U.S. Senate Committee on Energy and Natural Resources
August 3, 2021 Hearing: *The Richmond, Stachelberg, and Berhe Nominations*
Questions for the Record Submitted to Dr. Geraldine Richmond

Questions from Ranking Member John Barrasso

Question 1: Many of the statutory responsibilities of the Director of the Office of Science and the Under Secretary for Science sound quite similar—for example, monitoring DOE's research and development (R&D) programs, advising the Secretary about DOE's national laboratories, and advising the Secretary about DOE's education and training activities.

a. What do you see as your role in these areas?

If confirmed, I see the responsibility of the Director of the Office of Science to be involved in the overall prioritization and management of basic research portfolio and activities, including at the DOE national laboratories. I would look forward to working with the Director and the leadership team of the Office of Science to ensure that they have what they need to continue our outstanding track record of exciting new scientific discoveries.

With the expanded role of the Under Secretary for Science to include the applied Energy responsibilities, much of my effort will be focused on strengthening the integration of activities across DOE's Office of Science national laboratories, our applied energy national laboratories, universities, and the private sector.

b. How would you ensure that your actions are coordinated but not duplicative?

If confirmed, I will set clear expectations for the science and applied energy program offices and ensure we have effective cross-cutting teams and priorities that will not only avoid duplication, but more seamlessly translate our investments in basic research to applied energy outcomes.

Question 2: The science and engineering capabilities of DOE's national laboratories are wide-ranging. To what extent should the laboratories focus on executing DOE's own programs, versus making their capabilities and facilities available to other agencies, U.S. industry, academia, and others?

The Department's national laboratories are a national asset that help advance U.S. global leadership in science and technology. An important aspect of the work happening at the national laboratories is their collaboration with the broader scientific community, which already includes U.S. industry and academia as well as conducting research for other federal agencies. The national laboratories also operate world-unique scientific user facilities such as light sources and high-performance computing assets that are available for the broader scientific community to use in advancing U.S. science and technology in a wide range of fundamental, applied energy and other areas important to our national and economic security.

Question 3: Science and technology developed by the DOE national laboratories can be valuable to U.S. industry, the economy broadly, and other national goals. How can DOE improve its technology transfer efforts to ensure that its R&D results are efficiently and successfully commercialized?

The Department of Energy has a special role to play in creating a vibrant innovation ecosystem and stimulating new economic opportunity by translating R&D activities into tangible outcomes for the American people. In recent years, DOE has provided additional tools for the national laboratories to use that make it easier to work

with industry and university partners. For example, DOE created the novel mechanism - Agreements for Commercializing Technology (ACT) – to provide an alternative approach for non-Federal partners to engage with the national laboratories that allows for more business-ready terms and conditions.

The Department has also developed several new programs to facilitate the development and commercialization of technologies that incorporate the unique capabilities of the national laboratories. For example, DOE created the Lab-Embedded Entrepreneurship Program (LEEP) which embeds top entrepreneurial scientists and engineers within the national laboratories to perform early-stage research and development (R&D) that may lead to the launch of energy or manufacturing businesses in the future. I will continue developing these programs as well as those of the Office of Technology Transitions (OTT) to enable it to fully deliver on its congressional mandate to "expand the commercial impact of the research investments of the Department" by supporting activities across the DOE science and applied energy programs, national laboratories, and the private sector.

Question 4: Security and competitiveness concerns about foreign access to U.S. R&D results have grown in recent years. The scientific user facilities at the DOE national laboratories host thousands of foreign researchers each year.

a. How should DOE balance the advantages of scientific openness against the potential risks associated with foreign access to these facilities and the R&D conducted at them?

The Department has taken a series of actions to address risks to research security while maintaining an open, collaborative, and world-leading enterprise. These policy initiatives aim to reduce the risk posed by specific threats, including threats posed by certain foreign governments, to the U.S. research enterprise including the DOE national laboratories. At the same time, we need to retain the strengths of our enterprise including its highly collaborative approach to complex science and technology problems and our ability to recruit and retain top talent from all over the globe.

DOE has taken steps to prohibit federal and laboratory personnel from participating in foreign government talent recruitment programs sponsored by countries of risk such as China, Russia, Iran, and North Korea. DOE has also restricted federal and laboratory personnel from participating in other foreign government sponsored or affiliated activities that could pose a security risk. DOE works closely with the chief research officers across the 17 National Laboratories to maintain a Science and Technology Risk Matrix, which takes a risk-based approach to identifying critical and emerging technology areas that have potential economic and national security implications, but that do not otherwise have traditional protections in place.

b. What additional steps, if any, are needed to ensure that DOE-funded R&D results are not illegally or inappropriately transmitted to potential foreign adversaries?

DOE continues to actively co-chair the National Science and Technology Council Subcommittee on Research Security to ensure a coordinated interagency approach to research security, as well as participate in the National Counterintelligence Task Force campaign on research security. If confirmed, I will work to ensure that DOE continues to review and update these policies to ensure that this risk-based approach strikes the right balance

between protecting our intellectual property and assets, while also maintaining the openness that underpins our innovation ecosystem.

Question 5: What are the advantages and disadvantages of having a single Under Secretary for Science and Energy as opposed to separating the roles of Under Secretary for Science and Under Secretary for Energy?

Having a single Under Secretary for Science and Energy greatly enables DOE to advance its investments from the earliest stages of Research and Development (R&D) through to demonstrations of clean energy technologies, and ultimately, clean energy deployments in the market. This integrated approach is important for a number of technology areas such as hydrogen, energy storage, and carbon capture, as well as artificial intelligence and quantum computing.

Question 6: The Biden Administration has proposed creating an Advanced Research Projects Agency–Climate (ARPA-C) within DOE.

a. How would the climate-related R&D conducted by ARPA-C be different from R&D conducted by the existing DOE offices?

ARPA-C would focus on creating investments in topical areas of high potential for alleviating the climate crisis that cannot be addressed individually by other Agencies, including ARPA-E and DOE science and applied energy program offices. Potential examples may include:

- Resilient infrastructure to protect against severe-weather events
- Elimination, mitigation, or prevention of greenhouse-gas emissions from land sources such as warming permafrost or landfills
- Direct air or ocean capture of CO2
- Negative-emissions agricultural products, including products that throughout its lifecycle removes and sequesters more carbon than it emits

b. What are the potential advantages of creating a new organization for this purpose?

If created, the U.S. Department of Energy's Advanced Research Projects Agency-Climate (ARPA-C) could invest in climate-related innovations necessary to enable adaptation, increase resilience, and achieve net zero non-energy emissions by 2050, while coordination to avoid duplication with ARPA-E. ARPA-C's climate mission complements ARPA-E's advanced energy mission but reflects the need to address research activities that encompass more than only specifically energy-related emissions. ARPA-C will harness innovation to solve the global climate crisis while enhancing the economic and energy security of the United States through development of new technologies that will lead to economic opportunities for American workers and businesses.

c. What are the potential challenges?

Full expression of ARPA-C would require legislation beyond the current ARPA-E authorization, and thoughtful design to avoid duplication with existing efforts. These include provisions relating to technology investments needed to enable mitigation of non-energy greenhouse gas (GHG) emissions and others to enhance climate resiliency and adaptation. None of these climate-critical mission areas are fully authorized to the ARPA-E currently, and application spaces that may be only partially pertinent to ARPA-E could be addressed much more broadly and effectively under an ARPA-C.

Question 7: The President's FY2022 budget proposes $300 million for other agencies to further fund the mission of ARPA-C.

a. What are the advantages and disadvantages of such a cross-agency effort?

ARPA-C crosscutting efforts would lay the foundation for future improvements in R&D across the Federal Government by working with the other Agencies to develop transformative solutions for the climate crisis including adaptation, and resilience.

b. **What would you do to ensure coordination between DOE and the other agencies involved in ARPA-C**?

While ARPA-C is currently planned to reside within DOE, ARPA-C will have a broad mission and will be a cross-disciplinary effort. The additional $300 million requested for other government agencies to support ARPA-C programs will insert ARPA-C into these other agencies budgetary process ensuring coordination via congressional appropriations and annual budget process.

Question 8: The funds requested in the President's FY2022 budget would result in rapid growth in DOE's applied energy programs, especially the Office of Energy Efficiency and Renewable Energy.

a. What challenges would such rapid expansion bring for effective program management, R&D quality, researcher career paths, and other considerations?

EERE has well-established policies and procedures for consistent budget planning and execution across its programs, as well as active project management practices to support stewardship of federal funds. The greatest challenge to a rapid budget expansion is the corresponding need for additional staff to support planning, execution, and oversight. Having both technical and operational staff, including technology managers, technical project officers, and contract and grants management specialists, among others, to ensure R&D quality and effective project management is essential.

b. What would you do to address those challenges?

My understanding is that EERE has been working with the DOE Office of the Human Capital Officer to streamline hiring processes where possible and expedite the selection and onboarding of the best qualified

staff. Specific measures include using direct hire and other special authorities whenever possible, using standard position descriptions and job analyses, selecting multiple applicants from the same hiring certificate for similar vacancies, hiring manager training, vacancy amplification strategies to support broad awareness of open positions, and streamlined hiring incentive processes that support the onboarding of the best and brightest talent. If confirmed, I would work with EERE to continue applying these strategies as it moves into and prepares for FY 2022.

Question 9: The President has proposed to increase funding for the Office of Nuclear Energy.

a. What do you see as the role of nuclear energy in the future U.S. energy supply system?

Nuclear energy is critical to our current and future energy supply system, and it is imperative that we not only keep our current fleet of nuclear reactors running as long as possible, but also that we deploy and construct advanced nuclear reactors to achieve a carbon-free electricity sector by 2035 and net-zero emissions, economy-wide, by no later than 2050.

b. What are the most important R&D priorities to help enable that future while ensuring safety and environmental protection?

It is imperative that we develop and deploy advanced nuclear reactors, next-generation fuels, and advanced manufacturing methods that enhance safety and enable flexible operation to generate process heat as well as electricity.

Question 10: The DOE Office of Fossil Energy recently became the Office of Fossil Energy and Carbon Management, reflecting the Administration's priority on using this program for R&D on topics such as carbon capture and storage, carbon dioxide removal, and reducing methane emissions from natural gas development.

a. What do you see as the role of coal, oil, and natural gas in the evolving U.S. energy system over the next 20 years?

Fossil fuels play an important role in our energy supply. In order to reach 100% clean electricity by 2035 and to achieve a net-zero carbon economy by 2050, Carbon Capture, Utilization and Storage (CCUS) will play a critical role along with efforts that ensure a leak-tight natural gas supply chain and eliminate net life cycle emissions from the use of natural gas and other fossil fuels. The Department of Energy (DOE) is investing in technologies and approaches and deploying regional initiatives to both forward the deployment of CCUS on existing fossil plants and provide resources and expertise in the transition to a net-zero carbon economy in coal and fossil-based power plant communities. Novel technologies and business models will enable low-cost CCUS to improve the environmental performance of power plants, hydrogen production, and industrial systems across America; support secure, long-term, regional carbon storage; and provide feedstocks for valuable

new products. Overall, CCUS has many potential benefits and can be a cost competitive option for managing carbon relative to other low-carbon sources of electricity and products.

b. How should DOE's R&D on fossil fuels be prioritized to balance environmental goals against goals such as developing advanced technologies for resource extraction and making fossil-fired power plants more efficient?

The Department of Energy's (DOE) fiscal year 2022 (FY 2022) budget request for the Office of Fossil Energy and Carbon Management (FECM) highlights DOE's prioritization on balancing environmental goals with resource extraction, efficiency, and in transitioning fossil fuel R&D to activities with future opportunities such as hydrogen production with CCUS. In most cases, these priorities are not mutually exclusive. For example, extraction of resources such as critical minerals (CM) and rare earth elements (REE) must be done in a sustainable manner. They also present opportunities to achieve environmental goals by utilizing waste materials for recovery of these CMs/REEs, and also by utilizing the waste material itself as a feedstock along with carbon dioxide to produce building materials. Efficiency is also an overarching goal with any of the pathways DOE invests in since it is critical to make these systems as efficient as possible to reduce resources (fuels, electricity, water, etc.) necessary.

Question 11: What will you do to ensure that the national labs safeguard the intellectual property that emerges from their research?

Over the past several years, the Department has taken a series of actions to address risks to research security while maintaining an open, collaborative, and world-leading enterprise. These actions aim to reduce the risk posed to DOE intellectual property and assets by specific threats, including threats posed by certain foreign governments. For example, DOE has established a cross-cutting advisory body to identify and manage potential risks to research security. DOE worked closely with the chief research officers across the 17 National Laboratories to develop the Science and Technology (S&T) Risk Matrix. It takes a risk-based approach to identifying critical and emerging technology areas that have potential economic and national security implications, but that do not otherwise have traditional protections in place. The S&T Risk Matrix is used to guide and manage foreign engagements, cooperative research and development agreements, strategic partnership projects, official travel, and foreign national access to our labs.

If confirmed, I would ensure that DOE continues to review these policies to ensure that this risk-based approach strikes the right balance between protecting our intellectual property and assets, while also maintaining the openness that underpins our innovation ecosystem. DOE will continue to actively co-chair the National Science and Technology Council Subcommittee on Research Security to ensure a coordinated approach to research security, as well as participate in the National Counterintelligence Task Force campaign on research security. In addition, DOE will continue to engage with partners through State Department-led efforts to exchange information on experiences and best practices on research security.

Question 12: The Energy Act of 2020 authorized multiple technology demonstration programs.

These programs will require significant funding, which could detract from other critical programs. How will you ensure a balanced approach that guarantees success of the demonstration programs without negatively impacting other research and development activities and infrastructure investments?

Many provisions of the Energy Act of 2020 will give the Department additional flexibility to push innovation in critical areas for emissions reduction, energy security and demonstrations on carbon capture, hydrogen, and other energy technologies. Additional appropriations, such as those included in the Senate passed Bipartisan Infrastructure Deal would be necessary for the DOE to implement the demonstrations authorized in the Energy Act of 2020. If confirmed, I would work within the Congressional directive for new demonstrations, while continuing to advance our applied energy and fundamental science portfolios.

Question 13: The Office of Fossil Energy and Carbon Management supports R&D on carbon capture and storage, carbon removal, and reducing methane emissions from natural gas systems.

a. What do you see as the role of coal, oil, and natural gas in the energy system over the next 20 years?

Fossil fuels play an important role in our energy supply. In order to reach 100% clean electricity by 2035 and to achieve a net-zero carbon economy by 2050, Carbon Capture, Utilization and Storage (CCUS) will play a critical role along with efforts that ensure a leak-tight natural gas supply chain and eliminate net life cycle emissions from the use of natural gas and other fossil fuels. The Department of Energy (DOE) is investing in technologies and approaches and deploying regional initiatives to both forward the deployment of CCUS on existing fossil plants and provide resources and expertise in the transition to a net-zero carbon economy in coal and fossil-based power plant communities.

b. What do you see as the most important areas of R&D that can deliver environmental gains while maintaining viable and secure fossil fuel industries?

There are critical areas of R&D, as reflected in FECM's FY 2022 research, development, demonstration, and deployment (RDD&D) budget request:

- **Reduce Methane Emissions:** Develop technologies and deploy regional initiatives to monitor and reduce methane emissions across the fossil fuel infrastructure including coal, oil, and gas.
- **Accelerate Carbon-Neutral Hydrogen (H_2):** Develop technologies that leverage the natural gas infrastructure for H_2 production, transportation, storage, and use coupled to carbon management.
- **Develop Low-Carbon Supply Chains for Industries:** Develop novel approaches to recycle carbon oxide emissions, principally carbon dioxide (CO_2), into value-added products such as cement, concrete, steel, chemicals, and fuels using systems-based carbon management approaches.
- **Advance Carbon Dioxide Removal (CDR):** Research, develop, and demonstrate CDR technologies and approaches by investing in direct air capture (DAC) and mineral carbonation projects.
- **Invest in Thoughtful Transition Strategies:** Invest in technologies and approaches, such as co-firing fossil fuels with waste biomass coupled to carbon capture and deploying regional initiatives to help in the transition to a net-zero carbon economy in coal and fossil-based power plant communities.

- **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.
- **Advance Critical Minerals (CM), Rare Earth Elements (REE), Coal Waste to Products and Mine Remediation:** Develop technologies that enable the sustainable recovery of CM, including REE from multiple feed stocks, throughout the upstream, midstream, and downstream supply chain from carbon and other ores, mining by-products, abandoned mines and wells and other valuable sources.

Question 14: The Nuclear Waste Policy Act directs DOE to site, construct, and operate a geologic repository for high-level waste at Yucca Mountain. DOE has failed to fulfill its legal obligation to move forward with the repository. If confirmed, how do you plan to ensure that DOE complies with the law?

Since Yucca Mountain has proven not to be a workable solution and has not received any Congressional appropriations for over a decade, if confirmed, I plan to move forward, under existing law, to identify sites for a federal consolidated interim storage facility for spent nuclear fuel using a consent-based process, as directed in the Consolidated Appropriations Act, 2021, and accompanying Congressional reports.

Question 15: Please describe the distinct missions of the Department of Energy and the National Science Foundation. It doesn't make sense to me that federal agencies should compete for research dollars and leadership roles in key focus areas. What is your view?

Given the urgency of the economic and national security challenges today, our federal agencies must resist the impulse to compete against one another and develop collaborations that will move us faster and farther together. With the parallel advisory roles that I have held at the National Science Foundation and the Department of Energy over my career, I have a good understanding of the distinct differences and similarities in the research portfolios, leadership roles, laboratory facilities and missions of the two agencies. Unique to DOE are its world-class National Laboratories and user facilities that address large scale, complex research and development challenges that have allowed translation of basic science to innovation for decades. NSF is unique in its efforts in education and social science research and with a broader portfolio in the geosciences and astronomy than DOE. Such differences provide significant opportunities for synergistic collaborations. If confirmed, I would look forward to working with the Director of NSF to develop collaborations in areas of mutual interest to our two agencies.

Question 16: If confirmed as Under Secretary for Science, you will also assume oversight responsibility for the Department's applied energy programs. How will you approach the challenge of dedicating sufficient time to each of these major programs?

If confirmed, I will work closely with the leadership of all the applied energy programs to understand their capabilities and investments and ensure they are successful in providing the U.S. with abundant, clean, reliable energy. I see my role as ensuring that they are able to capitalize on the many years of investments DOE has made in basic energy research. Given the diversity of the Under Secretary's portfolio, I will look forward to

spending more time learning about the full capabilities of the applied energy programs and making certain that we use every available opportunity to integrate DOE's science and applied energy programs to make significant progress on advancing clean energy for the American people. I will bring to this responsibility the advantage of my long experience engaging with many of the DOE Office of Science and applied energy national laboratories.

Question 17: We have multiple agencies that support science and technology innovation. Do you agree that the Department of Energy should continue to have a leading role in applied science and technology innovation?

Yes.

Question 18: The Experimental Program to Stimulate Competitive Research ("EPSCoR") within DOE's Office of Science is designed to improve energy-related research in 24 largely rural states, including Wyoming. DOE needs to continue to build basic research capacity in EPSCoR states.

If confirmed, would you support increasing funding for the EPSCoR program?

Yes. EPSCoR is ideally designed for rural and underserved states such as Wyoming. As with a number of other more rural states, there is significant capacity and economic need for growth in the advanced energy research and technology sector with EPSCoR funds that could fuel economic growth and jobs.

Question 19: If confirmed as Under Secretary for Science and Energy, you will be responsible for advising Secretary Granholm on the management and the state of the national laboratories overseen by the Department. You have years of experience serving on committees and boards at the Energy Department and our national laboratories.

a. Can you tell the committee a little about your background working with these entities?

My experience with the national laboratories is extensive and covers many years of service to these entities. This has included participating in leadership and advisory activities, search committees, oversight boards, research program reviews, proposal reviews, and multiple DOE federal advisory committees. As a scientist, I have also led multiple research collaborations with national laboratory scientists. Beyond my scientific, leadership and advisory board roles, I have had many opportunities to visit the user facilities and research laboratories at many of the DOE national laboratories, as well as engage directly with their leadership and staff-level scientists. As part of the COACh program that I have run out of the University of Oregon since 1998, I have led research on issues related to workforce development for scientists and engineers in the United States at various institutions and laboratories, which has been presented to the National Laboratory Directors' Council.

b. How do you view the current management of the national laboratories and if confirmed, what would you do differently?

I view the current management of the national laboratories quite positively. With nearly flat budgets in recent years, the directors and their leadership teams have had a challenging time to keep their best scientists and their facilities fully operational. I do however believe that improvements can be made in developing stronger

research collaborations across the national laboratories and with the private sector. If confirmed, I would be active in trying to increase such collaborations and ensure maximum benefit for DOE investments at the national laboratories.

Question 20: The Nation's electricity system is critical to our economic and national security. As we have witnessed during recent weather events like the deep freeze across a large portion of the country this February and summer blackouts in California, Americans suffer when they lack access to affordable and reliable electricity.

In July a coalition of consumer groups wrote a letter to this Committee asking us to examine the cost and reliability impacts of regional transmission organizations (RTOs) and vertically integrated markets and provide an analysis of whether RTO expansion will benefit or harm retail consumers. Both a 2007 task force report directed by the Energy Policy Act of 2005 and a 2008 report from the GAO determined that there was no clear consensus on the benefits of RTOs to retail consumers. It is long overdue that the federal government revisit this critical issue.

Under the DOE's present organizational structure, you would oversee the applied energy offices, including the Office of Electricity. Do you commit to analyzing and reporting back to this Committee the cost and reliability impacts of RTOs, and to what extent any cost or reliability benefits of RTOs flow through to retail customers?

Answer: I agree with you that recent weather impacts demonstrate the nation's tremendous need to modernize our electrical grid infrastructure. DOE's Office of Electricity supports significant R&D efforts and works with utilities and RTOs to address issues of reliability. The Office of Electricity's portfolio includes work on technologies to increase grid resilience and to modernize the grid, including microgrids, energy storage, and grid enhancing technologies. If confirmed, I would work with the Office of Electricity to continue this work partnering with utilities, identifying grid infrastructure challenges, providing technical assistance to state and local government stakeholders, and ensuring that retail customers have reliable and affordable power.

Questions from Senator James E. Risch

Question 1: My home state of Idaho is home to the lead DOE nuclear energy laboratory, the Idaho National Lab. The INL is an applied energy lab in the Office of Nuclear Energy, but my understanding is that the Office of Science sometimes incorporates applied energy research into its programs. Can you speak to the relationship between the Office of Science and applied energy programs at DOE?

Coordination between the Department's basic research and applied energy programs is now a high priority within DOE and is facilitated in multiple ways including joint planning meetings, technical community workshops, annual contractor/awardee meetings, joint research solicitations, DOE program working groups, and collaborative program management of DOE's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs.

DOE leadership has established formal Science and Energy Technology Teams that cross the Department and meet on a regular basis to discuss R&D activities and goals across the science and applied energy and other programs such as ARPA-E. Coordinated funding of research activities at the DOE National Laboratories, support for ancillary equipment and end stations at scientific user facilities, and partnership/collaboration-encouraging funding mechanisms also help facilitate research integration across the basic and applied research communities. The Office of Science's R&D coordination also occurs at the interagency level.

Question 2: Do you support continued appropriate interactions between the Office of Science and the applied energy programs?

Yes.