remote communities, including through the Energy Transitions Initiative (ETI). In FY22, DOE proposes continuing to support ETI as a high-impact initiative from within the Office of Strategic Programs and increasing alignment with and ultimately funding from the Office of Energy Efficiency and Renewable Energy's (EERE) technology offices. DOE will expand its outreach and approach to address more communities and their needs for resilience and capacity building, better managing energy use and costs, and achieving other community objectives by coordinating new investments across technology offices including renewable power and sustainable transportation. The total expansion will depend on community-level opportunities for specific technology deployment based on resource potential, local priorities and other factors.

Additional resources will go to communities already within the existing partnership as well as to new communities. In FY22, DOE plans the second cohort of competitively-selected Partnership Project (ETIPP) communities, expanding upon existing regional partnerships serving communities in Alaska, Hawaii, Maine, and North Carolina. In addition, DOE plans to add at least one new partner organization, to expand its reach in the pacific northwest region of the US. Near term, DOE is actively considering where new regional partners could enable ETI support for additional regions and communities facing challenges the ETI program has experience addressing. The scope of this additional work, and the balance struck between existing and new partnership opportunities, depends on the level of appropriations. Any new regional partners would be selected based upon their capacity to benefit from ETI's place-based approach to community energy resilience.

Q11. Recently, the Cold Climate Housing Research Center announced a partnership with the National Renewable Energy Laboratory, to facilitate more innovation and maturation of their research and development. Have you been briefed on this partnership, and how it's coming along? Can you share any updates with myself and the committee? How is this partnership and work prioritized in the budget request?

A11. It's been just over a year since the Cold Climate Housing Research Center (CCHRC) joined the National Renewable Energy Laboratory (NREL) to expand energy efficiency and resilience in the Arctic and extreme climates. The relationship between NREL and CCHRC has enhanced existing Advanced

Building Construction (ABC) projects previously awarded to CCHRC by leveraging the national lab infrastructure. These ABC projects bring competitive and advanced building technologies to market, which can be leveraged by industry to deliver clean, energy-efficient and resilient energy systems to the American people. NREL's CCHRC is a place-based model for collaborative research that advances the service of the national lab to some of the coldest climates and expands the impact of research to answer unique concerns of American Indians and Alaska Natives. Place-based initiatives enable NREL to proactively build resiliency and economic opportunities across the country. The CCHRC operational budget is incorporated into the cost of NREL operations and staff time is reimbursed by DOE's Office of Energy Efficiency and Renewable Energy and non-DOE Strategic Program Partnership projects.

Q12. The Loan Program Office has not financed any projects since late 2011. This is clearly an issue that has transcended administrations. Does the Department have plans to expedite funding coming out of the LPO?

A12. Though the pace of deal closings has slowed over the past ten years, the Loan Program Office (LPO) funded the Vogtle project in a series of loans, totaling $12 billion, which closed in 2014 ($6.5 billion), 2015 ($1.8 billion) and 2017 ($3.7 billion). LPO has plans to accelerate the pace of funding coming out of the Title XVII Innovative Energy Loan Guarantee Program, Advanced Technology Vehicles Manufacturing Direct Loan Program (ATVM), and the Tribal Energy Loan Guarantee Program (TELGP) and has already instituted changes to that effect. For example, LPO has established a more robust outreach team to fill the deal pipeline with more potential applicants, and the program is already seeing increased interest and applications. LPO has been receiving an average of two to three new loan applications a week since the beginning of May 2021, totaling billions of dollars in loan requests. In comparison, prior to the Energy Act of 2020 elimination of upfront fees, LPO received only a handful of applications in the entire calendar year of 2020. We expect to obligate all of the remaining loan and loan guarantee authority over the next few years. LPO has also updated the application review process for Title XVII, focusing the Part I application review on technical eligibility and innovation so that applicants can know earlier in the process whether their project is eligible for debt financing before submitting a Part II application. Additionally, per the Energy Act of 2020, LPO no longer requires Title XVII applicants to pay application fees and third-party advisor costs upfront, and instead defers the payments to the time of loan closure. These measures remove the barriers for project companies to apply

for loans and streamline the application review process so LPO can respond to applicants in a more efficient manner.

Q13. According to your testimony, the Department's budget request reorganizes the Strategic Petroleum Reserve under the Office of Cybersecurity, Energy Security and Emergency Response (CESER), with your justification being that the SPR will benefit from an enhanced cybersecurity profile. Can you please describe further how specifically SPR would benefit from being administratively reorganized under CESER? Do you believe other components of the Department experience detriments from *not* being under the umbrella of CESER?

A13. As reflected in the Department's FY 22 Budget Request, CESER will manage all of DOE's emergency response functions and authorities to facilitate energy sector response efforts. This would include moving the Office of Petroleum Reserves (OPR) from the Office of Fossil Energy to CESER, improving the Department's ability to utilize the strategic reserves to help respond to disruptive events, as well as shifting the Department's Federal Power Act section 202(c) responsibilities from the Office of Electricity. These moves streamline and strengthen the Department's emergency response functions and authorities.

QUESTION FROM SENATOR CATHERINE CORTEZ MASTO

Q1. As portions of the country continue to experience depleted snowpack and prolonged drought, it is imperative that the Department (and our nation) prioritize technologies that decrease water consumption in energy production.

For these reasons, I introduced the Energy and Water Research Integration Act last Congress. Portions of this Act were merged with former Chairman Murkowski's Nexus of Energy and Water Sustainability (NEWS) Act and included as Section 1010 of the Energy Act of 2020. Specifically, this Section established an interagency committee – led by the Secretaries of Energy and the Interior – to coordinate and collaborate on energy-water nexus activities. It also requires the Department of Energy (DOE) to integrate water and energy considerations into its Research, Development, and Demonstration (RD&D) Programs.

What is the status of Section 1010 of the Energy Act of 2020 and how does it compliment DOE's RD&D priorities included throughout the Fiscal Year (FY) 2022 Budget Request?

A1. DOE has ongoing coordination and collaboration in the nexus of energy and water sustainability through the Water Subcabinet and the Water Treatment Interagency (WATR) Working Group, both led by the Department of Interior (DOI). DOE plans to set up an interagency coordination committee co-led by DOI as part of the existing WATR Working Group by the end of this fiscal year. The WATR interagency coordination committee will develop a draft strategic plan in the nexus of energy and water sustainability by May 2022 for interagency review and other key stakeholder feedback before finalizing a report to Congress.[9]

DOE's FY22 Budget Request is $78.5M for Energy-Water Nexus activities, an increase of $12.5M over FY21. The RD&D is addressing the energy and cost challenges to making water available from non-traditional water sources to alleviate drought; improving water efficiency in industry, agriculture, municipalities, and utilities; and decarbonizing our water infrastructure by recovering valuable co-products and water for reuse. Specifically, these activities include:

- Reducing the energy intensity and overall costs for treating non-traditional water sources such as brackish groundwater, seawater, municipal wastewater, industrial wastewater, and agricultural wastewater via desalination to alleviate water stress and drought across the country. Our biggest investment in this space is the Energy-Water Desalination Hub called the National Alliance for

[9] Energy Act of 2020, Sec. 1010

Water Innovation (NAWI), a research consortium led by Lawrence Berkeley National Laboratory with Oak Ridge National Laboratory, the National Renewable Energy Laboratory, and the National Energy Technology Laboratory plus over 200 participating university, industry, state/local government, and non-profit organizations. These technology advancements apply to both large-scale desalination facilities as well as small, modular, autonomous desalination treatment systems.

- Investing in RD&D in solar thermal desalination through the Solar Energy Technologies Office.
- Recovering valuable resources during water/wastewater treatment for producing biofuels/biopower, hydrogen, fertilizers, and water for reuse to achieve net-zero or net energy positive treatment facilities.
- Providing technical assistance to communities and industry for identifying water and energy savings opportunities and adopting best-in-class commercially available technologies. This includes programs such as Better Plants, Industrial Assessment Centers, and Combined Heat and Power.
- Investing in wave powered desalination to provide modular systems to provide potable water in coasts and island communities. The Water Power Technologies Office (WPTO) is proposing building on the Waves to Water Prize for longer-duration demonstrations to advance wave energy desalination systems for applications ranging from disaster relief or aquaculture to small-scale community applications.
- Continuing to fund the Integrated Water Power Resilience project to study resilience frameworks based on cascading risks in rural communities where water supply, irrigation, and power are inextricably linked. WPTO work is focused on identifying barriers to integration, and developing frameworks and tools, supporting coordination, and planning future research and development to turn barriers into opportunities for mutual resilience of the power and water sectors.
- Supporting and enhancing the resilience and reliability of hydropower by investing in new innovative technologies such as new turbines and control systems that can enhance hydropower's flexibility to help maintain grid reliability and resilience, while improving the environmental impacts of all water power technologies. The FY2022 budget expands on the HydroWIRES program, focused on increasing efficiency in hydropower.

- Evaluating the impact of climate change and hydrologic events on hydropower and developing the tools and analysis necessary to plan, evaluate, and understanding the changing climate environment on power. WPTO's budget request builds on previous work, and expands, to understand and assess the potential effects of long-term hydrologic change on water availability for hydropower generation.
- Demonstrating systems to address water and power challenges for irrigation districts. WPTO's budget request builds on previous efforts for a visualization tool for irrigation districts, to work with U.S. Department of Agriculture and the Bureau of Reclamation to develop the tools, technologies, and networks needed to modernize irrigation water infrastructure and unlock community benefits such as increased revenue for farmers, conserve water to improve intentional management, enhance water quality, and support renewable energy development such as small in-conduit hydropower.

QUESTIONS FROM SENATOR ROGER MARSHALL

Q1. Will the President's budget remove the percentage depletion credit and the intangible drilling cost dedication for small oil and natural gas producers? Why would the administration target a deduction that only affects small oil and gas producers?

A1. The Department of Energy does not have authority over the Department of Treasury's tax policy.

Q2. A proposal in the Biden Administration's FY22 budget for the Department of Treasury that would expand and reform the 45Q tax credit for Carbon Capture Utilization and Storage (CCUS). Specifically, the proposal would include an enhanced credit for CO2 captured from "hard-to-abate industrial sectors such as cement production, steelmaking, hydrogen production, and petroleum refining." Unfortunately, the enhanced credit would not apply to ethanol, natural gas processing, or ammonia production facilities.

Do you support extending the 45Q tax credit to ethanol, natural gas processing, and ammonia production facilities? What is the reasoning behind excluding if the goal is to sequester carbon?

A2. The Administration supports the use of the 45Q tax credit for Carbon Capture, Utilization and Storage (CCUS) in all industrial sectors. Treasury's FY22 proposal extends the "commence construction" date by 5 years and gives taxpayers the option to elect cash payment in lieu of the 45Q tax credit for all sectors. This additional time and flexibility will make the credit more accessible to a wider range of facilities, including ethanol, natural gas processing, and ammonia production plants. For systems with high-purity streams of carbon dioxide (CO_2), such as natural gas processing and ethanol, the cost of CO_2 capture is significantly lower than more dilute streams such as cement and power. Because the cost of capturing CO_2 is higher in other industrial sectors, the Administration supports enhancing the credit for those industrial sector facilities.

Q3. Do you have plans to enlarge the Strategic Petroleum Reserve?

A3. The Office of Fossil Energy and Carbon Management, Office of Petroleum Reserves (OPR) are finalizing two studies that will explore options available in planning the future of the Strategic Petroleum Reserve (SPR). The first study is the SPR Post-Sale Configuration Study, which is currently going through internal review within the Department of Energy and will consider how the SPR is configured at the end of all Congressionally mandated and authorized SPR crude oil sales. The second study is the SPR Requirements Study, which is also going through final DOE review. The SPR Requirements Study is designed to consider the purpose, goals, and objectives of the SPR, which could

be used to help determine a policy-preferred size of the SPR. The SPR Requirements Study could also be used to inform policymakers on areas related to the size of the SPR.

Q4. How do you plan to protect the Strategic Petroleum Reserve from cyber-attacks?

A4. The Department recognizes the threat posed by cyber attacks to the Strategic Petroleum Reserve (SPR). As an emergency response function, the SPR must remain available for deployment. Partly in recognition of this fact, we are in the process of moving the SPR to our office of Cybersecurity, Energy Security, and Emergency Response (CESER) where it will be co-situated with similar emergency functions.

The SPR operates a cyber security program based on the National Institute of Standards and Technology (NIST) Risk Management Framework, and implementation of cyber security controls as defined in NIST Special Publication 800-53, Security and Privacy Controls for Information Systems and Organizations. A defense-in-depth posture is maintained along with robust patch, vulnerability, and identity management procedures. The SPR information systems have an Authority to Operate (ATO) with ongoing Continuous Diagnostics and Mitigation to ensure information systems are operating at an acceptable level of risk. Periodic penetration testing activities are conducted to verify the security of SPR information systems, discover vulnerabilities to be remediated, and identify opportunities for improvement. Incident response tabletop exercises are also conducted to test and improve cyber security incident response to ensure continuity of operations during cyber-attacks.

SPR control systems have an ATO and are integrated into the existing cyber security program. Patch management and vulnerability management processes extend to control systems. SPR control systems are isolated from the Internet with restricted access for sharing data with the business network. Firewalls and intrusion detection systems are implemented for the control systems, with security alerting in place. For continuity of operations, SPR control systems are distributed with each SPR site having the ability to operate independently of the other sites. An alternate operating location is established at each SPR site to support reconstitution of the control system, if necessary, using spare equipment from the New Orleans Project Management Office. The SPR has conducted penetration testing activities specific to its control systems, to include testing of the control system border. SPR cyber security personnel work

closely with the control systems maintenance staff to ensure these systems are maintained and operated with cyber security as a primary consideration. SPR personnel meet regularly with the distributed control system vendor to share knowledge and learn about security capabilities being developed by the vendor for integration into their product.

Q5. How do you plan to strengthen the US-India partnership through natural gas exports?

A5. The Department of Energy collaborates with India through the U.S.-India Strategic Clean Energy Partnership to support India's goal of reducing its consumption of high-polluting fuels by increasing the use of natural gas as a cleaner alternative to coal and other fossil-based fuels for transportation, industrial, and residential purposes. The partnership focuses on addressing India's natural gas policy, technology, and regulatory barriers by promoting efficient and market-driven solutions aimed at India's growing energy demand and emissions reduction targets, including through methane abatement. India is a major buyer of U.S. domestically produced liquified natural gas (LNG). And while U.S. LNG has room to grow in improving its environmental performance in order to support a 2050 net zero goal, it offers a comparatively beneficial emissions profile against the fuels it displaces in India. U.S. LNG exports to India grew from approximately 16 billion cubic feet in 2016, when U.S. LNG exports to India began, to approximately 124 billion cubic feet in 2020.

Q6a. Has the Department of Energy considered the total environmental impact of electric vehicles from cradle to grave?

A6a. Environmental impacts extends beyond the raw material components and manufacturing aspects of electric vehicles to the systems that provide fuel between cradle and grave. Internal combustion engine vehicles are supported by a fueling infrastructure that requires physical transport by tanker trucks to nearly every point in the system where fuel is dispensed. Electric vehicle fueling infrastructure is provided by an installed and stationary grid, eliminating most environmental impacts related to physical fuel delivery and storage.

In 2016, the Department of Energy co-authored with industry partners a cradle-to-grave analysis and found that—even including fuel upstream and vehicle material and manufacturing considerations—electric vehicles reduce lifecycle emissions by 25–40 percent today, with the potential for even greater

reductions in the future.[10] The Office of Electricity has also conducted some research on the re-use of electric vehicle batteries that are unsuitable for transportation but retain useful battery life for stationary grid storage.[11]

Q6b. What impact would converting the entire transportation industry to electric have on the power grid?

A6b. Energy is a foundational pillar of almost every aspect of society. The aggressive goals to decarbonize the Nation's energy system, with goals of decarbonizing the U.S. electric grid by 2035 and the American economy by 2050, and an increasing focus on electrification—of transportation, of industry, and of commercial and residential needs—will increase its importance. A significant element of that new future includes the vision of an electrified transportation sector. Bringing the energy and transportation sectors together will create greater interdependencies than currently exist, making it imperative that long term strategic issues are evaluated and considered. The sectors will need to consciously plan and adapt—both individually and in the context of each operating together—to maximize national and societal benefits and minimize the risks without compromising the primary mission of each sector. The coupling of these two sectors will require careful and disciplined consideration, and the Department has the capability to perform such analysis.

As of 2020, the Transportation sector was 90 percent dependent on petroleum, 5 percent on biomass, 4 percent on natural gas, and slightly under 1 percent on electricity. Converting the entire Transportation sector to electricity as a fuel would require an increase in current electric generation capacity by approximately 25 percent. This estimate is based upon the 24.3 Quads of energy currently used by the Transportation sector in the figure above, combined with the fact that electric vehicles are approximately three times as efficient at converting stored energy to propulsion (60 percent efficient vs. 20 percent efficient). As the energy generated and delivered by the electric grid increases, increases in electric transmission and electric distribution system capacity will have to be made, but the magnitude of such increases is not easy to estimate. There are additional considerations for full transportation electrification. Important considerations relate to the reliability and resilience of the electric grid. For example, if an essential service—the movement of goods, services, and people—comes to rely heavily

[10] https://greet.es.anl.gov/publication-c2g-2016-report
[11] https://www.ornl.gov/news/second-act-used-electric-vehicle-batteries-charge-grid

on electricity, are present reliability and resilience numbers acceptable? Today, a power outage can have mild to severe consequences on citizens and businesses. If transportation is impaired at the same time, the acceptable levels of resilience and reliability may be higher than they are today. An analysis employing grid architecture, simulation, and modeling in combination with other resources would provide many of the necessary insights.

While meeting the charging needs of a fully electrified transportation sector would require an increase in the generation and transmission of electricity, electric vehicles are also a potential grid asset that can improve overall grid efficiencies, resilience, and reliability. The Department previously supported the National Renewable Energy Laboratory's Electrification Futures Study[12] to understand potential impacts of highly electrified futures on the buildout and operation of the power system, and continues RD&D on advanced Smart Charge Management technologies, integration of distributed energy resources into high power charging facility architectures, and bi-directional power flow technologies. These technologies will allow electric vehicles and their supporting charging infrastructure to provide grid services such as voltage support, frequency regulation, black start capabilities, and others. Coupling these capabilities with the advanced sensing and control methodologies being developed and deployed for the evolving smart grid will provide benefits to consumers, charging network operators, grid service aggregators, and grid operators.

Q7. The policies of the Biden Administration have caused the price of gas to increase. I'm concerned they will also cause the price of utilities to increase. Do you agree that these rising prices create a social injustice?

A7. For far too long, communities of color and low-income communities have borne the brunt of pollution to the air, water, and soil they rely on to live and raise their families. The clean energy revolution must lift up these communities that have been left behind, and make sure those who have suffered the most are the first to benefit.

DOE's Office of Economic Impact and Diversity will lead this effort through a new role committed to implementing President Biden's Justice40 Initiative —a plan to deliver 40% of the overall benefits of

[12] https://www.nrel.gov/analysis/electrification-futures.html

climate investments to disadvantaged communities and inform equitable research, development, and deployment within the DOE. Efforts are being coordinated across DOE to ensure an all-of-DOE approach.

The recent increase in the price of gas is due to market forces associated with the pandemic and other factors. DOE remains committed to addressing climate change, job opportunities, and economic growth while minimizing any impact of gasoline and electricity costs.

Q8. Where does the concept of affordable energy fit into your plan for leading the Department of Energy?

A8. Transportation energy is an important component of household budgets. Household vehicle fuel, one part of total transportation energy costs is over 3% of total household expenditures nationwide in the U.S. The average annual expenditure of over $2,000 for vehicle fuel (mostly gasoline) is comparable to the total average household expenditures for electricity and natural gas combined. However, these average values vary geographically, and lower income households can face higher energy cost burdens.

In an Argonne National Lab report[13], ANL quantifies the household transportation energy affordability, defined as the percentage of annual household income spent on the household vehicle fuel costs and provides county and tract level data to enable a better understanding of the spatial variation in household transportation energy burden by connecting vehicle miles traveled (VMT), vehicle fuel economy, fuel costs, and income data at the census tract level.

The baseline data and framework developed here can be used to assess the spatially distributed impacts of additional transportation energy component costs or transportation policies on household transportation affordability.

In addition to experiencing the disproportionate impacts of transportation burden, low- to moderate-income households also disproportionately experience household energy burden. Moreover, according to an analysis conducted by the Energy Information Administration in its 2015 Residential Energy Consumption Survey, communities of color (Black, Latinx, and Native American Households)

[13] Affordability of Household Transportation Fuel Costs by Region and Socioeconomic Factors (anl.gov)

experience higher rates of energy insecurity than the national average. The Office of Economic Impact and Diversity will lead the President's historic Justice40 Initiative, which promises 40% of the benefits of certain climate and clean energy investments, to disadvantaged communities. Tackling energy burden and energy insecurity will form a key part of the agency's Justice40 strategy.