

**OVERVIEW OF THE SCIENCE
AND ENERGY RESEARCH ENTERPRISE
OF THE U.S. DEPARTMENT OF ENERGY**

HEARING
BEFORE THE
**COMMITTEE ON SCIENCE, SPACE,
AND TECHNOLOGY**
HOUSE OF REPRESENTATIVES
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THURSDAY, MAY 27, 2021

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Committee met, pursuant to notice, at 1 o'clock p.m., via Zoom, Hon. Eddie Bernice Johnson [Chairwoman of the Committee] presiding.

**COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
HEARING CHARTER**

Overview of the Science and Energy Research Enterprise of the U.S. Department of Energy
Thursday, May 27, 2021
1:00PM ET

PURPOSE

The purpose of this hearing is to examine the research, development, demonstration, and commercialization programs and activities carried out by the Department of Energy (DOE). It will also consider the goals and impacts of the Department's Fiscal Year 2022 discretionary budget request.

WITNESS

- **The Honorable Jennifer Granholm**, Secretary of Energy, U.S. Department of Energy

Background

This Committee has exclusive jurisdiction over the Department of Energy's science and energy research, development, demonstration, and commercial application activities. This includes the management and support of 17 national laboratories, and programs that advance technologies and our scientific understanding in areas as varied as: renewable energy, nuclear power, carbon capture and storage, fusion energy, particle physics, materials science, computational modeling, energy efficiency, energy storage, modernization of the electric grid, climate research, engineering biology, next generation vehicle technologies, and more.

Department of Energy Fiscal Year 2022 Discretionary Budget Request

The discretionary budget request would provide \$46.1 billion overall for the Department of Energy in FY 2022, a 10.2% increase from the 2021 enacted level. The detailed budget request has not yet been released, though the Administration provided a brief summary of the request on April 9th. According to this summary, the request "invests more than \$8 billion, an increase of at least 27 percent over 2021 funding, in technology such as advanced nuclear energy technologies, electric vehicles, green hydrogen, and even innovative approaches to air conditioning and

refrigeration. These investments would leverage the tremendous innovation capacity of the National Laboratories, universities, and entrepreneurs to transform America's power, transportation, buildings, and industrial sectors to achieve a net-zero emissions economy by 2050.”¹

In addition, it would provide “increased funding for a revitalized Office of Fossil Energy and Carbon Management,” currently named the Office of Fossil Energy, and support additional grants and workforce development programs for Minority-Serving Institutions.²

Office of Science

The Office of Science is the lead federal agency supporting scientific research for energy applications and the nation's largest supporter of research in the physical sciences. The Office supports large-scale research programs in materials science, climate science, biofuels, carbon management, advanced computing, fusion energy, high-energy physics, and nuclear physics. It also provides a unique service to the U.S. research enterprise by building and managing 29 national scientific user facilities, which are some of the most advanced tools of modern science. They include the world's fastest supercomputers, light sources and neutron sources to study the properties of new materials for a wide range of applications, accelerators to explore the building blocks of matter, and facilities for studying the nanoworld. The Office supports 25,000 researchers from industry, universities, national laboratories, other federal agencies, and international partners.³

In addition to discipline-specific programs, the Office of Science leads or significantly contributes to the Department's initiatives in several emerging and crosscutting areas. One such area is quantum information science (QIS), where the Office of Science supports five National QIS Research Centers and stewards a broad research program focused on quantum computing, sensing, and communication among other related fields. The Office of Science also leads crosscutting research activities in artificial intelligence, high-performance computing, and microelectronics.

Budget

FY 2021 Enacted:	\$ 7 billion
FY 2022 Discretionary Request:	\$ 7.4 billion

¹ <https://www.whitehouse.gov/wp-content/uploads/2021/04/FY2022-Discretionary-Request.pdf>

² Ibid.

³ <https://www.energy.gov/science/about-office-science>

Difference: +\$ 400 million (+5.7%)

The President's FY 2022 discretionary request would, if enacted, increase federal support for the Office of Science by 5.7% from the FY21 enacted level.

Note: The Office of Science is currently the only major element within DOE that the Administration has provided a specific budget request level for.

Office of Energy Efficiency and Renewable Energy

The Office of Energy Efficiency and Renewable Energy (EERE) supports investments in a wide range of clean energy technologies, including solar, wind, geothermal, marine and hydrokinetic power, bioenergy, vehicle technologies, hydrogen and fuel cells, critical materials, advanced manufacturing, and building technologies.⁴

Office of Electricity

The Office of Electricity (OE) leads efforts to ensure that the Nation's energy delivery system is resilient and reliable. The office supports the development of new technologies to improve the infrastructure that stores and transports electricity, and the federal and state electricity policies and programs that shape electricity system planning and market operations.⁵

Office of Cybersecurity, Energy Security, and Emergency Response

The mission of the Office of Cybersecurity, Energy Security, and Emergency Response (CESER) is to enhance the security of U.S. critical energy infrastructure to all hazards, mitigate the impacts of disruptive events and risk to the sector overall through preparedness and innovation, and respond to and facilitate recovery from energy disruptions.⁶

⁴ <https://www.energy.gov/eere/office-energy-efficiency-renewable-energy>

⁵ <https://www.energy.gov/oe/office-electricity>

⁶ <https://www.energy.gov/ceser/ceser-mission#:~:text=To%20enhance%20the%20security%20of,Federal%20agencies%2C%20the%20private%20sector%2C>

Office of Fossil Energy

The Office of Fossil Energy (FE) supports R&D projects in the areas of carbon capture, utilization, and storage (CCUS), carbon removal, methane leak detection and mitigation, and other areas related to the extraction and use of coal and natural gas with a focus on reducing environmental impacts and improving efficiency.⁷

In addition to changing its name to the Office of Fossil Energy and Carbon Management, the Administration’s discretionary request states that it “would 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.”⁸

Office of Nuclear Energy

The Office of Nuclear Energy (NE) supports RD&D activities to resolve the technical, cost, safety, and waste management challenges of increased use of nuclear energy to ensure that this resource remains a viable clean energy option for the nation.⁹

Advanced Research Projects Agency-Energy

The Advanced Research Projects Agency-Energy (ARPA-E) was established in 2009 after being authorized in the America COMPETES Act and funded through the American Recovery and Reinvestment Act. Modeled on the military’s DARPA program, ARPA-E funds the type of high-risk, high-impact research projects that industry, universities, national labs, and other government programs are unlikely to pursue on their own. Like DARPA, its business model makes it unique, with a flat management structure and small staff that consists largely of technical and scientific experts hired for limited terms of 2-4 years, and business practices that emphasize reducing transactional speed and adhering to “go/no go” milestones for projects.¹⁰

The request includes \$1 billion total for a new Advanced Research Projects Agency for Climate and for activities supported by ARPA-E, of which \$700 million would be funded through DOE. ARPA-E received \$427 million in FY21.

⁷ <https://www.energy.gov/fe/about-fossil-energy>

⁸ <https://www.whitehouse.gov/wp-content/uploads/2021/04/FY2022-Discretionary-Request.pdf>

⁹ <https://www.energy.gov/ne/about-us>

¹⁰ <https://arpa-e.energy.gov/about/our-impact>

Loan Programs Office

The DOE's Loan Programs, administered by the Loan Programs Office (LPO), enable the Department to work with private companies and lenders to mitigate the financing risks associated with first-of-a-kind commercial clean energy projects, and thereby encourage their development on a larger scale. LPO stewards three major programs, the Innovative Energy Loan Guarantee Program, the Advanced Technology Vehicles Manufacturing Loan Program, and the Tribal Energy Loan Program through which it originates, guarantees, and monitors loans.¹¹

Office of Technology Transitions

The Department of Energy's Office of Technology Transitions (OTT) serves as the hub for the technology transfer activities across the Department of Energy's R&D enterprise. The Office works to expand the commercial impact of the Department of Energy's research and development portfolio. It focuses on streamlining information and access to DOE's national labs and sites to accelerate the transfer of DOE-supported innovations into the marketplace.¹²

Arctic Energy Office

The Department of Energy's Arctic Energy Office leads cross-cutting R&D operations in the Arctic to address energy, science, and national security challenges. The Office will represent the Department in engagements involving the Arctic.¹³

¹¹ <https://www.energy.gov/lpo/about-us-home>

¹² <https://www.energy.gov/technologytransitions/about-us>

¹³ <https://www.energy.gov/arctic/arctic-energy-office>

Chairwoman JOHNSON. Thank you very much. This meeting will come to order. Without objection, the Chair is authorized to declare recess at any time, and before I deliver my opening remarks, I want to make note that today, the Committee is meeting virtually. I want to announce a couple of reminders to the Members about the conduct of the hearing.

First, Members should keep their video feed on as long as they're present in the hearing. Members are responsible for their own microphones. Please also keep your microphones muted until you are speaking. Finally, if Members have documents they wish to submit to the record, please email them to the Committee Clerk, whose email address was circulated prior to the meeting.

Good morning to everyone, and thank you, Madam Secretary, for appearing before us today. It is so great to see you. As you know, this Committee has jurisdiction over all of the Department of Energy's (DOE's) essential science and energy research and development (R&D) activities, their laboratories, and facilities. So, I very much look forward to working with you throughout this Congress.

We are meeting today at a critical time in history. Unfortunately, climate change remains a growing threat across the world. Many of us have been firsthand and have seen firsthand the devastating effects it can have in our communities. We are going through some of that right now in my community with lots and lots of rain. Especially our front-line and disadvantaged communities are suffering. At the same time, this novel coronavirus has substantially disrupted the world as we knew it. And that includes much of the critical scientific research that we spend a lot of time on this Committee learning about and discussing.

But with great challenges, great opportunities. We are currently in the midst of a budget season, and we are very eagerly awaiting release of President Biden's detailed budget request. I was pleased to see the preliminary request that included a 27 percent increase from the fiscal year 2021 levels for the Department of Energy's applied energy programs. This includes support for advanced nuclear technologies, electric vehicles (EVs), and hydrogen production, just to name a few. There are brighter days on the horizon.

Members of this Committee are also currently working on a bipartisan reauthorization of the DOE Office of Science. I support the administration's goal of additional funding for the Office's critical efforts to improve our competitiveness and decarbonize our country. However, I would also urge the administration to consider the benefits of additional funding to support some of our Nation's most important science and energy research programs and facilities. The discretionary request for the Office of Science includes a \$400 million increase to a total of \$7.4 billion. While this is certainly appreciated, I believe that this level of growth is not sufficient for the current needs of the world-class user facilities, research programs, and national laboratories stewarded by the Office. So, I hope that we will do better when Congress acts on DOE's budget request later this year.

Moving forward, the budget we are here today to provide an opportunity for our Members to ask questions pertaining to any and all of the science and energy research activities carried out by the Department. Constituents from Member districts on both sides of

the aisle benefit greatly from these programs, and we believe it is our duty to ensure the responsible use of their tax dollars.

I am proud to say, though, that a lot of thoughtful hard work and dedication, we were able to authorize many of these programs in a bipartisan fashion in the *Energy Act of 2020*, which was signed into law late last year. We look forward to working with you on the implementation of that new law, among many other areas of mutual interest.

One last note to my colleagues. The Secretary will have to depart at 4 p.m., so I encourage you to keep your questions to 5 minutes so that we can have ample opportunity to engage with all of our Members, and I will endeavor to do the same.

So, with that, I would like to thank you again for being here, and I look forward to a productive session.

[The prepared statement of Chairwoman Johnson follows:]

Good morning everyone, and thank you, Madam Secretary, for appearing before us today. It is so great to see you. As you know, this Committee has jurisdiction over all of the Department of Energy's essential science and energy research and development activities, laboratories, and facilities. So I very much look forward to working with you throughout this Congress.

We are meeting today at a critical time in history. Unfortunately, climate change remains a growing threat across the world. Many of us have seen first-hand the devastating effects it can have in our communities, especially our front-line and disadvantaged communities. At the same time, this novel coronavirus has substantially disrupted the world as we knew it. And that includes much of the critical scientific research that we spend a lot of our time on this Committee learning about and discussing.

But with great challenges come great opportunities. We are currently in the midst of budget season, and are very eagerly awaiting the release of President Biden's detailed budget request. I was pleased to see the preliminary request, which includes a 27% increase from the FY21 levels for the Department of Energy's applied energy programs. This includes support for advanced nuclear technologies, electric vehicles, and hydrogen production just to name a few. There are brighter days on the horizon.

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Moving beyond the budget, we are here today to provide an opportunity for our Members to ask questions pertaining to any and all of the science and energy research activities carried out by the Department. Constituents from Member districts on both sides of the aisle benefit greatly from these programs, and we believe it is our duty to ensure the responsible use of their tax dollars. I am proud to say that through a lot of thoughtful hard work and dedication, we were able to authorize many of these programs in a bipartisan fashion in the *Energy Act of 2020*, which was signed into law late last year. We look forward to working with you on the implementation of that law, among many other areas of mutual interest.

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With that, I would like to thank you again for being here, and I look forward to a productive discussion this morning.

Chairwoman JOHNSON. I now recognize Mr. Lucas for his opening statement.

Mr. LUCAS. Thank you, Chairwoman, for hosting this hearing. Today, we welcome Secretary of Energy Jennifer Granholm to discuss the Department's priorities for fiscal year 2022 and beyond. I'm looking forward to hearing how the Department will provide robust support for the high-priority research programs and infrastructure carried out by the Department.

DOE is one of the Nation's largest Federal sponsor of basic research in the physical sciences, and is world leader in technology development and innovation. As such, it's critical to our work on the Science Committee to address two of the biggest challenges facing our country right now: climate change and global competitiveness.

To address climate change and continue our economic growth, we must develop cleaner, more reliable energy sources. But we have to approach this in a way that doesn't raise energy prices and take away American jobs. We need to invest in research that produces next generation technologies, ensuring America is the leader in affordable energy production and global emissions reductions for years to come.

At the same time, we face serious threats to our scientific leadership from the Chinese Communist Party. In order for the U.S. research enterprise to keep its position as the world's leader in innovation, we must make significant investments in R&D that provide a stable, sustainable path forward in key technology focus areas, and across the scientific disciplines. DOE is uniquely positioned in both of these challenges. It is our responsibility on the Science Committee to ensure that the Department has the authorities and the resources it needs to get the job done.

Last Congress, we worked together to pass the *Energy Act of 2020*, the first comprehensive update of U.S. energy policy in over a decade. This bill includes more than a dozen bills from this Committee and focuses on diverse and competitive clean energy solutions driven by research across DOE's applied energy offices. It recognizes that the most effective way to improve energy efficiency, reduce greenhouse gases, and maintain U.S. energy independence is through technological innovations, which we can support by investing in basic and early stage research.

This afternoon, I look forward to hearing from the Secretary about DOE's plans to fully implement this legislation, to build on the successes of the *Energy Act*, and to ensure that DOE's essential contributions to the Federal research enterprise, we must work together to pass comprehensive DOE Office of Science legislation.

Today, Chairwoman Johnson and I released the text of a bipartisan bill to reauthorize the Office of Science, increase our investment, and provide a roadmap for DOE's research and development work. This is the first comprehensive reauthorization of the Office of Science, and it could not possibly come at a better time. Working with the Energy Subcommittee Ranking Member, Mr. Weber, and Subcommittee Chairman, Mr. Bowman, we drafted a bill that will invest nearly \$50 billion over 5 years, giving the Office of Science and our national labs the resources they need to continue to excel. We need cutting edge facilities for our Federal scientists and researchers with academic and industry to conduct big science, research that can't be done in individual labs and requires massive

equipment that industry cannot provide, like advanced light sources and neutron sources. This Office of Science legislation which will be formally introduced tomorrow is the part of a two-pronged approach to build up America's research program, along with the *NSF for the Future Act*.

Chairwoman Johnson and I have taken a deliberative approach to revitalizing American research. We are doing so within reauthorization bills which comprehensively fund the National Science Foundation and the Office of Science. Rather than throwing money at these agencies or pitting them against each other for funding, we are investing in the programs that work, creating new ones where needed. We are giving agencies the resources to sustainably scale up their work. The last thing we need is a massive, one-time injection of money that will dry up when the attention turns away from America's research needs.

The *NSF for the Future Act* and this Office of Science reauthorization are both in line with the *Securing America's Leadership and Technology Act*, *SALSTA*, a bill I introduced to double the Office of Science funding over the next 10 years, invest in our national labs, and improve technology transfer, and protect American research from theft by foreign adversaries.

I appreciate Chairwoman Johnson's commitment to our shared goal of strengthening our research enterprise. I look forward to working together to pass these bills into law. And I also want to thank the Secretary for her testimony today, and for outlining her plans to execute DOE's mission objectives in the upcoming fiscal year and beyond. I look forward to a productive discussion.

Thank you, Chairwoman Johnson, and I yield back the balance of my time.

[The prepared statement of Mr. Lucas follows:]

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At the same time, we face serious threats to our scientific leadership from the Chinese Communist Party. In order for the U.S. research enterprise to keep its position as the world's leader in innovation, we must make significant investments in R&D that provide a stable and sustainable path forward in key technology focus areas and across the scientific disciplines.

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We need cutting-edge facilities for our federal scientists and researchers from academia and industry to conduct big science-research that can't be done in individual labs and requires massive equipment that industry cannot provide, like advanced light sources and neutron sources. This Office of Science legislation, which will be formally introduced tomorrow, is part of a two-pronged approach to buildup America's research program along with the *NSF for the Future Act*,

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The *NSF for the Future Act* and this Office of Science reauthorization are both in line with the *Securing American Leadership in Technology Act (SALSTA)*, a bill I introduced to double Office of Science funding over the next 10 years, invest in our national laboratories, improve technology transfer, and protect American research from theft by foreign adversaries I appreciate Chairwoman Johnson's commitment to our shared goal of strengthening our research enterprise and I look forward to working together to pass these bills into law.

I want to thank Secretary Granholm for her testimony today, and for outlining her plans to execute DOE's mission objectives in the upcoming fiscal year and beyond. I look forward to a productive discussion. Thank you Chairwoman Johnson, I yield back the balance of my time.

Chairwoman JOHNSON. Thank you very much, Mr. Lucas.

If there are Members who wish to submit additional opening statements, your statements will be added to the record at this point.

At this time, I will now like to welcome our esteemed witness, who really needs little introduction, but I will give some.

The Honorable Jennifer Granholm is the 16th United States Secretary of Energy. She served as the Governor of Michigan from 2003 to 2011, as well as Attorney General of Michigan from 1998 to 2002, and was the first woman to serve in either role. After two terms of Governor, Ms. Granholm joined the faculty at the University of California at Berkeley as a distinguished professor of practice in the Goldman School of Public Policy, focusing on the intersection of law, clean energy, manufacturing, policy, and industry. She also served as an advisor to the Clean Energy Program at the Pew Charitable Trust.

I look forward to working with Secretary Granholm to help build an equitable clean energy future, and so, thank you, Secretary, for joining us today. You will have 5 minutes for your spoken testimony, and your written testimony will be included in the record for the hearing. When you have completed your spoken testimony, we will begin questions and each Member will have 5 minutes to ask questions.

You now can begin your testimony.

**TESTIMONY OF THE HONORABLE JENNIFER GRANHOLM,
SECRETARY OF ENERGY, U.S. DEPARTMENT OF ENERGY**

Secretary GRANHOLM. Great. Thank you so much, Chairwoman Johnson, and thank you to Ranking Member Frank Lucas, and to all of the Members of the House Committee on Science, Space, and Technology. It is a treat to be before you today, and it is a treat to be able to share the Biden Administration's vision and priorities for the Department of Energy.

So, as the 16th, as was said, Secretary of Energy, it is my mission to carry out the basic science and national security efforts that have long been pivotal to the Department's work, and at the same time, driving forward the research and development deployment of cutting-edge clean energy technologies that are going to power our energy and economic security throughout the 21st century.

We have made a lot of progress just in a few months' time, but we've also come to recognize how urgent some aspects of our work really are. And we can start on that score with, for example, the Colonial Pipeline issue.

As you know, on May 7, the Colonial Pipeline company fell victim to a ransomware attack that forced them to shut down their largest fuel pipeline on the East Coast, and President Biden immediately launched an interagency whole of government response, which was coordinated by the Department of Energy. And I am proud that the quick efforts helped to move those fuel supplies to the impacted areas, and of course, supporting the company while they attempted to resume operations quickly and safely. But the incident really made clear that as these systems that Americans rely on in our daily lives grow increasingly interconnected, so too do the vulnerabilities in these systems and the potential for disruption.

So, we have to take a wide view of the possible risks, and we have to engage every relevant part of the Federal Government to develop the safeguards and the best practices to keep the systems that touch that critical infrastructure a step ahead of our adversaries. So, I would welcome conversations with this Committee around the steps necessary to keep America's energy systems secure, and clearly, the Department of Energy has a key role to play.

So, as you know, DOE has many core competencies. You all have been very busy passing bills and working in these quantum information sciences and advanced computing and artificial intelligence, you know, just to scratch the surface of all that we deploy at the Department, and of course, led by the unparalleled research capacity of our 17 national labs. It is not lost on us that the Members of this Committee have rightly pushed to authorize the Department to advance these specialties, along with propelling advanced manufacturing and so many other areas of applied science that we excel in. I really appreciate the Chairwoman's great support and remarks about the importance of investing in science, and I can just tell you in the short time that I have been leading the Department, I am in awe of the work that our scientists and our researchers are doing. So, we really thank you so much for recognizing the invaluable contributions they make to their fields, but also to the Nation.

So, we hope to continue working in a collaborative, complementary manner with the full suite of federally supported scientific enterprises. The research and development work, though, would ex-

pand by orders of magnitude with the passage of the American Jobs Plan. As you know, it is a just a once in a generation investment that would supercharge these research and development efforts around clean energy, while creating millions of good paying jobs. It would really launch us to the forefront of clean energy innovation worldwide. It would ensure that American scientists are the ones making the major breakthroughs in cutting edge technologies like carbon capture and storage and hydrogen. It would—the American Jobs Plan would position American entrepreneurs to take these technologies to scale. It would give American workers the opportunity to build them in factories right here at home. The American Jobs Plan would also deliver essential upgrades to both the brick-and-mortar facilities, and the computing capabilities of our national labs, along with other research infrastructure across the country, and it would make the necessary investments in the industries of the future. It would also help us take major leaps over barriers to diversity in America’s STEM (science, technology, engineering, and mathematics) fields by making long overdue increases in support for historically Black colleges and universities, and other minority-serving institutions.

So, I am so pleased to note that the President’s proposed 2022 discretionary funding request would put \$46.2 billion behind all of these key priorities, along with our very essential work to strengthen the Department’s nuclear security mission, and advance our environmental management programs.

So, these are ambitious objectives, and yet, the global march of innovation makes it imperative that we achieve them. I am really humbled to lead the wealth of talent that we have in the Department of Energy as we work toward these ambitious goals, and I am confident that with your continuing partnership, we will be successful.

So, thank you so much.

[The prepared statement of Secretary Granholm follows:]

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, CO₂ 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 Plant 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.

Jennifer M. Granholm was sworn in as the 16th Secretary of Energy on February 25, 2021, becoming just the second woman to lead the U.S. Department of Energy (DOE).

Secretary Granholm will lead DOE in helping America achieve President Biden's goal of net-zero carbon emissions by 2050 by advancing cutting-edge clean energy technologies, creating millions of good-paying union clean energy jobs, and building an equitable clean energy future. Secretary Granholm will also oversee DOE's core missions of promoting American leadership in scientific discovery, maintaining the nuclear deterrent and reducing nuclear danger, and remediating the environmental harms caused by legacy defense programs.

Prior to her nomination as Secretary of Energy, Jennifer Granholm was the first woman elected Governor of Michigan, serving two terms from 2003 to 2011.

As Governor, Jennifer Granholm faced economic downturns caused by the Great Recession and meltdown in the automotive and manufacturing sectors. She successfully led efforts to diversify the state's economy, strengthen its auto industry, preserve the manufacturing sector, and add emerging sectors — such as clean energy — to Michigan's economic portfolio. Today, one-third of all North American electric vehicle battery production takes place in Michigan, the state is one of the top five states for clean energy patents, and 126,000 Michiganders were employed in the clean energy sector prior to COVID-19.

Secretary Granholm was also the first woman elected Attorney General of Michigan and served as the state's top law enforcement officer from 1998 to 2002.

After two terms as governor, Jennifer Granholm joined the faculty of the University of California, Berkeley as a Distinguished Professor of Practice in the Goldman School of Public Policy, focusing on the intersection of law, clean energy, manufacturing, policy, and industry. She also served as an advisor to the Clean Energy Program of the Pew Charitable Trusts.

Jennifer Granholm began her career in public service as a judicial clerk for Michigan's 6th Circuit Court of Appeals. She became a federal prosecutor in Detroit in 1990, and in 1994, she was appointed Wayne County Corporation Counsel.

Secretary Granholm, an immigrant from Canada, is an honors graduate of both the University of California, Berkeley and Harvard Law School. She and her husband, Daniel G. Mulhern, have three children.

Chairwoman JOHNSON. Well, thank you, Madam Secretary.

At this point, we will begin our first round of questions, and the chair recognizes herself for 5 minutes.

Madam Secretary, here on the Science Committee, we are planning to introduce a comprehensive bipartisan authorization bill for the Office of Science tomorrow. I was encouraged to see that the Office of Science was one of the few line items provided for the Department of Energy in the initial discretionary budget request. However, I am disappointed in the level of increase, as it is unlikely to be enough to support the current needs of these facilities, research programs, and the national laboratories stewarded by the office.

Given the major construction activities currently being carried out by the Office of Science to build and upgrade its various world-class facilities, this level of support may well result in a cut to major research accounts, or it could lead to inadequate funding to keep the Office's construction activities on schedule and minimize their costs.

Could you address how the administration arrived at 5.7 percent increase in the Office of Science, especially in comparison to the major increases proposed for DOE's Applied Energy Programs and the National Science Foundation? Is this any indication of the lack of support or appreciation for the unique and significant role that the Office of Science plays in fostering U.S. competitiveness?

Secretary GRANHOLM. Not at all. I so appreciate your question.

Obviously research and development is so critical to our competitiveness, and although I certainly share the sentiment that stronger funding for R&D would further support our competitiveness, I would note, as you did, that the Office of Science is receiving a \$400 million increase from enacted levels, which would enable us to support all of the key areas that that office covers, from quantum technology to biology.

But I also want to say, this is the—this represents the single-largest budget, if it were enacted, at DOE, so there is no reason to think that this is anything but huge. Plus, billions will be added to the labs and the Office of Science through the American Jobs Plan, assuming that Congress passes it.

So, believe me. This administration is all in on funding scientific research. We recognize that we need to up our game in the basic sciences and research and development, and that those investments are needed and that the administration is deeply committed to the national labs and the Office of Science, and so that's why the American Jobs Plan is so big and robust on funding research and development.

So, we are very excited about that and to work with you, and so grateful for your expression of support for the Office of Science.

Chairwoman JOHNSON. Well, thank you.

How will you keep the Office of Science's major construction activities, including our commitment to the ITER (International Thermonuclear Experimental Reactor) International Fusion Project, on track with this level of funding?

Secretary GRANHOLM. Yeah. The ITER Project, as you know, is a very important priority for the Office of Science, and certainly important for this administration. They are committed to the ITER

Project, and I can assure you that the U.S. contributions to the ITER Project are being effectively and efficiently managed by the Office of Fusion Energy Science and by the U.S. ITER Project Office with its associated national laboratories, including Oak Ridge National Lab and Princeton, and the Savannah River National Lab.

So, the goal, of course, with this project is to demonstrate the feasibility of fusion as a large-scale and carbon-free source of energy. It is the holy grail, and I am super eager to see the project succeed.

Chairwoman JOHNSON. Well thank you. One last question.

Will you be able to support these projects at levels that the Department has previously estimated would be necessary to minimize their total costs? Or would these cost estimates need to be increased as a result?

Secretary GRANHOLM. No, I can assure you that the Department is committed to bringing resources to bear on these—this project and other projects. It is a priority for you. It is a priority for Members of the Committee, and I look forward to working with you on it.

Chairwoman JOHNSON. Thank you very much.

I now recognize Mr. Lucas for 5 minutes.

Mr. LUCAS. Thank you, Madam Chair.

The United States has vast global geothermal resources. If harnessed correctly, these resources have the capacity to provide clean, renewable, secure load-based power, not just for Oklahoma, but for Americans across the country. This is why last Congress I introduced the *Advanced Geothermal Research and Development Act*, which I'm pleased to see was incorporated in the *Energy Act of 2020*. This Congress, I am closely following the Department's progress in carrying out the activities authorized in my bill.

Secretary, can you please provide us with a brief description on the update on the Department's continued implementation of these provisions on geothermal.

Secretary GRANHOLM. You bet. You bet, thank you, Ranking Member Lucas. I really appreciate the question, and all of the great work that this Committee did really in a bipartisan way, which we hope can be replicated this year to get that *Energy Act of 2020* passed.

You know, the—many of the pieces we are already working on, for example, on the geothermal side like the Forge Initiative, which I know you are very supportive of, enhanced geothermal systems represents the largest opportunity for geothermal power production in the U.S., and the 2019 DOE—I think they had a geovision report that suggested that those are the enhanced geothermal systems, if they're used to their maximum potential, could provide up to 8-1/2 percent of all power generation in the U.S. by 2050. I feel like geothermal is an underused resource. I am a big believer in it. I have met several times with our own geothermal office to make sure that we can accelerate this.

You know, we could say on the storage side of things, too, because the *Energy Act* was so bullish on storage, as it should have been. I mean, DOE has continued to support the Energy Storage Grant Challenge as well, which is obviously a comprehensive pro-

gram that cuts across all of our offices. And because that *Energy Act of 2020* was a great authorization for a lot of programs and a lot of that *Energy Act*, it has informed the American Jobs Plan. So, if we can get the appropriations attached to the great projects that were identified there, we can really take off.

So, thank you for your leadership.

Mr. LUCAS. Absolutely, Secretary.

And along with that, the President's proposed an advanced research project agency focused on climate called ARPA-C (Advanced Research Projects Agency—Climate). So far, we have limited information on ARPA-C, but it sounds a lot like DOE's ARPA-E (Advanced Research Projects Agency—Energy) program. As longtime supporters of ARPA-E, Chairwoman Johnson and I successfully reformed and reauthorized the program last year.

So, Secretary, I have got a series of short questions about the ARPA-C proposal that hopefully can get me a set of brief answers.

First, do you support the creation of ARPA-C?

Secretary GRANHOLM. Yes, I do.

Mr. LUCAS. Second, what role will DOE play in its management? Do you know that yet?

Secretary GRANHOLM. Yeah, well, we want to work with you all on it, but we expect that ARPA-C and ARPA-E will work together. We don't want them to duplicate, which is a question I can understand that people might have. ARPA-C could invest in different kinds of research, critical research areas that are beyond the purely energy-focused work of ARPA-E, to look at, for example, non-energy related emissions reduction technologies, or an entire area of climate-related work, like the work of making our society more resilient, for example, to the effects of climate change that are already occurring.

So, we expect that they would work together, hand in glove. They could be working maybe under the same umbrella, but I like the expansion of the notion of energy and climate under an umbrella that would fall within the Department of Energy.

Mr. LUCAS. So, in the time I have left, let's visit for a little bit about how you will balance implementing the ARPA-E provisions authorized in the *Energy Act* while supporting the establishment of ARPA-C? As you can see, ARPA-E has tremendous support in its present form on this Committee. Tell me about how you balance those two things as you implement them with the stuff authorized under the Act?

Secretary GRANHOLM. I mean, as you know, ARPA-E really is focused on energy, and they have—we would expect that they would work together, as I say, hand in glove, but they would have distinct areas of focus purely on energy. One on non-energy-related climate work. And you know, it could be that they are in the same office. It could be sort of the same—you know, an expanded umbrella, but we want to work with you on what that looks like, especially in light of all the climate challenges that we have seen in communities across the country—

Mr. LUCAS. Absolutely.

Secretary GRANHOLM [continuing]. Related to—

Mr. LUCAS. Madam Secretary, I would agree. And success in developing new forms of clean, consistent energy will address many of those other issues.

So, I have faith in the market economy. We just need to provide the resources to the economy to respond.

With that, I yield back, Chairwoman. Thank you very much.

Chairwoman JOHNSON. Thank you very much.

We'll now go to staff support to begin our question periods.

STAFF. Ms. Bonamici is recognized.

Ms. BONAMICI. Thank you so much to Chairwoman Johnson and Ranking Member Lucas, and thank you, Secretary Granholm. I truly appreciate your strong commitment to transitioning to a clean energy economy, creating good paying, high quality union jobs, and promoting energy justice to support front line communities.

And as we work to mitigate the climate crisis and transition to 100 percent clean energy economy, we cannot ignore our oceans.

So, last year, this Committee worked in a bipartisan, bicameral manner to pass the comprehensive energy package we've been talking about, including my bipartisan *Water Power Research and Development Act* to strengthen the efforts at DOE's Water Power Technologies Office.

So, in Oregon, we are at the forefront of marine energy. In large part because of the sustained support from the Department of Energy, Oregon State University recently received the first of its kind lease and license to build and operate the Nation's first wave energy test facility, PacWave, which I invite you to visit.

The project, which is located off the coast of Newport, Oregon, will provide wave energy developers with resources to harness the power of waves, tides, currents, and transmit energy back to the electrical grid. Marine energy has tremendous potential as one of the last untapped clean energy sources, and Federal investment can truly help unlock it.

So, I have two questions and I'm going to ask them both now, and then give you the balance to answer.

So, Secretary Granholm, what steps has the Department taken to implement the marine energy provisions in the *Energy Act of 2020*, and is there an opportunity in the American Jobs Plan to scale that up? And then the second question deals with historically, we've had Federal investments that have focused on the conceptual and early research stages, leaving valuable projects to face a commercialization or valley of death. In the coming months, I am going to be reintroducing my *Regional Clean Energy Innovation Act* to establish a network of regional energy innovation and development institutes to address this issue, and I look forward to working with you on this.

So, the second question is what steps can the Department of Energy take to connect regional governments with academia, businesses, and clean energy stakeholders to help post research innovations in clean energy thrive on a regional scale, and meet market needs?

Secretary GRANHOLM. I love these questions, so thank you for that.

I mean, the full range of—on the first one on water power technologies, you know, the Department of Energy puts a lot of effort

into, and I want to thank you for your leadership and support on marine energy in particular, including the provisions you included in the energy package. I want to especially congratulate Oregon State for the progress they've made on bringing this world class marine energy test facility to fruition, like PacWave.

You know, you'll see support for the Water Power Technologies Office in the budget, and getting appropriations, of course, is the key to the first step in acting on that. I would love to work with you on how to pursue these opportunities. We are very bullish on marine energy, whether it is offshore wind or wave energy. Research still has to go on. We want to commercialize those technologies, which leads to the second question that you had regarding commercialization and regional innovation.

You know, local partnerships and—I mean, I just say this as a former Governor, too, that these regional partnerships with business and industry are so important, because that's where progress happens on clean energy, and it's how we can make sure that the economic benefits of our research and development—the new businesses, the new jobs benefit local communities. So, we do a ton of this kind of work across our applied energy offices. We're going to figure out how we can ramp up regional place-based strategies to make sure we're taking the opportunity to help different regions and communities take on the specific challenges, and take advantage of their unique opportunities, and that includes making sure that—I would say, I must plug the disadvantaged communities who have experienced disproportionately impacts of pollution for far too long, and that they see the benefits of clean energy. And it also includes making sure that coal communities and other communities that have been left behind, I'll say, by the transition and the clean energy economy do not remain left behind. The American Jobs Plan has as part of it some community-based grants, State-based grants to encourage and foster these kinds of technologies and the jobs that go with them, and so, there's a whole new window that could open up on these kind of place-based economic development strategies if the American Jobs Plan is passed.

Ms. BONAMICI. Thank you so much, Madam Secretary. And as we know, the regional approach is so important because the needs are different in various regions, and the resources are different. So, I really appreciate your commitment.

Thank you so much, and I yield back, Madam Chair.

STAFF. Mr. Babin is next.

Seeing no Mr. Babin, Mr. Waltz is next. OK. Mr. —

Mr. WALTZ. Thank you, Madam Chairman. Excuse me, Madam Chairman. I'm having some technical difficulties there. Can you hear me OK?

STAFF. Yes, we can hear you.

Mr. WALTZ. Madam Secretary, thank you so much for joining us today.

Your opening statement, you mentioned your coordinating role for the Colonial Pipeline engagements, and I would imagine in that role that you directly engaged with the private sector, and particularly with the Colonial executives. Is that the case, as part of your remit?

Secretary GRANHOLM. Yes.

Mr. WALTZ. And so, in that, did Colonial inform you or inform your office of their intent to pay a ransom?

Secretary GRANHOLM. They did not. They did not. The FBI (Federal Bureau of Investigation) had been in contact with them. We did not discuss that with them, nor did they tell us. Of course, if they had, we would have said do not pay ransom. But they didn't—we didn't—that wasn't part of our charge with them.

Mr. WALTZ. So, that's what I want to get to, you know, you have an international affairs office which does great work. Part of its objective is enhancing energy security by countering malign influence. So, it's your department's stated policy that our infrastructure, in particular, our pipeline managers, should not pay ransom as part of ransomware attacks or any other type of attack, is that correct?

Secretary GRANHOLM. That's correct.

Mr. WALTZ. That's reassuring to hear.

With the recorded ransom payment or with the ransom payment, one thing that I think a lot of people are struggling with is we have this incredible attack by Russian-backed hackers, many of which moonlight for Russian security services. You know, they don't have the same distinctions that we have. A ransom is paid, and really little else is done in response to that attack, particularly to established deterrents. And then just a short time later, we lift all sanctions on Russia's pipeline.

What level of engagement did you have—what type of engagement do you have with our European allies on the lifting of sanctions on Nord Stream?

Secretary GRANHOLM. I did not, but I know obviously others in the Federal ecosystem did, and of course, the two were not related, given that these were actors of Russia. But there is no indication that they were directed by—at least, we don't have any information on that now. I'm not saying it's not true, but I know it's a subject that—I've learned that it's a subject that the President is—

Mr. WALTZ. You know, I think there's an established pattern that if Putin wanted to stop these attacks—

Secretary GRANHOLM. Yeah, no doubt.

Mr. WALTZ [continuing]. He certainly could.

Secretary GRANHOLM. And he should.

Mr. WALTZ. What did the United States get in response, or what did we get in return for the lifting of these sanctions?

Secretary GRANHOLM. I wasn't—again, I wasn't part of that—those discussions with respect to the sanctions. So, you'd have to direct that to the Department of State.

Mr. WALTZ. So, the Department of Energy, the Department of International Affairs with the ENR Bureau, the Energy Bureau, State Department, is there not coordination with the Energy Department when it comes to engaging our European partners and the pipeline?

Secretary GRANHOLM. Generally, yes, and we obviously oppose the pipeline. And I'll say from the Department of Energy, one of the reasons that in addition to the geopolitical issues relative to Russia, one of the reasons why I think that pipeline is very dangerous is because it is carrying the dirtiest form of natural gas on earth—

Mr. WALTZ. That's right.

Secretary GRANHOLM [continuing]. With no security on methane emissions, et cetera. So, I think for a variety of reasons, it is a problem.

Mr. WALTZ. No, that's absolutely right. So, it's actually encouraging, from a climate standpoint, which obviously you mentioned extensively in your opening statement, this is worse for the climate, for a climate agenda, because it does carry—

Secretary GRANHOLM. Not just for a climate agenda.

Mr. WALTZ [continuing]. Some of the dirtiest—so, the Department of Energy opposed the lifting of the sanctions, so the President made that decision over the Department of Energy's objections?

Secretary GRANHOLM. Well again, I was not in the discussion over those particular sanctions, and I know obviously the administration has opposed the continued expansion of Nord Stream 2, and there may have been other considerations that went into it. You know, arguably this issue about sanctioning a pipeline should have come much earlier in the construction of it, because it is at the very tail end now, and we ought to—it's a good lesson for going forward. We ought to have stopped it before it was built, essentially, rather than after it has been built.

Mr. WALTZ. Well, I certainly agree, but I think just lifting the sanctions for little in response, for nothing in response, which is actually countervailing to a climate agenda that will move dirtier oil and make our EU partners more dependent on Russia. From a geopolitical standpoint, from a climate standpoint, I think it was an incredibly bad decision, and I find it more disturbing that your department wasn't a key part of it.

But I'll have some further questions for the record. Thank you, Madam Secretary, and Madam Chairman, I yield my time.

STAFF. Mr. Bera is recognized.

Mr. BERA. Thank you, Madam Chairwoman.

You know, Madam Secretary, one of the most ambitious parts of the President's American Jobs Plan and infrastructure plan is this transition from gas-powered vehicles to electric vehicles, and the infrastructure that, you know, will take place to build EV charging stations and help folks transition. You already—obviously in your home State of Michigan, you're seeing a lot of that. The automakers started to make those plans to go to all electric vehicles.

Can you expand on DOE's role in helping make this transition, plan out what that infrastructure looks like, where these charging stations will be, et cetera?

Secretary GRANHOLM. Yeah. We—

Mr. BERA. How we also address equity in there as well.

Secretary GRANHOLM. Yeah, this is a great question.

Obviously, you know, if the private sector was going to step up and do this on its own, that would have already begun. But unfortunately, we have gaps. We have gaps on highways where people don't—wouldn't charge up as much, and we have gaps inside of communities that have been left behind.

So, we have—our labs have started the process of doing a map for the United States about where the necessary charging is going to have to step in to fill that gap, the federally funded necessary

charging to fill that gap, so that all parts of the country, all pockets of America have access to electrification. And we all know that, you know, there's a chicken and egg issue of people are uncomfortable buying an electric vehicle because they feel like they may want to take a longer trip and not have the ability to charge up. That's going to prevent them from choosing an electric vehicle. So, we have to address that very important infrastructure issue, which of course, is addressed in the American Jobs Plan through the President's commitment of 500,000 charging stations across the country in areas where it's sparse and in areas where the private sector has not stepped up, particularly in low-income communities.

So, it's that, and incentivizing them—the purchase of electric vehicles at the point of sale, and making sure we've done the research necessary to keep the continuous improvement of the electrification of the vehicle, which includes the research being done at our national labs on the battery.

Mr. BERA. And so, that all is very encouraging. And obviously, the battery side, I think from a technology and economic perspective, we want to maintain that innovation edge over other competitor nations in terms of battery technology and battery production.

If I were to play off a question—or an answer you gave to one of Ms. Bonamici's questions. I understand the human reaction, you know, in places like the Rio Grande Valley in Texas or in West Virginia as we transition off of older energies and fossil fuels, and some of the anxiety about job loss, et cetera.

How is DOE thinking about—you know, we think about strategic investments and, you know, helping some of these communities leave some of the older fossil fuel jobs or coal mining jobs, but also then thinking about the job training to help transition communities to, you know, better paying jobs and jobs of the future.

Secretary GRANHOLM. This is my favorite question, because I think that there's so much promise in these clean energy jobs. They're not just one-off jobs. These are careers and jobs that can go to communities like you have described that have been left behind. So, you know, if you're in coal country or if you're in an oil and gas area, you know, you've got workers who know how to do that work. Well, why not have them transition to be able to be mining, for example, for geothermal or laying the pipes for CO₂ for carbon capture and sequestration, or attaching that CCUS (carbon capture, utilization, and sequestration) technology onto power plants, or laying pipes for hydrogen? I mean, the American Jobs Plan has got these 25 demonstration projects in hydrogen and CCUS. Those in the kinds of communities we're talking about could be utter game changers, could help those communities see themselves empowering the future of America, insofar as they have seen themselves as powering the past. And we don't want them to feel like they have been left behind, so that's why strategically investing these kind of demonstration projects on a place-based strategy manner—the President created an intergovernmental working group on coal and power plant communities. In that intergovernmental report, there were 27 communities that were identified that were at greatest risk, the coal and power plant communities. Those communities could be the places that actually take us to the next level, not just in the United States, but globally with the tech-

nology that we could deploy, take to scale, work on research, develop. It's really exciting if that act is passed for those communities to be part of the future, and not viewed as or feeling like they're just part of the past of America's energy.

Mr. BERA. Great. Thank you for that answer.

Madam Chairwoman, I'll yield back.

STAFF. Mr. Gonzalez is recognized.

Mr. GONZALEZ. Thank you, Mr. Chairman, and thank you, Secretary, for your time and attention today, and your testimony. The COVID-19 pandemic has certainly justified the importance of American innovation. It's impossible, almost, to imagine us getting through this if we hadn't innovated in testing therapeutics, and of course, the vaccine development. I think, similarly, it's hard, or I would argue impossible, to imagine addressing energy and environmental challenges without further innovation in energy storage, nuclear, carbon capture. I'm pleased to see you mention those technologies. And innovation's always been a core strength of our country. In our geopolitical competition with China, Russia, and Iran, we have to stay advanced and ahead of the game.

I want to focus specifically on nuclear for a second, if we could. I've been pleased to read some of your comments regarding commercial nuclear energy here in the U.S., particularly the importance of maintaining our existing fleet, which I think is critically important, in the face of looming shutdowns, oftentimes driven by backwards politics. But I want to get your thoughts on our progress with advanced nuclear reactors and fuel specifically. Last month I sent a letter to you alongside a bipartisan group of lawmakers in support of the Advanced Reactor Demonstration Program and Advanced Nuclear Fuel Availability Program. What actions are you and the agency taking to ensure these programs are fully implemented, and what role do you anticipate advanced nuclear will play as we transition away from more carbon intensive energy sources?

Secretary GRANHOLM. Yeah. It's going to play an important role, and I want—I would love for people on both sides of the aisle to appreciate the fact that 55 percent of our clean energy now comes from nuclear, and America has the most rigorous and thoughtful safety regime. It's not a question of safety. Most people—for many people it's a question of waste, and we can talk about that as well, but I think nuclear energy can and must play an important role in helping the U.S. meet its clean energy goals. We pursue, at the DOE, both demonstration and early stage research and development efforts for multiple nuclear technologies based on where those technologies are in their development, and how they are developing relative to the field's needs. For instance, DOE's Advanced Reactor Program supports the development of multiple initiatives and innovative U.S.-based design for the small—SMR, small modular reactors. This technology, I think, has the potential to provide, you know, clean, safe, cost-competitive energy generations options for both domestic and international markets. We're already seeing promising results with the work of NuScale, which is the first small modular reactor developer to obtain the Nuclear Regulatory Commission's (NRC's) approval of its final safety evaluation report. So hopefully that NuScale reactor will be on track to be the first full NRC certified reactor mid to late this year.

Mr. GONZALEZ. Yeah. I want to stay on the NRC for a second. As I talk to a lot of companies who are developing advanced reactors, one of the top criticisms I hear is how ill equipped the NRC is to evaluate and approve them, and they almost feel like they're trying to get to no, as opposed to trying to find ways to get to yes. How's the agency engaging with the NRC to alleviate these concerns and streamline the deployment of advanced reactors?

Secretary GRANHOLM. Yeah, it's—this is a great question. I have heard this as well, and am looking into it. We are well aware, and, if you like, I can get back to you on the specific steps that we are taking, but I appreciate you raising it. We want the NRC, as all of our commissions and committees, to be effective, and nimble, and efficient, and we want to make sure that we support the NRC in getting there.

Mr. GONZALEZ. Thank you. And then, final question on nuclear, you mentioned waste as one of the objections that is constantly brought up. How do you respond to that? I'd be curious for your thoughts on it.

Secretary GRANHOLM. Yeah. I mean, as a nation, we have got to figure out the waste issue. We have got to figure out where it is going to be. Yucca is not an option, Yucca Mountain, so the question is what's next? You're aware, I'm sure, that the Blue Ribbon Commission suggested a consent-based siting process for interim storage, and we at the Department are going to launch a request for information about, and start that conversation with communities. You have to do this in partnership with communities in a thoughtful way, with sensitivity, and we want to begin those discussions, because we want to find a location that is safe, and secure, and accepted. And it may mean that we have to, and that we should, compensate communities who decide to raise their hand to do that. So that process we're going to start.

Ultimately, though, of course, you want to develop—you want to have nuclear in a way that doesn't generate that kind of waste, which gets back to the ITER question, the question of fusion, and perhaps exploration, research-wise, of what you can do with existing waste. All of that is within the purview of DOE, and all are things we're pursuing.

Mr. GONZALEZ. Thank you. I look forward to working together on this, and I yield back.

Secretary GRANHOLM. Great.

STAFF. Ms. Stevens is recognized.

Ms. STEVENS. Well, thank you. Secretary Granholm, how wonderful to see some Michigan energy, and have some Michigan energy, on the Committee today. And, you know, I have some remarkable memories, going back a long time, with you, particularly when we were working on the U.S. Auto Rescue. And for those who don't know, for the record, our then-Governor of Michigan really led one of the most comprehensive economic overhauls of our State, developing programs like the State Small Business Initiative—Credit Initiative to give credit to our suppliers and small businesses who, in a very different financial time, couldn't get it, and that program resulted in the creation of the *State Small Business Jobs Act of 2010*. And it was because Michigan was leading the way under a very skilled Governor.

And so now, as the Secretary of Energy, I wanted to ask you about the leadership, and the way in which you are seeing some of the programs that the DOE is responsible for with advanced vehicle technologies, particularly also the investments that come from the ATVM (Advanced Technology Vehicles Manufacturing) Program, and how you intend to lead the Department of Energy with those programs, what we need to do with them, you know, if it's plussing up, because certainly we've got to move on the access to the materials for these electric vehicles, and also what's going to go into the battery.

Secretary GRANHOLM. Well, thank you so much. It's so great to see you. And, you know, as I was working on the outside of Federal Government with the auto industry, I know you were working on the inside, and without your leadership we would not see a domestic auto industry like we see today. I mean, the fact that General Motors has gone all in on electric vehicles, the announcement by Ford yesterday, you know, I mean, it's so exciting, the future. So you talk about the ATVM, the—we want to make sure the Advanced Technology Vehicle Provision of the Loan Program Office (LPO) includes not just light duty vehicles, but heavy duty vehicles as well, because you see that Ford—going into the truck and making sure that the F-150 is all electric, we want to make sure that we continue that kind of research, and development, and deployment.

You know, the American Jobs Plan supports all parts of electrifying transportation, from the vehicle, to the charging infrastructure, and everything in between, and that means not just re-tooling vehicle factories, but making sure we've got full and robust supply chains from components back to batteries and critical minerals, so it also means more than cars. It means, as I say, SUVs (sport utility vehicles), and pickups, and long haul trucks, and ships for long distance shipping, and the ferries that make many communities unique, as well as aviation. So I look forward to working with you to make sure that we've got all of the pieces in place to accelerate deployment of electric vehicles, broadly defined, and particularly passenger vehicles, as we know the American Jobs Act—or Plan is supportive of.

And I just want to say, on the supply chain issue, because you—and I've come from this great manufacturing State, we want to make sure that we support and incentivize manufacturing here at home. I know the American Jobs Plan does some of that. that 48(c) tax credit was——

Ms. STEVENS. Um-hum.

Secretary GRANHOLM [continuing]. Embedded in that——

Ms. STEVENS. Yeah.

Secretary GRANHOLM [continuing]. So we want to make sure that we do all we can, policy-wise, to ensure that we are building stuff here in America, using it here, and then exporting it to other places.

Ms. STEVENS. Yeah. Over a decade on, and the 48(c) tax incentive being overprescribed, and still ready to go, we would love to see that get done, Madam Secretary. And you also have the full support of the mapping of the supply chain for the battery, identifying those missing middles where we aren't producing here. I

know in a community you know well, Northville, Michigan, there's a company called SoulBrain that does the electrolytes manufacturing that goes into the lithium-ion battery. I would love to take you there. They are the only one in Michigan, and one of two. The other type of manufacturer along these lines is located in Oak Ridge, but I'd love to take you here, because I—you know, they are growing, but they are a part of that supply chain, so, alongside the Department of Commerce, we support you in those efforts. And, with 10 seconds left, if you have anything else, Madam Secretary, otherwise I'll cede it back over to a colleague.

Secretary GRANHOLM. I'm just so proud that Michigan now produces 1/3 of all North American batteries, so let's keep it going.

Ms. STEVENS. Let's keep it going. And with that, Madam Chair, I yield back. Thank you.

STAFF. Representative Baird is next.

Mr. BAIRD. Yes. Thank you, and I want to thank Chairwoman Johnson and Ranking Member Lucas for holding this overview of science and energy research enterprise. And, Madam Secretary, we certainly appreciate you being here, and I think you're holding up extremely well to be the only witness on the program, so—

Secretary GRANHOLM. Well—

Mr. BAIRD [continuing]. Congratulations on doing that.

Secretary GRANHOLM. All right. Go easy on me, then.

Mr. BAIRD. I'll give you a break. I've got about a paragraph or two, and then I'm going to get to the question. But anyway, I represent Indiana's Fourth District, which is heavily reliant on agriculture production and research. My background is in animal science, and I currently serve on the Ag Committee, along with being on the Science Committee, which works out extremely well, in my opinion. But accordingly, I understand the relationship—or I think I do, parts of it—the relationship between humans, and animals, and plants, and biology in general, and I also recognize the need to invest in biological research, and biological research infrastructure, within the Office of Science to improve this understanding in the knowledge that we obtain, and this is the reason why I introduced the DOE *BIO (Biological Innovation Opportunities) Act*, which really reauthorizes DOE's—those Bioenergy Research Centers, and establishes a program to develop, construct, and maintain those biological and environmental research user facilities because I think that increases the access that young researchers and U.S. researchers have to study some of these very complex biological and Earth and environmental systems.

So, with that kind of background, my question to you is how do you feel the Department of Energy is uniquely qualified to provide leadership in this U.S. biological science research and development activities?

Secretary GRANHOLM. We are. Thank you for that. I mean, there is a critical need to sustain U.S. preeminence in this emerging and globally competitive, really, bioeconomy, which spans the entire research and biotechnical innovation space for the life sciences, for economic, you know, for—I mean, we know that the innovation space for social and national security benefits, et cetera, it all touches on this bioeconomy. DOE specifically focuses on the

genomic science of plants, and microorganisms, and microbial communities to achieve its mission goals.

You know, a priority clean energy activity in the Office of Sciences before Bio Research Centers, which are tackling the basic science challenges that are needed to produce fuels, and chemicals, and other products from sustainable and renewable biomass resources. So fundamental geonomic science—genomic science on plants and microorganisms is leading to the development of dedicated and resilient bioenergy crops, which is great, and important, and a broad range of modified microorganisms and capabilities to advance the biotechnology solutions that are needed to underpin a burgeoning and globally competitive bioeconomy, and so we're going to continue to move on that.

And I would just put a plug in as well for biofuels, and for—especially biofuels related to aviation. Hugely important. The aviation world is all in on those advanced biofuels, and I think the Department of Energy and the Department of Agriculture can be partners in making some of those refineries reality in the United States.

Mr. BAIRD. So for whatever it's worth to you, I really think you're right on target. I agree with you, and one of the things that I see happening is—looking at the genotype in soybeans, and then, with cameras going across the fields, taking in a tremendous amount of data so that we can connect genotype to phenotype, and that in the interest of trying to improve productivity, and increase crop yields, and so on, and so that requires tremendous computing capabilities—

Secretary GRANHOLM. Yeah.

Mr. BAIRD [continuing]. And you have access to the quantum computer, so—I guess I'm about to run out of time. I certainly would have other questions, but I think you're right on target, and I appreciate the opportunity to share that with you.

Secretary GRANHOLM. 1,000 percent. Thank you so much.

Mr. BAIRD. And I yield back. Thank you.

STAFF. Mr. Sherman is next.

Mr. SHERMAN. Why thank you. One comment on recharging stations, and that is, while it's important to have them out on the highways for vacation, the most important thing is that they be available where we work and where we live, and we need to require all of the—those who provide paid parking, those employers that have over 50 parking spaces, big office buildings, to provide enough places for people to recharge, and we need to make sure that landlords who provide parking to their apartment residents provide at least some of those spaces with recharging stations.

Madam Secretary, I want to thank you for concluding your prepared testimony by acknowledging the Department of Energy's duty to clean up contaminated sites, many of them leftover from World War II and the cold war. And I want to direct your attention to the Santa Susana Field Lab, which was the subject of a 2007 consent decree. There's some 90 acres that is the responsibility of the Department of Energy. There's adjoining acreage that is the responsibility of NASA (National Aeronautics and Space Administration) and of Boeing. This contaminated site is immediately adjacent to the city of Los Angeles, so it affects hundreds and hundreds of thousands of people. Some 700,000 signatures have appeared on

the petition demanding full cleanup of the site, and I'm going to be getting to you the documentary "In the Dark of the Valley", that being the San Fernando Valley, about the effect of this nuclear contamination on hundreds of thousands of people. And I would like to know whether we can count on you to use the Department of Energy to comply with the 2007 consent decree, and hopefully do what has not happened since 2007, and see major action taken on the ground in furtherance of that decree.

Secretary GRANHOLM. Yeah, thanks for asking. As you alluded to, we're already out of compliance with the decree. There were steps that needed to be taken, like the cleanup of soil, that have not been completed at this point, and so I look forward to working with you, and with the State of California, to put in place progress steps that we can see. I know that there is—if I'm not mistaken, a building was just taken down, and there's another one that will be completed by the end of this year, and—so that the soil now can be the next up—teed up on our list.

Clearly, in this case, as well as the other environmental management sites, you know, the Department used to have, I want to say 116 of these sites, and we're down to 16 of them, or it's 107 and we're down to 16, something like that—

Mr. SHERMAN. Um-hum.

Secretary GRANHOLM [continuing]. So they've made progress, but some of these are more difficult than others, as you know, and a lot of it relies upon resources to make happen. You have my commitment. This is a priority in the Department—

Mr. SHERMAN. And your predecessor, Secretary Perry, came to visit the site. I would welcome if you would do that, but more important, we actually have to take the action, and of the 16 remaining sites, this is the site that's—it seems to be second from the bottom in terms of money that's available. I do want to—so I look forward to working with you on this, and I want to commend to you, and I will get to your office, the documentary "In the Dark of the Valley".

Secretary GRANHOLM. Very good.

Mr. SHERMAN. One other issue is wind. Much of the wind is offshore, and marine engineering is difficult, and has its challenges. On land, an awful lot of the wind is up on the mountain, where you don't have a road. And you're trying to get up there with, like, a 100-ton device, then a blade on the rotor of 160 feet long. And, one, sorry, you can't do it without a road. You may not be able to build a road, and if you build a road, it's got to be a pretty big road, because you're talking about big stuff. One other way to do this is with an airship, and I hope that the Department of Energy would focus on the ability to use a buoyancy control airship, which is just in development now, to be able to get these items to the top of the mountain.

Secretary GRANHOLM. Well, I'm so interested in this. I mean, I have heard of this idea, of using innovative aircraft for wind farm construction, especially when you're talking these logistical challenges. So I want to see it, I just haven't—I hope—I don't know if there's one near where you are, or if there's—but if there is an opportunity for us to partner on something like this, we're always looking for these innovative solutions. Our Office of Energy Effi-

ciency and Renewable Energy is working on these logistical challenges. As you know, the wind, especially with large blades, it's just so—it's—they're very difficult to move into very large—very large blades into spaces, so I'd be super interested, and I would love to connect with you and your staff.

Mr. SHERMAN. We'll get you some information. The ship——

Secretary GRANHOLM. Great.

Mr. SHERMAN [continuing]. Doesn't exist yet, but an awful lot of engineering and prototypes do, so we'll get them——

Secretary GRANHOLM. All right.

Mr. SHERMAN. I yield back.

STAFF. Mr. Garcia is recognized.

Mr. GARCIA. Thank you, Madam Chairwoman, for pulling this together, Ranking Member Lucas as well. Secretary, it's a pleasure to see you. Hopefully get to meet you in person soon. I will get to my question here shortly, but I do want to follow up on my colleague Mr. Sherman's question. He and I share a border. Santa Susana Field Lab actually straddles, and in many ways, the delineating line between——

Secretary GRANHOLM. Um-hum.

Mr. GARCIA [continuing]. Our two districts. I do support a cleanup. I think the definition of full cleanup is what's at issue right now, not only at the State level, but at local levels. I think there's a lot of data. I think we need to clean up the areas that do, in fact, have waste, and I think there's different approaches, so I would just recommend that before we, at an administration level or at the DOE level, move forward with anything additional, that we look at exactly how we're cleaning up, and simply removing eight to 10 feet of dirt from 40 to 60 acres of land may actually expose the citizens around that area to more risks, and actually do more damage, so I don't think our policies and our funding streams should be supported by documentaries that are, in some cases, outdated, and had bad data. That's more of a commentary.

My question actually revolves around the nuclear waste issue that you mentioned. I think you were spot on. I don't think that there's a question about safety. I think we need to figure out how to scale up. I do think it's the right answer. When it comes to clean energy, other nations have figured it out similar to us, but maybe at higher levels, but the waste issues still remains I'd say the long pole in the tent on us actually being able to scale up, given what's happened at Yucca, and basically now the 80,000 or so metric tons of waste that's scattered across the country.

We've seen prospects developing in different industry that are actually being able to recycle some of this high level waste, and breaking it down to the point where, instead of getting down to, say, background radioactivity levels after 100,000 years, the recycling process and breaking it down actually gets it down to below 300 years. Would you support a domestic nuclear recycling program—and I think it may even be mature to ask if you support a program. I think that there's a need for feasibility studies, tech demonstration funding levels at lower dollar values for some of these companies that are figuring this out, and then tech maturation programs where we can actually compete multiple businesses to figure out exactly what they have. But the prospects of being

able to effectively recycle a lot of this waste, and actually get to reactor grade plutonium that would support some of next gen reactors that we were discussing earlier, I believe is actually a very encouraging sign. I just wanted to get your comments that——

Secretary GRANHOLM. Yeah.

Mr. GARCIA [continuing]. And any sort of R&D efforts behind it.

Secretary GRANHOLM. You know, I mean, obviously I'm supportive of science, and I'm supportive of the Department of Energy being the Solutions Department, and this is a big problem, and it's a big problem that potentially could have some solutions, and so efforts related to that, I would love to work with you on, and I think that there would be a team in our Fossil Energy Office that would be very excited to work on this further as well.

With respect to specific efforts that are happening inside the labs, I think there are some, but I just don't have those at the top of my head, but I'm happy to get back to you, and have the staff get back to you, on exactly what's happening right now on the specifics of recycling.

Mr. GARCIA. That would be fantastic. Happy to cooperate with you on that. I think there are a lot of great opportunities here, and there's actually some companies that are already moving out on their own——

Secretary GRANHOLM. I'm sure.

Mr. GARCIA. R&D—efforts, and we can probably leverage that as well. Before my time is up, I do just want to put a quick commentary about the sanctions on Russia and the Nord Stream 2. You made the statement that we should've stopped it before it was built. I know that you weren't part of those discussions. I think, actually, that that's a mistake, to not have the DOE as part of those discussions on the waiver of sanctions, but I do believe that there's a bit of an irony that we actually stopped the Keystone Pipeline in the midst of its construction on our own soil, and I do think it's more than just anxiety about job loss. There were literally thousands of jobs lost as a result of that decision. And, honestly, I think it's shameful at the national level that we waive sanctions on a Russian company in support of their gas lines, which are dirty, which are going to do harm, and we actually stop ours which did have a great opportunity. So I was discouraged to hear that you weren't allowed to be part of those conversations, and I'll save the follow-up question for the next round. Thank you, Madam Secretary, I'm out of time.

STAFF. Mr. McNerney is next.

Mr. MCNERNEY. Thank you. Secretary Granholm, it's great to see you again after last week's appearance at Energy and Commerce.

Secretary GRANHOLM. Yes——

Mr. MCNERNEY. I truly appreciate your enthusiasm, and your breadth of knowledge, and I hope to continue to have access to your office in the future. So the DOE possesses some of the most powerful computers in the world, and you're scheduled to deploy even more of those later this year. These systems are critical to develop artificial intelligence (AI) capabilities and other research areas. Can you provide us a preview of the Department's scientific computing agenda under your leadership?

Secretary GRANHOLM. Now, we are obviously—the labs have a broad swath of supercomputing capabilities, and the Federal Government has invested enormously in those capabilities, and that is fantastic, and we don't want to lose that edge. And I—let me just say slightly off to you—off of your question, but I really am concerned that America is falling behind in developing advanced supercomputers, because last year a Japanese system became the top supercomputer, and the U.S. dropped from having four of the top 10 supercomputers to only two of the top 10. So, as you know, that is a problem.

So high performance computing is needed to maintain the leadership of the U.S. in these—computational and data science. We remain on track to deploy the Nation's first exascale computer this year at Oak Ridge, which is great. If that computer performs as expected, we anticipate that the United States is going to regain the top spot for the Top 500 list this fall. And our second exascale computer is on track to be delivered at Argonne in 2022, and our third at Livermore in 2023, so very exciting stuff. The high performance aspect of computing is also needed to maintain the leadership, so we're, you know, we want to make sure that this exascale computing initiative, and strategic computing, remains an administration priority, and I think with the American Jobs Plan, and the investments that have been articulated here, we will be able to do that.

Mr. MCNERNEY. Thank you. I like that enthusiasm. I believe that our society will sooner or later need to count on fusion to provide clean, reliable energy to human civilization, which our—with our growing energy appetite. Do you agree with that assessment?

Secretary GRANHOLM. Absolutely.

Mr. MCNERNEY. Very good. Is there room in the Department's fusion research budget for work that is high risk? In other words, not necessarily in the mainstream, but has potential for high payback?

Secretary GRANHOLM. I think there's always room. Of course, you know, fusion would require a major further investment, since these projects are very large, and very cost-intensive, but the reward could be enormously beneficial. So we're looking into ways to support public/private partnerships in fusion energy, including through the Innovation Network for Fusion Energy, INFUSE, I think it's called, which is an initiative to help provide promising fusion energy companies with access to technical and financial support from the National Labs to bring their technologies closer to commercialization.

Mr. MCNERNEY. Well—see, this past December Canada joined a list of countries that plan to simulate the production of hydrogen. You've already talked about hydrogen a little bit, but according to the International Energy Agency's (IEA's) Hydrogen Projects Data base, nearly 320 green hydrogen production demonstrations have been announced worldwide, with new ones being added every week. Do you foresee the Department leveraging your capabilities to keep pace with the global hydrogen technology trends?

Secretary GRANHOLM. Yeah, but we've got to get on it. I mean, this is why what's happened in the American Jobs Plan, with these 25 demonstration projects, 15 of which would be for hydrogen. I mean, we want to make sure that we are in the game on this. I

speak with my counterparts in other countries all the time, and, in addition to fusion, which is a little further out, hydrogen is the holy grail in terms of dispatchable, transportable power, clean, and green hydrogen. So we know that all of these countries are rushing to make it happen. We need to be in the game, and that's why—it can obviously create jobs in regional areas, but it also can put the U.S. in the leadership.

We just announced that we would be part—leading part of the hydrogen initiative at the G7, the United States will be, so—but in order to have any credibility, we've got to be able to fund these demonstration projects, which is why I hope that this Committee, and others, are supportive of the demonstration projects to enable us to get into that leadership position.

Mr. MCNERNEY. Well, thank you, Madam Secretary. I yield back.

STAFF. Ms. Bice is recognized.

Ms. BICE. Thank you so much. Thank you, Madam Secretary, for being with us this afternoon. We've talked a little bit about electric vehicles, and so I want to focus briefly on that. Right now there are about 1.5 million EVs on the road. The Pacific Northwest National Laboratory (PNNL) researchers found that through 2028 the overall power system could support up to 24 million EVs, or about 9 percent of current traffic in the United States. So while the growing number of EVs is admirable, I worry about the grid's capacity to handle the amount of electrification this administration is calling for. What happens after that 9 percent threshold is reached? Are we going to have to sacrifice electricity for our homes and businesses to power electric vehicles?

Secretary GRANHOLM. No. What we have to do is to increase the capacity and the resiliency on the grid. I mean, it's another reason why—I don't want to be, you know, Johnny or Jenny One-Note, but the American Jobs Plan has those investments in grid capacity so that we can add more renewables and accommodate more demand on the grid. We're going to need it anyway. I mean, there's just massive demand out there for interconnections, even without additional EV charging. So we just—we need to accelerate this, and making the—putting the incentives in the right place, which is what the American Jobs Plan does, it would enable us to expand the grid to be able to accommodate that additional demand, as well as to accommodate renewable energy that we want to put on the grid.

Ms. BICE. I do worry about picking and choosing where to invest, though. I mean, candidly, you know, States like California tend to be more open at wanting to move toward an EV, but they're having a difficult time powering their own infrastructure currently. States like Oklahoma, who tend to rely more on a fossil fuel strategy, don't have those challenges, and so are we going to be sacrificed at the expense of putting more electrification in California? So just something that I think about.

The second question, as it relates to EVs, is who's going to pay for the electrification of these EVs? And what I mean by that is are we going to ask convenience stores, or States that you mentioned having 500,000 new charging stations across the country. Where's the cost of that burden going to lie?

Secretary GRANHOLM. Well, it depends, right? So in some places the private sector decides that it's in their interest to have a charging station, and therefore they will pay for the electricity, the output of it. So if you're a 7–11, maybe you decide that it's worth your while to pay for the electricity because somebody might be in the store longer and buying more things. If you are an individual in and driving down a freeway, then you have perhaps an arrangement with a charging company that allows you to pay for it with a card as you pull up to a charger somewhere that may not be associated with a private enterprise. I think it depends. It's all very contextual. But, you know, it is paid for. Just a question of, you know, where the—

Ms. BICE. Who's paying?

Secretary GRANHOLM. Well, the person might be paying, like you pay for filling up your gas, or the business might be paying, if they decide that it's in their best interest.

Ms. BICE. So, speaking of that, in my home State of Oklahoma, the current gas tax is used for critical transportation infrastructure expenses. The average Oklahoman drives around 19,000 miles a year, with a per gallon tax rate at 18 cents federally and 20 by the State, and it results in about \$345 million in revenue. How are we going to make up the loss in revenue with the shift to electric vehicles?

Secretary GRANHOLM. Yeah, it's a good question. We have to have a discussion about that, about how we fund our infrastructure. Are we simply going to continue to rely upon these user fees, it's—as some have suggested, or do we want to take this on as a Federal enterprise and say we need to invest in this infrastructure through more generalized—through our more generalized general fund, or our, you know, special purpose funds. The bottom line is I think that, in this administration anyway, there's not a desire to raise the gas tax on everyday citizens, but it's—this conversation about how you fund infrastructure I think is happening probably—even as I speak among those who are putting forth various proposals, and I think it's a worthy discussion.

Ms. BICE. Well, it's been in a discussion in my home State, and, as a matter of fact, I championed some initiatives to try to address it here a couple of years ago, so I think we need to be mindful as we're talking about infrastructure as a whole. It's not just charging stations, or subsidizing electric vehicles, but there's also a very real need for infrastructure, and I think that needs to come first. And so I thank you for your time today, and, Madam Chair, I yield back.

STAFF. Mr. Tonko is next.

Mr. TONKO. Thank you. Could you hear me?

Secretary GRANHOLM. I can.

Mr. TONKO. OK. Thank you, Secretary Granholm, for joining us today, and it's great to see you again. I appreciated the opportunity to engage with you in your appearance before the Energy and Commerce Committee last week, and look forward to discussing DOE's efforts to develop science and energy research, and was very, very pleased by your responses at that Committee meeting.

Wind power will play an important role in achieving our clean energy goals, and as we look to increase clean energy on the grid,

innovation is key to greater technical efficiency and economic growth. For example, in my district, researchers at General Electric's Global Research Center in Upstate Niskayuna, New York are working on a way to make massive wind turbines float by themselves in the middle of the ocean. This technology could significantly increase the amount of offshore wind production, and I am excited indeed that New York's Capital Region is helping lead the way. So last Congress my *Wind Energy Research and Development Act* authorized the Office of Wind Energy. What role can the Office of Wind Energy play in improving the efficiency, the reliability, and the capacity of wind energy technologies?

Secretary GRANHOLM. Yes, thank you for asking that. Our Wind Technology Office, and, of course, our relationships with the labs who are doing all of the research—so much of the research on this is obviously leading the way. I'm very bullish on these floating turbines as well. I know they're not quite ready for prime time, and a lot of—there's a lot of effort right now going into making sure that they work, and that they are particularly in the areas where a land-based effort is not that feasible. Often opposite from you, but on the West Coast we're seeing a lot of effort in that.

You know, the notion—I—can I just say broadly, on wind energy, it is really a top priority, because we have so much untapped wind across the country, both offshore and onshore, along with solar, of course, and it's so—it's become not just one of our most reliable sources of carbon free energy, but, because of DOE's R&D efforts, you know, cost competitive, cheaper, cheaper than any other source of power now. So rapidly accelerating deployment of wind and solar is a big component of how we're going to build our clean energy economy and meet the climate goals of getting to 100 percent clean electricity by 2035, and net zero carbon emissions by 2050, but, of course, there are those new innovation horizons as well, and we are deeply committed to them. You know, the triple win of offshore, because not just jobs, huge jobs—

Mr. TONKO. Um-hum.

Secretary GRANHOLM [continuing]. Right, in construction and manufacturing, good union jobs. The combination of proximity to population centers and high wind resources off the coast means it can play just a critical role in moving that—the country to the 100 percent goal. And we know that the President has committed to this national goal of 30 gigawatts of offshore wind by 2030, and so it's going to—and it is taking a whole of government coordinated effort between, you know, DOE, and the Department of Interior, and the, you know, all of these entities that are really focused on making sure we can do this, including the Department of Defense, which, you know, often use an—offshore as a way of doing maneuvers, and are working with us to make sure we carve out areas that are capable for wind development.

So, bottom line—and let me just say, the administration took another big stride toward that goal this week with the announcement of nearly 400 square miles of sea off of the coast of California that it's going to make available early next year, which unlocks the potential for this Great American Wind Project in the Pacific Ocean, and it could be the first commercial floating wind project as well.

So, bottom line, I'm with you 100 percent on it. Very excited about it.

Mr. TONKO. Thank you, and thank you for the enthusiasm. What other additional DOE research is needed to ensure that we maximize wind energy's potential?

Secretary GRANHOLM. Yeah, I would say a couple of things. One is clearly on the floating turbines. So, you know, we've had conversations, and we know others have as well, with, for example, those who do the rigs for oil and gas, and those, you know, platforms have gone through a lot, and so the wind turbines themselves that are floating have to withstand a lot of motion, and so the research related to the best sort of anchoring of a floating thing on top of the water is critical, and that piece of research is going on. Continual research on whether you can use offshore wind to also create green hydrogen. Can you put electrolyzers, for example, in the base of one of these massive wind turbines to create green hydrogen from the wind turbine? So—

Mr. TONKO. Um-hum.

Secretary GRANHOLM [continuing]. Stuff like that, a creative combination of things, whether you have a platform perhaps that is also doing tidal energy as—below, and wind energy above, that kind of research is very interesting, as well as material science research continually on the blades, those massive blades. The bigger they get, the more you have to have a very sophisticated strategy on materials. So all of that's super exciting.

Mr. TONKO. Madam Secretary, my time is up. I'll just tell you that Plug Power is an industry leader in hydrogen. They're located in my district. I have other questions on hydrogen that I'll forward you—

Secretary GRANHOLM. Great.

Mr. TONKO [continuing]. And would appreciate your response, but—

Secretary GRANHOLM. You bet.

Mr. TONKO [continuing]. Congratulations on the appointment, again, and look forward to working with you.

Secretary GRANHOLM. Thank you.

Mr. TONKO. I yield back, Madam Chair.

STAFF. Mr. Feenstra is next.

Mr. FEENSTRA. Thank you, Chairwoman Johnson, and Ranking Member Lucas. Secretary Granholm, thank you for testifying before the Committee today. As you know, Iowa is a leader in our Nation in producing clean biofuels, and my congressional district is the No. 1 producer of biofuels in the country. I appreciate the work that the DOE is doing to look at the innovative uses for our biofuels, such as helping decarbonize our airline industry, and expanding their use as low carbon fuels. I am actively working on legislative solutions for these issues, and I look forward to working with the DOE. I also look forward to working with the DOE to continue to advance our biofuel industry toward being a net carbon negative fuel through innovative research. Today I would like to focus on some recent research findings and reports by your Department.

Secretary, earlier this week the DOE Argonne National Lab released a study. I'll quote the headline for you. "Corn Ethanol Re-

duces Carbon Footprint and Diminishes Greenhouse Gases”. This study showed that from 2005 to 2019 corn ethanol resulted in more than 500 million tons of greenhouse gas reductions, and carbon intensity in ethanol decreased by 23 percent. This shows that corn ethanol created significant emission reductions and biofuel’s overall carbon footprint is rapidly declining. Based on this data, would you agree with me that today’s current biofuels have already created significant emission reductions in our auto sector?

Secretary GRANHOLM. Yes, today and for the future as well. We’ve got a whole biofuels and bio energy team that’s working on this. You mentioned the Argonne study. I’m glad you asked about that. We—you know, electric vehicles obviously have emerged as this great technology for light duty vehicles, and cars, and SUVs, and pickups, but the heaviest duty transportation modes that really need energy density liquid fuels, which is where biofuels obviously are going to play a critical role, and, as you mentioned, aviation and marine fuels as well, so it’s a very—

Mr. FEENSTRA. Well, thank you.

Secretary GRANHOLM [continuing]. Exciting area—

Mr. FEENSTRA. Yeah.

Secretary GRANHOLM [continuing]. And I’m glad to see that Argonne study.

Mr. FEENSTRA. Yeah. Thanks, Secretary. Are you aware that in February of this year the Energy Information Agency published their 2021 annual energy outlook, and it estimates that by 2050 liquid fuel vehicles will still account of 79 percent of the new vehicle sales? Did you note that?

Secretary GRANHOLM. I saw that, yes.

Mr. FEENSTRA. Yeah. I just want you to know that the Information Agency has a whole subsection highlighting the gasoline and flex fuel vehicles, and we’ll only see 16 percent decline by 2050. Given this, it seems wise to me that we continue investing and expanding in biofuels. My concern, Madam Secretary, is that even though the facts paint a clear picture that biofuels present a solution to automotive emissions, the Biden Administration has hardly mentioned them when discussing the American Jobs Plan. Instead, Biden has called for 174 billion in spending in electric vehicles that the DOT (Department of Transportation) projects will account for less than 20 percent of the vehicles by 2050. Would you have—we should have automotive competition in low carbon automotive marketplace, and we can’t ignore the findings of your own department. Biofuels have a significant and essential role to play as we move forward into the future. Can I get your commitment to take these DOE findings to President Biden to ensure that biofuels are part of this administration’s future automotive policy?

Secretary GRANHOLM. I mean, honestly, I believe that biofuels are going to be a big part of this administration’s future policy with respect to transportation, as I mentioned, particularly on heavy duty and aviation, so I think that you’re pushing on an open door.

Mr. FEENSTRA. Well, thank you, Secretary. I just want to reiterate how important it is that our auto industry can also use biofuels and ethanol, and ethanol is so paramount. And I know the administration and yourself talk about—well, it’s important to, you know, larger aircraft and all this other stuff, but, just like the facts

point out, there's still going to be a large percent of our cars that need liquid fuels. So I hear what you're saying, I hear your support, but the American Jobs Plan does not include biofuels, and that's where I'm really concerned about it, and I hope, I passionately hope, that you and the administration can advocate for biofuels as we move forward. Thank you, Secretary, I yield back.

STAFF. Mr. Foster is recognized.

Mr. FOSTER. Thank you. Am I audible here?

Secretary GRANHOLM. You are.

Mr. FOSTER. OK. Well, Secretary Granholm, first off, congratulations on your confirmation, and in taking what one of your predecessors, Governor Rick Perry, called the coolest job in the world.

Secretary GRANHOLM. It is. It is.

Mr. FOSTER. So I'd like to use my time to encourage you to throw deep, and with major new investments in the sort of large science facilities and initiatives that the United States Department of Energy is really uniquely positioned to propose, to lead, and to execute. You have, at the Department of Energy, an organization with a unique capability, and an incredible track record for successfully executing technically challenging large scientific projects. But, for most of the last 10 years, the pipeline of those large transformative projects has been largely running dry, at least in the United States, because the U.S., science generally, and DOE Office of Science specifically, has been struggling even to preserve its already inadequate budgets.

Over the last decade we saw Paul Ryan budgets proposing 17 percent cuts to science. We saw the Trump/Mulvaney proposals for 100 percent cuts in various areas, so that, for many of the last 10 years, even preserving a flat science budget sometimes seemed like a victory. As a result of this, the U.S. has been increasingly forced to become a relatively minor participant in large international projects, rather than the host of world-leading scientific facilities that was our traditional role.

But that attitude, fortunately, has changed, at least on the House Science Committee. It was over a year ago, well before COVID, that we were graced with the wonderful prospect of dueling Republican and Democratic proposals to double the scientific research budget. And then they both concentrated especially on the fundamental scientific research that will be necessary in the long run to solve climate change, to meet our other challenges, and to preserve the U.S. leadership in understanding the mysteries of the universe. And I remember out on the campaign trail Vice President Biden—then Vice President Biden would oscillate between doubling and tripling the science budgets, which I guess is the range of flip-flopping that we can—most of us can tolerate. So I'm really very proud that, under the bipartisan leadership of Chair Johnson and Ranking Member Lucas, this Committee is working toward a thoughtful and technically feasible reauthorization, you know, not only for the Department of Energy, but across our entire science portfolio. That's the way our government and budget process should work.

You know, you could take the opening statements of our Chair and Ranking Member, and you could interchange them without noticing a difference, and I don't know of another Committee in Con-

gress that you could say that of. You know, but there is a long list of large science investments that are overdue—that are really overdue. For example, infusion. As the large international ITER Project is approaching the finish line, the international community is now looking at the design and the site of the next machines. Good candidates for this include a next generation either light tokamak, or perhaps in a significantly higher field, or perhaps an optimized stellarator, the U.S. invention which was successfully prototyped in Germany that promises a simpler and more economical operating path for fusion, or many other designs. And there are many similarly large new projects, many waiting in the wings for over a decade, in high energy particle physics, in bioinformatics, quantum, cloud-based biology, neuromorphic community, you know, the list goes on.

There are opportunities for big new investments in DOE also outside of the Office of Science. At NSA (National Nuclear Security Administration), after a decade of progress at NIF (National Ignition Facility), we are now in a position to write down the design of a next generation laser ignition facility that could reliably be projected to achieve robust laboratory scale thermonuclear fusion, which is perhaps the most scientifically exciting use for our stockpile stewardship workforce. And we—many Members here have mentioned the nuclear waste problem, and while we have struggled for decades with the politics of nuclear waste storage at Yucca Mountain, in Europe there is a project underway to demonstrate that instead of finding someplace to store long nuclear waste, you can simply incinerate it using a charged particle beam that's very much like the one the Spallation Neutron Source at Oak Ridge uses every day. But unless we make these big new investments on these large new projects, our competitors are going to get there first. So I'd like to echo Chair Johnson's observation that a 5 percent increase doesn't really cut it for the Office of Science, and I hope that we do better when this procedure settles out. So throw deep, as I said. You know, the Department of Energy team has a lot of good receivers, and they are wide open, and they are far downfield. In Congress, we are ready to hand off the ball to you, the budgetary football, but you have to call the plays, you have to hit the open targets. You have to put a few scores on the board, and we can have a pretty good first quarter. And I have now used up my time, but I look forward to working with you.

Secretary GRANHOLM. That was beautiful. Thank you for that.

STAFF. Ms. Kim is recognized.

Ms. KIM. OK. Thank you. Thank you, Chairman, and Ranking Member Lucas, for holding this important hearing, and I want to thank you, Secretary Granholm, for being with us today.

You know, unfortunately, residents of my home State of California have firsthand experience with energy infrastructure that cannot meet the demand. Like, last summer, over 800,000 customers suffered power outages over two evenings in August. You may recall that. Californians only averted another round of rolling blackouts in the coming days through emergency measures and voluntary conservation. And California adopted a requirement that renewable energy and zero carbon resources supply 100 percent of retail electricity by 2045. So as this plan requires fossil fuels to be

phased out, are advances in grid resiliency keeping pace with the increased use of renewable energy necessary to meet the standard?

Secretary GRANHOLM. I'm sorry, the question is are——

Ms. KIM. Advances in grid resiliency——

Secretary GRANHOLM. Yes.

Ms. KIM [continuing]. Pace with the increased use of renewable energy——

Secretary GRANHOLM. Yeah, we clearly need to do both. I mean, there is no doubt that the grid issues—I mean, California's grid issues are a combination of things, right? One of them is that you've got an old grid, and the grid is on poles that were put up in the 1950's, and you need to underground—you—not you personally, but California needs to underground the wires so that it is resilient from wind. A lot of the outages had to do with anticipated high wind events, where we didn't want to create fires, and so people, you know, saw their system shut down as a result of that. We shouldn't—in the 21st century we shouldn't have that kind of a system. A grid should be resilient, it should be reliable, it should be secure, and we should have enough capacity to be able to meet the energy needs of our citizens, and we—so we need to work on that in California.

I think the importance of investing in the technology of grid, in—and what—the American Jobs Plan is a signal for this. You know, being prepared means a lot more than having a plan, it means making the investments in the transmission system, and the generating resources. The grid itself has got to be resilient enough to be managed under various extreme weather circumstances, and that challenge is connected with the generation, you know? So, bottom line is we've—it's very complicated, but we have to invest in the basics, which is——

Ms. KIM. Sure.

Secretary GRANHOLM [continuing]. A grid that is underinvested in. And California doesn't have the resources to pay for it all by itself, so this is why we need to have an aggressive public/private partnership with the transmission operators to get these new lines built, and to underground the lines that we have.

Ms. KIM. So how are DOE's research and development activities preparing utilities to address that high demand on hot, windless days, as temperatures peak in the afternoon and early evening, while solar generation decreases as sunset approaches?

Secretary GRANHOLM. Yeah. I know that the Office of Electricity is looking at various technological advances on energy grids, first of all, to make sure that grid dispatching is efficient, and that means AI, and making sure we've got the right technology on the grid to make it efficient, but it also means that we have got to invest in the kind of wires that are resilient. So that means replacing a lot of wires, making them resilient to heat, making them, you know, further research and development to lowering the cost of undergrounding, where it's appropriate to be able to do that. So a lot of the work that we are doing is, you know, learning from what has happened both in California, in Texas, you know, and across the country to make sure that we—but ultimately we need to invest to get—to upgrade the system.

You know, in Europe they do a huge amount of undergrounding of high speed DC wires, and they underground them in trenches, and they may run underneath agricultural land. You don't even know that they're there. They may compensate the owners for it. So there's a lot that we could be doing policy-wise to shore up and harden——

Ms. KIM. Secretary, I have 30 seconds left so I——

Secretary GRANHOLM. Yeah. I'm sorry.

Ms. KIM [continuing]. Let me reclaim my time, because——

Secretary GRANHOLM. Thank you.

Ms. KIM [continuing]. Express my concern that a shift to renewable resources for which our grid is not prepared could increase the frequency of blackouts. And I believe you have stated that our country's electric grid is unprepared for extreme weather events such as wildfires, so, in your opinion, what is the greatest challenge in improving grid resilience and minimizing service disruption in areas frequently threatened by wildfires, and how is DOE addressing this?

Secretary GRANHOLM. Yeah. I mean, honestly, what we have to do is invest in the grid to harden our defenses. It doesn't mean that we shouldn't be adding capacity like clean energy to the grid. It means we have to add capacity, and we have to shore up the existing lines and wires, whether it's undergrounding, or adding the microchips that make it smart for dispatchable power to be sent where it needs to go at the time it needs to go. So, you know, the—we have to invest in all aspects of the grid, including cyber. But right now we have been—we have really turned our back on the grid, and this is why—this is a moment. We're all in this moment of being able to say this is a time to invest in this piece of infrastructure. And I would really posit that while we're talking about infrastructure investment, investing in the grid is infrastructure.

Ms. KIM. OK. Well, thank you so much. I think my time's up. I yield back.

Secretary GRANHOLM. OK.

Ms. KIM. Thank you, Secretary, for being with us.

STAFF. Ms. Ross is recognized.

Ms. ROSS. Thank you so much, and, Secretary Granholm, I could not be happier that you're where you are. Clearly you're thinking the right way, and you're thinking about the future, which is the most important thing. I represent the Research Triangle area in North Carolina. As a matter of fact, I've seen you at NC State University talking about renewable energy and clean energy. And, by the way, the Chancellor told me he really wants you to come back, so this is an open invitation to come back to NC State. And I've learned that both NC State and Wake Tech Community College, which is very near NC State, have programs in cybersecurity, training up the next generation to help us avoid problems like the Colonial Pipeline crisis that, you know, we experienced so directly here in North Carolina.

But because so many of my colleagues have asked you questions that I was going to talk about, including the one on the grid, great answer, and the one about offshore wind, I want to focus on something that we are not hearing enough about, but I think is really a big part of solving the climate crisis, and that's energy conserva-

tion, and making sure that we have better buildings, and ways of making sure that we have energy resilience, and so the less energy we use, the less energy we have to produce. But our utilities don't have an incentive to implement these conservation programs because they sell less energy. If they build fewer things, then they have less to put into their rate base, and less of a rate of return.

And I've seen this here in North Carolina. I represented municipalities who wanted our monopoly utilities to give them better ways to load ship, to have more advanced meters, so that people could figure out what they were doing, and how to reduce their energy bills. And I would like to know how we can move forward on this, because I'm all for all the new and different ways of having energy and having a new grid, but wouldn't it be great if we could just conserve some and save our constituents some money?

Secretary GRANHOLM. Yes, yes, yes. I mean, both have to happen. We have to generate renewable and clean energy, and we have to have energy efficiency, and we have to put the incentives in the right spots, right, for the utilities to be able to produce what used to be called the fifth fuel, which was energy efficiency. This is why having a clean energy—an energy efficiency standard, which is what is contemplated in the American Jobs Plan, is such an important piece of things. You can see the benefit if you put the incentives in the right places. We did this in Michigan, a number States have done this. There is—there are ways to construct it, and I would say the American Jobs Plan as well gives States—allows us to shape State block grants that would reward States that do that, that reward efficiency.

I mean, you know, there's a big emphasis in the American Jobs Plan for increasing weatherization and building—retrofitting homes and buildings, and, honestly, the energy efficiency piece, it's not just about the climate. It's really about the climate, but it's not just about it. It's also about people. I mean, when you think about how much, particularly poor families, pay, up to 30 percent of their income on energy, it's just wrong. We need to have secure homes that don't leak, and it would be wise for us to make sure the incentive structures are accurate, and right—and placed in the right way so that we can incentivize building back better for all communities.

Ms. ROSS. And could you speak a little bit about how we inspire our people to want to conserve energy, and maybe turn off the lights, and things like that. And it—when I was growing up, that's what we did, because we had energy—an energy crisis, but I think that we've taken for granted that we're always going to be able to plug in our devices, and everything's going to be there, and, you know, it might be good if we inspire people to be a little bit more conscious of what they're doing.

Secretary GRANHOLM. 1,000 percent. One would hope that the financial savings would be inspiration enough. I would also say that sometimes it's difficult to inspire individuals, but you can construct technology that does the work for you so that people don't really have to think about it. So smart buildings, for example, energy savings in building's management that will automatically turn off lights when there's no movement, the smart and efficient appliances that save people \$600 on average per year, and if that's not

enough on their own, but having that as part of building codes I think is a critically important piece of a comprehensive strategy with respect to energy.

Ms. ROSS. Thank you very much, and I yield back.

STAFF. Mr. Babin is recognized. Mr. Babin is not with us anymore.

Mr. BABIN. Here I am.

STAFF. There—

Mr. BABIN. Here I am. I'm sorry. I apologize. I've got a few questions that I'd like to ask. Appreciate you being here, Madam Secretary. Thank you so very much.

Secretary GRANHOLM. Thank you.

Mr. BABIN. And this is a very, very important subject and issue. On the first day in office President Biden announced that his intention was to rejoin the Paris Agreement. In April he submitted the United States Nationally Determined Contribution, which was an emissions reduction target of 50 to 52 percent below 2005 levels by the year 2030. The submission did not offer much information, other than vague phrases on how it was determined, like saying the National Climate Advisor conducted an inter-agency process across the Federal Government, and consulted a range of other stakeholders. The Obama Administration's pledge to reach 80 percent reduction by 2040 was estimated to cost the United States economy \$3 trillion and 6.5 million industrial sector jobs. Therefore, I want to ask, and well, let me just say this. I believe that the American people deserve transparency, and a justification if their jobs and economy are really on the line like this. So, Secretary Granholm, what was DOE's role in determining this target, and did you meet or communicate directly with the National Climate Advisor, Ms. Gina McCarthy, and what, if any, models or data sources from DOE were used to inform this process? Please, ma'am.

Secretary GRANHOLM. Yeah, thank you for asking that. Yeah, it's part of a whole of government approach. We are all about making sure every agency is looking at this. They've used a number of resources, economic models, I've certainly talked with them, et cetera, and the whole point is that there are a number of paths that one could get to. You ratchet up one a little bit higher, one maybe going a little bit lower, but there are a number of reports out there that are publicly available that suggest that there are different paths to be able to achieve getting to that goal of 50 percent reduction, or 50 to 52 percent reduction, by 2030.

Mr. BABIN. Yes. OK. Well, I understand. Now, the second one I want to pivot to touch on a topic relevant to my role as the Ranking Member of the Space and Aeronautics Subcommittee. The ability to use nuclear power in propulsion systems safely, securely, and sustainably is vital to maintaining and advancing U.S. leadership in space. The National Strategy for Space Nuclear Power and Propulsion was issued last year in an effort to increase coordination and collaboration across all relevant Federal agencies, and maximize efficiency and return on taxpayer investment. Additionally, capitalizing on the commonalities among space nuclear power systems and terrestrial nuclear systems, especially fuels or fuel

variants, could shorten the timescale for the development of critical capabilities.

And, Secretary Granholm, how is DOE coordinating with other Federal agencies on existing and future space nuclear power initiatives, especially with an eye toward future applications of the Department's current R&D efforts, and how is DOE engaging with the private sector to meet the needs of civil and national security space? In one instance, should agencies consider issuing a request for a proposal for the development and construction of an in-space or lunar surface power reactor system or demonstration? I know I packed in about three questions.

Secretary GRANHOLM. Wow. You've got a lot in that one.

Mr. BABIN. I'm sorry. I'm sorry.

Secretary GRANHOLM. That's OK. That's all right. So let me just say, I'm excited and really proud of how the Department of Energy assists NASA in its important space exploration missions. So, for example, our national labs, like Idaho, and Los Alamos, and Oak Ridge developed and assembled the plutonium power source for the Perseverance Rover that landed on Mars earlier this year, so—and DOE itself has built nearly 50 radio isotopic power systems units that have powered and—more than two dozen, I think, space missions. So we have partnered with NASA, and we're excited about that, and of course DOD—DOE and the National Labs are also leading teams to develop new nuclear thermal propulsion rockets that have the potential to be able to move, you know, and, I would say, to carry and significantly reduce travel times. And we're also working with the Department of Defense on the development of fission power systems, especially microreactors, that could perhaps provide surface power for missions on the Moon, and maybe even Mars. So I look forward to working—continuing to work with NASA, and I'm glad to know that you're really interested in that as well, and space exploration. So, you know, we look forward to working with you and with the Committee on that.

Mr. BABIN. Well, thank you so very much, Madam Secretary. That's a very good answer. And so, with that, Mr. Chairman, thank you, I'll yield back. Appreciate this informative hearing.

STAFF. Mr. Crist is recognized.

Mr. CRIST. Thank you, Mr. Chairman, and, Secretary Granholm, it's great to see you, and thank you for joining us today, always a pleasure. The Department of Energy recently announced an ambitious and laudable goal of cutting the cost of solar energy by 60 percent within the next 10 years. What programs and initiative does the Department plan to use to meet the goal, and what can Congress do to help you support that?

Secretary GRANHOLM. Yeah, thank you for asking. I mean, obviously the cost of solar has dropped so dramatically, but we announced we're cutting it yet again by 60 percent. And we do have a great plan. I'm really proud of how we're going to keep that price of solar coming down, and down, down. And, as you noted, you know, we were really being aggressive about it, so to help us get there, we're committing funding, and we're committing assistance to support that goal. It's a comprehensive plan. Every bit of the process, from the raw materials, to the point a solar panel is delivering electrons to your house, it includes—this plan that we're get-

ting there to reduce by 60 percent includes continuing the front end R&D on material science to develop lower cost and higher performing solar technology, like our work in perovskites, as one example. Just this past March we announced more funding for that effort.

And it also includes things people don't even think about, like, for example, the soft costs of permitting and siting, so there's—I'm—those soft costs, they are a big part of why, as cheap as solar has gotten, it's still more expensive to install than—here in the United States than in other countries. So, as one example, we are partnering with State and local governments to use this online permitting tool so that people can get standard rooftop solar permitted instantly, rather than waiting for months, and our solar office—I'm not getting ahead of myself here, but we're going to be announcing this—launching this app next month to completely eliminate the soft waiting time, et cetera, and the cost associated with that, so you can appreciate the role of getting all these distributed energy resources online in Florida for sure, and making sure that they're benefiting Floridians. Long story short, there's a lot going on in this area. I'd be happy to have your team connect with our Solar Energy Technologies Office if you'd like even more detail.

Mr. CRIST. Well, thank you, that would be great. While solar energy is growing in Florida, my home State hasn't exactly lived up to our nickname as the Sunshine State, so, as I'm sure you're probably aware, Secretary, State energy policies in Florida can make it difficult for homeowners to install, integrate, and fully benefit from solar panels. Meanwhile, Florida is arguably the State most susceptible to the impacts of climate change, and therefore the State most in need of increased renewable energy development. How can the Department of Energy incentivize States to increase integration of renewable energy into the grid?

Secretary GRANHOLM. That's a great question too. I mean, this is critical, as we need States, and localities, and companies to all work together, along with the Federal Government, to achieve our goals for renewable energy. And so the State Energy Program, SEP we call it, is in the Office of Energy Efficiency inside of DOE—Energy Efficiency and Renewable Energy, and it's working this year to strategically engage the leadership of States in deploying clean energy technologies across the country. SEP funding helps to establish and to implement these clean energy policies and programs to reduce energy costs, and enhance competitiveness, and all of that, and improve the environment.

And in addition, our national labs, and all of our program offices, have tools to help States integrate more clean energy onto the grid. But we can do a lot more, and want to do more, and the American Jobs Plan would help us do that, and also to give States, and local units as well, incentives to come up with their own homegrown strategies to move toward 100 percent clean energy. You'll see that in the jobs plan, the State Clean Energy Block Grant Program, that I like calling the Build Back Better Challenge Grant Program. And my vision is really to work with States to come up with the best strategies to maximize clean energy, and if the State government is not so interested to work with the local units of government inside of that State to do the very same thing to support

these resources. And the further they go in figuring out how to integrate clean energy, the more resources we would get to them to help them fulfill that vision. So I'd love to work with you on developing that program too.

Mr. CRIST. Thank you, Madam Secretary, I truly appreciate that, and I yield back the balance of my time.

STAFF. Mr. OBERNOLTE is recognized.

Mr. OBERNOLTE. Thank you, Mr. Chairman, and thank you, Secretary Granholm, for what's been a really fascinating hearing. In your testimony you mentioned the problems with the Colonial Pipeline, and the threats to the civilian supply chain, and, obviously, that's something that the Committee here has been very concerned about also. We had an Investigations and Oversight hearing on that exact topic this week. Although we were more focused on the government supply chain, obviously the economic supply chain for the rest of the country is even more important. I'm wondering what you think needs to be done to try and address those vulnerabilities, because, unfortunately, your job is even harder than the job that we were looking into because you run the risk of over-regulating if you require everyone to comply with something, and also you create changes to the competitive landscape if you were to require things that only large companies were positioned to comply with. So—

Secretary GRANHOLM. Yeah.

Mr. OBERNOLTE [continuing]. What do you think needs to be done about this, and how can we help you get that done?

Secretary GRANHOLM. Yeah, I appreciate you asking. It is really a sensitive issue, because you want to, you know, you want to encourage innovation, and you want to cure—encourage adaptation of whatever the solutions are that you are promoting, but you also, you know, you want to make sure that everybody can do it, right? So, you know, you're aware, of course, since you had had a hearing on this, and you saw this week, that the TSA (Transportation Security Administration) has—who has regulatory authority over pipelines, right? So—but at this—up to this point it's been voluntary. On the electricity side, that—the utilities have really been grateful for the fact that there are some minimum standards that are on their end, and—that they use to make sure that the, you know, that the transmission grid and distribution system is as safe as possible.

One wonders whether we can borrow from what is happening on the electricity side to put over to the oil and gas side to make sure that we at least have knowledge of what is going on. So, for example, on the electricity side, we—many of the transmission operators have technology that was developed by PNNL, actually, and is on the grid, called CRISP (Cybersecurity Risk Information Sharing Program), and it identifies when there is a threat, a hack, et cetera, and it also alerts PNNL. It alerts those who are monitoring it, and CESER (Cybersecurity, Energy Security, and Emergency Response), and make sure that our intelligence community is aware, especially if there is an international threat. There's no such system like that on the pipeline side, and so one wonders if that might be something that we should require, or if that should be considered.

You know, the utility community is all in on making sure—because they see it happening, and so should the folks on the pipeline side. So TSA announced this week that it was going to be requiring pipeline operators to tell them when there was a hack, and I think that's an important step. And the final thing I'll say—I'm sorry to go on, but I think it's a really important question—that NIST (National Institute of Standards and Technology), over at the Department of Commerce, has developed some basic cyber floor, I will say, that entities should be using, in terms of cyber hygiene. And I think that having some basic requirements on these systems is important, because we have to continually upgrade, but we also make to—need to make sure that everybody has some basic protections on systems that we all benefit from.

Mr. OBERNOLTE. Sure. Thank you. That was a great discussion, and I think you're absolutely right. The point that came up over and over again in our Subcommittee hearing earlier this week was that it's not enough for NIST just to upgrade guidance. You know, it's going to require some kind of—and if not regulation, then maybe some automation, as you say to—

Secretary GRANHOLM. Yeah.

Mr. OBERNOLTE [continuing]. Highlight the vulnerabilities that we have in the supply chain, because otherwise this is just going to continue to happen to us.

Secretary GRANHOLM. Agreed.

Mr. OBERNOLTE. And then, lastly, if I could ask you about some of the research programs at DOE? I know you share my concern for the U.S. falling behind in its competitiveness in programs like exascale computing and artificial intelligence, you know, things that really have the capacity to fundamentally transform our economy, and I think it's just vital to maintain our competitive stance there. What can we do to better assist the DOE with implementing those programs? Because my concern is not just the basic research, but also vocational training for the next generation of Americans to prepare them to compete in this space.

Secretary GRANHOLM. Yeah. I mean, I agree with you that we have to continue to buildup the STEM workforce. I acknowledge, I think, that you have a Master's degree in artificial intelligence, and you're, like, the only one in Congress that may have that. That's pretty amazing.

Mr. OBERNOLTE. I haven't researched that. I don't know.

Secretary GRANHOLM. But it would be great to see more interest in areas that often are seen by young people—you know, if they're not interested in computers off the top, then they may not be at all looking at—in this space, but we need to really build out this pipeline. Today DOE announced an initiative—a \$100 million initiative to fund the research of young science efforts to make sure that we are continuing to support these young STEM future career workers, but we need to get—go deeper and go younger to really expand that STEM pipeline, and a lot of times—I mean, I taught at Berkeley. There's a class there that is essentially computer science—in the Computer Science Department, but for Liberal Arts majors. And the number of women, the number of diverse folks who took that class because they felt it was less threatening, perhaps, was amazing. They had enormous success. We need to de-

velop—we need to be thinking about how young people view it. And, if they don't see themselves as a math person, they might not be interested in going into this field, and I think we've got to be more creative.

I will say that the labs have been great about expanding the STEM pipeline, and really focusing, and now this is our effort inside on a diverse STEM population, because, in the space of artificial intelligence, in the space of designing, programming, if you don't have good inputs, you're going to have bad outputs, as you know, and if you don't have a diverse population at least providing some of those inputs, you're going to see like what we did with the facial recognition software, way overidentifying African-American men, for example, in the criminal justice space, et cetera. So we need to have a diverse pipeline of inputs and there—and of STEM workers in order to be able to achieve what we want to achieve.

Mr. OBERNOLTE. Well, it's an exciting initiative, and I know we're looking forward to working with you on that, so——

Secretary GRANHOLM. Great.

Mr. OBERNOLTE [continuing]. Thank you very much, Secretary Granholm, and I yield back.

Secretary GRANHOLM. Thank you.

STAFF. Mr. Kildee is recognized.

Mr. KILDEE. Thank you. And, hey, Secretary Granholm, how are you? It's good to——

Secretary GRANHOLM. I am great. It's great to see you too.

Mr. KILDEE. Both to you and Dan. Congratulations again on your confirmation. It's good to have you, as a Michigander, as a Midwesterner, in this administration, particularly in this role. Obviously we're focused very much on the auto sector, and knowing that the future of the automotive industry is electric. We know that we have to act boldly and aggressively, if not, China will lead the future of this industry, and we have to have specific and strategic Federal policy to make sure that American workers and American companies can compete in this 21st century economy, particularly in this space, and particularly given the ascendancy of China in this particular area. Right now electric vehicles make up about 2 percent of vehicle sales. So, as you know, and we've chatted about this, I'm working with Senator Stabenow to extend and to expand the electric vehicle tax credit to increase demand for electric vehicles, and to lower costs for the purchase of those vehicles for consumers, but that's just one of the tools that we need to help grow this industry.

So, as you and Representative Stevens discussed earlier, at the Department of Energy there's a program, the Advanced Technology Vehicle Manufacturing Loan Program, the ATVM Program, which provides loans to support the manufacture of advanced light duty vehicles. So far this program has supported the production of more than four million advanced technology vehicles. Unfortunately, however, past administrations have not used this program as Congress intended, and as such there hasn't been a loan disbursed since—really since 2012. There are billions remaining in this loan authority, and I would like to see it used more aggressively to help us essentially take an all of the above approach to making sure that we're going to win the future. Do you have thoughts on how

to use the ATVM Program to support production of EVs, and to create those really good paying jobs that we know that it can create right here in the U.S.?

Secretary GRANHOLM. Yes. Thank you for asking this question, and thanks for your leadership and concern, especially about expanding the definition of what is available for access to the ATVM Program, including heavier duty vehicles. So you are aware, I know, and for everybody who may not be following this so closely, we have brought in a fellow named Jigar Shaw to run our Loan Programs Office, which includes the ATVM Loan Program, and he is—he's an—he's a—he comes from the financial world, and is completely obsessed with retooling the loan program to make it accessible. I mean, the—it has been moribund. Not just the ATVM, but the other Loan Program Office, you know, opportunities.

You know, before—I mean, the LPO had demonstrated great success in providing financing, for example, to Tesla as an EV startup, right, and it recapitalized Ford's manufacturing plants in a number of States, and it also helped to refinance the Nissan plant in Tennessee. But there are—we just need to go further. I mean, there's whole a whole—there have been a series of hurdles that were set up at the Loan Program Office that made it inaccessible not just to those big players, but to smaller players as well, and we want to, you know, let 1,000 flowers bloom, and that means allowing, you know, bringing down some of the initial costs that make that a barrier to entry, et cetera. So Jigar Shaw is working on a whole plan on this. He is an impatient soul, and I think you will be seeing some results from this very quickly. But we know this is a huge opportunity, and we are not going to miss it.

Mr. KILDEE. Well, I appreciate that. Changing the subject just slightly, you may have touched on this, I've had to come and go during the hearing, but I wonder if you could comment on your Department's strategy around research on storage. The whole broad range of issues around energy storage. Obviously, with renewables, one of the challenges we have is dealing with peak demand, and one of the ways to address that is with more effective technology related to energy storage. Is there—who's the—who's got the tip of the spear on that research, and what's the U.S. DOE's role in that?

Secretary GRANHOLM. Well, there are a number of labs that are doing research on storage, but I will say—and I just came from a virtual tour of one of them, the Pacific Northwest National Lab, where we have this whole grid storage launch pad on—particularly on energy storage—on energy storage—on utility scale storage, and that is very exciting. We have a whole—you know, the Vehicle Technologies Office is doing a huge amount on batteries, and the storage component of it, we want to bring down the cost of utility scale storage, and we'll be announcing an initiative on that in the next couple of weeks, in terms of a challenge to be able to get it down to the cost that we need to have it be readily adopted.

You know, the ARPA-E has been focused on that as well, and has been—has announced challenges related to storage and materials. We've looked at critical minerals as a component of the need—on the vehicle side in particular to make sure that we have the capacity in the United States to build the batteries in the United States, and so making sure we are mining in a responsible

way for these materials. So, for example, DOE has funded—in the Salton Sea in California, has helped to fund a project by—that was—had been funded by BHO, which is a responsibly mined geothermal project where we pull lithium from the Salton Sea, and that lithium is being used now in vehicle batteries, or will be used in vehicle batteries. It's just starting up. So the bottom line is we have to be—we have to look at the supply chain of energy storage from soup to nuts, and from vehicles to utilities, and the 17 national labs, I would say probably half of them have got energy storage initiatives, working on different components. We're coordinating, and working on different components, to make sure that we are, you know, are being responsible.

And I will say thank you to this Committee, that adopted the *Better Energy Storage Technology Act*, the *BEST Act*, from the *Energy Act of 2020*. You know, it was signed into law, and we're working on a lot of the priorities that emanated from that. It needs to be funded, right, but we are—we've got all this cost cutting research and development work that the Act certainly gave—pushed us in the direction of, and we're excited to be able to take that to scale with both the American Jobs Plan, and/or with funding that is—that was—that—funding the authorization of that Act.

Mr. KILDEE. Well, thank you very much. I really appreciate your thoughtful approach to all these issues. Keep up the good work. I look forward to seeing you in person soon.

Secretary GRANHOLM. Very good.

Mr. KILDEE. Thanks.

STAFF. Mr. Sessions is recognized.

Mr. SESSIONS. Thank you very much. Ms. Secretary, I want to thank you for taking time not only to join us today, but for your service to this country. I think it's important that, as this Committee engage you, and other Members engage you, we give you the real sense that what we're trying to do is to move forward the best positions the United States to be prepared for its future. And one of the things that we have talked about in earlier Committee hearings is American competitiveness, and American competitiveness means that we grow what we have in our universities, that we grow in our labs, and we grow in collaboration with public/private partnerships with companies that can take on, perhaps, more specific things, and take things further down the road.

One of the things that I would say to you is that, in your role, I wholeheartedly encourage you to know that a viewpoint that is not always shared by everyone is a word that we use, all of the above. And that is that we believe that, if you live in the Northwest, or have something that is—where you have hydropower, good for you. If you live in Texas, or if you live somewhere where the resources might be different, or in the Northeast, where they might be entirely different, that you utilize those that make sense, and in Texas, and in the Southwest, it is natural gas.

What my point to you is is that it is my hope that you will know that this Committee wants your leadership. We expect you to aim to the best, and lead to the best, but I would also remind you that the United States, whether we are with solar panels, whether we're moving—and we have those directly in the district—the congressional district that I represent in Central Texas—or whether we

have the big 38 story wind turbines, we all want to work together, and it's my hope that as you do champion those things that are clean and better energy, please remember that there's also people like my family and others that have disabled children, and people who come home with a loved one who may have been in the military, and they have to have a big SUV because they have a disabled person, or perhaps a wheelchair, or some other things.

And I think too many times there's a tendency from some people—it's hard to say, sometimes it could be me, even—but who finds a way to become more narrow rather than acknowledging that we're all in different circumstances, and we all have different needs, and we need each of these areas, like—I'm big, you know, into nuclear power, because it's a non-emitting source. My point is thank you, and I hope that you know that this Committee wants and needs you to be successful, but that I hope that you'll remember that that balance comes about, that different people have different needs. And I know a good number of the young people in your party are pushing you, and I get that. That does not bother me. They're pushing you in certain angles. I would encourage you to remember everybody. And I want to thank you very much. The gentlewoman, Eddie Bernice Johnson, and I have served together in a district right next to each other.

Secretary GRANHOLM. Um-hum.

Mr. SESSIONS. I know her well. Her professional nature, her abilities, are dominant when she chooses to put them to play, and she does. And I will tell you that we all wish you well, and want this to be a spectacular opportunity for everyone that's involved. I know you've got about 20—35 seconds, but Secretary, I want to thank you.

Secretary GRANHOLM. Well, I appreciate that. If I could just say, thank you. I want to see all as well, and I think that the great thing about this energy space is that there are good paying jobs for all kinds of people in all pockets of the country. For communities like you're talking about that have relied on fossil fuels, the technology that we can bring to be able to manage carbon emissions is really an opportunity for them, and so I'm excited to work with this Committee, and I appreciate your real uplifting of the bipartisan nature of that. I have been questioned, certainly, but that obviously is reflected—reflective of the spirit of esprit de corps of this Committee. So thank you for that.

Mr. SESSIONS. Yes, ma'am. We'll I've got—only got 23 years in, but if I can be of assistance to you, Ed Perlmutter and I are good friends, Eddie Bernice—Chairwoman Eddie Bernice Johnson are good friends. We wish you the best, and, quite honestly, we need you to succeed. And thank you very much, Madam Chairman, I yield back my time.

STAFF. Mr. Beyer is recognized.

Mr. BEYER. Thank you very much. Madam Secretary, welcome. It's been really fun learning so much from you. And I think it's truly weird that we had all those football analogies from the—

Secretary GRANHOLM. Amazing.

Mr. BEYER [continuing]. Only Ph.D. physicist here. But—and I've been trying to rewrite my notes to do that, but I can't. So—and as you probably know, we've put together a—an informal Fusion Cau-

cus here in the House. Democrats and Republicans, the Science Committee, a lot of folks on the Energy Subcommittee in Appropriations, and—recently sent a letter to you, which you and your staff—very polite response, we’re just thrilled. We didn’t get any responses the last 4 years. And our letter specifically asked that you highlighted the energy programs, and Conor Lamb’s *Energy Act of 2020*, which included alternative and enabling concepts, milestone base development program, design of future fusion systems, full support for the construction of the ITER Project, on time and on budget. And I’d just love to get your sense of your commitment, and DOE’s commitment, to following through on all these fusion energy landmarks we sent out.

Secretary GRANHOLM. Yeah, thank you for asking. I do feel like, as I mentioned earlier, that fusion is kind of the holy grail. If we can crack that code, you know, it solves so much, right? So the ITER Project is going to be a key step toward the eventual development of fusion energy, and—so I think it’s 72 percent complete to achieving the first plasma, but I think the impacts of the COVID-19 pandemic are still being evaluated in the system. But our U.S. progress on it I think is about 67 percent complete, so we have finished two of 12 of the hardware-in-kind contributions, and we’re seeing that funding—the funding below the project’s approved baseline has hampered our ability to provide the in-kind components and systems in a timely manner, so I look forward to continuing to work with Congress to help ensure that the U.S. can effectively aid the completion of the project.

And on fusion more generally, you know, the Fusion Energy Sciences Program within the DOE Office of Science is building the foundation that’s necessary to develop a fusion energy source separate from ITER, or in parallel with. The ’22 budget request invests in transformative R&D to accelerate progress toward fusion energy, and it includes investments in additive manufacturing, and in quantum information, science, and artificial intelligence, and it’s also going to support the D3D National Fusion Facility, which is a world-leading fusion experimental—experiment—experimental device located in La Jolla. So bottom line is we are in on fusion, we think its progress is enormous. And, you know, it may not be in the times we are serving here, who knows? It may be we’re looking to the future, to our children or grandchildren who will be able to benefit, but nonetheless, as I often say, leadership is sometimes planting trees under whose shade you will never sit.

Mr. BEYER. OK, but I’d love to get a reset on that, because that’s sort of what we heard all of our lives, and what—the—we talked to a lot of physicists in the last year who say stop thinking about 25 years, or our children, or our grandchildren.

Secretary GRANHOLM. All right.

Mr. BEYER. Let’s think this decade. And let’s also not just think ITER, which is the classic Big Government approach. There are at least nine small fusion energy companies, commercial companies, in the U.S. that have a couple of billion dollars invested in them already, some doing accelerators, some doing tokamaks. We were up at the National Academies a couple weeks ago, and they were like, yeah, 2035 to 2040. But Commonwealth Fusion, TAE, some of these others—I’m really interested in—you know, I only have 50

seconds, but getting DOE and your fusion efforts combined with the small, aggressive people who can make it happen fast.

Secretary GRANHOLM. Yeah, yeah. 1,000 percent. We're doing this through INFUSE, you know, the Innovation Network for Fusion Energy, which is working at ways to support the public/private partnerships with these companies that are looking to make quicker advances. So I don't mean to suggest that we're only going to get it long term. I know that that is what everybody says, but we are proceeding with these smaller efforts through INFUSE.

Mr. BEYER. I just think we got a vaccine in under a year.

Secretary GRANHOLM. Good point.

Mr. BEYER. In fact, we got it under 2 months, and it took—

Secretary GRANHOLM. Good point.

Mr. BEYER [continuing]. A year to get it out there. We need to think about fusion energy that way.

Secretary GRANHOLM. All right.

Mr. BEYER. And the holy grail is perfect. There's a German phrase, "eierlegende Wollmilchsau."

Secretary GRANHOLM. I'm never going to remember that—

Mr. BEYER [continuing]. That lays eggs gives you wool, gives you milk, and bacon. And that's what fusion energy is for the future of this planet.

Secretary GRANHOLM. Awesome.

Mr. BEYER. Thank you, Madam—

Secretary GRANHOLM. Thank you.

STAFF. Mr. Meijer is recognized.

Mr. MEIJER. Thank you, and welcome, Madam Secretary. I think the last time we met, I was a cadet at West Point, and you were the Governor of the State of Michigan, so—

Chairwoman JOHNSON. My gosh.

Mr. MEIJER [continuing]. It's great to—it's good to see you again, and congratulations on your—

Secretary GRANHOLM. It's great—

Mr. MEIJER [continuing]. Confirmation.

Secretary GRANHOLM [continuing]. To meet you—great to see you.

Mr. MEIJER. You know, I want to kind of route it back into Michigan a little bit. I know that really a priority of this administration's energy plan has been around supporting green jobs, supporting jobs in the energy sector, and being mindful of the implication on some of the transitions that are underway, what implication that will have on the labor market more broadly.

You know, I'm sure this issue came up when you were Governor of our great State of Michigan, but recently the Enbridge Line 5 Pipeline that starts over there in, you know, in the Wisconsin/Minnesota border, crosses through the Upper Peninsula, crosses under the Strait of Mackinaw, and then heads over into Sarnia, Governor Whitmer, your successor's successor, has been engaged in a pretty long struggle to shut down that pipeline, specifically citing the concerns of the path of the pipeline under the Strait of Mackinaw. Enbridge agreed to build a tunnel, but so far that tunnelling operation has been put on hold because of State-level concerns, which I find personally frustrating because every day that the tunnel sits there is a risk, and that—or, sorry, every day that the pipeline sits

on the bed of the Straits of Mackinaw it presents a greater risk, and we could solve that with the tunnel.

Now, I think we're all in broad agreement on the need to be entering into an all of the above scenario, increasing the use of renewables, increasing the use of low carbon, or carbon zero energy production technologies, and I think we also all agree we're not going to arrive there overnight. This is going to be a transition period. We'll always need some base load on demand, and we have a lot of consumers right now who are dependent on fossil fuels, whether for transportation or for home heating, and Line 5 is critical for propane distribution throughout the State. And this is an issue that even the Canadian ambassador has raised out of concern that a premature shutdown of Line 5 will have cascading energy impacts, and that it's something—I'm fully supportive of a green future, but also know that we need to build a bridge to get there. So I wondered if you could speak to where the administration's stance is on the Line 5 Pipeline, and on kind of the Governor of Michigan—on Governor Whitmer's efforts to shut that down.

Secretary GRANHOLM. Yeah. Thanks for the question, and for your service. So it is a matter that's in active litigation, and DOE doesn't have a direct role regarding this project, but, because it's in active litigation, I'm not going to comment further on it.

Mr. MEIJER. All right. Well, I understand that position, I just wish that there—especially considering our strong partnership with Canada, and the way in which this impacts our bilateral relationship with our neighbor, and vital trading partner, that the administration will do everything they can to expedite that tunnelling so that, again, we can reduce the risk of any sort of pipeline spill, while at the same time ensuring we are stabilizing markets, and not putting an undue burden on the citizens in Michigan, on their energy needs. And especially given some of the initial steps toward shutting down the Keystone XL Pipeline, again, we're in a transition. We need to be managing it well, rather than kind of more signaling measures.

But on a more positive note, I also wanted to say, you know, the DOE MSU (Michigan State University) Facility for Rare Isotopes is in our State as well. It's cutting edge. We're really excited about it on the research side. I think we went back to 2001, when the concept was originally considered, and cost estimates were initially 1.1 billion. Now we're looking at, through a cooperative agreement, a total cost of around 730 million, so significant cost savings. In these tight fiscal times, how are you considering innovative measures at DOE to support world class research, but doing so in as cost-effective a manner as possible?

Secretary GRANHOLM. Yeah. Thanks for that too. I mean, I'm very excited about FRIB (Facility for Rare Isotopes Beams), and, you know, it was initially a germ of an idea when I was Governor. It's very exciting that Michigan State has got this very important facility, and, you know, hopefully it's a—game—we know that it's a game changer, and I think the research is going to start next spring at the Facility for Rare Isotopes Beams. So, you know, it's a game changer for the international research community as well.

So, I mean, on the broader question, you know, this is why it is so important that—first of all, that this Committee has taken such a leadership role in supporting science, and supporting the facilities that support science. This is a big facility, it's an expensive facility, but it is—it's going to be a huge jewel in the crown of facilities that we in the United States have to advance—advanced research. So whether it's exascale computing, or the, you know, FRIB, or the efforts with the cyclotrons, I mean, honestly, there's so much capital and funding that have gone into these important facilities that when the—when Congress decides that it is going to fund research and support these facilities, it is a statement to both America, to our researchers, but it is a statement to the world that we are committed to leading. And so I am grateful, at the very start of this, that our Chairwoman said we've got to really double down and support the Office of Science. And, of course, under the Office of Science, all of these facilities, which are the great labs, and they're—and the expensive facilities that the American taxpayers have paid for, but that are producing great results, so thanks for raising that, and thanks to the Committee for continuing to support it.

Mr. MEIJER. Thank you, Madam Secretary. I yield back.

STAFF. Mr. Casten is next.

Mr. CASTEN. Secretary Granholm, so nice to see you again. The—I know I've always been impressed by you, but, my goodness, your patience and your knowledge in this hearing is—it's astounding, so thank you so much. And I think, also, as a child of the 1980's, I think of this as a Clash song. Some of my older colleagues may think of it as The Crickets, but, you know, when you fight the law, the law wins, and it is so refreshing to have a secretary at the Department of Energy who is not trying to fight the laws of physics and win, so thank you.

Secretary GRANHOLM. Right. We do our best not to violate the laws of physics.

Mr. CASTEN. Well, not to fight them, right? The—you can't violate them. I want to ask you a couple of questions, sort of more in the context of your position, you know, as one of the senior advisors to the President on our climate policy, maybe beyond your role at the DOE, but certainly including. I am so impressed by the seriousness at which the Biden White House has addressed climate change. The—you know, recognizing that what's necessary may exceed what's politically possible, and the laws of physics will win. The goals, as I understand it, 50 percent reduction by 2030, net zero by 2050. And, you know, in here, as I know you know, last week, the IEA, which I don't think anybody would think of as some, you know, lefty, uber-progressive organization, came out and said the path to net zero is narrow. Staying on it requires immediate and massive deployment of all available clean and efficient energy technologies, and that a large—there is a large and growing gap between the stated goals of nearly every nation and their actual policies. And so my question, and I think I know the answer to this, and I don't want to put you in a difficult point, but I would just love to get you on the record, as ambitious as the Biden White House goals are, do you think they are more or less ambitious than what the IEA is saying we must do?

Secretary GRANHOLM. Well, I would say our goals for our, you know, for our commitments are extremely ambitious, but we also have to lead in a way that holds other countries to their goals, right? I mean, we have to make sure that everybody has equally ambitious goals. Not equally, because everybody's in a slightly different place, but that we hold these countries to the goals of getting to the over—I mean, the reason why they signed on—196 countries signed on to the Paris Accord is because everybody agrees to net zero carbon emissions by 2050, and that's the way we're going to hold, you know, climate change down.

So, you know, I think that many components of the report that the International Energy Agency discussed were really helpful, because it did set people's hair on fire, as you alluded to. You know, they mirror the priorities you—that you see in this administration's approach. It's why—I mean, John Kerry has been going all over the world to hold other countries' feet to the fire. It's why when the President held the Leaders' Summit here, I mean, he did it as a way of saying, yes, America's back, and we're serious, and we want you to be serious too, and we want as many of you to articulate goals, and then show us how you are going to achieve those goals.

And, you know, 100 percent zero carbon electricity as the basis for getting to a net zero economy is a big lift, we know. But we also know that the technologies exist today to be able to get there, and so it's an exciting time to be—for the United States to be at the helm of this pushing other countries because, in addition to the climate goals, there's also the economic opportunities that go with it, and the President is focused on both.

Mr. CASTEN. Yeah. And I guess I'm—and maybe I'm inartfully asking the question, but I just—it strikes me that we are always in this line of work that, you know, all of us on this call have, having to grapple with political—the need for political compromise. And the laws of physics will win every time. And, you know, if your view is that we are being way more ambitious than we need to be in your plan, and we have room to compromise, you know, let us know. My sense is that we need to at least do what's in that plan. And, yes, then make sure our international partners do as well.

Secretary GRANHOLM. Yes, yes.

Mr. CASTEN. And—

Secretary GRANHOLM. Yes. I'm sorry. I should've just said—

Mr. CASTEN. Yeah.

Secretary GRANHOLM [continuing]. Yes to your question.

Mr. CASTEN. Well, it—but, you know, I had some other stuff I wanted to talk about, and we're running near the end of the time, but I would just ask you that I hope, you know, continue to not fight the laws of physics. And—doesn't matter why we fight the laws of physics. Maybe we fight them to appease our donors, maybe we fight them to appease our voters, maybe we fight them in the name of finding room for bipartisan compromise. It doesn't matter why we fight them. The laws of physics are going to win.

Secretary GRANHOLM. Every time.

Mr. CASTEN. And stay strong, and we've got your back, and let us know how we can help.

Secretary GRANHOLM. Appreciate it. Thank you—

Mr. CASTEN. Thank you—yield back.

Secretary GRANHOLM. —Congressman.

STAFF. Mr. Bowman is recognized.

Mr. BOWMAN. Thank you. Secretary Granholm, thank you so much for joining us today, and for your leadership in advancing a bold energy transition that weaves in equity throughout. I'm wondering if you could tell us more about your overall vision for energy justice, and what that means to you, and your approach to implementing the Justice 40 Initiative at DOE.

Secretary GRANHOLM. Thank you for asking this question. I mean, the—first of all, the President has made sure that Justice 40, EJ-40, is embedded in everything we do. And so that means that can't just be words. That has to be actions. So, you know this, everybody should know this, that too many communities in our country, low-income communities, communities of color, urban and rural, have experienced disproportionate downsides from issues like pollution stemming from the energy system, and have missed out on the benefits, so 40 percent of the benefits of the American Jobs Plan are going to be directed to communities that have been left behind. And to implement that Justice 40 initiative across the DOE complex, and to coordinate with other Federal agencies, we—he has developed a whole of government approach.

And one thing that's really going to help us with this work is the early stages of piloting. For example, we have—Shalanda Baker, who heads our Office of Equity, is piloting an online visualization tool that displays our investments through an energy justice lens, so that we are transparent about where these funds are going, and which communities are benefit—benefiting. It's going to show DOE spending data, and then overlay the data from indicators like EPA's (Environmental Protection Agency's) EJ (environmental justice) screen tool, which shows the communities facing the worst pollution, for example. So, you know, we are focused on making sure we right historic wrongs with this, and as we do this. And that's not—that's in communities of color. It's also in coal and power plant communities who also have felt left behind. These communities, across the swath, who have felt left behind, are the communities who should benefit from the most—the most from these investments.

And, to us, making sure that we have a Department that reflects that full spate of communities, meaning people who we've appointed who are helping to make these decisions and guide us are really and critically important so that the policy outcomes are the right ones. So Environmental Justice 40, to the Biden Administration, is a whole of government effort to make sure that we see all of these communities, and that we not just see them, but that we help make sure that they also—they—not they also, that they lead our desire to have a clean energy future. Jobs, investments, homes, rebuilding, you name it.

Mr. BOWMAN. Um-hum. You know, one—thank you for that answer. One of the things I've seen is the current infrastructure that's in place, much of it is already inequitable, but those are the companies and individuals who have the capacity to apply for some of the new grants that are going to be coming from DOE. How can we assure new entrepreneurs of color and grassroots organizations have the capacity to apply for some of these grants?

Secretary GRANHOLM. Yeah, this is a great question, and we have been meeting with various grassroots organizations to ensure that we have developed our process in a way that allows access, and that doesn't create further systemic barriers to access. So Shalanda Baker—I don't know if you know her or have met her, but I would love to have her connect with you. She, as I say, is leading our whole DOE effort, but she's also connected, of course, to—the Council on Environmental Quality is making sure that we—they lead the whole of government approach, but making sure that we listen to the voices who are most impacted, but also who have the opportunity to help us overcome and tear down the barriers that historically have existed to accessing these programs is a key part of it. It's just a key part of it.

Mr. BOWMAN. Awesome. Thank you so much, and I'll follow up with your office and Ms. Baker as well.

Secretary GRANHOLM. We'll follow up with you. Yeah.

Mr. BOWMAN. Thank you. Thank you.

Secretary GRANHOLM. All right.

Mr. BOWMAN. Thank you. I yield back.

STAFF. Mr. Lamb is recognized.

Mr. LAMB. Madam Secretary, thank you for serving, again, and for hanging with us in this long hearing. I wanted to talk to you, if I could, about steelmaking in Western Pennsylvania. And I know that a couple other Members, including Representative Kildee, have asked about the Loan Program Office. In the *Energy Act* last year we made a change to the authorization for the LPO that would specifically allow them to get involved in industrial processes like steelmaking, and decarbonizing steelmaking. This has a new urgency in Western Pennsylvania today because we were all expecting U.S. Steel to make about a billion and a half dollars of investment in their historic Mon Valley Works here in Western Pennsylvania, and it was going to lower the carbon impact, and improve emissions, air quality, all that kind of thing. Unfortunately, they recently announced that they're not going to make that investment in Western Pennsylvania anymore. They seem to be wanting to move resources to their non-union operations in the South.

There's a long history of U.S. Steel moving investment away from Western Pennsylvania, unfortunately, to other places, whether non-union operations or overseas, and so many of us want to fight for these workers and for these jobs—

Secretary GRANHOLM. Yeah.

Mr. LAMB [continuing]. In the area that has produced some of the best steel that has really allowed America to be what it is. It's the time to start making investments in steelmaking processes based on natural gas and hydrogen, that are much less carbon intensive, and I think the LPO will have the authority to be a partner here. I'm just curious if you know whether you guys have started coming up with any sort of a plan or a program to get involved specifically in steel? I know that's kind of a new thing for the LPO, and just—

Secretary GRANHOLM. Yeah. I mean, it does—steel qualifies in the LPO, and, Congressman, I'm happy to also connect you with Jigar Shaw to talk through how he's thinking about this, because absolutely we want to use the LPO to help, and to help decarbonize

these hard to decarbonize areas, as well as to help make sure that they are providing the means for the products that we want to be building, and this whole manufacturing ecosystem that we want to create in clean energy.

I noticed—I noted that today Citi—Citibank, and Goldman Sachs, and Société Générale, and Standard Charter, and UniCredit, these are all major lenders to steel producers, they're all announcing today that they're working toward a financing agreement to decarbonize the steel industry as well. And—so, you know, DOE can provide—you know, can work with and provide banks, you know, credit guarantees to fund the debt that—directly to steel companies, so I think we have to develop a strategy around this. Because we—I mean, they—you know, they should be going to an area that has steelmaking in its DNA, like you.

Mr. LAMB. Right. There's nowhere in America that has the heritage that we do and—

Secretary GRANHOLM. Yeah. Yeah.

Mr. LAMB [continuing]. Just be starting off further ahead here. Bill Gates has it in his recent book that the average American consumes 600 pounds of steel a year, so that's not going away. We have to figure out—

Secretary GRANHOLM. Yeah.

Mr. LAMB [continuing]. A way to make it without carbon. I would really like to encourage you to come to Western Pennsylvania. Our staffs have actually already been in touch, and so I—

Secretary GRANHOLM. Yeah.

Mr. LAMB [continuing]. Think there's some impetus, but we have a group together there between the United Steelworkers, many of the building trades unions, the universities, the National Energy Technology Laboratory that we have there led by Brian Anderson, who I should tell you is fantastic. U.S. Steel is involved, EQT and natural gas companies involved, other steel companies are involved. It remains to be seen who is willing to, you know, put their chips down on their Western Pennsylvania workers. U.S. Steel has not proven to do that recently, but others may, or maybe they will have a change of heart. But anyway, this proposal is coming together, and we really would like you to listen to it and see if there's ways that we can work together to bet on the future of steel manufacturing in Western Pennsylvania. So we'll be—

Secretary GRANHOLM. 1,000 percent. Let—let's do it.

Mr. LAMB. But just wanted to put that on your radar—

Secretary GRANHOLM. OK. Great. I appreciate it.

Mr. LAMB. Thank you very much. Madam Secretary—or Madam Chairwoman, I yield back.

STAFF. Mr. Perlmutter is recognized.

Mr. PERLMUTTER. Thank you. Last but not least, I think. But I just want to be—I'll be kind of parochial, but first I want to say Congressman Beyer should've spoken to you in French, not German. It would've been much easier for you to remember the saying. The second thing is I want to join Mr. Sessions in wishing you all the success at the Department. It is so key, this time in our country's history, in the world's history.

So I'm in a building about a half a mile east of the National Renewable Energy Lab (NREL), a building that was designed by some

engineers in the predecessor lab called the Solar Energy Research Institute. And so I can look right out my window to the mountains, and to the lab, where it's nestled right in there next to a mesa just as we get to the mountains, and they are busy, and they are active over there, and we've got fantastic scientists and engineers, and I think my job is—they advocate for themselves, but I want to advocate for them.

In the infrastructure package that we're all discussing, there is substantial support for the labs sort of writ large. I just want to make sure that, as part of your list of priorities, that NREL is part of that list.

Secretary GRANHOLM. Of course.

Mr. PERLMUTTER [continuing]. Such a fantastic laboratory.

Secretary GRANHOLM. Absolutely, absolutely. I mean, you know, Office of Energy Efficiency and Renewable Energy and NREL are the collaborating team that are at the global forefront of delivering our zero-carbon technology, so absolutely, and you are blessed to be in that State and near them.

Mr. PERLMUTTER. You know—and so there is—we're actually, and the DOE is part of it, doing a land swap with the State and with the county to make sure that the top of the mesa, and it sits right on one of the flanks of the mesa, remains open. So we have—it's a big open space thing, and then they're creating a parcel of ground where there will be a public/private kind of an area where a lot of energy efficiency and renewable energy companies can come and locate in a specific area right next to the lab. And I just want to thank the Department for being part of that effort.

Secretary GRANHOLM. Awesome. Well, happy to, and look forward to continued collaborations on—whether they're in Colorado or out of Colorado, because they're—I mean, NREL's amazing.

Mr. PERLMUTTER. Well, when you're in town, we'd love to visit the lab with you. And it's right in an area—and I've invited the Chair of our Committee, and it was postponed because of COVID, but there are a number of labs right here on the very front range of Colorado. There's the Colorado School of Mines, which—

Secretary GRANHOLM. Yeah.

Mr. PERLMUTTER [continuing]. Has so many professors working on energy efficiency and solar renewable stuff, but a whole bunch of labs in this area. So maybe the Chairwoman of the Committee will join you when you're out here, and we'll tour these labs together. So I'm just reminding our Chairwoman about our postponed visit. So, with that, I'll yield back, and thank you, Secretary—

Secretary GRANHOLM. Thank you. Thanks so much.

Mr. PERLMUTTER [continuing]. This hearing.

Chairwoman JOHNSON. I think that concludes all of our—participation of our Members, and let me hasten to thank—Madam Secretary for your participation, for your patience, and for your very well-prepared responses. And let the record—the record will remain open for 2 weeks for additional statements from Members, and for additional questions that come before the Committee. Our witness is excused, and we thank you again, and the hearing is adjourned.

Secretary GRANHOLM. Thank you.

[Whereupon, at 3:52 p.m., the Committee was adjourned.]

Appendix

ANSWERS TO POST-HEARING QUESTIONS

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Responses by the Honorable Jennifer Granholm

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COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

“Overview of the Science and Energy Research Enterprise of the U.S. Department of Energy”

Questions for the Record to:

The Honorable Jennifer Granholm

Secretary of Energy

U.S. Department of Energy

QUESTIONS BY REPRESENTATIVE EDDIE BERNICE JOHNSON, CHAIRWOMAN,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

- Q1. **Secretary Granholm**, I am concerned that the level of funding proposed for the Office of Science by the Administration is insufficient to support the current needs of its facilities, research programs, and the national laboratories stewarded by the Office. Given the major construction activities currently being carried out by the Office of Science to build and upgrade its various world-class user facilities, if enacted, this level of support would result in inadequate funding to keep construction activities on schedule and minimize their total costs. And it would inhibit the Office’s ability to take on any significant new research initiatives called for in recent DOE advisory committee and National Academies reports and recommendations.
- Q1a. How will you keep the Office of Science’s major construction activities on track if this level of funding for the Office is enacted?
- A1a. The FY 2022 President’s Request for the Office of Science supports a balanced portfolio of forefront research to advance the frontiers of science, construction and upgrade of world-leading scientific user facilities, and operation of these facilities. Each facet of this portfolio is essential to maintaining international competitiveness and advancing the energy, economic, and national security of the United States. Within the requested funding, the Office of Science aims at delivering our highest priority investments in facility construction and upgrades.
- Q1a.i. Will you be able to support these projects at levels that the Department had previously estimated would be necessary to minimize their total costs, or would these cost estimates need to be increased as a result?
- A1a.i. The FY 2022 Request balances competing priorities across the Office of Science portfolio. Cost impacts to projects for those that are funded below planned levels in FY 2022 will depend on outyear funding availability.

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- Q2. The Fusion Energy Sciences Advisory Committee and the National Academies both recently released significant reports that represented a broad community consensus on the next steps necessary for fusion research to achieve the ultimate goal of a commercially viable power plant. And in the Energy Act of 2020, thanks to an excellent proposal offered by my colleague Mr. Lamb, we provided the Department with substantial direction that is consistent with the activities laid out in these reports. They include research in innovative fusion concepts, the design of future fusion systems, inertial fusion energy, a milestone-based development program, and full support for the construction of the international ITER project on time and on budget. And we authorized the resources required to carry them all out.
- Q2a. Will you commit to ensuring that the Department faithfully implements this important statutory direction for fusion research going forward?
- A2a. The Department is committed to implementation of the statutory direction, subject to appropriations. The FY 2022 Budget Request supports investments in key areas that will enable the U.S. to continue as a world leader in high-priority research areas to address the scientific challenges to achieving fusion energy, while also supporting research in fundamental plasma science with important societal applications. The Request will enable the FES program to be guided by the recent Fusion Energy Sciences Advisory Committee Long-Range Plan. The Request will support U.S. Contributions to the ITER project and initiate an ITER Research program. Also, the Request will keep SC fusion user facilities world-leading; maintain research partnerships for access to international facilities with unique capabilities; and support high-impact research in fusion nuclear science and materials; continue to seek opportunities with public-private partnerships; and support studies of future facilities.
- Q2b. Will you work to ensure that future budget requests from the Administration include resources that are consistent with this direction?
- A2b. As previously stated, the Department is committed to implementation of this statutory

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direction, subject to appropriations.

- Q3. Since his appointment as Director General of the ITER international fusion project about 6 years ago, Dr. Bigot and his team have made remarkable progress in improving the management of what may well be the most complex scientific project in the world. And the U.S. played a leading role in pushing for the major personnel and management changes that have gotten this project back on track. Yet the Department’s budget requests for ITER over the last several years have been a fraction of the DOE-approved estimates for what it will take to minimize the project’s total cost to U.S. taxpayers and to maintain its current schedule. So I have a few questions I’d like to ask to help us all better understand the need for and the current status of this project.
- Q3a. Do you agree that ITER’s current leadership has done an excellent job in overseeing this project, even in the face of a global pandemic, and are you confident in their ability to maintain this progress?
- A3a. ITER Director-General (DG) Bernard Bigot, the ITER Organization (IO), and the ITER Members have done an excellent job of managing the project through the COVID-19 pandemic. The Department is confident that the DG, IO, and ITER Members will continue to make progress on the project. However, because of the impacts on the project by the COVID-19 pandemic and other delays, it is anticipated that it is no longer technically feasible to achieve the first-plasma milestone in late 2025. It will be necessary for the ITER Organization to formulate a revised project baseline in the 2022 timeframe.
- Q3b. Will you commit to working with our Committee to ensure that ITER has the resources required to maintain its schedule, minimize total costs, and meet our international commitments?
- A3b. The Department appreciates the work of the Committee on ITER and looks forward to working with the Committee on future appropriations for ITER.
- Q3c. Could you provide us with a brief summary of the unique insights that the ITER international

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fusion project will provide for the development of a viable fusion reactor?

- A3c. ITER is designed to create the world’s first 500 mega-watt (500,000,000 watts) fusion “burning plasma” with a duration of several minutes. This performance will provide insight into the nature and control of plasmas that approach commercial energy magnitude. While ITER will not produce energy for the grid, the insights from ITER will inform future demonstration projects and the development of production power plants. ITER will explore areas including, but not limited to, materials, plasma control, and disruption suppression in a “burning plasma” environment. ITER also brings together the technical and financial resources of the seven international Members (i.e., 34 countries), while giving the U.S. fusion program full access to ITER research results.
- Q4. Over the past few years, several promising alternative approaches to achieving a viable fusion reactor have emerged from small and mid-sized start-ups, as well as academia and our national labs. In 2016, ARPA-E established a 3-year program to further explore the potential for some of these concepts, particularly an approach called “magnetized target fusion”. But, like all ARPA-E initiatives, this effort and its follow-on programs are temporary, and do not have the breadth or resources to support the full range of emerging alternatives that currently receive no federal support.
- Q4a. What is the Department doing to ensure that the full range of viable options to achieve commercial fusion energy is sufficiently vetted and, where appropriate, actively pursued?
- A4a. FES continues to support the stellarator concept as the main alternative to the tokamak concept. The support in the FY 2022 Request for stellarator research is consistent with previous years, including our own domestic activities as well as international collaborations with Germany and Japan. FES supports several projects relevant to alternative approaches (including magnetized target fusion) through the Innovation Network for Fusion Energy (INFUSE) program. As for enabling concepts, the FY 2022 Request continues to support research activities identified in Section 2008 of the

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Consolidated Appropriations Act 2021, including high-temperature superconductors, liquid metals, breeding blanket technology, and advanced scientific computing.

- Q5. The Department of Energy Research and Innovation Act, which was signed into law in September 2018, required the Department to establish a program to support research and development activities in alternative and enabling fusion concepts. And the Energy Act of 2020 expanded on this direction, also providing significant authorized funding levels.
- Q5a. Would you provide us with an update on the Department’s implementation of this statutory requirement to establish an ongoing innovative fusion concepts program?
- A5a. The FY 2022 President’s Budget Request for the FES program took into consideration the recommendations and prioritizations in the recent Long-Range Plan from the Fusion Energy Sciences Advisory Committee (FESAC)¹.
- Q6. I understand that the Office of Science recently launched an initiative called the Innovation Network for Fusion Energy, or INFUSE for short, which provides funds to help private sector companies partner with DOE labs to advance new fusion energy concepts. This is modeled on a similar initiative established by DOE’s Nuclear Energy office. But at \$4 million, the budget for INFUSE is quite small in comparison to the fusion budget overall.
- Q6a. Is it your view that INFUSE will essentially serve as the Office of Science’s sole program to support alternative and innovative fusion concepts?
- A6a. The INFUSE program provides private-sector fusion companies with access to the expertise and facilities of DOE’s National Laboratories to overcome critical scientific and technological hurdles in pursuing the development of fusion energy systems. The INFUSE program does not provide direct funding to the private companies, but instead provides support to DOE laboratories to enable them to

¹ https://science.osti.gov/-/media/fes/fesac/pdf/2020/202012/FESAC_Report_2020_Powering_the_Future.pdf

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collaborate with industrial partners. The private companies are expected to contribute a 20 percent cost share. An increase in funding for this program is included in the FY 2022 Request.

- Q6b. How do you plan to support the development of alternative approaches to fusion energy that do not originate in the private sector, but rather from the academic or national lab research communities?
- A6b. The Department’s fusion research activities are geared toward research understanding and the path to a burning plasma. We continue to believe that a burning plasma facility is necessary to provide the insights and advancements required to underpin other advancements in fusion research and development. We will continually assess the portfolio of potential approaches to fusion energy to see if there is a better way to achieve our goals.
- Q7. The Energy Act of 2020 directed the Department to establish a program that would only provide federal funds to a private sector partner if specific milestones agreed upon by DOE and its industry partner are achieved, modeled after a successful approach to innovation that was previously carried out by NASA.
- Q7a. What are DOE’s plans to implement this program?
- A7a. At this time, DOE is still formulating a plan to implement such a program with existing resources. DOE will continue to consider various public-private partnership opportunities in future budget requests.
- Q7b. More broadly, what are your views on this model for federal support of advancing fusion energy concepts that are currently only supported by the private sector?
- A7b. The Department is pleased that there has been a surge in interest in fusion energy. While we cannot make long-term financial commitments to all fusion approaches, we can make assessments and do what we can to nurture interest and investment in the field. One way that the Department is

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encouraging such development is through the “Innovation Network for Fusion Energy” (INFUSE), a program for public-private partnerships that provides access to technical capabilities at the DOE national laboratories. Through INFUSE, a number of alternative fusion reactor concepts at private fusion companies are being supported. We will also continue to work to ensure that research findings from facilities such as ITER are made available generally, which will be useful to U.S. private entities pursuing commercial development of fusion energy.

- Q8. I am very proud of the incredible amount of hard work Members of this Committee put into developing the Energy Act of 2020 last Congress, which was signed into law late in December 2020. This bill was a 100% consensus-based product, meaning both sides in both chambers signed off on every single provision in the final bill. I think we all can recognize just how difficult it is to pull off such a feat. Most of the law focuses on authorizing research, development, demonstration, and commercial application programs across DOE, many of which had never been authorized before. And what’s more is that substantial authorizations of appropriations are included for nearly all of these programs.
- Q8a. Will the administration prioritize fully appropriating the funds authorized in the Energy Act of 2020?
- A8a. I look forward to working with Congress to see that the authorizations in the energy act are funded, the American Jobs Plan would fully fund much of the Energy Act of 2020 implementation.
- Q8b. What is the overall status of implementing this law?
- A8b. **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.

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- 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

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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).

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- 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).

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- 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).

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- 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 EPCA 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

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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

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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:

Crosscut Objectives:

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- ***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,

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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.

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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.²

² Congressional Budget Justification, Volume 2, p 245

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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.³

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 extraction to processing and manufacturing to recycling and reuse.

³ Congressional Budget Justification, Volume 3 Part 1, p 379-382.

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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,

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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

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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.⁴ The FY22 budget request \$19.47 million for OTT, an increase of \$1.831 million above FY21 enacted levels.⁵

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 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.

- Q9. Often times when people think of climate science research, they think of NOAA, EPA, and NSF, and understandably so, but they may forget about the vital work that DOE does in this space, such as contributions to national climate science and modeling efforts through the U.S. Global Change Research Program and on the international level through contributions to the Intergovernmental

⁴ <https://www.energy.gov/technologytransitions/lab-partnering-service>

⁵ Congressional Budget Justification, Volume 2, p 199.

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Panel on Climate Change.

- Q9a. Can you discuss what makes the Department of Energy uniquely qualified among the federal government’s science agencies to conduct climate science research?
- A9a. Climate science research focuses on studies of processes level interactions, involving the atmosphere, oceans, cryosphere, and the world’s diverse ecosystems. Human activities, such as greenhouse emissions dominated by the energy sector, represent the primary drivers of climate change. In recent decades, the energy sector has witnessed increasing vulnerabilities to our warming climate, and these vulnerabilities will amplify with continued warming. It is the DOE’s responsibility to understand the system-level scientific foundations governing climate change and its impacts on energy, and these interactions extend from increasingly severe weather impacts on local infrastructures to larger scale impacts that affect grid stability and offshore production. DOE’s unique climate science approach focuses on its investments in decadal-scale experiments to understand the causes of changing patterns of climate extremes, ecological responses to climate change, and how El Nino and other modes of variability can steer patterns of climate extremes. Currently, DOE supports long term system-level field experiments involving the atmospheric sciences in the world’s most climate sensitive regions as well as ecological experiments that span the Arctic to the Tropics. Recognizing that highly accurate predictions of climate extremes require access to the world’s fastest computers, DOE’s climate science closely coordinates with DOE’s exascale computing research. Currently, the climate prediction models at DOE are the most sophisticated and comprehensive such capabilities in the world.
- Q9b. To what extent do these agencies currently collaborate on climate scienceresearch? Is there a need for improved collaboration?
- A9b. For more than three decades, the federal agencies that support climate science coordinate their activities through the U. S. Global Change Research Program (USGCRP). DOE is strongly

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committed to this Program, e.g., with DOE staff serving important roles as Executive Director, chair of its Interagency Group on Integrative Modeling, and co-chair of numerous other working groups. USGCRP holds monthly meetings to coordinate climate science research across the federal government, and DOE seeks collaboration opportunities to more efficiently advance the science. Within USGCRP, DOE has collaboration arrangements with the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), and the National Science Foundation (NSF), on a wide variety of topics involving climate science experiments and modeling. In addition to USGCRP, DOE is actively involved in other interagency groups that include climate science, e.g., Interagency Arctic Research Policy Committee, Subcommittee on Ocean Science and Technology, and the Interagency Council to Advance Meteorological Services. With these existing organizations, DOE believes that there are excellent coordinating mechanisms already in place to serve the federal climate sciences.

Q10. The Department of Energy Research and Innovation Act signed into law in September 2018 required DOE to re-establish a low-dose radiation research program to enhance the scientific knowledge of, and reduce uncertainties associated with, the effects of exposure to low-dose radiation. Since then, the Energy Act of 2020 signed into law in December 2020 authorized more specific program requirements. Additionally, the FY20 and FY21 Energy and Water Appropriations Reports included funding for the Office of Science’s Biological and Environmental Research program (or BER) to develop a low-dose radiation research plan.

Q10a. Could you inform us of your progress thus far in this area?

A10a. BER funded a study at the National Academy of Science, Engineering and Medicine (NASEM) to develop a long-term strategy for a low dose radiation research program. The committee has been approved by NASEM and is developing a 12-month agenda to complete this task. Additionally, BER is pursuing collaborative efforts with the National Cancer Institute (NCI) to assemble datasets and develop new computational methods to detect genomic signatures of radiation exposure. The activity combines DOE’s computational infrastructure, including artificial intelligence and machine-learning

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techniques (AI/ML) with NCI’s large datasets to develop analysis tools that could inform a more mechanistic understanding of radiation effects on cells/tissues.

Q10b. How does the Department intend to address public concerns on the risks of lowdoses of radiation?

A10b. DOE follows the radiation protection guidance issued by the Environmental Protection Agency (EPA) to address public concerns about the risks of low dose radiation to the public. This guidance is informed by other national and international entities such as the National Council on Radiation Protection and Measurements (NCRP) and the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). These agencies provide expert reviews of the latest developments in the science and propose periodic updates to public protection guidelines as needed.

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QUESTIONS BY REPRESENTATIVE ZOE LOFGREN

- Q1. The Department of Energy Research and Innovation Act, which was signed into law in September 2018, required the Department to establish a program to support research and development activities in inertial fusion for energy applications. And the Energy Act of 2020 expanded on this direction, also providing significant authorized funding levels. Such a program would be consistent with the major recommendations of a 2013 National Academies report on this subject, which the Department still has yet to act upon, and it would likely leverage the expertise and capabilities of DOE’s weapons stockpile stewardship program.
- Q1a. Would you provide us with an update on the Department’s implementation of this statutory requirement to establish an inertial fusion energy R&D program?
- A1a. Given the significant length of time since FES has supported inertial fusion energy (IFE) research, DOE is planning to hold a Basic Research Needs (BRN) workshop to identify and prioritize research directions in IFE research. BRN workshops are a proven and effective tool frequently used by DOE’s Office of Science.

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QUESTIONS BY REPRESENTATIVE JAKE LATURNER

- Q1. Madam Secretary, the 2nd District of Kansas relies on a mix of energy sources to keep the lights on including coal, natural gas, and nuclear power from the Wolf Creek generating station, and I think it is important to recognize the roles that each of those sources play. Turning off the coal or natural gas power we currently have would be detrimental to communities. Thankfully, the Energy Act of 2020 authorized multiple carbon capture demonstration facilities to keep those operating as a clean energy source. Two demonstrations are specifically for natural gas generation and two more are for coalelectric generation facilities. Secretary Granholm, can you give us an update on DOE’s progress in implementing the Energy Act, specifically on the timeline to get these demonstration projects set up and operating?
- Q1a. What is your expectation when it comes to commercializing technologies from demonstrations? Is that something that could happen in just a couple years? And are these the kind of technologies that could keep natural gas and coal plants operating for years to come?
- A1a. The main purpose of demonstrating the technologies is to establish technical and economic feasibility. It will take approximately 3-5 years to demonstrate the technology and establish its commercial viability. For carbon capture technology, the Section 45Q tax credit could enhance the feasibility of implementation on coal and natural gas power plants.

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QUESTIONS BY REPRESENTATIVE ED PERLMUTTER

- Q1. One specific area I’ve been hearing about recently is DOE’s work on sustainable transportation technologies and the possibilities for their work beyond just the automotive sector.
- Q1a. Can you describe the work that EERE’s Sustainable Transportation Office is doing on expanding hydrogen, fuel cell, and battery technologies, and other alternatives, to make aircraft transportation more sustainable?
- A1a. DOE is considering several pathways with a focus on high energy density, liquid, sustainable aviation fuels (SAFs) for long-distance aviation. For shorter distances or smaller aircraft, including drones, DOE is also investigating hydrogen, fuel cells, and battery technologies. Activities include research and development (R&D) to enable low-cost, clean hydrogen, high-density hydrogen storage and delivery as well as fuel cells with high power density, efficiency, and durability. Currently, DOE’s Hydrogen and Fuel Cell Technologies Office (HFTO) is conducting technical analysis on hydrogen-powered small aircraft (i.e., unmanned aerial vehicles, urban air mobility, and small fixed-wing planes). A report on this analysis by Argonne National Lab will be published soon. Battery R&D focuses on technologies with higher specific energies and energy densities, lower costs, and required cycle life for relevant aviation applications.

The Bioenergy Technologies Office (BETO) is focused on the production of cost-effective, low carbon Sustainable Aviation Fuel (SAF) utilizing the nation’s abundant biomass and waste resources. Activities include R&D, as well as scaling up promising technologies from bench through pilot to commercial demonstration scale to reduce the risk of building out a SAF industry. Working with its National Labs, DOE published in 2020 the report, “Sustainable Aviation Fuels, Review of Technology Pathways”, that outlines the overall potential technologies that are under development.⁶

⁶ <https://www.energy.gov/sites/default/files/2020/09/178/beto-sust-aviation-fuel-sep-2020.pdf>

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- Q1b. Can you discuss DOE’s partnerships with the Department of Defense on sustainable transportation and sustainable aviation fuels?
- A1b. DOE works closely with the DOD in several areas relevant to sustainable transportation, including batteries, hydrogen and fuel cells, and bioenergy. For instance, we hold joint workshops, conduct jointly funded research and analyses, and staff from both agencies serve as proposal and merit reviewers to ensure a coordinated approach and avoid duplication. One example of a jointly funded project is H2Rescue for a prototype fuel cell truck that operates on hydrogen and can provide power, heat, and potable water at a disaster mitigation site. In November 2020, the DOE Hydrogen and Fuel Cell Technologies Office (HFTO), in collaboration with the United States Air Force, held a workshop (H2@Airports) with industry stakeholders to examine hydrogen fuel cell power for aircraft. In addition, the Vehicle Technologies Office (VTO) has worked closely with DOD since 2011 through the Advanced Vehicle Power Technology Alliance. Collaborations included combining financial resources to support common research objectives, reviewing proposals in response to competitive solicitations, organizing joint workshops, sharing research and test facilities, and increasing interactions among personnel to identify and address research issues. Since 2011, DOE and DOD have contributed a total of approximately \$138M towards jointly funded projects in the following thrust areas:
- Advanced combustion engines and transmissions
 - Lightweight structures and materials
 - Energy recovery and thermal management
 - Alternative fuels and lubricants
 - Electrified propulsion systems
 - Energy storage and batteries
 - Development and validation of analytical tools
 - Autonomy-enabled technologies

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Where requirements are common, DOE and DOD have leveraged resources to improve and transition technologies into both the commercial and military marketplaces. Collaborations have also leveraged industrial R&D partnerships with commercial and defense ground vehicle manufacturers to expedite technology transition and increase precompetitive research and development.

VTO also collaborates with DOD through the Federal Consortium for Advanced Batteries (FCAB). FCAB is led by the Departments of Energy, Defense, Commerce, and State and includes many organizations across the government. FCAB brings together Federal agencies to provide a coordinated approach to ensuring a domestic supply of lithium batteries and accelerating the development of a robust and secure domestic industrial base. The Federal consortium recently developed the National Blueprint for Lithium Batteries 2021-2030 that details a path to achieve this desired outcome. Strong collaboration with U.S. academic institutions, national laboratories, industrial stakeholders, and international allies is an integral feature of this blueprint.

The Bioenergy Technologies Office (BETO) and DoD/Navy have jointly funded two commercial demonstration-scale biorefinery projects that aim to convert municipal solid waste and forestry residues into sustainable aviation fuels suitable for use by the Navy (each contributing \$200M to the effort). One project, Fulcrum, has recently announced the completion of construction of the Sierra Biofuels facility in Reno, Nevada. That facility converts municipal solid waste into sustainable jet fuel and has now entered the commissioning phase. In continuing with the collaborations around biofuels, DOD and DLA participate in the Interagency Working Group on Sustainable Aviation Fuels through the Biomass Research and Development Board. This group is currently developing a roadmap to produce SAF to meet 100% of the nation’s needs by 2050.

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QUESTIONS BY REPRESENTATIVE MIKE WALTZ

- Q1. Section 7002 of Division Z of the FY21 appropriations bill authorized an R&D program at the Department of Energy for recycling, production, processing, and use of critical materials, which includes a consortium and research database. These provisions were originally introduced in the American Critical Mineral Exploration and Innovation Act of 2020 that I sponsored. Can you please provide an implementation status of the program and provide the committee a schedule for fully implementing it?
- A1. Current Department of Energy (DOE) investments within the Advanced Research Program Agency-Energy (ARPA-E), Office of Science (SC), Office of Energy Efficiency and Renewable Energy (EERE), Office of Fossil Energy and Carbon Management (FECM), Office of Nuclear Energy (NE) and Office of Technology Transitions (OTT) support DOE’s three pillars across the full lifecycle of critical minerals and materials (CMM), from extraction to processing and manufacturing to recycling and reuse. EERE and FECM support applied research, development and demonstration (RD&D) across these topics, while SC provides the necessary fundamental research and world-class user facilities necessary to complete much of the work in this topic area.

EERE, FECM, and SC collaborate their programmatic efforts through the Critical Minerals and Materials Crosscut, which guides research, development, demonstration, and deployment (RDD&D) across the entire supply chain for key technologies, including batteries, rare earth magnets, and catalysts. These offices have approved and continue to implement a strategy for RDD&D across supply chains that is consistent with Section 7002 of in the Energy Act of 2020. The strategy addresses technology gaps identified through stakeholder engagement and assesses the potential resources from unconventional and secondary sources so they can be linked to large-scale business opportunities through infrastructure development. This will require advances in the geosciences, chemical engineering, materials science, and data science. In the upstream area, RDD&D is focused on unconventional/secondary technology and technique development from resource characterization and prediction, including novel extraction from sources such as geothermal and produced water

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brines, acid mine drainage and refuse. In the midstream area, technology development focused on environmentally sustainable, efficient, and cost-effective extraction, processing, refining of resources to diversify domestic critical minerals (CM) resources. In downstream (i.e., manufacturing, technology development and process RD&D focuses on reduced or eliminated CMMs, recycling collection, transportation, fundamental materials science, predictive theory/modeling, and data science.

Specific actions occurring within the Critical Minerals and Materials Crosscut in accordance with the Energy Act include:

- FECM’s development of an integrated CM/rare earth element (REE)/Carbon Ore Database that includes data acquisition, integration, and rehosting efforts pertaining to datasets. FECM REE/CM/Carbon Ore databases and online analytical tools will include an integrative, online platform that pulls data resources from multiple agencies and pairs it with relevant, open-source data and tools. The database would allow Tribal/Federal/State and Local stakeholders to visualize the data and underlying attributes, create maps, and download data for research, commercial, environmental, and socio-economic applications.
- Advanced Manufacturing Office (AMO)’s request in the FY2022 Budget to establishment of a new lab-industry consortium in accordance with the Energy Act of 2020 (Section 7002 of Division Z). The consortium will build on the existing Critical Materials Institute and other DOE programs to de-risk and validate successful technology innovations for CM, including supporting test-bed facilities to scale up technology solutions around identified gaps such as metal conversion or magnet manufacturing.
- FECM’s development of the Technology Innovation Centers as part of the Carbon Ore, Rare Earth, and Critical Minerals (CORE-CM) Initiative, which involves a regional approach to engage stakeholders and enabling the development of CM infrastructure from

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unconventional sources, and involves transformational technologies for individually separated, highly purified CMs/REEs, while improving jobs prospects for members of impacted communities. Ongoing pre-front-end engineering design (FEED) studies, depending on Congressional Appropriations, would lead to large-scale pilots (i.e., producing 1-3 metric tons/day of high purity, commercial grade REEs) operational in the 2024-time frame.

- AMO’s FY22 request to continue funding high priority critical materials RD&D in an integrated and coordinated program executed through Annual Operating Plans (AOP), Lab Calls, and Funding Opportunity Announcements (FOAs).
- AMO’s FY22 request to continue funding high priority critical materials RD&D in an integrated and coordinated program executed through Annual Operating Plans (AOP), Lab Calls, and Funding Opportunity Announcements (FOAs).

- Q2. A few weeks ago I offered an amendment to the “NSF For the Future Act” to have the Director of the National Science Foundation develop a set of required online academic security training modules for the research community. These training modules will ensure that individual researchers understand what makes an appropriate partnership and the importance of accurate disclosures, setting a baseline for what is acceptable and unacceptable for future applicants. Do you think requiring the same trainings for applicants of DOE -funded research, or even all federal science agencies, would be beneficial? Why or why not? Can you please explain the importance of having coherent academic security policies and requirements across the federal government?
- A2. Enhancing the security and integrity of our research enterprise requires a partnership between the Federal government and the research community. Training can help the research community better understand and fulfill their role in upholding research security and integrity. To the extent possible, consistent training information should be conveyed to recipients of Federally funded research.

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Research security policies manage risks to research security and integrity while enabling our open, collaborative, world-leading science enterprise. Standardization of research security policies and requirements across federal science agencies, to the maximum extent possible, is beneficial as it communicates a common understanding of expectations, reduces administrative burdens, and enables compliance. DOE is an active participant in interagency processes focused on coordinated implementation of research security policies, including National Security Presidential Memorandum-33.

- Q3. At your confirmation hearing, you responded to a question about whether or not to source the raw mined materials necessary for clean energy technologies domestically or continue our nation's increasing reliance on foreign sources by saying: “I think it's important to promote responsible mineral development that will protect the environment and provide the United States a competitive advantage in producing batteries and other technologies that will enable us to advance renewable energy, and other industries supported by critical mineral development. If confirmed as Secretary, I am eager to work with you and others to make sure that the United States has its own critical mineral supply.” Several recent news reports indicate that the Biden Administration is actively working to secure mineral supply chains from allied countries. I ask you, do you believe that the U.S. should have a robust mining sector to support domestically produced critical mineral supply chains?
- A3. It is of the utmost importance to the United States to ensure secure, resilient, environmentally sustainable CM supply chains as we transition to a clean energy future. As global demand increases for clean energy technologies, it will also impact other industries that require these minerals and metals. As you point out, the Biden Administration is working with our allied countries as one pathway for a secure supply of CM, including REEs. However, the U.S. has always been and intends to remain at the leading edge of technology development and deployment for effectively utilizing our natural resources. DOE is one of many Federal agencies working collectively to quickly assess the quantity of CM resources available domestically. DOE believes that it is of great importance to create a circular economy around CM, and thus to assess and obtain resources from recycled,

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unconventional, and secondary sources, such as extraction of CM/REE from used batteries, discarded electronics, acid mine drainage, refuse, and combusted ash, as well as extraction from other energy-related sources such as geothermal and produced water brines. As such, the FY 2022 DOE Budget Request includes funding that will support environmentally sound domestic extraction of mineral substances, including REEs, lithium, tellurium, and other minerals used in the production of batteries, magnets, and other components necessary for clean energy technologies.

However, not enough CM can be produced from recycled and waste materials to meet projected future demand. Therefore, sustainable mining will necessarily be part of the solution. The U.S. mining sector has enabled this industry to be a world leader since the industrial revolution. A robust mining industry with worker protections and sustainable mining practices that are safe, secure, and minimize environmental impact will be critical to supporting the Biden Administration’s goals of ensuring environmental justice and creating positive impact to on jobs in communities across the country. As domestic supply chains are established, DOE will be working to develop the next-generation workforce through training of technicians, skilled workers and Science, Technology, Engineering and Math (STEM) professionals in the very communities being impacted by the energy transition.

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QUESTIONS BY REPRESENTATIVE GWEN MOORE

- Q1. Secretary Granholm – In your prepared statement, you said that DOE would prioritize “addressing long-standing and persistent racial and environmental injustice and targeting benefits to disadvantaged communities.” You noted you held an interagency Jobs and Justice townhall on equity but what concrete steps can we count on in the next year in this area? For example, how will you ensure that the \$1.9 billion the President has proposed for the Building Clean Energy Projects and Workforce Initiative at DOE targets these communities, including on the workforce piece?
- A1. Section 223 of EO 14008, *Tackling the Climate Crisis at Home and Abroad*, 86 FR 7619 (Feb. 1, 2021), established the Justice40 Initiative, which sets a goal of delivering 40 percent of the overall benefits of certain Federal investments (primarily climate and clean energy investments) to disadvantaged communities. Our Office of Economic Impact and Diversity (ED) is leading the Justice40 Initiative and is laser-focused on job creation. ED will coordinate with the Office of Energy Jobs (in the Office of Policy) on workforce training and development and enterprise acceleration.
- Q1a. Your testimony says that “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.” How?
- A1a. The Justice40 Initiative, led by ED and the Secretarial Advisor on Equity, will target investments toward disadvantaged communities broadly defined by characteristics that include underinvestment and disproportionate burdens such as high pollution, high energy cost burdens, and climate vulnerability.
- Q2. What is DOE doing to help create a more diverse STEM workforce/support diverse researchers/institutions through its grant programs?
- A2. Increasing diversity in STEM fields aligned with the U.S. Department of Energy (DOE or the Department) mission is a key priority for DOE and the Biden-Harris Administration. As

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part of the FY 2022 President’s Request, DOE plans to initiate a new activity, Reaching a New Energy Sciences Workforce (RENEW), within the Office of Science (SC), which will significantly increase outreach and greatly expand the workforce training opportunities to the underrepresented and underserved stakeholder groups, including tribal communities, historically Black colleges and universities, Hispanic serving institutions, and other minority serving institutions.

Complementing DOE’s grant programs are research opportunities for students and faculty members at the DOE national laboratories. Through providing research funding to individuals and institutions and hands-on training opportunities at DOE national laboratories, DOE has been making strides in reaching underserved and underrepresented groups in the STEM pipeline and in the scientific research community. DOE recently awarded \$17.3 million in STEM internships for undergraduate and community college students. These opportunities went to 804 undergraduate students and 90 community college students, 20% of whom are from Minority Serving Institutions (MSIs), who will work directly with DOE national laboratory scientists and engineers this summer on research and technology projects that support DOE’s missions. An additional 66 college and university faculty members and 30 students representing 57 institutions, including 26 MSIs, will collaborate with national laboratories research staff this summer on projects of mutual interest⁽⁶⁶⁾. Additionally, DOE is exploring opportunities to collaborate with tribal colleges and universities to promote STEM workforce efforts.

- Q2a. How does it interact with tribal communities and are there any new initiatives focused on tribal communities that you think would be of interest to this committee?
- A2a. In July, DOE announced \$12 million in funding to 13 American Indian communities across the nation and Alaska Native communities for projects that will reduce energy costs and

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increase energy security and resiliency. DOE is continuing to build on the important partnerships our program offices have with Tribal nations. We will also amplify our commitments to research, development, and deployment in communities thus far left behind in the energy transition. The Department is also currently updating its consultation process in coordination with President Biden’s Memorandum on Tribal Consultation and Strengthening Nation-to Nation Relationships which will result in improved communication and collaboration between the Department and Tribal communities.

DOE also has three Tribal working groups that interact with Tribes around the country in projects that are managed by different program offices. Members of the Nuclear Energy, State and Tribal Government, and Indian Country Energy and Infrastructure working groups are actively involved with the Offices of Nuclear Energy, Environmental Management, and Indian Energy Policy and Programs.

Among the existing efforts to provide hands-on training opportunities at DOE national laboratories, tribal communities are an important stakeholder group for DOE. Outreach efforts funded by the DOE Office of Science (SC) aimed at recruiting underrepresented minorities into undergraduate research opportunities at the DOE national laboratories have focused on students and faculty at Tribal Colleges and Universities.

- Q2b. Beyond Minority-Serving Institutions and HBCUs, how is DOE going to ensure that research funding is also reaching minority students at other 2- and 4-year colleges and technical schools?’
- A2b. The DOE Office of Science’s (SC) Office of Workforce Development for Teachers and Scientists (WDTS), in coordination with all SC research programs and offices, expands the reach of SC by providing authentic research experiences and technical training at DOE national

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laboratories to students from 2- and 4-year colleges (including Associates and Career colleges) and universities. More specifically, the Science Undergraduate Laboratory Internships (SULI) program encourages undergraduate students and recent graduates from 2- and 4-year colleges and universities to pursue STEM careers by providing research experiences at the DOE national laboratories. The Community College Internships (CCI) program provides dedicated technical training to community college students who are interested in pursuing technical careers relevant to the DOE mission. SULI and CCI support research opportunities in STEM areas across the DOE mission, not just those supported by SC.

WDTS has developed a focused outreach strategy to reach minority students from 2- and 4-year colleges and universities. The colleges and universities that grant a relatively high number of degrees (Associates and Bachelors) to minority students are identified annually and WDTS directly reaches out to those colleges/universities to encourage the faculty members and students to apply and participate in the research and training opportunities supported by SC.

As part of the FY 2022 President’s Request, DOE plans to initiate a new activity, Reaching a New Energy Sciences Workforce (RENEW), within the Office of Science (SC), which will significantly increase outreach and greatly expand the workforce training opportunities to the underrepresented and underserved stakeholder groups, including tribal communities, historically Black colleges and universities, Hispanic serving institutions, and other minority serving institutions.

- Q2c. Has the department looked at both hiring practices and how research time is allotted at DOE’s 17 national labs to assess if there are ways to increase diversity at these institutions?
- A2c. The success of the DOE national laboratories depends on the unique contributions and perspectives enabled by a diverse workforce. The DOE national laboratories are each engaged in

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diversity, equity, and inclusion initiatives focused on:

- Creating an inclusive work environment where a variety of differences and talents are leveraged to create world-class science;
- Advancing the recruitment, development, and retention of a diverse and talented workforce;
- Preventing discrimination, bias, and harassment; and
- Expanding the science, technology, engineering, and mathematics (STEM) talent pipeline through STEM training programs and outreach.

Such efforts are required under their contracts.

Since 2017, the DOE national laboratories have been publicly reporting the collective demographics of their staff⁷ for transparency as a demonstration of their commitment to improving their efforts to increase diversity of workforce of their respective laboratories. Many of the DOE laboratories have also individually posted their laboratory workforce demographics.⁸

Each of the DOE Laboratories are required to have detailed diversity, equity, and inclusion (DEI) strategies and update those strategies annually. In 2016, the DOE Office of Science (SC) established a uniform process for how the ten SC DOE Laboratories develop their strategies including defining overall goals and objectives, current and planned actions, and credible metrics for assessing progress. SC reviews those strategies annually and has shared its practice with other DOE offices that steward national laboratories. In 2019, SC held an external peer review of the SC laboratories’ DEI efforts where both strengths and opportunities for improvement were identified and communicated back to the SC laboratories.

⁷ [Diversity & Inclusion | The National Laboratories \(nationallabs.org\)](https://www.nsls.gov/diversity-inclusion)

⁸ <https://science.osti.gov/sc-2/Research-and-Conduct-Policies/Diversity-Equity-and-Inclusion/Diversity-Equity-and-Inclusion-at-the-DOE-National-Laboratories>

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DOE’s Office of Science National Laboratories have taken proactive actions to ensure diversity in their workforce. This issue is assessed in each laboratory’s annual performance evaluation. Many have added new leadership staff to support these programs, and all have aggressive targets for their workforce. Access to Office of Science user facilities is through peer review of short proposals to determine priorities for accessing the capabilities. Ensuring opportunities for new users is an important part of these assessments. In addition, all facilities have staff who help users with the application process, identifying which of the beamlines or instruments would be best suited for the proposed research. Further, diversity is a consideration in the annual x-ray and neutron summer school. Specific outreach to minority-serving institutions is growing, building on historical practices. For example, Brookhaven National Laboratory has established relationships through the Interdisciplinary Consortium for Research and Educational Access in Science and Engineering (INCREASE), whose goal is to assist minority-serving institutions in gaining access to world-class research facilities. This partnership has extended to include other x-ray light sources.

DOE is committed to DEI at the Department and the national laboratories, and to identifying potential barriers that underrepresented communities and individuals face in accessing employment opportunities at the Department and national laboratories. It is also committed to developing new policies, regulations, or guidance documents that may be necessary to advance equity in hiring.

- Q3. In March 22, 2019, DOE announced it had signed an agreement with the Milwaukee Water Council to support its efforts to develop prize competitions to drive innovation on new water technologies, such as sensors to support intelligent water systems, advanced filtration and alternative disinfection. I am aware of the efforts at the water council to help turn Milwaukee into a water hub by bringing together industry and academia to facilitate water technology research. I was encouraged to hear of that effort and want to know more about what the outcomes of that effort were and whether your Department will continue to do similar efforts, especially when it comes to water research and technology, including outside of the energy-water nexus?

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- Q3a. Is there a larger role or emphasis on water research and technology that the Office of Science could undertake (again, including outside of the energy-water nexus potentially)?
- A3a. As part of its investments in Earth and Environmental system sciences, DOE’s Office of Science (SC) supports research to improve understanding of the interdependence of water and energy infrastructures and their role in climate change. A special focus of this investment is to examine how perturbations to energy and/or water supply can lead to vulnerabilities in U.S. infrastructures, and to explore conditions that can potentially lead to cascading failure. Because water cycling is governed by a wide range of scale interactions and given that DOE’s modeling capabilities will soon achieve much finer spatial resolutions, an emerging research frontier involving the science of ‘local’ resilience will require studies of local scale water infrastructures that are embedded within regional and large-scale Earth systems that are exposed to climate change.
- Q3b. Explain to me how your department’s programs can help Wisconsin to remain a global leader in water-related science, technology, and economic growth?
- A3b. Basic science accomplishments and successes that are supported by DOE’s Office of Science are disseminated in the public domain, e.g., through conferences, workshops, publications, and other venues. The Office of Science welcomes an opportunity to discuss with the Milwaukee Water Council areas of overlapping interests.
- Q4. Many studies have linked an increase in rates of health issues like asthma, infant and maternal mortality, heart attack and strokes to the more extreme heat our communities are experiencing in summer due to Climate Change. This goes double for disenfranchised communities who experience the impacts of this at a higher rate due to the Urban Heat Island effect (a well-documented effect through which some areas of cities experience more intense heat waves as a result of lack of tree cover), who many times do not have the luxury, if you can call it a luxury, of turning on their air conditioner.

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- Q4a. As DOE selects Climate Research projects, how will you focus that research on the needs of our most vulnerable communities?
- A4a. Under the leadership of my Equity Advisor, the Agency is engaged in an analysis of how our research portfolio currently serves underserved populations.
- Q4b. How else does the department plan to focus its efforts on the Environmental Justice priorities of this administration?
- A4b. The Department has a long track record of working with environmental justice communities and will continue to do so. DOE is also prepared to advance the President’s environmental justice agenda. For example, Section 223 of EO 14008 *Tackling the Climate Crisis at Home and Abroad*, 86 FR 7619 (Feb. 1, 2021) established the Justice40 Initiative which sets a goal that 40 percent of the overall benefits of certain Federal investments (primarily climate and clean energy investments) accrue to disadvantaged communities. The Justice40 Initiative is a critical part of the Administration’s whole of government approach to advancing environmental justice.
- Q5a. How much of the DOE’s funding goes to support research and other efforts in the Great Lakes?
- A5a. In the FY 2022 President’s Request, DOE seeks to fund \$3.5 billion in financial assistance for research awards, for commercialization and demonstration projects, and for S&T activities at the DOE National Labs (Argonne National Laboratory, Fermi National Laboratory, Brookhaven National Laboratory) in the Great Lakes bordering states of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin.
- Q5b. How about Office of Science grants are ARPA-E funding goes to Great Lakes regions?

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- A5b. In the FY 2022 President’s Request, the Office of Science seeks to fund at least \$80 million in grants for research in the Great Lakes bordering states. Given ARPA-E’s model, programs are not created nor projects selected until after the funds have been appropriated. So decisions on where FY 2022 funding is to be located have not yet been made. However, for context to date projects in the states Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin were obligated approximately \$155 million in FY 2020 funds and \$68 million in FY 2021 funds.
- Q5c. Is there a way for DOE to help increase its focus or its partnership with Great Lakes states, researchers, and private sector stakeholders?
- A5c. The Office of Science (SC) could increase its focus or partnership with Great Lakes states, researchers, and private sector stakeholders through enhanced outreach, regional workshops, access to Office of Science user facilities, and collaborative activities with all of the DOE National Laboratories.
- Q6. It’s my understanding that for several years now, the House Appropriations Committee has been asking the Department to report on how its programs within its jurisdiction contribute to the alleviation of poverty. But the Department has not provided that report. Can you explain why, and can you share some examples of how your Department helps alleviate poverty?
- A6. This report is in progress. There are many examples of how the Department can do its part to help alleviate stressors that contribute to financial hardship. For instance, the Department’s Weatherization Assistance Program (WAP) provides funding to help consumers improve their homes energy efficiency and reduce energy burdens (the share of household income spent on energy costs) for energy consumers. In addition to pre-existing programs like WAP, the clean energy and energy efficiency focus of the Justice 40 Initiative will target communities with high

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energy cost burdens and low energy access.⁹ The Justice40 Initiative will also focus on: 1) clean energy workforce training and development with a goal of increasing the number of and participation in clean energy job training and hiring by low-income, high and/or persistent poverty people and communities, and 2) new business acceleration among underrepresented groups (e.g., racial/ethnic minorities, woman, disabled persons) and in disadvantaged communities, creating sustainable wealth generation.

- Q7. The Department of Energy’s Weatherization program has been immensely helpful to my constituents who need assistance both keeping their homes in good shape for the cold winter months and hot summers, as well as reducing their energy costs. My bill, the Empowering Homeowners Energy Efficiency Act, which I plan to reintroduce this Congress, provides a tax credit for homeowners who get a home energy audit to assess where they can make improvements to reduce their energy costs and carbon footprint.
- Q7a. How can the department better target energy efficiency research to increase both reduce the cost and increase emissions reduction benefits of energy-efficient appliances for homeowners?
- A7a: DOE targets research, development, and deployment (RD&D) aimed at improving the efficiency of home appliances which will lower utility bills while maintaining or reducing the cost of the appliances themselves. Focusing on cost reduction for technologies that can provide beneficial electrification can better target emission reduction benefits. This RD&D (along with other federal measures such as appliance efficiency standards, and tax credits, and other financial incentives for energy-efficient appliances) helps bring about highly efficient appliances that will help households cut their energy bills and resulting emissions. Additionally, DOE’s R&D will help make appliances with advanced features, such as grid-interactive and “smart” appliances, more affordable to consumers. Grid-interactive and smart appliances can be more easily controlled by consumers to

⁹ Background Data and Statistics on Low-Income Energy Use and Burden for the Weatherization Assistance Program - Update for Fiscal Year 2020: https://weatherization.ornl.gov/wp-content/uploads/2021/01/ORNL_TM-2020_1566.pdf

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save energy, money, and emissions, while helping ensure that equipment is installed correctly and runs efficiently by alerting homeowners when performance is sub-par (e.g., initial leaks of refrigerants).

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QUESTIONS BY REPRESENTATIVE ANTHONY GONZALEZ

- Q1. I commend DOE for funding new and innovative battery cell technology research to ensure American economic competitiveness on a global scale. However, in light of recent transportation electrification efforts, I am concerned that there has been hyper-focused on vehicle battery technologies, inadvertently neglecting and exacerbating a critical gap in the domestic manufacturing supply chain: non-EV battery cell technologies. While various programs continue and are expected to receive increased funding for vehicle battery technologies, funding for other battery cell technologies, which also represent national security concerns and gaps in the U.S. supply chain, are not currently available. This necessitates action on our end to ensure that DOE funding supports non-EV battery cell companies demonstrating, de-risking and scaling their next technologies to accelerate the development of energy-storage technologies and sustain American global leadership in the energy storage technologies of the future. Secretary Granholm, how will the Department of Energy ensure that funding for battery manufacturing research and development does not preclude non-EV battery cell companies from manufacturing battery cell technologies beyond vehicle battery technologies, and instead encourage such research and development, in order to address a critical gap in the domestic manufacturing supply chain?
- A1. Lithium batteries for electric vehicles represent a subset of a broader spectrum of energy storage technologies with applications beyond electric vehicles, as articulated in DOE’s Energy Storage Grand Challenge Roadmap¹⁰, released in December 2020. The Department of Energy supports research, development, demonstration, and deployment (RDD&D) efforts aimed at developing a secure domestic supply chain for batteries for electric vehicles as well as stationary storage, aviation, and defense applications.

In support of stationary storage, DOE issued a Flow Battery Systems Manufacturing RD&D FOA earlier this year. While lithium batteries are currently the most common battery technology for the grid as well as EVs, flow batteries present a fitting opportunity because of their superior performance and safety for longer-duration grid storage. DOE also believes that strengthening the domestic

¹⁰ [Energy Storage Grand Challenge Roadmap](#)

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supply chain for flow batteries and increasing their systems manufacturability will enable the U.S. to compete in the global energy storage market, especially given that other countries have already heavily invested in their flow battery-grid integration, such as Germany and notably China, which planned to launch the largest battery complex in the world in 2020 to focus on flow batteries. DOE is now in the full application review process for the FOA. DOE also supports significant R&D efforts on all aspects of flow battery materials and chemistries, including through the Batteries and Energy Storage Energy Innovation Hub supported by the Office of Science, Basic Energy Sciences. This spans from fundamental science to lab-scale prototypes.

In July, the Department announced its second Energy Earthshot, “Long Duration Storage Shot.” With a new goal to reduce the cost of grid-scale, long duration energy storage by 90% within the decade ‘Storage Shot’ beckons for breakthroughs that store clean electricity to make it available anytime, anywhere and support more abundant, affordable, and reliable clean energy solutions. The “Long Duration Storage Shot” aims to support all types of technologies – whether electrochemical, mechanical, thermal, chemical carriers, or any combination that have the potential to meet the necessary duration and cost targets for grid flexibility.

To strengthen the domestic manufacturing base, DOE supports RD&D activities to address challenges across the supply chain for batteries and other energy storage technologies, with a particular focus on lithium batteries. The activities include the development of improved methods for economically extracting battery-grade lithium from domestic resources, such as geothermal brines and lithium clays. For example, earlier this year, DOE announced the launch of a demonstration-scale project, led by BHER Minerals, LLC, on advanced conversion of lithium from the Salton Sea into battery-grade materials. DOE is also focused on accelerating the scale-up of manufacturing. In August 2020, DOE announced the selection of 13 projects through a Battery Manufacturing Lab Call with combined funding of almost \$15 million over three years. The call sought proposals from

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National Laboratories to establish public-private partnerships that address engineering challenges for advanced battery materials and devices, with a focus on de-risking, scaling, and accelerating the adoption of new technologies. DOE also sponsors the Lithium-Ion Battery Recycling Prize. The phased prize competition is designed to help find innovative solutions to collecting, storing, and transporting discarded lithium-ion batteries for eventual recycling. The goal is to develop and demonstrate processes that, when scaled, have the potential to profitably capture 90% of all discarded or spent lithium-based batteries in the United States, and re-introduce key materials into the U.S. supply chain.

To ensure advances in battery technologies benefit everyone, DOE is taking steps to reduce the cost, volume, and weight of batteries, while simultaneously improving batteries’ performance and ability to tolerate abuse conditions. Accomplishing these goals will require a series of strategies and initiatives, working with partners who share the vision of what batteries are capable of. The federal strategy for lithium battery RD&D, which complements the Energy Storage Grand Challenge, is summarized in the National Blueprint for Lithium Batteries¹¹ released by the Federal Consortium for Advanced Batteries (FCAB) in June 2021. FCAB is led by DOE and the Departments of Defense, Commerce, and State, and brings together Federal agencies to provide a coordinated approach to ensure a domestic supply of lithium batteries and accelerate the development of a robust and secure domestic industrial base. The blueprint articulates steps to achieve five goals, which include: 1) Securing access to raw and refined materials and discover alternatives for critical minerals for commercial and defense applications, 2) Supporting the growth of a U.S. materials-processing base able to meet domestic battery manufacturing demand, 3) Stimulating the U.S. electrode, cell, and pack manufacturing sectors, 4) Enabling U.S. end-of-life reuse and critical materials recycling at scale and a full competitive value chain in the United States, and 5) Maintaining and advancing U.S.

¹¹ [National Blueprint for Lithium Batteries 2021-2030 \(energy.gov\)](https://www.energy.gov/national-blueprint-for-lithium-batteries-2021-2030)

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battery technology leadership by strongly supporting scientific R&D, STEM education, and workforce development.

- Q2. Secretary Granholm, advanced nuclear reactors are key to a clean energy future, but they need fuel to operate. I recently signed a bipartisan, bicameral letter to you in support of the High Assay, Low Enriched Uranium demonstration program in Ohio. We support expanding this HALEU production capability to meet the needs of the U.S. advanced reactor community. Do you also support building out additional enrichment capacity in Ohio to assure an American source of this essential material?
- A2. The Fiscal Year (FY) 2022 budget request seeks to make available small quantities of HALEU from limited DOE uranium inventories. Further, the Administration requests sufficient 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 current budget request is sufficient to sustain the HALEU demonstration in the short term, we also believe that in order to avoid a reliance on foreign sources of HALEU for future fuel supply for these reactors and their successors, we will need to continue working with the private sector in its building out of commercial HALEU production and supply chain capability in the U.S. for the long-term. A request for information to be issued by the end of the calendar year will inform the Department on actions it could take to incentivize a sustainable commercial HALEU supply for the long term. The Department of Energy is committed to evaluating alternatives on meeting U.S. HALEU needs.
- Q3. Sec. Granholm, in your view, is there a realistic path to zero carbon emissions that involves abandoning fossil fuels completely or stopping all the other activities that produce greenhouse gases? If we are going to make a scientifically honest effort to reach these goals, I think carbon capture and energy storage technologies will have to be advanced considerably. Last year’s Energy Act authorized several demonstration programs and I’d like to know what progress you

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are seeing in these fields. Are there certain actions we should be considering to further advance these technologies and accelerate their deployment?

- A3. There are likely many different pathways to achieve zero carbon emissions, such as those outlined in a recent report from Princeton University.¹² We agree that carbon capture and energy storage technologies will have an important role in achieving the Administration’s goals of 100% clean electricity by 2035 and a net zero carbon economy by 2050.

Regarding carbon capture, the Department of Energy (DOE) has made investments in nine front-end engineering design (FEED) studies for power generation, five pre-feasibility studies for the industrial sector, and has recently closed a funding opportunity announcement (FOA) for additional FEED studies for the industrial sector and also natural gas-based power generation.

For energy storage technologies, DOE’s Energy Storage Grand Challenge Program has made investments in twenty-nine projects that are focused on maturing near-term energy storage technologies which are integrated with fossil assets to enable wide-spread deployment.

The Department’s FY 2022 Budget Request addresses many of the objectives in the Energy Act of 2020 and includes research and development (R&D) and pilot-scale tests for advanced carbon capture technologies, as well as additional FEED studies. The Budget Request includes funding for advanced energy storage, as well as investments on carbon storage initiatives such as the Carbon Storage Assurance Facility Enterprise (CarbonSAFE) and Regional Deployment Initiatives which will facilitate development of carbon storage hubs.

¹² E. Larson, C. Greig, J. Jenkins, E. Mayfield, A. Pascale, C. Zhang, J. Drossman, R. Williams, S. Pacala, R. Socolow, E. J. Baik, R. Birdsey, R. Duke, R. Jones, B. Haley, E. Leslie, K. Paustian, and A. Swan, *Net-Zero America: Potential Pathways, Infrastructure, and Impacts*, interim report, Princeton University, Princeton, NJ, December 15, 2020.

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The FY 2022 Budget Request also includes a new budget line in FECM on carbon dioxide removal (CDR). CDR will need play a role in decarbonizing hard-to-abate sectors such as shipping and aviation. It can also potentially enable carbon negative supply chains when CDR technologies such as direct air capture are coupled with carbon utilization to produce materials such as aggregate and subsequently low-carbon building materials such as concrete.

- Q4. Our all-of-the-above clean energy future depends on access to advanced energy storage technologies. With its energy sector expertise and leadership in basic research, DOE is uniquely suited to drive innovation in this space. Providing DOE researchers with the tools they need to carry out this work requires bipartisan commitment. This is why last Congress, I cosponsored the BEST Act and was glad to see it enacted in the Energy Act of 2020. Secretary Granholm, what are your top priorities for DOE energy storage in fiscal year 2022?
- A4. Energy storage technologies are critical to decarbonizing the energy system, whether for the power sector, transportation, buildings, or industrial end uses. Decarbonizing the power sector alone may require hundreds of gigawatts of new energy storage and necessitate a range of technologies that can provide everything from immediate response to the ability to discharge continuously for weeks or longer. Existing technologies must be demonstrated and validated for new uses, and new technologies must be developed, proven safe and effective, and commercialized within the next 10 years if the U.S. will achieve its ambitious decarbonization goals.

In the President’s FY 2022 Budget Request, DOE proposed to spend over \$1.1 billion on energy storage including more than \$385 million for the Office of Clean Energy Demonstrations. The crosscutting Energy Storage Grand Challenge (ESGC) initiative will be used to coordinate ongoing RD&D efforts in energy storage to accelerate the development, commercialization, and utilization of next-generation energy storage technologies at the scale necessary for the U.S. to reach its decarbonization goals. ESGC supports energy storage technologies across the full value chain, from basic and applied research through analysis, demonstration, and full integration into the power and

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end-use sectors. FY 2022 storage activities will be organized around five topic areas:

- **Technology Development** – focuses on evaluating, demonstrating, and validating different technologies for different specific end-use applications. This includes the first round of a demonstration program prioritizing use cases where storage can improve equity outcomes in the power system. The proposed budget initiates a new Rapid Operational Validation Initiative, which will provide lab and field validation of technology performance. Finally, the Request also includes support for the Grid Storage Launchpad at Pacific Northwest National Laboratory and the Advanced Research on Integrated Energy Systems platform at National Renewable Energy Laboratory, new signature capabilities that will accelerate the deployment of advanced energy storage materials, components, and systems.
- **Manufacturing and Supply Chain** – focuses on strengthening the domestic production of energy storage technologies, with secure supply chains free from critical materials, and ensuring sustainable recycling and end-of-life options. This includes strengthening the domestic production of current and emerging energy storage technologies by advancing research, development, demonstration, and deployment for processing of materials used in energy storage systems, manufacturing methods for system components, and systems integration and assembly.
- **Technology Transition** – focuses on commercializing energy storage technologies through public-private partnerships, bankable business models, technology standards, pro forma contracts, and the dissemination of high-quality market data. DOE will conduct market and supply chain analysis to identify and pursue commercialization, demonstration, and partnership opportunities.
- **Policy and Valuation** – will provide data, tools, and technical analysis that help policymakers and other energy system decision-makers maximize the value of energy storage to the power, industrial, and transportation systems. This includes providing technical

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assistance to support evaluating storage technologies, designing clean energy deployment programs, formulating market and policy solutions, and developing enhanced planning processes for state and local governments, regulators, system operators, utilities, and local communities transitioning to a carbon-free electric sector by 2035 and net-zero emissions, economy-wide, by no later than 2050.

- **Workforce Development** – focuses on investing in a skilled, diverse workforce for the expanding energy storage industry. DOE will deliver a report that provides a landscape analysis of the U.S. Energy Storage workforce, highlighting DOE’s capabilities and opportunity spaces in building a robust and diverse future workforce.

Q5. This Congress, we know there is more work to do for batteries. Recycling of lithium-based batteries is a process that desperately needs advancements. Of the 180,000 metric tons of lithium-ion batteries available for recycling worldwide in 2019, just a little over half were actually recycled. That is why I reintroduced the Advanced Recycling Research and Development Act, which authorizes a DOE research, development, and demonstration program focused on making lithium-based battery recycling cleaner and more cost effective for industry. Secretary Granholm, how is DOE ensuring that battery recycling is focused on more than just vehicle technologies? Can you talk about how this requires a cross-cutting effort and how the Office of Science and the Office of Fossil Energy can contribute to the Office of Energy Efficiency and Renewable Energy’s work?

A5. DOE’s strategy for bolstering the critical minerals and materials (CMM) supply chain is grounded in three pillars: diversify supply in a safe, sustainable, and environmentally just way, develop substitutes, and improve reuse and recycling.

These activities are carried out across DOE’s R&D program offices. Current DOE investments within the Office of Science (SC), Office of Energy Efficiency and Renewable Energy (EERE), and Office of Fossil Energy and Carbon Management (FECM) support these three pillars across the full lifecycle of CMM, from extraction to processing, and manufacturing to recycling and reuse. EERE

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and FECM support Applied RD&D across these topics, while SC provides the necessary fundamental research and world-class user facilities necessary to complete much of the work in this topic area.

EERE’s Lithium Ion Battery Recycling Prize and the ReCell Battery Recycling R&D Center focus on recovering and recycling of lithium-based batteries used in consumer electronics, stationary, and transportation applications. The Lithium-Ion Battery Recycling Prize encourages American entrepreneurs to find innovative solutions to collecting, storing, and transporting discarded lithium-based batteries for eventual recycling. The phased prize competition aims to accelerate the development of solutions from concept to prototype to demonstration. The goal of this Prize is to develop and demonstrate processes that, when scaled, have the potential to profitably capture 90% of all discarded or spent lithium-based batteries in the United States, and re-introduce key materials into the U.S. supply chain.

While the Battery Recycling Prize is focused on collecting spent lithium-based batteries, the ReCell Lithium Battery Recycling Center is focused on developing innovative, efficient recycling technologies to cost-effectively recover critical battery materials and reintroduce them into the materials supply chain. Recell focuses on direct recycling and battery materials recovery, design for recycling, and analysis to model and assess the cost, emissions, and energy impact of recycling processes and innovations.

Additionally, the Critical Materials Institute (CMI), an Energy Innovation Hub led by Ames Laboratory, is advancing recycling and recovery technologies for end-of-life lithium-ion batteries and mining wastes. While the ReCell Center is focused on direct recycling, CMI is focused on chemical and biochemical separation of individual critical materials. Rio Tinto, a Team member of CMI, opened a demonstration plant that is producing battery-grade lithium at a capacity of 10 tons

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per year from mine tailings at Rio Tinto’s boron mine site. The processing methods to produce lithium as a byproduct of boron was developed through a long-term partnership with CMI. Rio Tinto plans to optimize and scale operations to more than 5,000 tons per year, which is enough battery-grade lithium for about 70,000 electric vehicles.

EERE coordinates its lithium-based battery research and development activities within the Department of Energy and across the Federal government through the Federal Consortium for Advanced Batteries. FCAB is led by DOE and the Departments of Defense, Commerce, and State, and brings together Federal agencies to provide a coordinated approach to ensure a domestic supply of lithium batteries and accelerate the development of a robust and secure domestic industrial base. The goals of the FCAB include enabling U.S. end-of-life reuse and critical materials recycling at scale and a full competitive value chain in the United States.

DOE coordinates energy storage activities, broader than, but inclusive of, vehicle batteries, through the Energy Storage Grand Challenge (ESGC). The ESGC is a comprehensive program to accelerate the development, commercialization, and utilization of next-generation energy storage technologies and sustain American global leadership in energy storage. DOE’s ESGC roadmap, issued in December 2020, includes goals related to recycling of critical materials from batteries and other energy storage technologies. As part of the ESGC, DOE has launched a Long Duration Storage Energy Earthshot, which establishes a target to reduce the cost of grid-scale energy storage by 90 percent for systems that deliver more than 10 hours of duration within the decade.

EERE and FECM are coordinating work on the development of supply chains for electrolyzers and fuel cells, including reducing or eliminating the use of platinum group metals in catalysts. SC is advancing fundamental understanding in relevant areas such as catalysis and separations science to enable the reduction of platinum group metals and other critical materials. This work will facilitate

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applied recycling research by EERE and FECM.

- Q6. Secretary Granholm, as you know, last month President Biden set a goal to reach 100 percent carbon pollution-free electricity by 2035. While the White House has stated carbon capture and nuclear energy will play a role in this decarbonization, outside advisors and groups are expressing opposition to these projects, namely the White House Environmental Justice Advisory Council and the Sunrise Movement. Can you reaffirm the White House’s commitment to nuclear and carbon capture projects?
- A6. Yes, I can reaffirm the Administration’s commitment to carbon capture projects. The FY 2022 Budget Request for carbon capture, utilization, and storage (CCUS) research, development, demonstration, and deployment (RDD&D) represents a nearly 62% increase compared to the FY 2021 Enacted level. Additionally, the Administration’s American Jobs Plan proposes to establish ten pioneer facilities that demonstrate carbon capture retrofits for large steel, cement, and chemical production facilities, all while ensuring that overburdened communities are protected from increases in cumulative pollution. In line with the bipartisan Storing Carbon Dioxide (CO₂) and Lowering Emissions (SCALE) Act, the Administration will continue to support large-scale sequestration efforts that leverage the best science and prioritize community engagement. And to accelerate responsible carbon capture deployment and ensure permanent storage, the plan reforms and expands the bipartisan Section 45Q tax credit, making it direct pay and easier to use for hard-to-decarbonize industrial applications, direct air capture, and retrofits of existing power plants.

As demonstrated by the record Fiscal Year 2022 Congressional Budget Request for the Department of Energy’s Office of Nuclear Energy, President Biden and his administration are fully committed to nuclear energy projects. Nuclear energy is a key element of the President’s plan to put the United States on a path to net zero emissions by 2050.

Department of Energy FY2022 Congressional Budget Request, Volume 3 Part 2 (DOE/CF-0174), page 8.

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QUESTIONS BY REPRESENTATIVE CONOR LAMB

- Q1. Abandoned oil and gas wells emit millions of metric tons of methane around the country. Not only can it be expensive to plug these wells, but we lack an understanding of where these wells are located and how many there are. Current estimates range from 700,000 to 3,000,000 abandoned wells in the U.S. Additional challenges to a broad plugging program include reclaiming remotely located wells as well as discovering why certain wells are deemed “super emitters” - emitting much higher amounts of methane than similar abandoned wells. How can DOE best assist in producing much needed R&D on this topic?
- A1. As you note, addressing methane emissions from oil and natural gas wells that are no longer producing presents a number of challenges. The majority of oil and natural gas wells drilled after states began implementing regulations (generally starting in the 1940s) have been plugged and abandoned according to state standards. However, some these wells, for a variety of reasons, are allowing natural gas (methane) to be released to the atmosphere. While the states are diligent in requiring that operators properly plug and abandon the wells they drill, changes of ownership and bankruptcies have resulted in wells that are no longer producing, but for which there is no responsible party that the state can require to pay for the plugging of these “orphan” wells. Most states have orphan well plugging programs, but there are significant backlogs. To complicate matters, states with some of the earliest oil and natural gas production have wells that were drilled before regulatory programs were established, and there is no record of the ownership or location of these wells. These undocumented orphan wells represent a “known-unknown” source of methane emissions and potential drinking water contamination.

The Department of Energy (DOE) has previously worked with the Interstate Oil and Gas Compact Commission and some individual states, including Pennsylvania, in small-scale efforts to test existing technologies to locate undocumented orphan wells and to measure emissions from unplugged wells. The best way for DOE to assist in producing much needed research and

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development (R&D) on this topic would be to build on our previous efforts with an expanded research effort to develop improved, low cost technologies to locate undocumented wells and measure emissions, and to develop state-specific best practices for identifying, quantifying, prioritizing and then remediating unplugged or leaking plugged wells, especially in remote areas.

- Q1a. This Administration has clearly identified orphan wells as a priority. President Biden’s Build Back Better plan highlights the issue, and his January 27 Executive Order on “Tackling the Climate Crisis at Home and Abroad” highlights plugging oil and gas wells in section 217. This EO also sets up an Interagency Working Group on Coal and Power Plant Communities (and suggests plugging these wells would fall under this Working Group) that you highlight in your testimony and houses this at the Department of Energy. Can you provide us a status update of this working group?
- A1. The White House Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization has begun taking the first steps toward advancing the mandate set out in Executive Order (EO) 14008, *Tackling the Climate Crisis at Home and Abroad*. The Interagency Working Group drew upon the direction of the President’s EO, and reviewed domestic and international models for economic revitalization, compiled recommendations from advocacy groups and academics, and sought guidance from representatives of Energy Communities. Stakeholders from the Energy Communities included labor unions, community development organizations, local, regional, and tribal governments, the private sector, and philanthropic interests. In addition, the Interagency Working Group prepared a report *An Initial Report to the President on Empowering Workers through Revitalizing Energy Communities*, released in April 2021.

The report identifies a set of communities across the country that have been impacted by coal mine and power plant closures. The report identified existing federal programs with available funding that could be leveraged to support these communities. The report outlined potential uses for \$38 billion in available funds that could be used to provide immediate investments in these communities. Finally, the report identified specific steps the Interagency Working Group should take within the next year

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to support the identified communities.

One priority area identified in the report was the need to establish financing and grant funding programs to remediate abandoned mines, orphaned oil and gas wells, impacted ground water, brownfields, and to curb toxic emissions that pose serious safety hazards and cause air and water contamination. Specifically, the report identified displaced oil and gas workers as ideal candidates for employment on potential projects to plug orphan wells on federal lands.

- Q1b. DOE has authority under 349(g) of the Energy Policy Act to address orphaned wells on private land. As we consider a range of legislative options to address orphaned wells, would the Department of Energy be best equipped to address the orphan well issue, particularly on private land, given the existing authority and your leadership on the interagency working group?
- A1b. In addition to implementing the research effort described above, DOE is well equipped to manage an orphan and abandoned well program through our Office of Fossil Energy and Carbon Management’s Oil and Natural Gas Research Program. FECM has a long and successful history of managing financial assistance to states and other entities, and a long and successful history of working with states to address environmental issues associated with oil and natural gas production. A currently non-existent organizational structure (i.e., Program Office) would need to be established to initiate, implement, and oversee this activity.
- Q1c. What do you see as the main barriers preventing federal action on addressing methane emissions from abandoned wells?
- A1c. As the majority of U.S. oil and gas production does not come from federal lands, a primary consideration in addressing methane emissions from orphan and abandoned wells will be working with each of the individual oil and natural gas producing states. Each state has unique geologic factors to consider in plugging wells, as well as unique regulations for doing so. It will be important to recognize that there are no “one-size-fits-all” solutions. In addition, while state laws generally

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give state officials the authority to access and remediate currently regulated well sites, authority to access and remediate well sites on private land will likely require landowner approval for undocumented wells or previously regulated wells that have been released by the state.