JUDICIOUS SPENDING TO ENABLE SUCCESS AT THE OFFICE OF NUCLEAR ENERGY

JOINT HEARING

BEFORE THE

SUBCOMMITTEE ON INVESTIGATIONS
AND OVERSIGHT
SUBCOMMITTEE ON ENERGY

OF THE

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AND TECHNOLOGY
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C O N T E N T S

October 21, 2021

JUDICIOUS SPENDING TO ENABLE SUCCESS AT THE OFFICE OF NUCLEAR ENERGY

THURSDAY, OCTOBER 21, 2021

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,
JOINT WITH THE SUBCOMMITTEE ON ENERGY,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Subcommittees met, pursuant to notice, at 10:04 a.m., via Zoom, Hon. Bill Foster [Chairman of the Subcommittee on Investigations and Oversight] presiding.

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT
SUBCOMMITTEE ON ENERGY

HEARING CHARTER

Judicious Spending to Enable Success at the Office of Nuclear Energy

Thursday, October 21, 2021
10:00 a.m. EDT
Zoom

PURPOSE

The purpose of this hearing is to discuss several financial assistance awards made recently by the Department of Energy's Office of Nuclear Energy on a non-competitive basis. The Members and Witnesses will discuss best practices and principles for financial assistance agreements and contracting, including maximizing competition, limiting risk to the taxpayer, and informing spending decisions with technical and market analysis and documentation. The hearing will also seek to understand priorities of the Office of Nuclear Energy and discuss steps taken to date to carry out the relevant directions and authorizations provided in the Energy Act of 2020.

WITNESSES

- **Dr. Katy Huff,** Acting Assistant Secretary, Office of Nuclear Energy, U.S. Department of Energy
- **Ms. Amy Roma,** Founding Member, Nuclear Energy and National Security Coalition, Atlantic Council and Partner, Hogan Lovells US LLP
- **Dr. Todd Allen,** Director, Michigan Memorial Phoenix Project and Glenn F. and Gladys H. Knoll Department Chair of Nuclear Engineering and Radiological Sciences, University of Michigan
- **Mr. Scott Amey,** General Counsel and Executive Editorial Director, Project on Government Oversight

BACKGROUND

General Information on Office of Nuclear Energy

The mission of the Office of Nuclear Energy (NE) is to advance nuclear energy science and technology to meet U.S. energy, environmental, and economic needs.[1] NE is tasked with research, development, demonstration, and commercial application of innovations to support existing nuclear power plants and to enable new civilian reactor designs, among other supporting

[1] https://www.energy.gov/ne/about-us

areas, such as fuel cycle and advanced fuel technologies research. In recent years, NE's budget has been on a steady upward trend; the current FY21 level ($1.51 billion)[2] is nearly double the FY15 level ($833 million)[3]. The FY22 budget request for the office is $1.85 billion.[4] Historically, much of the critical nuclear energy research supported by the office has been carried out at Department of Energy (DOE) national laboratories. In recent years, there has been a large shift in efforts to further involve academic and industrial entities in the activities of NE. One example of this is the Advanced Reactor Demonstration Program (ARDP), which is a cost-shared public private partnership program that awarded grants following merit-based competitions with the ultimate goal of demonstrating advanced reactor technologies.[5] Another example is the development of the Versatile Test Reactor, which is a research reactor that will be capable of performing unique irradiation testing that is currently unavailable worldwide.[6] This type of testing is needed to help qualify materials required in advanced reactors. Beyond specific projects, NE has also stood up novel programs that increase the participation of varying entities to help enable innovation, such as the Gateway for Accelerated Innovation in Nuclear program, or GAIN, as well as the National Reactor Innovation Center, or NRIC. Both of these programs are designed to accelerate the development of nuclear energy technologies, with GAIN focusing on the beginning stages of technology development and NRIC focusing on the later stages.

Recent Non-Competitive Spending

May 2019 award to Centrus LLC

High-assay, low-enriched uranium (HALEU) is a nuclear reactor fuel that has been enriched to concentrations of 5-20% of Uranium-235, with the remainder consisting of Uranium-238. It is manufactured either by enriching lower concentrations, including U-235 found naturally in the earth, or by down-blending higher concentrations that may have originally been created for weapons or other purposes. HALEU is expected to be required for nearly all of the proposed advanced civilian reactor designs being developed today.[7]

On January 7, 2019, NE issued a Notice of Intent to award a no-bid contract to Centrus LLC to demonstrate production of HALEU at an enrichment facility in southern Ohio. On May 31, 2019, the Department formally noticed a contract for $115 million over three years to achieve this demonstration by June of 2022.[8]

In the Justification for Other than Full and Open Competition (JOFOC) that accompanied the announcement, DOE cited authority 6.302-1: Only one responsible source and no other supplies or services will satisfy agency requirements.[9] DOE argued that Centrus was the only firm qualified to perform the demonstration because it is U.S.-owned and controlled, and thus would

[2] https://www.energy.gov/sites/default/files/2021-06/doe-fy2022-budget-volume-3.2-v3.pdf
[3] https://www.energy.gov/sites/default/files/2015/02/f19/FY2016BudgetVolume3_7.pdf
[4] https://www.energy.gov/sites/default/files/2021-06/doe-fy2022-budget-volume-3.2-v3.pdf
[5] https://www.energy.gov/ne/advanced-reactor-demonstration-program
[6] https://www.energy.gov/ne/versatile-test-reactor
[7] NuScale's reactor designs do not require HALEU.
[8] https://science.house.gov/imo/media/doc/11.13.19%20DOE%20HALEU%20.pdf
[9] https://sam.gov/opp/f2ea2ab3c8258c1c1a77503c889ab6a3/view?keywords=high-assay&sort=-relevance&index=&is_active=true&page=1

allow for HALEU produced to be used in "defense-related" applications. In conversations with Science Committee staff, DOE referred to a policy limitation in the 1992 Treaty of Washington as justification for this restriction. However, DOE did not provide any direct reference to the Treaty in the JOFOC, nor did it articulate an argument for why NE would restrict competition in order to provide for defense applications, which are the responsibility of the Department of Defense (DOD) and DOE's National Nuclear Security Administration (NNSA). Neither DOD nor NNSA contributed funds to the Centrus award. Further, at least one foreign-owned, domestically-operated enrichment services company might have been in a position to compete for the contract if not for the restriction DOE issued to require a U.S.-owned firm for the contract.

Section 988(c) of the Energy Policy Act of 2005 requires no less than a 50% cost share from non-federal sources for DOE demonstration projects. For the Centrus LLC contract, then-Secretary of Energy Dan Brouillette waived that requirement, thus making NE responsible for up to 80% of project costs. In addition, DOE did not request appropriations in FY19 for a demonstration of HALEU production, and accordingly Congress did not allocate funds for this project that fiscal year. In order to gather the funds needed for the Centrus award, DOE withdrew $23 million from the Nuclear Engineering University Program (NEUP) – nearly one-third of its budget – in the middle of its funding cycle. The Nuclear Energy Department Heads Organization (NEDHO) wrote to then-Secretary Brouillette on February 1, 2019 describing this withdrawal as a significant hardship for university nuclear engineering programs.

Chairwoman Johnson and Ranking Member Lucas wrote to DOE in November 2019 articulating these concerns and seeking further information.[10] DOE responded in January 2020.

October 2020 award to CFPP LLC

NuScale Power is a private company headquartered in Oregon that develops small modular reactors (SMRs) for power generation. With bipartisan support from Congress, NE has been a partner to NuScale in its efforts to commercialize its design over the past decade, beginning in 2013 with a $224.5 million financial assistance award for research and development.

In 2015, Utah Associated Municipal Power Systems (UAMPS), a coalition of 46 community-owned power systems, formally launched the Carbon Free Power Project (CFPP) to develop NuScale SMRs for power production within their service territory. This project was to be the world's first demonstration of an advanced reactor. In December 2018, DOE announced a Memorandum of Understanding with UAMPS and Battelle Energy Alliance which described DOE's intent to support the CFPP and to make one of the twelve planned reactor modules available to Idaho National Laboratory for the Joint Use Modular Plant (JUMP) research and demonstration program. By December 2019, UAMPS had subscribed 200 megawatts (MW) of offtakers from among its 46 Members to the CFPP, which was planned to be twelve 60 MW

[10] https://science.house.gov/news/press-releases/committee-members-seek-answers-from-doe-on-sole-source-award-for-production-of-high-assay-low-enriched-uranium

units (for a total of 720 MW). In August 2020, the Nuclear Regulatory Commission (NRC) issued a design certification for NuScale's 50 MW SMR design.[11]

On October 16, 2020, NE finalized a non-competitive cooperative agreement with CFPP LLC to provide $1.355 billion in NE funds over ten years, subject to appropriations, to support commercial development of the CFPP.[12,13] $1.355 billion represents roughly one fiscal year's budget for the entirety of NE. The award was made two weeks before the October 31, 2020 "off ramp" date by which CFPP utility partners would have to secure financial commitments from their local city councils to remain project participants.

In the summer of 2020, DOE eliminated the JUMP program and rededicated the twelfth module to regular electricity production to be sold to UAMPS utilities.[14] The FY2020 Energy & Water Development Conference Report had allocated $10 million specifically for JUMP.[15]

As of October 2020, CFPP was slated to begin construction in 2023, with an anticipated completion date of 2029 and a levelized cost of electricity (LCOE) target of $55/megawatt-hour. In its justification for the non-competitive agreement, DOE argued that it knew of "no other entity which is conducting or is planning to conduct such an activity." However, several companies had recently submitted proposals to DOE for commercializing an advanced reactor by 2027 as part of the ARDP, many of which were small modular reactors, and two meritorious companies were awarded funds toward those efforts in September 2020, just a few weeks before the non-competitive award to CFPP LLC.

DOE is front-loading the cost share over the 10-year award tenure such that CFPP LLC bears a lower proportion of overall project costs in the earlier years of the project. DOE is slated to contribute 22.5% of total project costs over 10 years, but has agreed to cover up to 80% of annual project costs over the first three years.

About three weeks after DOE's award to CFPP LLC was announced, NuScale announced that it would be uprating its reactor design from 60 MW to 77 MW, and UAMPS announced that the CFPP would deploy only six of these 77 MW units, rather than the originally-planned twelve. The new reactor size will trigger the need for further safety evaluation and an updated design certification from the NRC. As of October 2021, DOE and CFPP LLC are in the process of negotiating the financial assistance agreement to reflect the changing project scope and its effects on both cost and timelines.

September 2021 award to Exelon

On January 12, 2021, NE signed a Determination of Non-competitive Financial Assistance (DNFA) for a non-competitive cooperative agreement with Exelon. The award will give $50

[11] https://www.nrc.gov/docs/ML2023/ML20231A804.pdf
[12] https://www.energy.gov/ne/articles/doe-approves-award-carbon-free-power-project
[13] 41df5556-8f47-47c3-af10-d3665271fd20 (uamps.com)
[14] https://www.losalamosnm.us/government/departments/utilities/energy_resources/CFPP/july_21_c_f_p_p_virtual_meeting
[15] HR083.PS (congress.gov) Page 100

million in DOE funds over 5 years to develop, demonstrate, upgrade, and modernize the instrumentation and controls at the Limerick Generating Station in Pennsylvania.[16] On February 25, DOE approved Exelon to begin incurring at-risk expenses on the project, called the Nuclear Industry Safety System Digital Upgrade. On September 30, DOE finalized the contract with Exelon to execute the agreement. The overall project cost is $92 million, thus making the cost share 54% federal. In the DNFA, DOE argued that the project is both a research activity and a demonstration and as such, the Upgrade does not require a waiver to satisfy 50-50 cost share requirements as required in Section 988 of EPAct of 2005. DOE acknowledged that the safety system design of the Limerick station is representative of other Boiling Water Reactors (BWRs) in the industry, which ensures that the lessons learned from the Upgrade are applicable at a minimum to other BWR operators, but also suggests that other BWRs in the United States could have competed for the award. DOE also pointed to a time pressure factor in making this award, arguing that competing the award would have made it impossible to meet the facility outages that were already planned for the Limerick reactors in 2025 and 2026.

Laws, Regulations, Guidelines, and Best Practices for DOE Spending

- **Regarding cost share:** Section 988(c) of the Energy Policy Act of 2005 requires no less than a 50% cost share from non-federal sources for DOE demonstration projects. Research and development projects must meet a 20% non-federal cost share. There is no statutory definition of what distinguishes "research and development" activities from "demonstration," although DOE Financial Assistance Rules do include a definition for research and development.[17]

- **Regarding DOE contracts:** All DOE contracts follow the government-wide Federal Acquisition Regulations (FAR). The FAR notes that "[c]ontracting without providing for full and open competition or full and open competition after exclusion of sources is a violation of statute, unless permitted by one of the exceptions in 6.302."[18] It articulates seven discrete statutory authorities under which noncompetitive contracting may be justified. It also requires that agencies gather special approvals and a written justification, a Justification for Other than Full and Open Competition (JOFOC), when offering contracts on a non-competitive basis.

- **Regarding DOE grants, cooperative agreements, and technology investment agreements:** There is no government-wide regulatory equivalent to the FAR for these types of federal expenditures. Instead, the Office of Management and Budget (OMB) issues guidance to Federal agencies on government-wide policies and procedures for the award and administration of grants, agreements, and regulations to implement those guidelines.[19] Agencies then prepare their own policies and regulations for grantmaking that are expected to satisfy the guidelines, OMB regulations, and other applicable laws.

[16] Award number DE-NE0009042
[17] https://www.law.cornell.edu/cfr/text/10/600.3
[18] https://www.acquisition.gov/far/6.301
[19] 2 CRF, Grants and Agreements. Available at https://www.ecfr.gov/current/title-2/subtitle-A/part-1

DOE's agency-specific Financial Assistance Rules can be found at 10 CFR 600.[20] They specify conditions under which DOE may authorize a "deviation" from normal grantmaking conditions. In addition, DOE's lengthier Guide to Financial Assistance notes that it is DOE policy to use competition in the award of grants and cooperative agreements to the maximum extent feasible."[21]

Relevant Nuclear Energy Legislation

Nuclear Energy Innovation Capabilities Act

This bill led by Energy Subcommittee Ranking Member Weber and Chairwoman Johnson provided significant authorization for NE. It included general authorization for nuclear energy research, development, demonstration, and commercial application activities supported by the office, and also authorized the establishment of a Versatile Test Reactor as well as the National Reactor Innovation Center, among other activities. The bill became law in September 2018.

Nuclear Energy Research and Development Act and the Energy Act of 2020

Prior Energy Subcommittee Chairman Lamb led the Nuclear Energy Research and Development Act which ultimately became law as part of the Energy Act of 2020 in December 2020. This bill updated and expanded upon the nuclear energy authorization in statute from the Nuclear Energy Innovation Capabilities Act and the Energy Policy Act of 2005. It authorized research, development, demonstration, and commercial application programs that would assist both the existing fleet of nuclear reactors as well as advanced nuclear reactor development. It authorized the ARDP, a HALEU program, used nuclear fuel research, and a suite of nuclear educational research and development programs, among other activities.

National Nuclear University Research Infrastructure Reinvestment Act of 2021

Rep. Gonzalez introduced this bill with Rep. Casten, Rep. Meijer, and Rep. Foster in July 2021. The bill establishes two initiatives which build off of Committee-led university reactor legislation authorized in the Energy Act of 2020. The first would provide additional authorization that would promote collaboration between research reactors and relevant users and entities, as well as upgrade existing research reactor facilities. The second initiative is focused on building new facilities and reactors to help advance nuclear energy technologies.

[20] https://www.law.cornell.edu/cfr/text/10/600.1
[21] https://www.energy.gov/sites/default/files/2021-07/FA%20GUIDE%20SEPT%202020_0.pdf

Chairman FOSTER. All right. Well, with that, this hearing will now come to order. And, without objection, the Chair is authorized to declare recess at any time.

The Committee is meeting virtually today, so I remind Members they should keep their video feed on as long as they are present in the hearing. Members are responsible for their own microphones, which they should keep muted unless they're speaking. If Members have documents they wish to submit for the record, please email them to the Committee Clerk.

Well, good morning to our witnesses, and thank you for joining us for our oversight hearing on the Office of Nuclear Energy, or NE. I'm also pleased to partner with Chairman Bowman and Ranking Member Weber for our first joint Subcommittee hearing.

NE has enjoyed broad bipartisan support from Congress, and the House Science Committee in particular, for many years. We endowed NE with new authorizations and opportunities in the bipartisan *Energy Act of 2020*, and we are working now to provide even more tools and more funding for DOE (Department of Energy) nuclear activities in both the Bipartisan Infrastructure Framework and the *Build Back Better Act*. I hope, though, that no one will mistake this support for NE for a free pass around the contract award procedures, project management protocols, and basic accountability measures for which the Department of Energy is widely held in high regard.

In particular, we are concerned about NE's procedures in issuing three major awards to private companies over the last couple of years. All three were made on a non-competitive basis. One of them was $92 million, another one was $115 million, and the third was for $1.35 billion. Now, $1.35 billion represents almost a full fiscal year's budget for the entire Office of Nuclear Energy. Awards of this size should merit painstaking due diligence and scrutiny, even if they had been competitive. To spend this kind of money on a sole-source basis, DOE's justifications should have been rock solid. But so far we have not seen that. The justifications for noncompetitive spending for each award were inadequate, inconsistent, and opaque to Congress and the public.

As a Member of Congress, I can go into the SCIF (Sensitive Compartmented Information Facility) in the basement of Forrestal and discuss the design details of our nuclear warheads. As a Member of the Financial Services Committee, during the financial crisis, we were getting near-real-time reports on the capital positions of giant banks as they teetered on insolvency. Elsewhere in DOE, if I want, I can ask for and view detailed procedures and criteria that were used for contract awards. And it is crucial that, going forward, NE is held to the same standard for transparency with Congress, and we appreciate their steps so far toward that end.

Now, this Committee understands that Congress and DOE leadership are asking a lot of NE. DOE needs to help demonstrate advanced nuclear technologies by the end of the decade in order to make a meaningful contribution to climate change before 2050. If we don't—we do not have a lot of time to reduce emissions in order to avoid catastrophic warming. New and existing nuclear reactions are two of our most powerful tools here.

We are also in a race against foreign competitors who would like to take up the mantle as global leaders in nuclear energy. China, Russia, and South Korea see an economic opportunity in technology exports, and they would like for their designs to dominate the market. To answer this challenge, we need to invest wisely in research, design, licensing, and deployment, and making full use of the world-class resources at our national labs.

And in any event, NE's skipping competition and waiving the normal project management and contracting guardrails will not help nuclear in the long term. The last thing the nuclear industry needs are new suspicions about political cronyism, secrecy, haste, or waste. We need to build confidence in the industry so that climate tech investors and utility off-takers will come to the table. We need to cultivate trust with ratepayers and communities who will be served by the new advanced reactors. We need the NRC (Nuclear Regulatory Commission) to act promptly and transparently, and if projects deserve it, to give these demonstration projects a gold star. In short, NE needs a sterling reputation, and the only way to get it is to earn it. NE must return to the basics for good governance in Federal spending: transparency, maximizing competition, establishing milestones and metrics for accountability, and avoiding risky contracting vehicles.

Dr. Huff, it's a pleasure to have you before the Committee. We are all aware that you did not join the Department until May of this year. All three of the awards that we are examining were approved under previous leadership, and only one of them was finalized early on your watch. We won't ask you to speculate about every decision made by your predecessors, but we do expect congressional staff, as well as our partners at the GAO (Government Accountability Office) and IG (Inspector General) offices, to have full access to whatever records of decision exist. And we will ask you to commit to a new game plan for accountability, one that will span Administrations and will permeate the culture of NE. I know that the Department of Energy is capable of this because we see it in other offices.

I appreciate the interactions you've had with the Committee staff in recent weeks about your intentions to correct course, and I'm looking forward to getting those sentiments on the record in today's hearing.

I also want to make clear that our hearing today is not about attacking the winners of the noncompetitive awards or the projects themselves. We have reviewed the value propositions for each of these projects, and on a bipartisan basis we find them laudable. But execution is key. DOE already has made several spending commitments on these projects, and we do not want to see a dime of waste going forward. But, in particular, we will have continuing questions about the $1.4 billion award to the Carbon Free Power Project (CFPP), which is only 1 year into a 10-year agreement.

[The prepared statement of Chairman Foster follows:]

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We are also in a race against foreign competitors who would like to take up the mantle as global leaders in nuclear energy. China, Russia, and South Korea see an economic opportunity in technology exports, and they would like for their designs to dominate the market. To answer this challenge, we need to be investing wisely in research, design, licensing and deployment, and making full use of the world-class resources at our National Labs.

But in any event, NE's skipping competition and waiving the normal project management and contracting guardrails will not help nuclear in the long term. The last thing the nuclear industry needs are new suspicions about political cronyism, secrecy, haste, or waste. We need to build confidence in the industry so that climate tech investors and utility off-takers come to the table. We need to cultivate trust with ratepayers and communities who will be served by new advanced reactors. We need the Nuclear Regulatory Commission to act promptly and transparently, and if projects deserve it, to give these demonstration projects a gold star. In short, NE needs a sterling reputation, and the only way to get it is to earn it. NE must return to the basics for "good governance" in federal spending: transparency, maximizing competition, establishing milestones and metrics for accountability, and avoiding risky contracting vehicles.

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Thank you.

Chairman FOSTER. And the Chair will now recognize the Ranking Member of the Subcommittee on Investigations and Oversight, Mr. Obernolte, for an opening statement.

Mr. OBERNOLTE. Thank you very much, Chairman Foster, and thank you to everyone for holding this very important hearing.

I represent the State of California, and recent events in my State illustrate the necessity of investing in next-generation clean and reliable power generation. No one is more equipped to lead that effort than the Department of Energy, and nuclear certainly plays a very important role in that. I mean, if you look at energy reliability, nuclear is the most reliable energy that we know how to make. U.S. generation of nuclear power, I think our uptime was 92 percent of full capacity for last year, which is just amazing. And also I think if you look at next-generation nuclear, it's clear that it has the potential to be, all things considered, the cleanest energy that mankind knows how to make, so that's a very important program that we oversee. And the Office of Nuclear Energy is really the tip of the spear in doing that.

So we here on the Science, Space, and Technology Committee want to be a good partner to NE in fulfilling its mission, but we also have an obligation of oversight, an obligation to ensure that taxpayer resources are wisely and appropriately spent and that U.S. procurement law is complied with. And that's, of course, the purpose of this hearing. That's—no one's finger-pointing here. We want to be good partners, but we also have an obligation to conduct some oversight.

U.S. procurement law certainly allows sole-source contracting under certain circumstances, so we want to make sure that we understand the rationale that was used in these cases, and also we want to understand the rationale that was used to waive or backload the cost-sharing in those agreements because although procurement law does allow for some flexibility there, there is an important reason why we have cost-sharing provisions in these contracts.

So I'm looking forward, along with the Chairman, to learning more about those particular contracts, but, more broadly, also learning about how we here in Congress can help the Office of Nuclear Energy fulfill its very important goal.

So thank you very much, Chairman Foster, and I yield back.

[The prepared statement of Mr. Obernolte follows:]

Good morning. Thank you, Chairman Foster, for holding this hearing.Californians are acutely aware of the challenges our country faces in ensuring that reliable, affordable energy is available to all. Recent price surges for energy commodities have sparked serious concerns for consumers who already face rising costs for essential goods. Rolling blackouts and power outages across my home state reinforce the need to support a diverse mix of reliable energy sources and ensure supply can meet demand.

The U.S. Department of Energy is uniquely equipped to lead the way in the development of next-generation clean energy technologies that will address these concerns—both back home in my district and around the world. Today, we have an opportunity to examine one of the Department's applied programs, the Office of Nuclear Energy. Nuclear energy will play a critical role in our clean energy future. In 2020, nuclear power plants operated at full capacity more than 92 percent of the time, making nuclear power the most reliable energy source in the United States. The Office of Nuclear Energy supports research and development to maintain American leadership in the nuclear technology sector, accelerate deployment of advanced

reactor designs, solve fuel cycle challenges, and increase cost effectiveness of existing facilities.

On the Science Committee, we share bipartisan support of this program and its essential activities. Last Congress, the Committee worked together to pass the *Energy Act of 2020,* which included significant nuclear energy R&D provisions. This Congress, the Science Committee has prioritized oversight of the Department's implementation of this legislation, and I am looking forward to receiving an update from the Department on its progress this morning.

But while we support robust funding for the Office of Nuclear Energy, we must ensure that American taxpayers are getting the best return on our investment in this program, especially as the national debt has climbed over $28 trillion. My colleagues and I on the House Budget Committee are confronted regularly with the dire consequences of ballooning government spending and failure to use our federal resources wisely.

Today, we hope to learn more about some of the Office of Nuclear Energy's recent "sole-source" awards and awards made outside of the competitive process to ensure the necessary safeguards are in place to limit costs and ensure a level playing field during the process. Over the past three years, the Office of Nuclear Energy has made at least three large sole source awards, for the demonstration of the production of high-assay low-enriched uranium, demonstration and deployment of small modular reactors, and instrumentation and control upgrades under the Light Water Reactor Sustainability program, respectively. In other words, the Department awarded funds for these projects without offering other prospective participants the opportunity to submit their own competing proposals. We hope to learn more about Office of Nuclear Energy's practices for making sure the most promising proposals have the opportunity to receive consideration and doing its due diligence when such sole source awards are necessary.

Federal agencies award contracts and financial assistance to partner with entities that can provide essential goods and services and to foster collaboration with stakeholders performing groundbreaking research, development, demonstration, and commercial application activities. As Members of Congress, it is our responsibility to ensure that agencies are being good stewards of taxpayer dollars when carrying out these transactions.

Federal law, with a few limited exceptions, mandates that agencies conducting procurement activities "obtain full and open competition" and utilize the competitive procedures best suited to the circumstances. Section 988 of the *Energy Policy Act of 2005* establishes cost-share requirements for most research, development, demonstration and commercial application activities at the Department. However, these requirements may be waived under certain circumstances. This waiver authority can be extremely useful for investing in novel technologies in the nuclear field but must also be exercised appropriately and carefully.

I look forward to hearing more about the incredible work at the Department's Office of Nuclear Energy, how Congress can be an effective partner in instilling best practices for contracts and financial awards, and recommendations for maximizing the value of this program's engagement with the stakeholder community moving forward.

I want to thank all of our witnesses for being here today to share your expertise with us. Thank you, Chairman Foster, and I yield back the balance of my time.

Chairman FOSTER. Thank you, and the Chair will now recognize Chair Bowman for an opening statement.

Mr. BOWMAN. Thank you very much, Mr. Chairman.

Good morning, and thank you to all of our witnesses who are joining us virtually today to discuss the importance of good governance and spending practices at the Department of Energy's Office of Nuclear Energy.

This hearing could not be happening at a more important time. Congress is currently engaged in negotiations on several proposals that could transform this country's infrastructure and social safety net, allowing us to unleash the full, brilliant potential of all Americans and our economy. The *Build Back Better* agenda will make major, desperately needed investments in tackling climate change, including in the research space. On this Committee, we have spent a great deal of time discussing how our government should address

the climate crisis, and it is time for us to move from talk to action. That applies to every aspect of our work here. Whenever the Federal Government is taking steps that could help decarbonize our society and improve people's lives, we need to make sure those activities are as transparent and effective as possible.

The budget of the Office of Nuclear Energy has nearly doubled in five or so years, with the budget request for Fiscal Year 2022 clocking in at $1.85 billion. And spending proposals currently under consideration would inject additional funds. In recent years, the office's work has shifted from almost entirely conducting research in our national labs, to significant amounts of funding now going to academic and industrial partners. This kind of applied research, including demonstration projects and the commercial application of new technologies, is critical to meeting the challenges of the 21st century.

This hearing is a step—is a next step for this Committee in a series of oversight activities we've engaged in regarding the Office of Nuclear Energy. We spend a lot of our time working on solutions and legislating as Members of Congress, but our oversight responsibility is inherent in all of the work that we do. The rapid expansion of the work and the budget of this office requires even more due diligence on our part. And in recent years, we have watched the office execute contracts and agreements for very large projects. I applaud the Office of Nuclear Energy for its ambitious approach. But our concerns primarily center around the fact that a few of these extremely large awards have been provided in a noncompetitive and nontransparent way. For example, it should never be quick and easy to make a government-funded award to one private company for over $1 billion, especially when Congress learns about it in the press. And that's part of what we're here to talk about today. Government-funded research, especially research that is important for addressing the climate crisis, needs to be done right the first time. We don't have many shots on goal here to experiment with. As a nation, we need to do our homework and turn in—turn it in on time. And if we fail, we need to fail fast, learn what we could do—could have done better, and regroup quickly.

Competition is certainly good as a general practice, as it maintains the integrity of public spending by ensuring that awards are provided on a merit-reviewed and rigorous basis. But competition is also an important way to broaden and deepen the kind of research relationships that our government establishes, and to bring more people into the process. This can help ensure that government funds are distributed more equitably and in line with President Biden's Justice40 Initiative, which says that 40 percent of overall benefits of Federal dollars should flow to marginalized communities. We need to be applying this concept at the beginning of the award process by including it in the parameters of a competitive award instead of thinking about it later in the process when it's too late to be useful. This is a topic that is near and dear to my heart as I am proud that this Committee is working to make our research activities more inclusive at every level.

To be clear, we perform oversight for all of the scientific agencies that the Science Committee oversees. In other words, this could just as easily be a hearing on any other energy technology if we

had similar governance concerns regarding the offices that work on those technologies. And this hearing also is not about specific administrative officials or a political party. All of the oversight we have performed on this office has been done in a strongly bipartisan way.

I want to again thank our excellent panel of witnesses assembled today, and I'm sorry that I will be missing the rest of this hearing. I'm attending an anniversary dedication ceremony at the Martin Luther King Jr. Memorial. I look forward to reviewing the hearing record and submitting questions.

With that, I yield back.

[The prepared statement of Mr. Bowman follows:]

Good morning, and thank you to all of our witnesses who are joining us virtually today to discuss the importance of good governance and spending practices at the Department of Energy's Office of Nuclear Energy.

This hearing could not be happening at a more important time. Congress is currently engaged in negotiations on several proposals that could transform this country's infrastructure and social safety net, allowing us to unleash the full, brilliant potential of all Americans and our economy. The Build Back Better agenda will make major, desperately needed investments in tackling climate change, including in the research space. On this Committee, we have spent a great deal of time discussing how our government should address the climate crisis, and it is time for us to move from talk to action. That applies to every aspect of our work here. Whenever the federal government is taking steps that could help decarbonize our society and improve people's lives, we need to make sure those activities are as transparent and effective as possible.

The budget of the Office of Nuclear Energy has nearly doubled in five or so years, with the budget request for fiscal year 2022 clocking in at $1.85 billion. And spending proposals currently under consideration would inject additional funds. In recent years, the office's work has shifted from almost entirely conducting research in our national labs, to a significant amount of funding now going to academic and industrial partners. This kind of applied research, including demonstration projects and the commercial application of new technologies, is critical for meeting the challenges of the 21st century.

This hearing is a next step for this Committee in a series of oversight activities we've engaged in regarding the Office of Nuclear Energy. We spend a lot of our time working on solutions and legislating as Members of Congress, but our oversight responsibility is inherent in all of the work that we do. The rapid expansion of the work and budget of this office requires even more due diligence on our part. And in recent years, we have watched the office execute contracts and agreements for very large projects. I applaud the Office of Nuclear Energy for its ambitious approach. But our concerns primarily center around the fact that a few of these extremely large awards have been provided in a non-competitive and non-transparent way. For example, it should never be quick and easy to make a government funded award to one private company for over a billion dollars, especially when Congress learns about it in the press. And that's part of what we're here to talk about today. Government funded research, especially research that is important for addressing the climate crisis, needs to be done right the first time. We don't have many shots on goal here to experiment with. As a nation, we need to do our homework and turn it in on time. And if we fail, we need to fail fast, learn what we could have done better, and regroup quickly.

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I want to again thank our excellent panel of witnesses assembled today, and I look forward to hearing your testimony. With that, I yield back.

Chairman FOSTER. Thank you. And the Chair will now recognize Ranking Member Weber for an opening statement.

Mr. WEBER. I thank you, Mr. Chairman, and thank you, Chairman, for holding this hearing.

I have been, and continue to be, a strong supporter of nuclear energy, and I'm pleased with the Committee's continued bipartisan support for DOE's nuclear energy research and development (R&D) activities. I hope today's conversations will inform and improve our shared efforts in supporting cutting-edge nuclear energy technology for the next generation.

As we all know, nuclear energy is a clean and reliable baseload energy source that is a central component of the U.S. energy portfolio. Last year, nuclear energy was our country's largest domestic source of carbon-free electricity. Robust Federal investment in advanced nuclear energy R&D is essential to our energy independence, our emissions reduction plans, our national security, and our international competitiveness.

We cannot afford to cede leadership in the global nuclear energy market to our international rivals, like China and Russia. That's why, last Congress, we passed the *Energy Act of 2020,* which provided a major update to U.S. nuclear energy policy. It was a tremendous bipartisan win that, among many things, modernized and reauthorized key nuclear energy research, development, demonstration, and commercial application activities at the Department of Energy.

This legislation was a landmark achievement for the Science Committee. I was proud to lead the effort in authorizing robust funding for the versatile neutron source, or versatile test reactor (VTR), codifying public-private partnerships in advanced nuclear research, and ensuring department-wide coordination for the nuclear energy high-performance computation research program.

But, as we all know, passing legislation is just the first step in a long journey to seeing those results here at home. Therefore, this morning, I am eager to hear more about the Department's progress in implementing the *Energy Act.* To build on this success, we also have a responsibility to examine the Office of Nuclear Energy's practices in awarding R&D funds. Responsible management of taxpayer dollars has long been a priority of mine—I trust it is for my colleagues—and I have always tried to encourage my colleagues to adopt this view to be sure we're all on the same page.

That's why, in 2019, I was part of a bipartisan Science Committee request to the Department for more information and further justification of a large sole-source award for the demonstration of nuclear fuel production. Today's hearing gives us a chance to explore some of our lingering questions on that award and several others. While issuing sole-source awards can sometimes be beneficial—I think our colleague Mr. Bowman pointed that out—we

need to make sure that the appropriate safeguards are in place and being utilized to make fully informed spending decisions.

Our nuclear research and development programs are too important for us to mismanage, and we want to make sure we get this right. The advanced nuclear landscape is rapidly—and let me emphasize that—rapidly changing, and the Department must appropriately capitalize on new opportunities, make sound investments, and harness the expertise of the nuclear stakeholder community.

Let me be clear: I support substantial Federal investment in advanced nuclear energy technologies, in case you can't tell. There is no clean energy future without nuclear energy, and the only way we can fend off the push for global market dominance from our adversaries is to continue developing cutting-edge technology right here at home. That is why it's critical that we closely monitor our—those investments.

I look forward to hearing more about the future direction of the Office of Nuclear Energy and to a productive discussion about how the Department and its partners can get the most value out of their collaborations on behalf of the American taxpayers. Thank you to our witnesses today for being here. And, Mr. Chairman, I yield back the balance of my time.

[The prepared statement of Mr. Weber follows:]

Good morning, and thank you, Chairman Foster for holding this hearing. I have been- and continue to be-a strong supporter of nuclear energy and I'm pleased with this Committee's continued bipartisan support for DOE's nuclear energy research and development activities. I hope today's conversations will inform and improve our shared efforts in supporting cutting edge nuclear energy technology for the next generation.

Nuclear energy is a clean and reliable baseload energy source that is a central component of the U.S. energy portfolio: last year, nuclear energy was our country's largest domestic source of carbon-free electricity. Robust federal investment in advanced nuclear energy R&D is essential to our energy independence, our emissions reduction plans, our national security, and our international competitiveness.

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This legislation was a landmark achievement for the Science Committee. I was proud to lead the effort in authorizing robust funding for the Versatile Neutron Source—or Versatile Test Reactor, codifying public-private partnerships in advanced nuclear research, and ensuring Department-wide coordination for the nuclear energy High- Performance Computation Research Program.

But, as we all know, passing legislation is just the first step in a long journey to seeing results at home. Therefore, this morning, I am eager to hear more about the Department's progress in implementing the *Energy Act.* To build on this success, we also have a responsibility to examine the Office of Nuclear Energy's practices in awarding R&D funds. Responsible management of taxpayer dollars has long been a priority of mine and I have always tried to encourage my colleagues to adopt this view.

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Our nuclear research and development programs are too important for us to mismanage, and we want to make sure we get this right. The advanced nuclear landscape is rapidly changing, and the Department must appropriately capitalize on new

opportunities, make sound investments, and harness the expertise of the nuclear stakeholder community.

I want to be clear, I support substantial Federal investment in advanced nuclear energy technologies. There is no clean energy future without nuclear energy, and the only way we can fend off the push for global market dominance from our adversaries is to continue developing cutting edge technology here at home. That is why it's critical that we closely monitor our investments.

I look forward to hearing more about the future direction of the Office of Nuclear Energy and to a productive discussion about how the Department and its partners can get the most value out of their collaborations. Thank you to our witnesses for being here today, and I yield back the balance of my time.

Chairman FOSTER. Thank you. And if there are Members who wish to submit additional opening statements, your statements will be added to the record at this point.

[The prepared statement of Chairwoman Johnson follows:]

Good morning and thank you, Chairman Foster and Chairman Bowman, for holding this joint oversight hearing on activities carried out by DOE's Office of Nuclear Energy. I am eager to discuss nuclear energy's importance to achieving a cleaner future, as well as how DOE can help further this goal.

Nuclear energy is a major pillar in U.S. clean energy production today. Generating 20% of our nation's electricity, the civilian nuclear fleet produces about half of the grid's clean energy and is key for decarbonizing our power sector. We must ensure that the Office of Nuclear Energy is set up for success to give the nuclear industry the tools to continue innovating, and usher in the next generation of these technologies.

That is why in my time today, I want to lay out some valuable lessons learned from a soon-to-be released report by the Government Accountability Office regarding DOE's record of project management in advancing new clean energy technologies. This assessment is pursuant to a requirement that our Committee included in the *Energy Act of 2020.*

Now to be clear, the focus of this particular GAO report is not on the activities of DOE's Nuclear Energy Office, but rather on demonstration projects carried out by its Office of Fossil Energy and Carbon Management over the last 15 years. That said, both the Nuclear and Fossil Energy Offices have overseen some of the largest projects supported by the Department. And these preliminary findings tell us that a decade ago, the Fossil office fell into similar pitfalls that we are seeing with several projects supported by the Office of Nuclear Energy in recent years, particularly regarding its sole-source awards to Centrus, the Carbon Free Power Project, and Exelon.

Out of nine carbon capture, utilization, and storage demonstration projects carried out by the Department over this period, only one was constructed and none remain in operation. There were many factors that led to these projects' failures, but in GAO's review, three themes that tie in with today's oversight hearing emerged.

First, DOE either waived cost-share requirements from private sector partners entirely, or had the federal government covering far more of its overall costs early in the project schedule. We saw this with both of the recent nuclear energy awards to Centrus and the Carbon Free Power Project.

Second, DOE kept increasing federal taxpayer exposure even though projects were not meeting their milestones. We have seen this with the Office of Nuclear Energy's Carbon Free Power Project and slipping timelines. The project's original commercial operation date was 2027, that has now shifted to the mid-2030s.

And third, DOE awarded FutureGen, a billion-dollar carbon capture demonstration project that failed to come to fruition, on a sole-source basis. The Nuclear Energy office's Centrus and Carbon Free Power Project awards were provided on a sole-source basis, as was the recent Exelon award signed by DOE just a few weeks ago. As we will hear from our witnesses, competition is critical to ensuring that the best projects are selected, as well protecting against fraud and abuse.

These risk-increasing factors can be mitigated by ensuring the awardee pays its fair share throughout the process; by setting—and sticking to—performance milestones; and by competitively awarding these projects.

I would appreciate hearing from our witnesses today about how the Office of Nuclear Energy can avoid the problems encountered by DOE's Fossil Energy office in the future, so that Congress and the American people have complete confidence in these critical projects. We can all agree-we are here to support this office in its efforts to address the climate crisis and enhance our national competitiveness.

Thank you, and I yield back.

Chairman FOSTER. And at this time I'd like to introduce our witnesses. Our first witness is Dr. Katy Huff. Dr. Huff serves as Acting Assistant Secretary and Principal Deputy Assistant Secretary for the Department of Energy's Office of Nuclear Energy. Prior to her current role, she was an Assistant Professor in the Department of Nuclear Plasma and Radiological Engineering at the University of Illinois at Urbana-Champaign where she led the Advanced Reactors and Fuel Cycles Research Group. She's an active member of the American Nuclear Society and the past Chair of both the Nuclear Nonproliferation and Policy Divisions and the Fuel Cycle and Waste Management Division and, I must point out, a proud graduate of the University of Wisconsin.

After Dr. Huff is Ms. Amy Roma. Ms. Roma is a founding member of the Nuclear Energy and National Security Coalition at the Atlantic Council, as well as a partner at the Hogan Lovells law firm. She began her legal career at the U.S. Nuclear Regulatory Commission and currently practices nuclear and radioactive materials law involving the NRC and the Department of Energy. She frequently serves as a nuclear regulatory counsel to clients during mergers and acquisitions. She's also testified at Senate hearings on the economic, climate, and national security benefits of nuclear energy for the United States.

Our third witness is Dr. Todd Allen. Dr. Allen is a Professor and the Department Chair of Nuclear Engineering and Radiological Services at the University of Michigan, as well as a Senior Fellow at the Third Way. He previously worked at the Idaho National Laboratory (INL) as both Deputy Director for Science and Technology and the Scientific Director for the Advanced Test Reactor National Scientific User Facility. He has served as a Professor in the Engineering Physics Department at the University of Wisconsin—shout out there—and as an officer in the United States Nuclear Navy Program.

As our final witness, we have Mr. Scott Amey. Mr. Amey is a General Counsel at the Project on Government Oversight, or POGO. He handles legal matters for the organization, directs its contract oversight and ethics investigations, and promotes policy reforms. POGO is a nonpartisan independent watchdog that investigates and exposes waste, corruption, and abuse of power and when the government fails to serve the public or silences those who report wrongdoing. The organization champions reforms to achieve a more effective, ethical, and accountable Federal Government that safeguards constitutional principles.

Our witnesses will each have five minutes for your spoken testimony. Your written testimony will be included in the record of the hearing. When you have all completed your spoken testimony, we will begin with questions. Each Member will have five minutes to question the panel.

And we'll start with Dr. Huff.

**TESTIMONY OF DR. KATY HUFF,
ACTING ASSISTANT SECRETARY,
OFFICE OF NUCLEAR ENERGY,
U.S. DEPARTMENT OF ENERGY**

Dr. HUFF. Chairman Bowman, Ranking Member Weber, Chairman Foster, Ranking Member Obernolte, and Members of the Subcommittees, it's an honor to appear before you today to discuss DOE's nuclear energy research, development, and demonstration or RD&D programs.

The Administration's climate policy is informed by science, and the science tells us that the time for climate action is now. Nuclear energy is a key element of President Biden's plan to put the United States on a path to net zero carbon future by 2050. To meet these ambitious carbon reduction goals and rebuild the U.S. leadership globally, the Biden-Harris Administration is prioritizing activities that preserve the existing fleet of nuclear power plants, deploy advanced reactor technologies, and expand nuclear energy to markets beyond electricity.

Nuclear energy will play a major role in the transition to a clean energy economy by fundamentally underpinning our Nation's targets for clean, carbon-free electricity, as well as nonelectric energy markets.

The current U.S. fleet of more than 90 reactors is imperative to solving our climate challenges. We must ensure that these reactors remain online and find new ways of using them to solve energy transition challenges. The Light Water Reactor Sustainability program conducts RD&D in support of the existing fleet to continue to provide safe, clean, and reliable energy. Additionally, NE supports RD&D to reduce the emissions of energy-intensive nonelectric applications such as clean hydrogen production for the transportation and industrial sectors, while improving the economics of nuclear energy.

The *Energy Act of 2020* is an important piece of legislation to ensure nuclear energy is a key element in meeting our aggressive climate goals, now and in the future. The Department is advancing these goals with the Advanced Reactor Demonstration Program (ARDP) and designing the versatile test reactor, or VTR. At the Department we're particularly optimistic about ARDP, which has set an aggressive timeline to develop, license, and build two operational advanced reactors. These two reactors—X-energy's Xe–100 and TerraPower's Natrium reactor will be sited in Washington and Wyoming respectively. The Natrium reactor will be built at a retiring coal power plant to utilize the existing infrastructure and workforce in the area. This is the type of coal-to-nuclear transition demonstration that will help us achieve our climate goals, while ensuring a just energy transition for the local workforce.

An economic and reliable supply of fuel will also be required to operate many of the innovative reactor technologies under development within the United States. DOE is actively working to establish the HALEU (high-assay low-enriched uranium) Availability Program, as envisioned in the *Energy Act of 2020,* and we look forward to working with Congress as we advance HALEU availability.

As we move from demonstrations to widespread commercialization, we need a fast neutron and test reactor that can support re-

search for all stages of technology development, including the existing fleet. And with bipartisan support of Congress and key Members of this Committee, DOE is designing VTR to produce an advanced fission environment, specifically a high-flux fast neutron environment, to support accelerated fuels and materials development and qualification over the next 60 years.

The Office of Nuclear Energy understands one of the purposes of this hearing is to address concerns regarding NE's past use of sole-source contracting during previous years. The Centrus/UAMPS (Utah Associated Municipal Power Systems), NuScale, and Exelon sole-source awards were prepared in accordance with the applicable regulations governing Federal acquisitions and cooperative agreements. They were thoroughly reviewed and approved by the Department's Office of Management and the Office of General Counsel and were documented and executed legally.

However, we agree with the premise that fair and open competition is the best practice for Federal procurement and financial assistance. Early and open expressions of interest by the Department ensure the greatest number of market participants for any competition. We take seriously the concerns expressed about the sole-source awards, and we're committed to communicating clearly with Congress about the need to use such awards.

But it's an exciting time to be involved in nuclear energy. As illustrated by broad support for new authorities granted in the *Energy Act of 2020,* Congress has placed their trust in DOE NE to advance nuclear energy as a key solution to tackle the climate crisis both at home and abroad. NE is ready to take on that role and pledges that these programs will be developed and managed with the utmost integrity, openness, and transparency, which are key tenets of the Biden-Harris administration.

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

[The prepared statement of Dr. Huff follows:]

Testimony of Acting Assistant Secretary Dr. Kathryn Huff

Office of Nuclear Energy

U.S. Department of Energy

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

Subcommittee on Energy/Subcommittee on Investigations and Oversight

October 21, 2021

Chairman Bowman, Ranking Member Weber, Chairman Foster, Ranking Member Obernolte, and Members of the Subcommittees, it is an honor to appear before you today to discuss the Department of Energy's ("the Department" or "DOE") nuclear energy research, development, and demonstration (RD&D) programs.

The Administration's climate policy is informed by science, and the science tells us that the time for climate action is now. Nuclear energy is a key element of President Biden's plan to put the United States on a path to a net-zero carbon future by 2050. The United States pioneered the development of nuclear power to produce electricity in the late 1940s. Since then, U.S. leadership in nuclear energy technology has given us the benefit of clean, reliable electricity for seven decades. In the United States, nuclear energy provides about 20% of our electricity and over 50% of the nation's annual clean electricity production, making it the largest and the most reliable source of clean, carbon-free electricity, operating with 92% availability, the highest in the world for nuclear generation and higher than any other generation source.

To meet our ambitious carbon reduction goals and rebuild U.S. leadership globally, the Biden-Harris Administration is prioritizing activities that preserve the existing fleet of nuclear power plants, deploy advanced reactor technologies, and expand nuclear energy to markets beyond electricity. Nuclear energy will play a major role in the transition to a clean energy economy by fundamentally underpinning our nation's target for clean, carbon-free electricity as well as non-electric energy markets. We also have the potential to decarbonize many industrial sectors in the United States and abroad.

At home, nuclear power plants serve as bedrocks for communities across the country. Nuclear power plants drive local economies, often serving as the largest employer and economic engine in small communities. It is imperative we preserve these plants not only to support access to clean energy but also to sustain good-paying clean energy jobs.

The Office of Nuclear Energy (NE) serves a vital role in addressing these challenges. As an applied energy research, development, and demonstration organization, we enable innovation, support unique research infrastructure, and solve crosscutting challenges facing the nuclear energy sector. NE invests in RD&D that the private sector or other non-governmental stakeholders are unable or unwilling to perform alone due to uncertainty, cost, scale, or timeframes. NE funds and creates opportunities for world-class researchers in industry,

academia, and the DOE National Laboratories to collaborate and solve pressing scientific and engineering challenges. NE programs leverage private-public partnerships, university collaborations, and our national laboratory system to make nuclear energy more cost effective, accelerate advanced reactor deployment, make nuclear fuel cycles more sustainable, encourage a resilient supply chain, and promote a strong nuclear workforce.

The current U.S. fleet of more than 90 reactors is imperative to solving our climate challenges. We must ensure that these reactors remain online and find new ways of using them to solve energy transition challenges. The Light Water Reactor Sustainability Program conducts RD&D in support of light water reactor (LWR) technologies so that the existing fleet of LWR power plants can continue to provide safe, clean, and reliable energy. Our goal is to work with industry to enhance the efficient and economic performance of current nuclear power plants while enabling their extended operation. For example, NE partnered with industry to demonstrate control room and plant modernization to combat aging and obsolescence of existing analog instrumentation and controls to improve plant efficiency. Additionally, NE supports RD&D to reduce the emissions of energy-intensive non-electric applications such as clean hydrogen production for the transportation and industrial sectors, while improving the economics of nuclear energy. NE also supports development of multiple accident tolerant fuel concepts, which offer real potential for substantially improved economics and safety margins for our existing fleet as well as advanced reactors.

The United States pioneered the development and peaceful use of nuclear power to produce around-the-clock, emissions-free baseload electricity generation as well as the development of the civilian nuclear fuel cycle. NE's work advances the effort to move new and innovative advanced reactors, small modular reactors, and microreactors from the conceptual and development stages into commercial deployment. More than 20 U.S. developers are pursuing advanced reactor technologies that will make nuclear energy more efficient and affordable to construct, operate, and maintain. With help from DOE and the National Laboratories, a new generation of reactors will be demonstrated by the end of the decade.

The Energy Act of 2020 is an important piece of legislation to ensure nuclear energy is a key element in meeting our aggressive climate goals, now and in the future. The Department is advancing these goals with the Advanced Reactor Demonstration Program (ARDP), designing the Versatile Test Reactor (VTR), and implementing the Integrated Energy System subprogram within NE, following the direction under Title II of the Act. In addition, the Department worked to implement, to the maximum extent practicable, dedicating 20% of our nuclear energy research and development funding for the Nuclear Energy University Program. The President's Budget for fiscal year 2022 requests funding to formally start new programs, such as the High-Assay, Low Enriched Uranium (HALEU) Availability program, and International Nuclear Energy Cooperation has been restored as a standalone program.

At the Department, we are particularly optimistic about ARDP. ARDP has set an aggressive timeline to develop, license, and build two operational advanced reactors. These two reactors, X-energy's Xe-100 high-temperature reactor and TerraPower's Natrium reactor will be sited in the states of Washington and Wyoming, respectively. Terrapower's Natrium reactor will be built at a retiring coal power plant and utilize the existing infrastructure and workforce in the area. This is

the type of coal-to-nuclear transition demonstration that will help us achieve our climate goals while ensuring a just energy transition for the local workforce. Through ARDP, we are also working to lower the risk of other promising technologies that could be commercialized in the 2030s along with R&D on additional concepts to help build a future pipeline of U.S. nuclear power reactors that will offer significant improvements over today's reactors.

These innovative advanced reactors are being designed to be smaller and scalable, and to operate with more flexibility and resilience. They should enable new product choices to utility customers and communities around the United States, and around the world. Additionally, these advanced reactors will be designed to adjust their electricity output to match demand and to pair with sources of renewable energy to provide around-the-clock, emissions-free electricity. With the transition towards clean, carbon-free electricity, including intermittent renewables such as wind and solar, the need for a reliable source of baseload generation capacity will only increase in the future, and nuclear energy can address that need. Furthermore, these advanced reactors have the potential to expand the benefits of nuclear energy beyond electricity generation by providing high quality heat for district heating, to generate hydrogen, to decarbonize the industrial and transportation sectors, and to generate clean drinking water from desalination plants, making these reactors key to meeting the U.S. and interested countries' climate targets as we work to decarbonize economy-wide.

An economic and reliable supply of the fuel that will be required to operate many of the innovative reactor technologies under development within the United States is also important. Many of these advanced reactor technologies are being designed to use HALEU, including the two ARDP reactors. HALEU is not currently commercially available from any domestic source. The Department is actively working to establish the HALEU Availability program, and we look forward to working with Congress as we advance HALEU availability. We are soliciting input from stakeholders and developing implementation plans.

As we move from demonstrations to widespread commercialization, we need a fast neutron test reactor that can support research for all stages of technology development - including the existing fleet of commercial reactors. With the bipartisan support of Congress and key members of this Committee, DOE is designing VTR to provide an advanced fission environment - specifically, a high flux, fast neutron environment - to support accelerated fuels and materials development and qualification over the next 60 years.

The proposed VTR would be the tool that, in harmony with demonstration reactors, would help us discover, test, and advance the innovative nuclear energy technologies that are needed to help our planet achieve zero carbon emissions. The proposed VTR would provide a unique opportunity for our nation to modernize the nuclear energy research infrastructure crucially needed to support new technologies that could re-energize the U.S. nuclear energy industry around the world.

Having a fast neutron test source in the United States would not only be an investment in our nuclear innovators but set the nation up for success in a future clean energy market that is estimated to be worth billions both domestically and internationally. Advanced nuclear can help grow our economy, reduce emissions, and create new jobs for our American workers. Without a

fast neutron source in the U.S. like the VTR, U.S. innovation will fall behind other countries which have fast neutron test reactors, and we simply cannot let that happen.

The Office of Nuclear Energy understands that one of the purposes of this hearing is a concern regarding NE's past use of sole source contracting during previous years. Specifically, we are aware of the Committee's concerns regarding the sole source awards for the following programs and projects:

- The High-Assay Low Enriched Uranium Demonstration Program and the resulting sole source award to American Centrifuge Operating LLC, a subsidiary of the Centrus Energy Corporation, for a total of $144M, with a government share of $115M, from FY2019 to FY2021, approved on May 31, 2018, and executed on December 30, 2018;

- The NuScale Small Modular Reactor First-of-a-Kind Nuclear Demonstration Readiness Project, and the resulting sole source award to NuScale Power, for $700M, with a government cost-share of $350M, from FY2019 to FY2024, approved on November 5, 2019, and executed on February 4, 2020;

- The Commercialization and Deployment of the First NuScale Power Small Modular Reactor in the United States, referred to as the Carbon Free Power Project, and the resulting sole source award to the Carbon Free Power Project, LLC, a wholly owned division of Utah Associated Municipal Power Systems, for $6B, with a government cost-share of $1.38B, from FY2020 to FY2030, approved on September 14, 2020, and executed on October 16, 2020; and,

- The Nuclear Industry Safety System Digital Upgrade Project, and the resulting sole source award to the Exelon Generation Company, for $92.5M, with a government cost-share of $50M, from FY2021 to FY2025, approved on January 12, 2021, and executed on September 30, 2021.

These four sole source awards were prepared in accordance with the applicable regulations governing federal acquisitions and cooperative agreements; were thoroughly reviewed and approved by the Department's Office of Management and the Office of the General Counsel; and were documented and executed legally. Additionally, we agree with the premise that fair and open competition is the best practice for federal procurement and financial assistance. Early and open expression of interest by the Department ensures the greatest number of market participants for competition.

We take seriously the concerns expressed about the use of sole source awards and are committed to communicating clearly with Congress about the need to use such awards. The use of sole source awards may apply in limited circumstances when such awards can serve the public interest or be in the best interest of the federal government and the taxpayer. The Department will ensure there is a very high bar for using such an exception to the competitive process. Should the Department determine that the pursuit of a sole source award meets such criteria at some point in the future, we will commit to communicating early with Congress.

Congress has placed their trust in the Office of Nuclear Energy to advance nuclear energy as a key solution to tackle the climate crisis, at home and abroad, as illustrated by the broad support for new authorities granted in the Energy Act of 2020. NE is ready to take on that role, and pledges that these programs will be developed and managed with the utmost integrity, openness, and transparency, which are key tenets of the Biden-Harris Administration.

Overall, it is an extremely exciting time to be involved in nuclear energy. We have not just a role but an essential role to play in fighting climate change and reducing carbon emissions. If we all work together, we can make it happen.

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

Dr. Kathryn D. Huff serves as the Acting Assistant Secretary and Principal Deputy Assistant Secretary for the Office of Nuclear Energy. Prior to her current role, she was an Assistant Professor in the Department of Nuclear, Plasma, and Radiological Engineering at the University of Illinois at Urbana-Champaign where she led the Advanced Reactors and Fuel Cycles Research Group. She was also a Blue Waters Assistant Professor with the National Center for Supercomputing Applications. She was previously a Postdoctoral Fellow in both the Nuclear Science and Security Consortium and the Berkeley Institute for Data Science at the University of California - Berkeley. She received her PhD in Nuclear Engineering from the University of Wisconsin-Madison in 2013 and her undergraduate degree in Physics from the University of Chicago. Her research focused on modeling and simulation of advanced nuclear reactors and fuel cycles.

She is an active member of the American Nuclear Society as the past Chair of both the Nuclear Nonproliferation and Policy Division and the Fuel Cycle and Waste Management Division, and recipient of both the Young Member Excellence and Mary Jane Oestmann Professional Women's Achievement awards. Through leadership within Software Carpentry, SciPy, the Hacker Within, and the Journal of Open Source Software she also advocates for best practices in open, reproducible scientific computing.

Chairman FOSTER. Thank you. And next, Ms. Roma is recognized for five minutes.

TESTIMONY OF MS. AMY ROMA, FOUNDING MEMBER, NUCLEAR ENERGY AND NATIONAL SECURITY COALITION, ATLANTIC COUNCIL

Ms. ROMA. Thank you. Good morning. My name is Amy Roma, and I'm a member of the Atlantic Council's Nuclear Energy and National Security Coalition and a lawyer at Hogan Lovells. Thank you for the opportunity to testify today. As I noted in my written testimony, while I wear many hats, today, I'm here in my individual capacity.

Commercial nuclear power serves as an important tool to achieve U.S. economic interests, including creating hundreds of thousands of jobs and enabling the United States to participate in a robust market of nuclear trade, climate change goals by providing over half of the U.S. carbon-free power and supporting a just transition to clean energy and U.S. nonproliferation—U.S. national security objectives by promoting U.S. safety, security, and nonproliferation standards globally and strengthening U.S. influence abroad.

While the United States has the largest nuclear feet and best-run plants in the world, we have seen our international role as a global leader as a reactor supplier sharply decline in recent years, replaced largely by Russia, with China close behind. Russia and China have identified nuclear energy innovation, domestic deployment of nuclear power, and nuclear trade as national priorities, promoted by the highest levels of government and backed by State financing and State-owned enterprises, and their focus has paid off. Nuclear power plants are being built all around the world, but Russia is building them. Russia uses nuclear exports as a tool to exert foreign influence and reap significant economic gains with a claimed $130 billion in orders for foreign reactors. Nuclear energy is also a component of China's Belt and Road Initiative (BRI), with China estimating it could have $145 billion in orders for foreign reactors and create 5 million Chinese jobs.

The U.S. nuclear power industry competing against foreign governments for new projects has quickly been sidelined on the foreign stage and has no new concrete orders for U.S. nuclear reactors abroad. But we have the opportunity to strengthen the United States' foothold in nuclear trade with advanced reactors, and we should want to take advantage of our position at the forefront of this technology. The market opportunity is immense, and the stakes of climate change are too high.

Nuclear energy supports the U.S. economy. The nuclear industry supports nearly half a million jobs in the United States and contributes about $60 billion to the U.S. GDP (gross domestic product) annually. It's a non-greenhouse-gas-emitting power generation source and a crucial tool in the battle against climate change. As the recent IPCC (Intergovernmental Panel on Climate Change) report makes clear, the world needs to take on a full court press in decarbonization. The electricity and industrial sectors account for about half of GHG (greenhouse gas) emissions. Nuclear power could be used to decarbonize both. It has the ability to provide clean, affordable, and reliable power around the world, helping

raise the global standard of living, including for the nearly billion people in the world without access to electricity, and it promotes energy independence and grid stability.

The world electricity demand is expected to double globally by 2050, presenting a huge market opportunity for the United States in the trillions of dollars. And advanced reactors have a wide range of sizes and applications beyond power generation. In addition to helping decarbonize the electricity and industrial sectors, it can be used to desalinate water, produce hydrogen, and support deep-sea exploration and space colonies. But we cannot harness this opportunity without the government and industry working together.

Currently, there are dozens of companies in the United States developing a diverse range of advanced nuclear technologies, but they need to be proven before they can be widely deployed. DOE's Office of Nuclear Energy support in advancing the commercialization of advanced reactors is critical. While it has undertaken a number of important programs, in particular, the recent Advanced Reactor Demonstration Program has been instrumental in turning discussions into actions. Under the program, NE supports the demonstration of two advanced reactors by 2027. That is fully operational plants that are providing power to the grid. ARDP also includes another eight awards to other advanced reactor developers to support commercial deployment of each of these technologies into the 2030's. ARDP means a number of advanced reactor companies have the opportunity to show the world that—what their technologies can do, opening the door to further domestic deployment and the global market, which is immense.

U.S. innovation, when properly supported, can stand up to State-backed competitors like Russia and China, and the world is eager for U.S. reactor options. We can reemerge as a global leader in nuclear power using U.S. innovation and U.S. Government support. The opportunity is there, we have the technology, and the stakes are worth it.

Thank you, and I'm happy to answer any questions that you may have.

[The prepared statement of Ms. Roma follows:]

Written Testimony of Amy C. Roma

Founding Member, Nuclear Energy and National Security Coalition (NENSC), Atlantic Council; Partner, Hogan Lovells US LLP

Before the House Committee on Science, Space, and Technology, Investigations & Oversight and Energy Subcommittees

Joint hearing titled "Judicious Spending to Enable Success at the Office of Nuclear Energy."

Thursday, October 21, 2021, 10:00 a.m.

My name is Amy Roma and I am a founding member of the Nuclear Energy and National Security Coalition at the Atlantic Council and a nuclear regulatory lawyer at the law firm of Hogan Lovells. Thank you for the opportunity to testify before the Subcommittees. This testimony represents my observations and in no way represents the views of the Atlantic Council, Hogan Lovells or its clients.

I. SETTING THE STAGE

A. A high stakes history lesson

Understanding the importance of commercial nuclear power—and therefore the importance of the Department of Energy's Office of Nuclear Energy (DOE-NE) and the activities it undertakes—begins with a history lesson that underscores the unique tool nuclear energy can give the U.S. both domestically and on the global stage.

Commercial nuclear energy and the United States government share a long history that is intertwined with the global struggle for peace and security.[1] Soon after the end of the Second World War, the U.S. government understood that its monopoly on nuclear weapons and nuclear technology would be short lived. In particular, the Soviet Union was catching up with the United States and could share the information with other countries to benefit its own geopolitical aims and undermine U.S. influence, safety, and policy of nonproliferation.[2]

In response, the U.S. government in the 1950s saw the value that peaceful use of nuclear energy could bring not just for the world but for its own security. President Eisenhower presented a bold proposal to the United Nations: The U.S. would share its nuclear energy technology with other nations if the receiving nation committed to not use the technology to develop nuclear

[1] Michael Wallace, Amy Roma, and Sachin Desai, *Back from the Brink: A Threatened Nuclear Energy Industry Compromises National Security*, Center for Strategic and International Studies (Jul. 2018), available at https://www.csis.org/analysis/back-brink-threatened-nuclear-energy -industry-compromises-national-security.

[2] Peter Lavoy, *Arms Control Today, The Enduring Effects of Atoms for Peace*, Arms Control Association (Dec.1, 2003), available at https://www.armscontrol.org/act/2003_12/Lavoy) ("U.S. officials feared that the Kremlin would score a huge propaganda victory, especially in the developing world, if the United States did not alter its own nuclear export policy.")

weapons.[3] This program, known as "Atoms for Peace," resulted in three important economic and national security objectives because it made the U.S. the leader in nuclear power: (1) it prevented the spread of nuclear weapons because the U.S. led and thus had oversight over global peaceful nuclear energy development and the terms under which technology was shared; (2) it ensured the U.S. maintained dominance in nuclear safety, security, nuclear technology development, and nuclear trade; and (3) it ensured the U.S. benefitted from the geopolitical relationship that goes with such significant assistance with a foreign country's power supply.

President Eisenhower's historic move has paid dividends for decades. With the United States at the forefront, the Atoms for Peace policy gave rise to many of the most important safety and nonproliferation standards of today's nuclear world.

Remarkably, many of the same arguments used to support the U.S. government's decision to bring nuclear energy to the world in the 1950s are still just as relevant today—that is, the United States should lead in nuclear trade because if we do not, another country will, which will undermine U.S. influence, as well as U.S. safety and nonproliferation standards.

Under today's current climate, Russia and China have identified building nuclear energy plants and nuclear trade as national priorities promoted by the highest levels of government and backed by state financing and state-owned enterprises and are aggressively pursuing the global market. Their focus has paid off. Russia now dominates nuclear energy plant construction around the world, using it as a tool to exert foreign influence and reap significant economic gains. Nuclear energy is also a component of China's "Belt and Road" initiative, with China expected to exceed the U.S. as both the largest domestic producer of nuclear power,[4] but also emerge as a close competitor to Russia for international new nuclear projects.[5] The struggling U.S. nuclear energy industry—competing against foreign governments for new projects abroad—has quickly been sidelined on the foreign stage. *See* Appendix A for a global breakdown of Russian and Chinese nuclear exports.

But while we have lost our leadership in supplying reactors around the world, we have a chance to regain it again with the development of advanced reactors—which DOE-NE is critical in supporting. The U.S. leads the world in the development of advanced fission reactors, as well as the nascent fusion industry. If the United States leads in implementing this new technology

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[3] Address of Dwight D. Eisenhower, President of the United States of America, to the 470th Plenary Meeting of the United Nations General Assembly (Dec. 8, 1953), available at https://www.iaea.org/about/history/atoms-for-peace-speech).

[4] Nikkei Asia, *China poised to overtake US in nuclear energy by 2030* (Aug. 31, 2020), available at https://asia.nikkei.com/Business/Energy /China-poised-to-overtake-US-in-nuclear-power-by-2030#:~:text=China%27s%20total%20nuclear%20power%20generation,Nuclear%20Association%2C%20an%20industry%20group; Council on Foreign Relations, *Independent Task Force Report No. 79, China's Belt and Road, Implications for the United States*, updated Mar. 2021 [hereinafter CFR Task Force Report], available at https://www.cfr.org/report/chinas-belt-and-road-implications-for-the-united-states/ (explaining: "Though principally aimed at developing countries, with Pakistan, Malaysia, Bangladesh, Myanmar, and Sri Lanka among the largest recipients of BRI funds, BRI also includes developed countries, with numerous U.S. allies participating.") *See also* Organization for Economic and Cooperation and Development (OECD) Business and Finance Outlook 2018, *China's Belt and Road Initiative in the Global Trade, Investment and Finance Landscape*, available at https://www.oecd.org/finance/Chinas-Belt-and-Road-Initiative-in-the-global-trade-investment-and-finance-landscape.pdf.

[5] *China could build 30 'Belt and Road' nuclear reactors by 2030: official*, Reuters (Jun. 20, 2019), available at https://www.reuters.com/article/us-china-nuclearpower/china-could-build-30-belt-and-road-nuclear-reactors-by-2030-official-idUSKCN1TL0HZ.

wave, safety will improve, our geopolitical relationships will strengthen, and non-proliferation will remain strong. However, if U.S. companies do not receive U.S. government support these benefits will fall to the wayside and other countries will emerge as leaders. We currently are well-positioned to deliver advanced reactor but we again have Russia and China close at our heels and need to work strategically to maintain our lead as advanced reactors come to the global market.

In addition to the historical importance of nuclear power, four other key benefit have emerged around climate change and energy growth that make the global market even more important:

- Nuclear energy is a non-greenhouse gas emitting power generation source, and a crucial tool in the battle against climate change;

- It has the ability to provide clean, affordable, and reliable power around the world, helping raise the global standard of living,[6] including for the approximately 860 million people in the world with no access to electricity;

- The world electricity demand is expected to double globally by 2050,[7] presenting a huge market opportunity for the U.S.; and

- Advanced reactors have a wide range of sizes and applications beyond power generations, and can help decarbonize the industrial sector, desalinate water, produce hydrogen, keep the U.S. at the forefront of travel by space and sea.

While U.S. innovation can turn the tide at home and abroad, just as SpaceX reclaimed the global launch market from Russia, until electrons are added to the grid, the U.S. will fall behind and risk losing hundreds of millions of dollars in revenues, and job opportunities for tens of thousands of Americans. I walk through these issues in further detail below.

B. Nuclear energy in the U.S. today

Nuclear boasts attractive features that routinely garner bipartisan support and is currently on President Biden's radar as well as on the legislative agenda for both parties. The United States is currently the world's largest producer of nuclear power, accounting for more than 30% of worldwide nuclear generation of electricity. Nuclear energy provides approximately 20% of U.S. power generation and around 55% of the country's carbon-free power generation. With a fleet of about 93 reactors, operated by 30 different power companies across 30 different states.[8]

The nuclear industry supports nearly half a million jobs in the United States and contributes about $60 billion to the U.S. GDP annually.[9] Current nuclear energy plants can employ up to 700 workers with salaries that are 30% higher than the local average, and they contribute billions of

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[6] *See, e.g.,* HL New Nuclear Blog, *IPCC Report Underscores Need for Nuclear for Rapid Decarbonization*, https://www.hlnewnuclear.com/2021/08/ipcc-report-underscores-need-for-nuclear-for-rapid-decarbonization/.

[7] Third Way, *Mapping the Global Market for Advanced Nuclear* (Sept. 22, 2020), available at https://www.thirdway.org/memo/mapping-the-global-market-for-advanced-nuclear.

[8] World Nuclear Association, *Nuclear energy in the USA* (Updated Sept. 2021), available at https://www.world-nuclear.org/information-library/country-profiles/countries-t-z/usa-nuclear-power.aspx.

[9] DOE-NE, *Advantages and Challenges of Nuclear Energy* (Mar. 29, 2021), available at https://www.energy.gov/ne/articles/advantages-and-challenges-nuclear-energy.

dollars annually to local economies through federal and state tax revenues.[10] In addition to providing large amount of carbon free power,[11] nuclear power plants also operate incredibly well, providing reliable power with an average capacity factor[12] of over 90% (compared with intermittent power sources such as wind (about 35% capacity factor) and solar PV (about 25% capacity factor)).[13]

Almost all the U.S. nuclear operating today comes from reactors built between 1967 and 1990. As recently as 2013, the U.S. had 104 operating domestic nuclear energy reactors, but the number has decreased to around 93 today, and about 1/3 of them are facing economic hardships due largely to the long-term decline in natural gas prices beginning around 2008 the led first to a number of cancelled planned plants and then to the premature shutdown of a number of operating plants.[14] While two new plants are under construction, no other large scale units are planned after this time.

Despite these challenges, U.S. reliance on nuclear energy has grown, with U.S. nuclear generation capacity doubling because of increased operational efficiencies and power uprates.[15] The U.S. nuclear industry has also achieved remarkable gains in power plant utilization. A number of states have moved to keep economically troubled nuclear energy plants open to preserve their low carbon attributes, using a "Social Cost of Carbon" metric to support the cost-benefit analyses of the programs, but these are intended to be a stop gap measures until a more permanent solution emerges.[16] At the current rate, more nuclear energy plants are expected to prematurely shutdown, leading to a significant degradation of the existing fleer and reduction in a large amount of carbon-free power.

II. ADVANCED REACTORS ARE ON THE CUSP ON DEPLOYMENT AND CAN SUPPORT A WIDE RANGE OF U.S. INTERESTS

A. A summary of the benefits of advanced reactors

The U.S. excels at technological innovation—both in developing nuclear energy technology and innovating it. Advanced reactors are no exception. In the near term, advanced reactors are the only new planned projects to join the nuclear energy mix in the United States and they are well poised to give the U.S. an opportunity to regain its global nuclear leadership and give us a strong tool in the fight against climate change—and there are dozens of ventures poised to enter the market in the advanced reactor space. This innovation can bring jobs, support the U.S.

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[10] *Id.*

[11] As used herein, "carbon free" means nuclear power generation does not emit carbon dioxide or other greenhouse gases.

[12] Capacity factor is the ratio between what a generation unit is capable of generating versus the unit's actual generation output over a period of time. Among other things, the higher the capacity factor, the more predictable the output of the plant.

[13] Energy Information Agency, Electric Power Monthly, *Table 6.07.B. Capacity Factors for Utility Scale Generators Primarily Using Non-Fossil Fuels* (through Dec. 2020), available at https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_b.

[14] Energy Information Agency, Frequently Asked Questions (FAQS), available at https://www.eia.gov/tools/faqs/faq.php?id=207&t=3.

[15] Energy Information Agency, *Nuclear explained: U.S. nuclear industry* (Last updated Apr. 15, 2020), available at https://www.eia.gov/energy explained/nuclear/us-nuclear-industry.php.

[16] For a summary of these program, please see HL New Nuclear Blog, *Biden Administration Reinvigorates the Social Cost of Greenhouse Gases*, by Amy Roma and Sachin Desai (Mar. 5, 2021), available at https://www.hlnewnuclear.com/2021/03/biden-administration-reinvigorates-the-social-cost-of-greenhouse-gases/.

economy and, and keep the U.S. at the cusp of technological advancements to support a range of interests, including international trade, decarbonization, space exploration, and geopolitical and national security interests.

Many advanced reactors contain enhanced safety systems, such as passive safety features and below grade construction, and would be able to support a wide range of applications that include not only power generation—from the tiny to the large, and everything in between--but also to provide process heat, which can be used to decarbonize the industrial sector and support other innovative technologies, such as hydrogen production or water desalination, and even space propulsion/power and shipping.[17]

If given a chance to thrive through private sector investment, regulatory streamlining, and political leadership (e.g., in supporting technological innovation, and on issues such as management of spent fuel), nuclear energy could see an incredible resurgence in the United States, bringing significant benefits to its citizens, national security, and even prospects in space.

In particular, advanced reactors offer great promise for actualizing a true Nuclear Renaissance. There are several dozen domestic ventures in next-generation nuclear technologies and new opportunities are being created every day (*see* Appendix B, for a global perspective of advanced nuclear development, showing significant activity in the United States).[18] These endeavors take many forms. Some hope to use liquid metal coolants, some want to use pebble-bed reactors with gaseous helium coolant, and some want to greatly improve current light water reactor designs. Some want to have liquid uranium fuel, and some want to use nuclear waste as fuel. Some propose to cut out fission altogether and move straight to nuclear fusion. Nearly all of them offer modular designs that can start small and scale with customer needs. And along with the advanced fission reactors under development, there are also a number of fusion ventures looking to demonstrate and commercialize fusion power technologies.[19]

Listed below are just some of the benefits nuclear can provide the U.S. if adequately supported:

- **<u>High-Paying Jobs</u>.** Investment in nuclear energy will result in skilled, highly compensated jobs in the nuclear industry, including the addition of professions such as reactor designers and service and maintenance professionals, as well as opportunities in fuel cycle facilities to mine, mill, and enrich uranium. Additionally, tens of thousands of STEM jobs are required to support nuclear plant operation. These positions open the door for highly skilled domestic employees, many of whom come to the field from the

[17] *See, e.g.,* World Nuclear Association, *Nuclear Process Heat for Industry* (Updated Sept. 2021), available at https://www.world-nuclear.org/information-library/non-power-nuclear-applications/industry/nuclear-process-heat-for-industry.aspx, and *Nuclear Reactors and Radioisotopes for Space* (Updated May 2021), available at https://www.world-nuclear.org/information-library/non-power-nuclear-applications/transport/nuclear-reactors-for-space.aspx.

[18] Third Way, *Keeping Up with the Advanced Nuclear Industry* (Jan. 2018), available at https://www.thirdway.org/graphic/keeping-up-with-the-advanced-nuclear-industry. This number shows a marked increase from the previous year, so the advanced reactor field is currently growing. *See also* Third Way, *The Advanced Nuclear Industry: 2016 Update* (Dec.12, 2016), available at https://www.thirdway.org/infographic/the-advanced-nuclear-industry-2016-update.

Navy or after pursuing extensive university programs.[20] In fact, nuclear energy has the highest paying jobs in the entire electric power generation sector, with the average mid-wage workers earning somewhere between 22% and 25% more per hour than the next best paying electric power generation sector (e.g., coal and natural gas, respectively).[21]

- **Low-Carbon Power.** Nuclear energy is an effective solution to help combat greenhouse gas emissions, while also producing more energy than alternative renewable sources and requiring far less land to produce a comparable amount of energy. Over half of zero-carbon emission electricity in the U.S. is generated by nuclear power, and the utilization of nuclear energy has prevented the emission of 528 million metric tons of carbon dioxide emissions.[22] Nuclear energy is an important tool in the toolbox of no- and low-carbon electricity. And while renewable energy sources like solar and wind may play an important role in our clean energy framework, nuclear energy provides a more efficient and reliable solution.

  A recent report estimates that based on future carbon mitigation goals, the U.S. nuclear market revenues could amount to $1.9 trillion over the next 30 years.[23] This growth and development is further spurred by the current focus, both domestically and abroad, on achieving a zero-carbon future. Commercializing advanced nuclear technology in the industrial sector can help facilitate climate-conscious policies, such as those influencing the industrial sector. The industrial sector contributes around 28% of global greenhouse gas emissions and its decarbonization will cost anywhere between $11 trillion and $21 trillion.[24] This massive effort will require strategic utilization of various front-line technologies, like those being developed in the nuclear space. Decarbonization will require and "all of the above" approach in order to ensure energy diversity and security.

- **Grid Security and Independence.** At the same time we need to decarbonize the grid, we need to make sure the lights stay on. Ironically, abnormal weather conditions—such as the kind we keep seeing linked to climate change—can lead to elevated risks to the grid—affecting both generation and demand, as well as causing energy shortages that

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[20] *See, e.g.,* Department of Energy , *Nuclear Energy University Program*, available at https://www.energy.gov/ne/nuclear-reactor-technologies/nuclear-energy -university-program. Since 2009, the Nuclear Energy University Program has awarded "approximately $290 million to 89 colleges and universities in 35 states and the District of Columbia to train the next generation of nuclear engineers and scientists in the United States and continue U.S. leadership in clean energy innovation."

[21] *See* Energy Futures Initiative and the National Association of State Energy Officials, U.*S. Energy and Employment Report*, at 108, 113 and 119 (2020), available at https://www.usenergy jobs.org/); American Nuclear Society, *The U.S. Nuclear R&D Imperative: A Report of the American Nuclear Society Task Force on Public Investment in Nuclear Research and Development*, at 13 (Feb. 2021), available at https://www.ans.org/file/3177/2/ANS%20RnD%20Task%20Force%20Report.pdf.

[22] Nuclear Energy Institute, Climate webpage, available at https://www.nei.org/advantages/climate.

[23] UxC, LLC, *Global Nuclear Market Assessment Based on IPCC Global Warming of 1.5° C Report* (Jul. 2020), available at https://www.nei.org/CorporateSite/media/filefolder/resources/reports-and-briefs/UxC-NEI-(IPCC-2050-Nuclear-Market-Analysis-PUBLIC)-2020-07-01.pdf.

[24] McKinsey, *Decarbonization of industrial sectors: the next frontier* (June 2018), available at https://www.mckinsey.com/business-functions/sustainability/our-insights/how-industry-can-move-toward-a-low-carbon-future.

lead to energy emergencies. In addition to providing large amount of carbon free power, nuclear power plants also operate incredibly well. As noted above, it provides reliable power with an average capacity factor[25] of over 90% (compared with much lower capacity factors for all other power generation sources, including about 35% for wind and 25% for solar PV).[26] Meaning that nuclear power is a very reliable carbon-free power source.

When the lights go out not only does it have significant financial impacts, but it costs lives as well.[27] The recent Texas power crisis that occurred in February 2021 is an example of this.[28] As outlined in a recent report, when the storm hit this past winter, more than 4.5 million households were left without electricity during an extreme cold snap, with the storm and outages leading to the loss of over 100 lives and causing an economic loss estimated to be about $155 billion.[29]

- **Reliable, Low-Carbon Process Heat.** Nuclear energy is often the only reliable zero-carbon source of industrial process heat in desalination, oil refining, ethanol production, and the like. Using nuclear in place of current energy alternatives in process heat applications can result in price stability, no carbon emissions, and increased security.[30] Besides its proven value in industrial processes, nuclear can also be used to create power generation sources, like hydrogen, for decarbonization. Although still in the research stage, heat from high-temperature nuclear reactors can potentially provide energy necessary for electrolysis, which can be used to make hydrogen production more efficient.[31] Future high-temperature reactors may also be used to make hydrogen thermochemically.[32]

- **U.S. Leadership in R&D.** Investing in the nuclear sector also adds value to the U.S. research mission by providing engineers' and scientists' resources for research.[33] The research resulting from nuclear reactors at leading U.S. universities has numerous spin-offs for other disciplines, such as superconductors, polymers, metals, and proteins.[34]

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[25] Capacity factor is the ratio between what a generation unit is capable of generating versus the unit's actual generation output over a period of time. Among other things, the higher the capacity factor, the more predictable the output of the plant.

[26] Energy Information Agency, Electric Power Monthly, *Table 6.07.B. Capacity Factors for Utility Scale Generators Primarily Using Non-Fossil Fuels* (through Dec. 2020), available at https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_b.

[27] HL New Nuclear Blog, *Grid Reliability Report Highlights Benefits of Pairing Advanced Nuclear with Renewables to Ensure Power Stays On* (Jun. 9, 2021), available at https://www.hlnewnuclear.com/2021/06/grid-reliability-report-highlights-benefits-of-pairing-advanced-nuclear-with-renewables-to-ensure-power-stays-on/.

[28] *Id.*

[29] Science Direct, *Cascading risks: Understanding the 2021 winter blackout in Texas* (Jul. 2021), available at https://www.sciencedirect.com/science/article/pii/S2214629621001997.

[30] World Nuclear Association, *Nuclear Process Heat for Energy* (Sept. 2021), available at https://www.world-nuclear.org/information-library/non-power-nuclear-applications/industry/nuclear-process-heat-for-industry.aspx.

[31] *Id.*

[32] World Nuclear Association, *Hydrogen production and uses* (Sept. 2021), available at https://www.world-nuclear.org/information-library/energy-and-the-environment/hydrogen-production-and-uses.aspx.

[33] U.S. Nuclear Regulatory Commission, *Backgrounder on Research and Test Reactors* (last reviewed Jan. 26, 2021), available at www.nrc.gov/reading-rm/doc-collections/fact-sheets/research-reactors-bg.html.

[34] *Id.*

Nuclear technology also aids in determining quality control for aerospace, automotive, and medical components. Nuclear energy itself is a key component of extra-orbital space research. For example, the Voyager spacecraft[35] and the Mars rover, Curiosity, use Radioisotope Thermoelectric Generators (RTGs) to continue to function.[36] And there are other applications for nuclear reactors as well, including propulsion for shipping and submarines, and power icebreakers. This is a technology that the U.S. needs to know, and we need to stay at the top of innovation in this space for not only commercial and economic purposes, but also to support our own national defense.

- **National Security.** Nuclear application in the naval and space industries is becoming more necessary with time. New nuclear reactors and technologies will be needed to support the U.S. military, such as the U.S. Navy's nuclear propulsion program, the Department of Defense's microreactor project for forward operating bases, energy independence for U.S. military bases, and future air and space travel. For example, the U.S. Navy has a command of the sea that affords the United States unrivaled international influence. For decades, its size and sophistication have enabled leaders in Washington to project American power over much of the earth, during times of both war and peace.[37] If the U.S. expects to maintain a strong naval presence, then it must prioritize new reactor designs that are likely to move naval vessels faster and more efficiently; otherwise, the U.S. risks falling behind other countries that are already working on such developments.

- **Leadership in Space.** Similarly, continued research in nuclear thermal propulsion (NTP) and nuclear electric propulsion (NEP) is necessary to develop capabilities of space exploration undergirded by nuclear power. This includes research on fuel options, including high-assay, low-enriched uranium fuels and highly enriched uranium. According to a recent report by the National Academies of Sciences, Engineering, and Medicine, both NTP and NEP systems "show great potential" in the realm of space exploration, particularly in a human exploration of Mars, but NASA and DOE must prioritize the development of such a mission if it is expected to come to fruition.[38]

Below, I walk through how DOE-NE supports advanced reactor deployment, as well as more detail on the climate change benefits of nuclear power and U.S. interest in deploying advanced reactors abroad.

B. Value of DOE-NE is supporting advanced reactors' deployment

DOE-NE has been key to supporting technology innovation and commercialization in the advanced reactor space. One of the most important programs is DOE-NE's Advanced Reactor Demonstration Program (ARDP)—because demonstration is pivotal to supporting widespread deployment in the commercial markets both in the U.S. and abroad.

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[35] NASA, *Voyager Spacecraft*, available at www.voyager.jpl.nasa.gov/mission/spacecraft/.
[36] NASA, *Radioisotope Power Systems*, available at www.rps.nasa.gov/.
[37] *See* Council on Foreign Relations, *Sea Power: The U.S. Navy and Foreign Policy*, by Jonathan Masters (Aug. 19, 2019), available at https://www.cfr.org/backgrounder/sea-power-us-navy-and-foreign-policy.
[38] National Academies of Sciences, Engineering, and Medicine, *Nuclear Propulsion for Human Mars Exploration* (2021), available at https://www.nationalacademies.org/our-work/space-nuclear-propulsion-technologies.

The ARDP is intended to speed the demonstration of advanced reactors through 50-50 cost-shared partnerships with U.S. industry. ARDP applicants can receive support through three different development and demonstration pathways:[39]

- **Advanced Reactor Demonstrations Projects**, which are expected to result in a fully functional advanced nuclear reactor by the end of 2027. DOE-NE has selected two awardees under this program. Congress appropriated $160 million for the Fiscal Year 2020 budget as initial funding for this program.

- **Risk Reduction for Future Demonstrations**, which will support up to five additional teams resolving technical, operational, and regulatory challenges to prepare for future demonstration opportunities. The goal of the Risk Reduction program is to design and develop safe and affordable reactor technologies that can be licensed and deployed over the next 10 to 14 years. DOE-NE has selected five awardees under this program. Congress appropriated $30 million in Fiscal Year 2020 for this program.

- **Advanced Reactor Concepts 2020 (ARC 20)**, which will support innovative and diverse designs with potential to commercialize in the mid-2030s. The goal of the ARC-20 program is to assist the progression of advanced reactor designs in their earliest phases. DOE-NE has selected three awardees under this program. Congress appropriated $20 million in Fiscal Year 2020 for this program.

Funding beyond the near-term is contingent on additional future appropriations, evaluations of satisfactory progress and DOE-NE approval of continuation applications.[40]

On October 13, 2020, the U.S. Department of Energy awarded X-energy and TerraPower $80 million each for their respective initiatives to build advanced nuclear reactors by 2027 under the ARDP demonstration arm. The initial award is for $80 million but DOE-NE has stated that it will invest a total of $3.2 billion over seven years, subject to the availability of future appropriations, with the industry partners providing matching funds, for these projects.[41]

Under its ARDP demonstration award, X-energy plans to deliver a commercial four-unit nuclear energy plant based on its Xe-100 reactor design. According to X-energy, the Xe-100 is a high temperature gas-cooled reactor that is ideally suited to provide flexible electricity output as well as process heat for a wide range of industrial heat applications, such as desalination and hydrogen production. The project also includes a commercial scale TRi-structural ISOtropic particle fuel (TRISO) fuel fabrication facility, supporting DOE-NE's interest in the development of TRISO fuel.[42]

Under its ARDP demonstration award, TerraPower plans to demonstrate the Natrium reactor, a sodium-cooled fast reactor that leverages of decades of development and design undertaken by TerraPower and its partner, GE-Hitachi. According to TerraPower, the high-operating temperature of the Natrium reactor, coupled with thermal energy storage, allows the

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[39] DOE-NE, *ARDP*, available at https://www.energy.gov/ne/advanced-reactor-demonstration-program.
[40] DOE-NE, *U.S. Department of Energy Announces $160 Million in First Awards under Advanced Reactor Demonstration Program*, (Oct. 13, 2020), available at https://www.energy.gov/ne/articles/us-department-energy -announces-160-million-first-awards-under-advanced-reactorailable.
[41] *Id.*
[42] *Id.*

plant to provide flexible electricity output that complements variable renewable generation such as wind a solar. This project will also establish a new metal fuel fabrication facility that is scaled to meet the needs of this demonstration program.[43]

X-energy has announced its intent to build its first facility in Washington state under the ARDP award. TerraPower has announced its intent to build its first facility in Wyoming, at a retired coal plant site.

On December 16, 2020, DOE-NE announced the selections of five teams to receive $30 million in FY2020 funding under ARDP's Risk Reduction for Future Demonstration program.[44] DOE-NE's estimated long terms support for this program is about $600 (subject to appropriations). One of the awardees under this branch of the ARDP, Kairos Power, recently submitted the technical portion of its NRC application for a test reactor to demonstrate its advanced reactor technology.[45]

Finally, in December 2020, DOE-NE announced the recipients of the ARC 20 awards.[46] These provide $20 million in awards for the third of the ARDP programs. For the ARC-20 projects, DOE-NE expects to invest a total of approximately $56 million over four years with industry partners providing at least 20 percent in matching funds.

In addition to the ARDP, DOE-NE has provided support for the NuScale project, a next generation light-water reactor and now NRC certified design, and a planned power project for a 12-module NuScale power plant to be located at Idaho National Laboratory.

DOE-NE also offers other critical support for nuclear innovation, including through the Gateway for Accelerated Innovation in Nuclear (GAIN) program, which provides the private sector with access to R&D at our National Laboratories; its support for investing in the next generation of nuclear energy leaders and advancing university-led nuclear innovation under DOE-NE's Nuclear Energy University Program; support for the Versatile Test Reactor, a new research reactor that will be capable of performing irradiation testing at much higher neutron energy fluxes than what is currently available today and which is critical for domestic materials testing, among other things; international collaboration and engagements; and R&D support. DOE-NE is also supporting the Department of Defense on Project Pele, which is working with a couple advanced reactor companies to design a micro-reactor to deploy at forward operating bases to provide reliable power in war zones and eliminate fuel delivery-related deaths.[47]

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[43] *Id.*

[44] DOE-NE, *Energy Department's Advanced Reactor Demonstration Program Awards $30 Million in Initial Funding for Risk Reduction Projects*, (Dec. 16, 2021), available at https://www.energy.gov/ne/articles/energy -departments-advanced-reactor-demonstration-program-awards-30-million-initial.

[45] World Nuclear News, *Kairos submits PSAR for Oak Ridge demonstration reactor* (Oct. 5, 2021), available at https://www.world-nuclear-news.org/Articles/Kairos-submits-PSAR-for-Oak-Ridge-demonstration-re.

[46] DOE-NE, *Energy Department's Advanced Reactor Demonstration Program Awards $20 million for Advanced Reactor Concepts* (Dec. 22, 2020), available at https://www.energy.gov/ne/articles/energy -departments-advanced-reactor-demonstration-program-awards-20-million-advanced.

[47] *See U.S. Military's mobile mini-nuclear: fewer fuel supply convoys mean fewer casualties*, Energy Post, by James Conca (May 17, 2019), available at https://energy post.eu/u-s-militarys-mobile-mini-nuclear-fewer-fuel-supply-convoys-mean-fewer-casualties/); *see also* Army Environmental Policy Institute, *Sustain the Mission Project: Casualty Factors for Fuel and Water Resupply Convoys Final Technical Report* (Sept. 2009), available at https://apps.dtic.mil/dtic/tr/fulltext/u2/b356341.pdf. "Multiple studies identify that air and ground delivery of liquid fuel comes at a significant cost in terms of lives and dollars. Approximately 18,700 casualties, or 52% of the approximately 36,000 total U.S. casualties over a nine-year period during Operation Iraqi Freedom and Operation

DOE-NE is also providing support for fuels for advanced reactors. There's a pressing need for high-assay low enriched uranium (HALEU) for fuel for advanced reactors and it is not commercially available. The nuclear industry anticipates it may need nearly 600 metric tonnes of HALEU by 2030 in order to deploy new reactors to the market.[48] DOE-NE is exploring both near term and long terms option to support the development of HALEU fuel for advanced reactors.[49]

The development of advanced reactors, supporting by DOE-NE, will provide support for proving that advanced reactors can meet the promises they offer—including providing jobs, domestic and global economic opportunity, and large abouts of carbon free power.

III. A DEEPER DIVE: CLIMATE CHANGE AND U.S. INTERESTS IN THE GLOBAL MARKET

A. Deployment of advanced reactors provide a strong tool in combatting climate change

Nuclear energy, including both current operating nuclear technologies and advanced reactor technology, plays a critical role in the fight against climate change.

The United Nations Intergovernmental Panel on Climate Change (IPCC) released its sixth assessment report (IPCC Report) on August 9, 2021 saying that climate change is widespread, rapid, and intensifying, which likely did not come as a surprise to anyone.[50] What was surprising, however, was how confident the report was in its key messages, including the following:

- **Climate change is humans' fault**. It is "unequivocal" that human activity has caused global warning, causing rapid and widespread warming of the atmosphere, ocean, and land.

- **Climate change is happening faster than we thought.** Global warming was happening faster than previously anticipated, and global surface temperatures will continue to increase unless deep reductions in carbon dioxide and other greenhouse gas emissions occur in the coming decades.

- **World carbon dioxide levels are at an all-time high**. Carbon dioxide levels were greater in 2019 than they had been in at least two million years. Methane and nitrous oxide levels, the second and third major contributors of warming respectively, were higher in 2019 than at any point in at least 800,000 years.

- **Changes like this to the climate system haven't happened in thousands of years**. The scale of recent changes across the climate system is unprecedented—going back hundreds and thousands of years as to global surface temperature, Arctic ice area, and rise of sea level.

Enduring Freedom occurred from hostile attacks during land transport missions, mainly associated with resupplying fuel and water."

[48] DOE-NE, *What is High-Assay Low-Enriched Uranium (HALEU)?* (Apr. 7. 2020), available at https://www.energy.gov/ne/articles/what-high-assay-low-enriched-uranium-haleu.

[49] *Id.*

[50] IPCC Report, available at https://www.ipcc.ch/report/ar6/wg1/.

- **Every place on the planet is being affected right now.** Climate change has impacting every region of the world. Evidence of observed changes in extreme weather includes heatwaves, heavy rains, droughts, and stronger tropical storms, just since the last IPCC Report seven years ago. Many changes in the climate system have become larger in direct relation to increasing global warming—making these already intensifying events ever more intense.

- **Many changes cannot be reversed for thousands of years.** Barring geoengineering, many changes due to past and future greenhouse gas emissions will be irreversible for centuries to millennia, especially changes to the ocean, ice sheets and global sea level.

But like Pandora's Box, after all the bad news, there was still a message of hope– *it's not too late to slow down and eventually reverse the most harmful effects of climate change, but the world has a lot to do and must act immediately.*

Notably, if the world undertakes strong and sustained reductions in emissions of carbon dioxide and other greenhouse gases, the impacts of climate change can be limited. While benefits for air quality would come quickly, it could take another 20-30 years to see global temperatures stabilize. The general global goal is net zero carbon emissions by 2050.[51] For the U.S, these goals also includes cutting greenhouse gas emissions by half by 2030, making the electricity grid carbon neutral by 2035, and reaching a reaching net zero emissions economy-wide by no later than 2050.[52]

While new technologies are needed to help combat climate change—such as advanced battery storage systems to pair with intermittent renewables like wind and solar—the U.S. and the world have an incredibly powerful tool for decarbonization already available to maintain and deploy: nuclear power.

In looking at the big picture:

- **Cleaning the current energy sector will be an immense task.** Decarbonization is not going to be an easy task. The electricity sector itself accounts for about 25 percent of both the U.S. and global total[53] emissions, with fossil fuel providing more than 60 percent of electricity[54] generated in the United States and globally.[55] Beyond the grid, decarbonizing other sectors—such as transportation (29% of U.S. emissions) and industry (23% of U.S. emissions)—will require access to both new clean technologies

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[51] UN News, *What is net zero and why is it important?* (Dec. 2, 2020), available at https://news.un.org/en/story/2020/12/1078612.

[52] White House, *Fact Sheet: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies* (Apr. 22, 2021), available at https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy -technologies/.

[53] U.S. Environmental Protection Agency, *Sources of Greenhouse Gas Emissions*, available at https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions.

[54] U.S. Energy Information Administration (U.S. EIA), *Frequently Asked Questions*, available at https://www.eia.gov/tools/faqs/faq.php?id=427&t=3.

[55] Our World in Data, *Electricity Mix*, available at https://ourworldindata.org/electricity-mix#:~:text=In%202019%2C%20almost%20two%2Dthirds,and%20nuclear%20energy %20for%2010.4%25.

(such as batteries for vehicles) and new sources of energy to power those clean technologies.

- **Energy use is expected to double at the same time it needs to be decarbonized.** At the same time the world needs to decarbonize the energy sector, there will also be a huge uptick in demand—with the Energy Information Agency estimating a 50% increase in world energy use by 2050.[56] There are also nearly a billion people in the world without access to electricity.[57] So, not only does the world need to decarbonize the energy sector we have, when we build new energy sources to meet the increased demand, they need to be non-carbon emitting.

- **Decarbonization will not succeed if the lights do not stay on.** At the same time we need to decarbonize the grid, we need to make sure we have reliable power. As explained above, power outages cause immense safety and economic harms.

The IPCC report makes clear that we need to use everything in our arsenal to reduce greenhouse gas emissions. Moreover, we need immense sources of energy that do not produce greenhouse gases, that support a reliable electricity grid.

Nuclear energy fits this bill as a very powerful tool to be used to combat climate change, but is an often overlooked part of the climate change solution. As explained herein, advanced reactors in the U.S. are on the brink of deployment, showing that nuclear energy can play a key role in the energy transition from fossil fuels.[58] Advanced reactors, which produce process heat, can decarbonize the electric grid as well as heavy industry (which accounts for 23% of U.S. emissions itself).[59]

And along with the existing fleet of nuclear energy plants and advanced reactors, the world is on the brink of commercializing fusion power.[60] Fusion, the process that powers the Sun, has long been seen as the "holy grail" of energy production. Whereas nuclear reactors split atoms apart to release energy , fusion facilities push them together. A key trait that they each share is the ability to produce an immense amount of electricity without emitting carbon dioxide and other greenhouse gases.

As the world's largest producer of nuclear power, accounting for more than 30% of worldwide nuclear generation,[61] and the second largest greenhouse gas emitting country,[62] the

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[56] U.S. EIA, *Today in Energy* (Sept. 24, 2019), available at https://www.eia.gov/todayinenergy /detail.php?id=41433.
[57] International Energy Agency, *Access to electricity*, available at https://www.iea.org/reports/sdg7-data-and-projections/access-to-electricity.
[58] HL New Nuclear Blog, *Advanced Nuclear Energy can Support a Just Transition for Communities that were Reliant on Coal* (Apr. 30. 2021), available at https://www.hlnewnuclear.com/2021/04/advanced-nuclear-energy -can-support-a-just-transition-for-communities-that-were-reliant-on-coal/.
[59] U.S. EPA, *Sources of Greenhouse Gas Emissions*, available at https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions.
[60] Amy Roma and Sachin Desai, *The Regulation of Fusion – A Practical and Innovation-Friendly Approach* (Feb. 14, 2020), available at https://www.hoganlovells.com/en/publications/the-regulation-of-fusion-a-practical-and-innovation-friendly-approach.
[61] World Nuclear Association, *Nuclear energy in the USA* (Sept. 2021), available at https://world-nuclear.org/information-library/country-profiles/countries-t-z/usa-nuclear-power.aspx
[62] U.S. EPA, *Sources of Greenhouse Gas Emissions*, available at https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions.

U.S. has a responsibility to promote innovation and deployment of technologies that can meaningfully combat climate change. That includes, at a minimum, making sure nuclear energy is part of the discussion and part of the solution for combatting climate change.

B. <u>Nuclear reactors are being built all over the work and U.S. interests are supported by the U.S. participation in this market.</u>

The nuclear community is expanding across all corners of the globe. There are currently around 440 reactors in operation around the world, with about 50 reactors under construction in 16 countries.[63] There are also a number of advanced reactor technologies under development—about 130 in total—using cutting-edge technologies and capabilities (*see* Appendix B).[64]

And this is just the beginning, according to experts, the market for nuclear could triple by 2050 and generate $400 billion of electricity annually.[65] According to the Department of Commerce, over the next ten years, the international market for nuclear equipment and services will yield about $740 billion, and every $1 billion of exports by U.S. companies could support anywhere from 5,000 to 10,000 jobs domestically.[66] If carbon mitigation measures are deployed, the 30-year cumulative market domestic opportunity for nuclear energy could reach up to $2 trillion, within a global market valued at around $8.6 trillion.[67]

With prospects such as these on the horizon, if the U.S. expects to become competitive, it must align its policies and programs with that goal.[68] This is what the competition is doing. While globally, nuclear energy is taking off, using traditional large light water reactor technology offerings, the U.S. has been struggling to gain a foothold in the foreign market competing against the aggressive tactics of Russia and China. These countries have invested heavily into building power plants across the world, in order to realize the economic and geopolitical benefits of having their customers dependent on Russian and Chinese-managed energy resources.

Russia dominates the global nuclear new build marketplace, and has secured 60% of nuclear reactor sales around the world.[69] China planning on coming up close on its heels.[70] China has built almost half of all nuclear reactors constructed since 2000 and has designed numerous others outside its borders.[71] Nuclear development in these competitor countries are government-

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[63] World Nuclear, *Plans for New Reactors Worldwide* (Mar. 2021), available at https://www.world-nuclear.org/information-library/current-and-future-generation/plans-for-new-reactors-worldwide.aspx.
[64] Third Way, *2020 Advanced Nuclear Map: Progress Amidst a Tumultuous Year* (Dec. 21, 2020), available at https://www.thirdway.org/graphic/2020-advanced-nuclear-map-progress-amidst-a-tumultuous-year.
[65] Third Way, *Mapping the Global Market for Advanced Nuclear* (Sept. 22, 2020), available at https://www.thirdway.org/memo/mapping-the-global-market-for-advanced-nuclear.
[66] Nuclear Energy Institute, *Nuclear Exports & Trade Overview*, available at https://www.nei.org/advocacy/compete-globally.
[67] *Global Nuclear Market Assessment Based on IPCC Global Warming of 1.5° C Report*, Prepared by UxC, LLC for the Nuclear Energy Institute (Jul. 2020), at 1 and 4, available at https://www.nei.org/resources/reports-briefs/uxc-global-nuclear-market-assessment-report.
[68] Breakthrough Energy , *Advancing the Landscape of Clean Energy Innovation* (Feb. 2019), available at https://www.breakthroughenergy.org/reports/advancing-the-landscape/.
[69] Nuclear Energy Institute, *Russia and China Are Expanding Nuclear Energy Exports. Can the U.S. Keep Up?* (Oct. 6. 2020), available at nei.org/news/2020/russia-china-expanding-nuclear-exports-us-keep-up.
[70] World Nuclear Association, *Plans for New Reactors Worldwide* (updated Sept. 2021), available at https://www.world-nuclear.org/information-library/current-and-future-generation/plans-for-new-reactors-worldwide.aspx.
[71] VOA News, *China on Track to Supplant US as Top Nuclear Energy Purveyor* (Jan. 14, 2020), available at https://www.voanews.com/east-asia-pacific/voa-news-china/china-track-supplant-us-top-nuclear-energy -purveyor.

backed, providing the respective countries' nuclear industry with financial, political and regulatory support, making it almost impossible for the U.S. to compete globally. *See* Appendix B, Map 1. This not just risks U.S. safety, but the longevity of U.S.-built nuclear safety and proliferation standards.

Russia has more than 50 reactors either under construction, planned, or proposed in 19 countries. Russia has stated that its book of business for nuclear construction projects is well over $130 billion.[72] Russia further estimates every 1 ruble of nuclear export contributes 2 rubles to national GDP. Russia has also developed the first modern floating small modular reactor technology, and is paving the way for fast reactors with closed nuclear fuel cycles through its Proryv Project where fuel is recycled to reduce nuclear waste.

China further estimates that it could build as many of 30 overseas reactors by 2030 (which is just 20% of the anticipated "Belt and Road" market), earning up to $145.5 billion and employing up to 5 million Chinese workers.[73] China has 49 operable nuclear reactors and 16 currently under construction.[74]

Aligned with its goal of becoming a leader in nuclear, China is exploring advanced nuclear options as well as maintaining and developing its nuclear fleet. China is building a molten salt reactor (a new type of advanced nuclear reactor) for potential application on aircraft carriers for naval population and flying drones.[75]

In addition, Russia and China are developing nuclear powered ice breakers for use in the arctic, an area of growing strategic importance for great power competition. Just recently, China closed its bidding process that solicited interest for a 152-meter, 33,069-ton nuclear-powered

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[72] World Nuclear Association, *Nuclear energy in Russia* (updated Jan. 2021), available at https://www.world-nuclear.org/information-library/country-profiles/countries-o-s/russia-nuclear-power.aspx.

[73] *Xi Touts BRI Nuclear Energy* , Analysis: In the News, Center for Strategic and International Studies (Aug. 2, 2019), https://reconnectingasia.csis.org/analysis/entries/bri-goes-nuclear/.

[74] World Nuclear, *Nuclear energy in China* (Jan. 2021), available at https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/china-nuclear-power.aspx. By way of background, China introduced its Belt and Road Initiative ("BRI") in 2013. Through the BRI, China initially sought to connect to the rest of Asia, as well as Africa and Europe, via land and maritime networks with the aim of spurring economic growth through interconnectivity. However, since its inception, BRI has now spanned to all regions of the world.1 The BRI is the largest ever global infrastructure undertaking. Under the BRI, Chinese banks and companies have provided billions of dollars for funding to build roads, power plants, railways, ports, and telecommunications infrastructure in dozens of countries. The objectives of BRI focus on establishing and building linkages between China and the rest of the world in the following five areas: (1) enhanced policy coordination; (2) improved infrastructure connectivity; (3) reinforced trade and investment cooperation; (4) financial integration; and (5) supporting people-to people collaboration. But the BRI efforts are not without consequences to both the host country and the United States. A recent Council on Foreign Relations Task Force report examining China's BRI finds "that BRI worryingly adds to countries' debt burdens, locks countries into carbon-intensive futures, tilts the playing field in major markets toward Chinese companies, and draws countries into tighter economic and political relationships with Beijing." Council on Foreign Relations, *Independent Task Force Report No. 79, China's Belt and Road, Implications for the United States*, updated Mar. 2021, at vii available at https://www.cfr.org/report/chinas-belt-and-road-implications-for-the-united-states/. The CFR Task Force concludes that "the risks for both the United States and host countries raised by BRI's implementation considerably outweigh its benefits." *Id.*

[75] Michael Wallace, Amy Roma, and Sachin Desai, *Back from the Brink: A Threatened Nuclear Energy Industry Compromises National Security*, Center for Strategic and International Studies (Jul. 2018), available at https://www.csis.org/analysis/back-brink-threatened-nuclear-energy -industry-compromises-national-security.

vessel.[76] Also Russia has 38 reactors in operation and 2 under construction domestically, and has stated that its book of business for nuclear construction projects is well over $130 billion.[77] It developed the first modern floating SMR technology,[78] and is paving the way for fast reactors with closed nuclear fuel cycles through its Proryv Project where fuel is recycled to reduce nuclear waste. China, in particular, plans to build a number of floating nuclear reactors to provide power to the artificial islands that it is building in the South China Sea.[79] *See* Appendix B, Map 2 for global advanced reactor developments.

Russian energy policy, in particular, expressly recognizes the export of energy technologies as a geostrategic tool to promote Russian national security, while China appears to generally view nuclear energy exports as an important economic opportunity. Nonetheless, lower-cost "turnkey" projects offered by the Russians and Chinese—which include state-supported financing packages, and "build, own, operate" models that handles the entire project and fuel cycle from start to finish—shuts out the United States. As China and Russia succeed in the deployment of their nuclear energy technologies in emerging economies, they gain critical geopolitical influence in these countries by effectively controlling baseload power and the fuel cycle to run these nuclear units. This influence runs for the long-term, at least for the life of the project and plant which can stretch to 100 years, with long-term implications for the geopolitical balance of power and economic influence, potentially threatening U.S. peace and security.

For example, Egypt and Russia recently finalized a $21 billion contract for the Russians to supply four reactors in Egypt.[80] A few months later, Egypt and Russia announced a preliminary agreement to allow Russian military jets to use its airspace and bases. The agreement will give Russia its deepest presence in Egypt since 1973.[81]

In fact, our core strategic allies—i.e., Japan, United Kingdom, and Korea—are also our main strategic nuclear generation partners. Other alliances that are less mature, such as that with the United Arab Emirates, have been solidified through more recent nuclear cooperation

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[76] South China Morning Post, *Could China's 'experimental' ship be the world's biggest nuclear-powered icebreaker?*, available at https://www.scmp.com/news/china/military/article/3002455/china-build-30000-tonne-nuclear-powered-ship-described.

[77] World Nuclear, *Nuclear energy in Russia* (Feb. 2021), available at https://www.world-nuclear.org/information-library/country-profiles/countries-o-s/russia-nuclear-power.aspx.

[78] World Nuclear News, Russia connects floating plant to grid (Dec. 2019), available at https://world-nuclear-news.org/Articles/Russia-connects-floating-plant-to-grid.

[79] *See* Viet Phuong Nguyen, The Diplomat, *China's Risky Plan for Floating Nuclear energy Plants in the South China Sea* (May 10, 2018), available at https://thediplomat.com/2018/05/chinas-risky-plan-for-floating-nuclear-power-plants-in-the-south-china-sea/.

[80] *See* Al-Masry Al-Youm, Egypt Independent, *Construction of First Nuclear Reactor at Dabaa Station to Start after Christmas Holidays* (Dec. 13, 2017), available at http://www.egyptindependent.com/construction-first-nuclear-reactor-dabaa-station-start-christmas-holidays/. The article notes that of the $21 billion price tag for the four new reactors, Russia will fund 85 percent of the plant through a loan, and the rest will be financed by Egypt. The deal was finalized in September 2017.

[81] *See* David D. Kirkpatrick, *In Snub to U.S., Russia and Egypt Move toward Deal on Air Bases*, New York Times (Nov. 30, 2017), available at https://www.nytimes.com/2017/11/30/world/middleeast/russia-egypt-air-bases.html. ("The United States has provided Egypt more than $70 billion in aid in the four decades since, at a rate of more than $1.3 billion a year in recent years. The cost is often justified in part by the argument that it secures the use of Egypt's airspace and bases for the U.S. military.")

agreements.[82] Many key U.S. allies and areas of geostrategic importance lack domestic energy reserves and are highly dependent on foreign energy imports making them dependent on other countries to support their energy needs. Nuclear energy plants provided by the U.S. can reduce our allies' dependence on potentially unstable energy sources, and deepen U.S. ties. And in the same vein, nuclear energy plants provided by our strategic competitors can harm long-term U.S. ties.

But there is opportunity still to turn things around. Around 30 countries across the Middle East, Africa, Central and South America, Europe, and Southeast Asia are considering or beginning new nuclear energy programs—each of which is an opportunity for the U.S. to regain a foothold in the global market.[83] In Europe Hungary and Poland are planning to site new nuclear reactors to replace retired energy systems.[84] A United Kingdom government whitepaper sets forth the Prime Minister's plan to tackle climate change and includes both large and small scale nuclear.[85]

With this incredible expanse of nuclear globally, U.S. innovation in nuclear energy can stand up to state backed competitors. We saw this in the aerospace market when Russia ceded control of the global commercial launch industry, a $5.5 billion market.[86] In 2013, Russia controlled about half of the launch industry with its fleet of launch vehicles, including rockets and Proton boosters. It is now estimated to capture only 10% of the market, due in part to competition from SpaceX.[87]

Continued U.S. presence in the global nuclear market is not good just for U.S. jobs and politics. It is also critically important to ensure that the most stringent safety and nonproliferation standards are exercised. While there are only nine counties today with nuclear weapons, despite President John F. Kennedy's prediction that there would be as many as 25 nuclear-armed states by the 1970's, strong nonproliferation standards are critical to developing the nuclear industry.[88] Developing and spreading U.S. nuclear technology will help ensure high standards for safety and nonproliferation globally.[89] The U.S. has historically used its technological leadership in nuclear energy to promote its geopolitics interests and nonproliferation objectives worldwide. This started with President Eisenhower's "Atoms or Peace" speech in 1954 and continued with the negotiation

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[82] Michael Wallace, Amy Roma, and Sachin Desai, *Back from the Brink: A Threatened Nuclear Energy Industry Compromises National Security*, Center for Strategic and International Studies (Jul. 2018), available at https://www.csis.org/analysis/back-brink-threatened-nuclear-energy -industry-compromises-national-security.
[83] World Nuclear, *Emerging Nuclear Energy Countries* (Mar. 2021),, available at https://www.world-nuclear.org/information-library/country-profiles/others/emerging-nuclear-energy -countries.aspx.
[84] World Nuclear News, *Hungary and Poland plan nuclear to replace coal* (Mar. 5. 2021), available at https://www.world-nuclear-news.org/Articles/Hungary-and-Poland-plan-nuclear-to-replace-coal.
[85] HM Government, Powering our Net Zero Future (Dec. 2020), available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945899/201216_BEIS_EWP_Command_Paper_Accessible.pdf.
[86] Ars Technica, Russia appears to have surrendered to SpaceX in the global launch market (Apr. 18, 2018), available at https://arstechnica.com/science/2018/04/russia-appears-to-have-surrendered-to-spacex-in-the-global-launch-market/)
[87] *Id.*
[88] Press Conference, President John F. Kennedy, President's News Conference (Mar. 21, 1963), available at https://perma.cc/B7LW-7WYR); Nuclear Weapons Programs Worldwide: An Historical Overview, INST. FOR SCI. & INT'LSECURITY, available at https://perma.cc/3XQV-P7LY.
[89] Atlantic Council, *U.S. Nuclear Energy Leadership: Innovation and the Strategic Global Challenge, Report of the Atlantic Council Task Force on U.S. Nuclear Energy Leadership* (May 2019), available at https://www.atlanticcouncil.org/wp-content/uploads/2019/05/US_Nuclear_Energy _Leadership-.pdf); *see* World Nuclear Association, *Nuclear energy in Russia* (last updated Aug. 2021), available at https://www.world-nuclear.org/information-library/country-profiles/countries-o-s/russia-nuclear-power.aspx.

of the Non-Proliferation Treaty (NPT) in 1968—where the world's nuclear powers agreed to share civilian nuclear technology with non-nuclear states who agreed to forego nuclear weapons. The U.S. has required each country with whom it has worked to sign and enforce strict commitments on the sharing of nuclear technology (i.e., U.S. 123 Agreements); adopt U.S. operational safety standards (e.g., those promulgated by the U.S. Institute of Nuclear energy Operations); and set forth a global fuel supply framework that reduces risk of proliferation (e.g., 2007 U.S. Assured Fuel Supply Program).

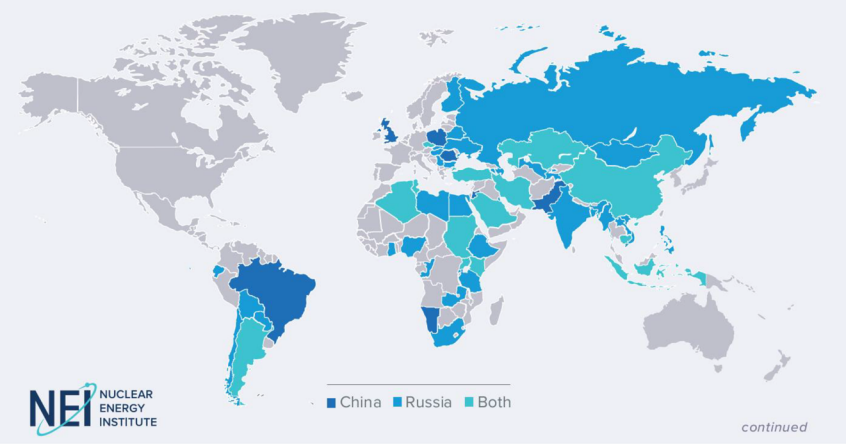
The importance of DOE-NE is advancing the development of advanced reactors and enabling their success in both the U.S. and abroad cannot be understated.

IV. CONCLUSION

Thank you for the opportunity to testify before the Subcommittees on the importance of nuclear energy in our current and future energy structure, and the key role that DOE-NE plays in driving this success. This is a pivotal time for the U.S. energy transition and the failure to recognize the case for advancing nuclear development with full-force congressional support will be a major loss for this country. Innovative U.S. companies working hard on advanced nuclear technologies should not be tempted to develop their work abroad for a lack of support at home. Americans who have dedicated their careers to supporting the energy sector should not miss out on well-paying jobs because the U.S. could not recognize a major opportunity in a growing field in time. And global safety and security should not be compromised due to the U.S.'s inaction in leveraging its relationships with other countries for the common good. Supporting the existing nuclear fleet and providing the resources and backing necessary for advanced nuclear to thrive can help keep the U.S. as a forerunner in the nuclear industry globally.

Appendix A

Map 1. Russia and China Global Presence



Source: Nuclear Energy Institute, 2020[90]

[90] Nuclear Energy Institute, *Russia and China Are Expanding Nuclear Energy Exports. Can the U.S. Keep Up?* (Oct. 6. 2020), available at nei.org/news/2020/russia-china-expanding-nuclear-exports-us-keep-up.

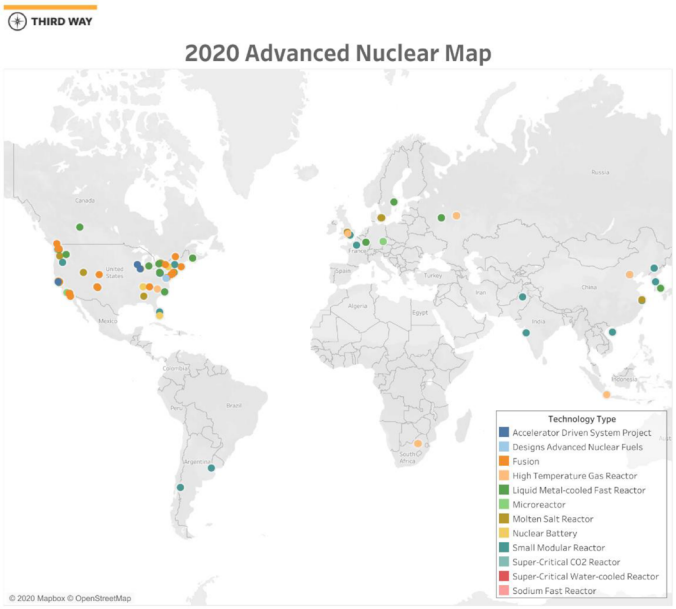
Map 2. Russian and Chinese LWR Export Targets

Source: Global Nexus Initiative, 2019[91]

[91] Global Nexus Initiative, *Responding to Climate Change and Strengthening Global Security* (2019), available at https://globalnexusinitiative.org/results/reports/advancing-nuclear-innovation-responding-to-climate-change-and-strengthening-global-security/.

Attachment B

Map 1. Global Advanced Nuclear Technology Development



Source: Third Way, 2020.[92]

[92] Third Way, *2020 Advanced Nuclear Map: Progress Amidst a Tumultuous Year* (Dec. 21, 2020), available at https://www.thirdway.org/graphic/2020-advanced-nuclear-map-progress-amidst-a-tumultuous-year.

Amy C. Roma

Biography

In Amy's role as a Partner at one of the largest law firms in the world, she counsels clients on all types of legal, business and policy matters involving the commercial nuclear energy industry, including issues involving the existing nuclear fleet, advanced reactors, fusion facilities, and supporting nuclear infrastructure. She also serves as the Global Energy Practice Area leader.

Amy has spearheaded many first-of-its-kind, cutting-edge energy projects in the United States and was recognized as one of the Top 10 Legal Practitioners in North America by the Financial Times "Special Report on North America Innovative Lawyers" (Dec. 2020) and by the National Law Journal in the first edition of "Energy & Environmental Trailblazers" (Apr. 2015), a special supplement paying tribute to the top 50 "great minds impacting the crucial intersection of energy production and the environment."

Amy is a prolific writer and public speaker on nuclear energy matters. She recently testified before the Senate Energy and Natural Resources Committee (Mar. 2021) and the Senate Energy and Public Works Committee (Aug. 2020) on the economic, climate, and national security benefits of nuclear energy for the United States.

A strong believer in community involvement, Amy also engages in extensive pro bono work, with more than 500 hours of pro bono work in 2020, and over 600 hours in 2021 to date. Tecently, Amy lead the legal team for the New England Patriots to send the team plane to China and import and donate two million N95 masks for the states of Massachusetts and New York to combat the COVID-19 pandemic. Amy is also a member of the firm's Environmental, Social, and Governance (ESG) Board.
Amy began her legal career at the U.S. Nuclear Regulatory Commission. She has been a partner at the firm since 2015. More information on her experience is available at her firm

Chairman FOSTER. Thank you. And next, Dr. Allen is recognized for five minutes.

TESTIMONY OF DR. TODD ALLEN, DIRECTOR, MICHIGAN MEMORIAL PHOENIX PROJECT AND GLENN F. AND GLADYS H. KNOLL DEPARTMENT CHAIR OF NUCLEAR ENGINEERING AND RADIOLOGICAL SCIENCES, UNIVERSITY OF MICHIGAN

Dr. ALLEN. Good morning, Chairman Foster, Chairman Bowman, Ranking Member Weber, Ranking Member Obernolte, and other distinguished Members of the Subcommittees. Thank you for the imitation to provide testimony on the importance of judicious spending to enable success at the Office of Nuclear Energy. My testimony today represents my own views and not those of my employer or any other organization with which I'm affiliated. I will focus on the pressing need for the creation of strategic and coordinated private-public pathways for the development of nuclear energy technologies.

Currently, approximately 50 American entrepreneurial companies are working to rapidly bring the next generation of advanced reactor technologies to the market with an emphasis on new energy applications and business models beyond large electricity production. The most advanced of these companies are in discussions with the U.S. Nuclear Regulatory Commission aiming to build their first plants in the next 5 to 10 years. Others are actively working with the National Reactor Innovation Center to demonstrate their novel technologies on a similar timescale. This is an exciting time for nuclear energy.

Congress has noted this emerging new commercial activity and responded in a timely and positive bipartisan manner with many legislative actions that have provided access to testing capabilities, streamlined the regulatory environment, established a demonstration program, and established a strong private-public partnership program. During this period, Congress has also increased overall budgets to provide more opportunities at universities and laboratories to not only support this first generation of advanced reactor deployments but also to innovate toward future generations of advanced nuclear energy systems.

While Congress' support for nuclear energy has been strong and many new important program elements have been established, these program elements still often appear to operate independently rather than as an integrated whole. The sophistication of the research, development, demonstration, and deployment program elements have increased thanks to congressional support. But the sophistication of the integrated program execution and project management have not yet caught up.

The Department of Energy programs need to simultaneously coordinate and support many things: a national research infrastructure program, early innovation, concept development, demonstrations, and ultimately, commercial deployment. Historically, the federally funded U.S. nuclear research programs have not consistently balanced all five of these elements. Continued and future success requires finding this balance.

One of the consequences of past insufficient program integration and lack of programmatic consistency is the limited results from previous nuclear technology development and deployment efforts. Though these programs have received significant investments, they've struggled to transition from programmatic success to commercial development and use. Therefore, a framework of principles and policies needs to be established that guides the programs and drives technologies for new ideas to deployment.

What might some of these principles include? A larger set is submitted with my written testimony, but I will highlight two examples. We should encourage early stage research that pushes the envelope but which might not yet yield near-term results. Such research drives innovation for decades. Early stage research should be daring. We should decide which early stage research should be continued based on the success of the research and not predetermined timeframes, as has become the inclination at the Department of Energy.

Second, we should support well-structured private-public cost-sharing as an important element in accelerating innovative technology deployment. Commercial deployment of new technologies is more likely to succeed if led by industry rather than by research institutions. The continued funding of these partnerships should depend on the success of meeting specific, measurable technical and financial milestones. The private-public partnerships should evolve based on performance rather than follow a fixed multiyear plan. Programs from infrastructure to early innovation to deployment need to connect to ensure the best new ideas are developed and deployed in a timely manner. Operationalizing these principles may require rethinking program structures and interfaces.

Additionally, it's important to provide the Office of Nuclear Energy sufficient staffing to evolve and support their management programs and to support collaborative work across the DOE. The funds provided to the staff of the Office of Nuclear Energy have not increased sufficiently even as R&D budgets have grown approximately 60 percent over the past 5 years.

So we're currently in an exciting and ambitious time for nuclear energy. Over the past three Administrations, Congress has provided increased funding and legislative support, recognizing the importance of nuclear technology for providing clean, reliable energy and supporting good jobs. A number of new critical program elements have been initiated, and a few more are needed. The principles and structures upon which these programs are executed need to be established to ensure funding is best used as we build 21st-century energy systems. I look forward to this dialog, as well as the support of the Committee as it considers how to enable success at the Office of Nuclear Energy. Thank you.

[The prepared statement of Dr. Allen follows:]

Good morning, Chairman Foster, Chairman Bowman, Ranking Member Weber, Ranking Member Obernolte, and other distinguished members of the Subcommittees. Thank you for the invitation to provide testimony on the importance of Judicious Spending to Enable Success at the Office of Nuclear Energy.

My testimony today represents my own views and not those of my employer or any other organization with which I am affiliated.

I will focus on the pressing need for the creation of strategic and coordinated private-public pathways for the development of nuclear energy technologies.

Where are we in the history of nuclear power development

Currently, approximately 50 American entrepreneurial companies are working to rapidly bring the next generation of advanced reactor technologies to the market, with an emphasis on new energy applications and business models beyond large electricity production. The most advanced of these companies are in discussions with the US Nuclear Regulatory Commission aiming to build their first plants in the next 5 to 10 years. Others are actively working with the National Reactor Innovation Center to demonstrate their novel technologies on a similar time scale. This is an exciting time for nuclear energy.

The Pivot of 2015-2020

Congress has noted this emerging new commercial activity and responded in a timely and positive bi-partisan manner with many legislative actions that provided access to testing capabilities, streamlined the regulatory environment, established a demonstration program, and established a strong private-public partnership program.

During this period, Congress has also increased overall budgets to provide more opportunities at universities and laboratories to not only support this first generation of advanced reactor deployments, but also to innovate towards future generations of advanced nuclear energy systems.

The need to structure RDD&D program management for success

While Congress' support for nuclear energy has been strong and many new important program elements have been established, these program elements still often appear to operate independently rather than as an integrated whole. The sophistication of the research, development, demonstration, and deployment program elements have increased thanks to Congressional support, but the sophistication of the integrated program execution and project management have not yet caught up.

The Department of Energy programs need to simultaneously coordinate and support many things: a national research infrastructure program, early innovation, concept development, demonstrations, and ultimately commercial deployment. Historically, the

federally funded U.S. nuclear research programs have not consistently balanced all five of these elements. Continued and future success requires finding this balance.

One of the consequences of past insufficient program integration and lack of programmatic consistency is the limited results from previous nuclear technology development and deployment efforts. Though these programs have received significant investments (~$2 billion since the late 1990s), they struggled to transition from programmatic success to commercial development and use (Appendix B). Therefore, a framework of principles and policies needs to be established that guides the programs and drives technologies from new ideas to deployment. What might some of these principles include (Appendix B, D)? A larger set is submitted with my written testimony, but I will highlight two examples:

1. We should encourage early-stage research that pushes the envelope (Appendix C) but which might not yield near-term results. Such research drives innovation for decades. Early-stage research should be daring! We should decide which early-stage research should be continued based on success of the research and not pre-determined time frames as has become the inclination at the DOE.
2. We should support well-structured private-public cost sharing as an important element in accelerating innovative technology development. Commercial deployment of new technologies is more likely to succeed if led by industry rather than by research institutions. The continued funding of these partnerships

should depend on the success in meeting specific measurable technical and financial milestones. The private-public partnerships should evolve based on performance rather than follow a fixed multi-year plan.

Programs, from infrastructure to early innovation to deployment, need to connect to ensure the best new ideas are developed and deployed in a timely manner. Operationalizing these principles may require re-thinking program structures and interfaces. It is important to engage the academic, laboratory, and practitioner communities broadly to provide independent advice on these principles.

There are also tremendous opportunities for the Office of Nuclear Energy to achieve its goals through collaboration and synergy with other programs and offices across DOE, such as the Loan Programs Office, the DOE NNSA to integrate safeguards into the design principles of advanced reactors, and cross-cutting hydrogen programs.

Additionally, it is important to provide the Office of Nuclear Energy sufficient staffing to evolve and support their management programs and to support collaborative work across DOE. The funds provided to staff the Office of Nuclear Energy have not increased sufficiently even as the R&D budgets have grown approximately 60% over the past 5 years.

Conclusion

We are currently in an exciting and ambitious time for nuclear energy. Over the past three administrations, Congress has provided increased funding and legislative support for nuclear energy, recognizing the importance of nuclear energy for providing clean reliable energy and supporting good jobs. A number of new, critical programs have been initiated and a few more are needed. The principles and structures upon which these programs are executed need to be established to ensure the funding is best used as we build 21st century energy systems.

I look forward to this dialogue as well as to supporting the Committee as it considers how to enable success at the Office of Nuclear Energy.

Appendix A

Where are we in the trajectory of nuclear power development: past and present practices and the need for an equity-centering future

Currently, 93 large light water reactors provide roughly 20% of the U.S. electricity. This is over 50% of the U.S. zero carbon electricity.

These reactors were built primarily during the 1960s through 1990s at a rate of about 30 GW per decade, proving we can build nuclear power at a rapid rate through the strategic coordination of private and public efforts. Many first-generation plants are now working with the Nuclear Regulatory Commission to extend their licenses to 60 years and 80 years. Other first-generation plants have started to shut down, often due to financial pressures based on the design of deregulated electricity market rules where the plant operates.

At the same time, approximately 50 entrepreneurial companies are working to rapidly bring the next generation of advanced reactor technologies to the market, with an emphasis on new energy applications and business models beyond large electricity production – including as examples, the provision of community scale heat and electricity to U.S. and international markets and direct heat to industry. The emerging low carbon energy systems – which combine firm sources of energy such as nuclear

reactors with variable sources such as renewables -- are more complex than those of the 20th century.

The most advanced of these companies are in discussions with the US Nuclear Regulatory Commission aiming to build first plants towards the end of this decade. Still others are actively working with the National Reactor Innovation Center to demonstrate their novel technologies on a similar time scale.

As we create these low carbon energy systems of the near future, we need to build new energy technologies that are simultaneously clean, affordable, resilient, and equitable. This last consideration is especially important for the energy sector writ large and the nuclear sector specifically because historic efforts to develop nuclear technologies -- energy and weapons -- have created inequities disproportionately borne by communities of color -- especially indigenous communities. (These communities are sometimes referred to as environmental justice communities.) These legacies of inequity require that special care and attention be paid, and reparative measures be undertaken, as the industry considers the development and use of a new generation of technologies.

Indeed, the DOE's Office of Nuclear Energy recognizes the importance of these considerations as it has called for centering principles of equity and justice and pursuing a sociotechnical approach to reactor develoployment in its most recent Consolidated Innovative Nuclear Research Funding Opportunity Announcement. As discussed in

Appendix D, an overarching equity-centering principle is needed to guide research, development, demonstration, and deployment efforts across the nuclear sector. Such an approach should be pursued because it is the right thing to do and also because it is likely to lead to the development of technologies that will successfully be put to use in service of society.

Appendix B

The following reference documents are suggested

- The U.S. Nuclear R&D Imperative, A Report of the American Nuclear Society Task Force on Public Investment in Nuclear Research and Development, February 2021. Chapter 4 on research structures is relevant.
- A Abdulla, M J Ford, MGMorgan, and D G Victor, “A retrospective analysis of funding and focus in US advanced fission innovation,” Environ. Res. Lett. 12 (2017) 084016
- Enabling Nuclear Innovation, In Search of A SpaceX for Nuclear Energy: A report by the Nuclear Innovation Alliance, May 2019

Appendix C

Illustrative examples

Major databases that require continuous modernization

- Nuclear cross sections
- Material and fuel properties
- Thermo-physical properties
- Public sentiment
- Multi-physics codes

Examples of early stage research

- Quantum computing
- Development of novel materials for applications in radiation intensive environments
- New manufacturing approaches such as additive manufacturing
- Artificial intelligence and sensing networks
- Automation
- Integrated Energy Systems
- Cybersecurity of interconnected systems
- Socially-engaged complex system design
- Consent-based processes

Appendix D

Example principles and policies to guide RDD&D programs

1. We should continually protect and modernize key national infrastructure and make it available to many innovators, from universities to laboratories to companies. This includes traditional infrastructure like test reactors and supercomputers, but also critical data sources and the educational infrastructure. Making critical research infrastructure widely available is essential because innovators and reactor developers today, unlike in the past, are carrying out technology design and development work in a variety of settings including startups, large companies, national labs, and universities. Increasing the availability of critical infrastructure ensures that novel ideas, wherever they emerge, will be pursued towards full development and commercialization.

2. We should encourage early-stage research that pushes the envelope but which might not yield near-term results. Such research drives innovation for decades. Early-stage research should be daring! We should decide which early-stage research should be continued based on success of the research and not pre-determined time frames as has become the inclination at the DOE.

3. We should decrease the time to make research funding decisions. The current lead time between concept development, proposal writing and funding is

over 18 months, which is effectively several years when you include uncertainty of funding, where several proposals are revised multiple times before successfully receiving research funding. When you include the time to perform the research, the period may exceed 5 years. This is one of the reasons why there is a disconnect between industry needs and the work of the research community.

4. We should support well-structured private-public cost sharing as an important element in accelerating innovative technology development. Commercial deployment of new technologies is more likely to succeed if led by industry rather than by research institutions. The continued funding of these partnerships should depend on the success in meeting specific measurable technical and financial milestones. The private-public partnerships should evolve based on performance rather than follow a fixed multi-year plan.

5. We should seek community input and engagement from the earliest stages of technology design and development towards ensuring that technologies being developed will ultimately be adopted by communities. Such an approach is especially important in light of historic inequities created by the development and use of nuclear energy, as well as the distributed and community-scale nature of new nuclear energy technologies. There is an unprecedented and urgent need to emphasize principles of equity and environmental justice in technology design and development.

Appendix E

Statement on Participation in a National Academy of Science, Engineering, and Medicine Consensus Committee

I am a member of a National Academies consensus committee whose task is to assess the opportunities and barriers to commercializing new and advanced nuclear technologies within the next 30 years, and in the context of decarbonization. The committee has made no findings, recommendations, or conclusions. Such results will only appear after the committee's final report has been written, reviewed, and formally released in the summer of 2022. The views expressed in this testimony are my own and do not reflect the thinking of that committee.

Appendix F

Examples of Recent Congressional Support for Nuclear Energy

· Passing the 2018 Nuclear Energy Innovation Capabilities Act to enable the testing and demonstration of reactor concepts proposed and funded by the private sector.

· Passing the 2019 Nuclear Energy Innovation and Modernization Act requiring the Nuclear Regulatory Commission to develop a regulatory framework for America's innovators who seek to deploy advanced nuclear technologies

· Funding the 2019 Nuclear Reactor Innovation Center, providing access to U.S. Government resources, facilities, sites, infrastructure, and expertise and

· Funding the Advanced Reactor Demonstration Program in 2020 to help the next generation of American nuclear reactors make the transition from concept to technology demonstration as a precursor to commercial development

Appendix G Personal History

My perspective on nuclear energy technology development comes from a diverse career working in the U.S. submarine fleet, as an academic at the University of Wisconsin and now at The University of Michigan, as a senior leader at the Idaho National Laboratory, and with the think tank Third Way. I also gain perspective as a Board member of the Nuclear Innovation Alliance and the Nuclear Energy Institute, as well as being the Chair of the Nuclear Engineering Department Heads Organization.

Dr. Todd Allen is Professor at the University of Michigan and a Senior Fellow at Third Way, a DC base Think Tank, supporting their Clean Energy Portfolio. He was the Deputy Director for Science and Technology at the Idaho National Laboratory from January 2013 through January 2016. Prior to INL he was a Professor in the Engineering Physics Department at the University of Wisconsin, a position held from September 2003 through December 2012 and again from January 2016-December 2018. From March 2008-December 2012, he was concurrently the Scientific Director of the Advanced Test Reactor National Scientific User Facility at INL. Prior to joining the University of Wisconsin, he was a Nuclear Engineer at Argonne National Laboratory-West in Idaho Falls. His Doctoral Degree is in Nuclear Engineering from the University of Michigan (1997) and his Bachelor's Degree in Nuclear Engineering is from Northwestern University (1984). Prior to graduate work, he was an officer in the United States Navy Nuclear Power Program.

Chairman FOSTER. Thank you. And finally, Mr. Amey is recognized for five minutes.

TESTIMONY OF MR. SCOTT AMEY,
GENERAL COUNSEL AND EXECUTIVE EDITORIAL DIRECTOR,
PROJECT ON GOVERNMENT OVERSIGHT

Mr. AMEY. Yes, thank you. Good morning. And I want to thank Chairman Foster, Bowman, and Ranking Members Obernolte and Weber and the Members of the Subcommittee for asking the Project on Government Oversight to testify about Federal spending best practices. I am Scott Amy, POGO's General Counsel and Executive Editorial Director. POGO is a nonpartisan independent watchdog that investigates and exposes waste, corruption, abuse of power, and when the government fails to serve the public or silences those who report wrongdoing. We made our mark in the 1980's spotlighting oversight on toilet seats, coffee makers, and hammers at the Department of Defense (DOD).

Throughout our 40-year history, POGO has created a niche in investigating, exposing, and helping to remedy waste, fraud, abuse, and government spending. We called attention to systems that placed taxpayer funds at risk and supported reforms that enhanced competition, accountability, oversight, and transparency. POGO also has a long history of investigating wasteful spending and performance issues at DOE and even a revolving-door instance that may be relevant to today's hearing.

Let's start this morning by putting Federal contracting grant spending in perspective. Those dollars have more than tripled since 2000 when contracts and grants totaled $500 billion. In Fiscal Year 2020 that total exploded to $1.6 trillion with contracts and grants totaling $667 billion and $971 billion respectfully. While energy is not spending money at that pace, DOE's spending on contracts and grants nearly doubled to just under $40 billion in 2020. Those numbers show that the government is handing out money at unprecedented levels, and we need to follow best practices, and we need financial stewards who spend money wisely.

Many events over the past 20 years have called into question the effectiveness of our spending systems. Spending has grown tremendously. The acquisition and grant workforces are stretched thin. Oversight has decreased, and spending on services now outpaces spending on goods. These—this changing landscape sometimes places public funds at risk. I present two questions to the Members of this Subcommittee that they should ask. What are we buying? What goods and services are required to meet the Department]of Energy's needs? Second, how are we buying them? That is a little more in the weeds, but this question is vital to buying smarter and for general good government practices. We need to look at the types of contracts and agreements that we're awarding, the levels of competition, the award process, statements of work and the requirements that are defined, fees, the length or term of the award, accountability, oversight, transparency, performance, and the results that we're getting.

As much as possible, the government must engage in the same practices as we do in our general lives. We need to seek competition that will ensure best quality and the best price, provide suffi-

cient administration and accountability, and fortunately with the workforce stagnation and in some cases cuts, that has led to a stretched workforce, especially considering the huge jump in spending. That workforce also lacks tools to make well-informed spending decisions and the ability to provide oversight of funds going forward. Agencies must be transparent because sunlight is the best disinfectant. Oftentimes, however, the public and even Congress don't have details or data to oversee spending.

Additionally, we lack information [inaudible] Federal dollars and are trusted with our national security information, which then could be stolen or provided to adversaries. We also need [inaudible] low-risk spending. While risk is inevitable, it can be calculated and deemed accessible. Low risk means avoiding sole-source contracts, risky spending types and vendors, and terms and conditions that place financing and other burdens on agencies and government officials.

We need to tune out claims from awardees that the Federal system is just littered with red tape. Currently, the system is more "catch me if you can" than smart buying. When it comes to the Department of Energy, there are numerous Inspector General and GAO reports about adequate—inadequate planning, poor requirements and statement of work, projects that are over budget and behind schedule, cozy dealing, sole-source awards, performance deficiencies, and longer-term agreements, which often lock out genuine competition.

Energy's large management and operation contracts have been criticized for years. Currently, GAO has contract and program management for two DOE offices on its high-risk list. I think today's hearing about recent awards is essential to ensuring that taxpayer dollars are spent wisely and to prevent DOE's Office of Nuclear Energy from making GAO's high-risk list. Thank you for inviting me to testify, and I look forward to working with the Subcommittees, and I welcome any questions that you may have.

[The prepared statement of Mr. Amey follows:]

PROJECT ON GOVERNMENT OVERSIGHT

Testimony of Scott Amey, General Counsel
Project On Government Oversight
before the House Committee on Science, Space, and Technology,
Subcommittee on Investigations and Oversight and Subcommittee on Energy
on "Judicious Spending to Enable Success at the Office of Nuclear Energy"
October 21, 2021

I want to thank Chairmen Foster and Bowman and Ranking Members Obernolte and Weber for asking the Project On Government Oversight (POGO) to testify about issues related to federal spending. I am Scott Amey, POGO's general counsel.

POGO is a nonpartisan, independent watchdog that oversees federal agencies, Congress, and government contractors. We made our mark in the 1980s by looking into Pentagon waste, fraud, and abuse, spotlighting overspending on $640 toilet seats, $7,600 coffee makers, and $436 hammers. POGO also has a long history of investigating wasteful spending and performance issues within the Department of Energy.[1]

Throughout our 40-year history, POGO has created a niche in investigating, exposing, and helping to remedy waste, fraud, and abuse in government spending.[2] We have supported many reforms that enhance competition, accountability, oversight, and transparency. Additionally, we have called attention to aspects of the federal spending systems that place taxpayer funds at risk.

Hurricane recovery, stimulus spending, and the pandemic have all highlighted gaps in the federal government's contract and grant spending systems. Emergency spending exacerbates systemic problems with these spending processes.

Many reforms were imposed prior to the large increase in federal contract spending last year. In fiscal year 2020, contract spending rose to $667 billion.[3] When combined with the $971 billion in grant awards in FY 2020,[4] those numbers show that the government is handing out taxpayer money at an unprecedented level. Agencies must follow best practices to avoid waste, fraud, abuse, and corruption and to ensure that money is spent wisely.

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[1] "Department of Energy," Project On Government Oversight, https://www.pogo.org/topics/department-of-energy/.
[2] Founded in 1981, POGO is a nonpartisan independent watchdog that investigates and exposes waste, corruption, abuse of power, and when the government fails to serve the public or silences those who report wrongdoing. We champion reforms to achieve a more effective, ethical, and accountable federal government that safeguards constitutional principles. For more information about POGO, please visit www.pogo.org.
[3] "Spending Over Time, FY 2020, All Contracts," USAspending.gov, https://www.usaspending.gov/search/?hash=d82c11510d1653b3d4164e866c81a935 (Click the "Time" tab to see the FY 2020 total obligations amount).
[4] "Spending Over Time, FY 2020, All Grants," USAspending.gov, https://www.usaspending.gov/search/?hash=78c8495f3d2619cde1eb47709da36f2f (Click the "Time" tab to see the FY 2020 total obligations amount).

Many events over the past 20 years have called into question the effectiveness of the federal contract and grant systems, and have highlighted how drastically the landscape has changed: Spending has grown tremendously; oversight has decreased; the acquisition and grant workforces are stretched thin and have been supplemented by contractors; and spending on services now outpaces spending on goods. This changing landscape sometimes places public funds at risk.

In light of today's hearing, and to better chart the landscape before us, I present two questions that members of the subcommittees should ask:

1. What are we buying?
2. How are we buying goods and services?

The first question requires a comprehensive look at the government's overall acquisition planning structure and how best to place agencies in a position to achieve their missions. We should ask, for example, "What goods and services are required to meet the Department of Energy's needs?"

The second question — how are we buying it? — places us more in the contracting weeds, which is still vital to buying better. The answer to that question often involves a discussion about types of contracts, levels of competition, award processes, statements of work and requirements, award and incentive fees, the length of term agreements, accountability, oversight, transparency, performance, and results.

Federal Spending Best Practices

Federal contract and grant spending seem complex and riddled with red tape, but they aren't much different from what individuals do every day when buying goods and services. We sit at home conducting research, locating vendors, obtaining written quotes, comparing prices, reviewing warranties, avoiding front-loaded payment options, and checking the finished product to ensure that we are satisfied. Circumstances can speed up or slow down those processes or cause us to make a spending decision that might take a bigger toll on our bank accounts, but we generally make well informed spending decisions. That isn't always the case when the federal government is spending our money.

As much as possible, the government should engage in the same practices we do at home:

1. Seek adequate competition;
2. Provide sufficient administration and accountability;
3. Add transparency; and
4. Practice low risk spending processes.

I will discuss each of these issues in detail and provide recommendations that will improve the way federal contracts and grants are created, awarded, monitored, and reviewed.

Adequate Competition

To better evaluate goods and services, and to get the best value for taxpayers, the government

must encourage genuine competition. At first glance, it may seem that federal agencies frequently award contracts competitively. For example, data shows that government-wide, 61% of contract dollars were awarded with competition in fiscal year 2020. In the Department of Energy, the competition award total was 97%.[5]

Those numbers, however, do not tell the entire story. The "competitive" label includes contracts awarded through less than full and open competition. This includes competitions within a limited pool of bidders, offers on which only a single bid was received, and follow-on contracts to a previously competed action.[6]

Data on grants is simply less transparent than contract awards, which creates genuine difficulties and limitations for robust analysis. Through the System for Award Management, we receive information on the process of awarding contracts, including solicitations and scope of work details, but there is no similar disclosure for grants or loans. And while grant awards and other types of assistance (loans, direct payments, insurance, and more) are included in USAspending.gov, the public doesn't get the same level of detail for these assistance awards as we do for contracts.

The public doesn't get access to requests for information, for example, or to the number of applications received versus approved. We get even less information about companies receiving assistance awards than we do federal contractors. Agencies fail to collect any information on the demographics of business owners or industry sectors of companies awarded assistance funds. Without this data, we don't know whether assistance programs are reaching minority businesses, women-owned businesses, veteran-owned businesses, and others. Without this data, we don't know who benefits.

Genuine competition between prospective awardees means the government gets the best quality goods and services at the best price. Competition also prevents waste, fraud, and abuse because contractors know they must perform at a high level or risk being replaced.

To ensure that contracts and grant awards are subject to genuine competition, federal agencies should:

1. Revise the definition of "competitive bidding" to ensure that genuine competition, and not pseudo-competition, takes place. To accurately track or evaluate competition, this term should apply only to awards on which more than one bid was received.
2. Reverse the current philosophy of quantity over quality. Acquisition is now about speed, treating competition as a burden. Circumventing the most important principles of a free market is a recipe for waste, fraud, abuse, and corruption. Federal agencies should conduct full and open competitions, to the maximum extent practicable, for all non-urgent purchases. Non-competitive awards should be used sparingly.
3. Require all spending opportunities in excess of $100,000 to be publicly announced for a at least 14 days prior to award unless public exigency or urgent national security considerations dictate otherwise.
4. Ensure that they are obtaining fair and reasonable prices when non-competitive

[5] "Competition Standard Report," System for Award Management, https://sam.gov/reports/awards/standard.
[6] "Glossary," USAspending.gov, https://www.usaspending.gov/?glossary=extent-competed.

procedures are used.

5. Unbundle requirements in order to invite more bidders to the table. Lumped-together requirements unnecessarily constrain the awardee pool that can provide goods and services to the government, excluding smaller businesses that could successfully provide one good or service, but are incapable of managing massive, multi-part contracts. Breaking apart unrelated items will reduce the multiple layers of subcontracting, which can drive up costs while adding little value.

The above recommendations fall in line with President Joe Biden's July executive order to promote competition in the American economy. President Biden's order stated that "a fair, open, and competitive marketplace has long been a cornerstone of the American economy," and highlighted that the federal government needs to do its part "through the procurement process."[7]

Federal agencies should heed President Biden's pro-competition mandate in federal spending awards.

Sufficient Administration and Accountability

Through the years, the government has placed a premium on speeding up the spending process, cutting administrative and oversight mechanisms, and, at times, propping up the industrial base.[8] Those policies led to a buying workforce that could not keep pace with growing government spending and a gutting of the oversight community.[9] When considering the large-scale increase in contract and grant spending during the past decade, we need to ask whether we have sufficient people and resources to watch the money as it goes out the door and to ensure we are obtaining the results agencies want.

Contract and grant dollars have more than tripled since 2000, when contract and grant spending totaled $205 billion and $295 billion, respectively.[10] By 2020, contract and grant spending were $667 billion and $971 billion, respectively. Yet the acquisition and grant management workforce has not increased on pace with spending.[11]

According to Office of Personnel Management federal employee data, Energy Department personnel involved in contracts and grant management were 622 and 72, respectively, as of June

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[7] Executive Order No. 14036, 86 Fed. Reg. 36987, 36989 (July 9, 2021), https://www.federalregister.gov/documents/2021/07/14/2021-15069/promoting-competition-in-the-american-economy.

[8] Jack Corrigan, "New Law Aims to Cut Red Tape," *Government Executive*, July 19, 2017, https://www.govexec.com/management/2017/07/new-law-aims-cut-red-tape/139564/; Sarah Ladislaw, "The United States Needs an Energy Industrial Strategy, and Everybody Knows It," Center for Strategic & International Studies, May 5, 2020, https://www.csis.org/analysis/united-states-needs-energy-industrial-strategy-and-everybody-knows-it.

[9] "Career Opportunities in the Federal Contracting Series (GS-1102)," Federal Acquisition Institute, (2020), 2, https://www.fai.gov/sites/default/files/1102-Career-Field-Brochure.pdf; Council of the Inspectors General on Integrity and Efficiency, *Top Management and Performance Challenges Facing Multiple Federal Agencies*, February 2021, 7-8, 16-22, https://www.ignet.gov/sites/default/files/untracked/TMPC_report_02022021.pdf.

[10] "FedSpending.org," Project On Government Oversight, https://www.fedspending.org/.

[11] CIGIE, *Top Management and Performance Challenges*, 7-8 [see note 9].

2021.[12] An average of the last ten years shows that 613 contracting and 67 grants management officials have worked on contracting and grants issues.[13] This stagnant contract and grant workforce occurred at the same time that the Energy Department increased spending on contracts and grants from $22.5 billion in 2000 to nearly $40 billion in 2020.[14] About the same number of people are spending and administering nearly twice as much money, which places taxpayer funds at risk.

Agencies need to invest in the contract and grant workforce as well as in the auditors and accountants who provide oversight and promote integrity in federal spending. Improving oversight will enhance contract management, resulting in savings that would more than pay for this workforce expansion. A strong oversight workforce can help the government get better returns for the taxpayer and can also help prevent programs from falling behind schedule and running over budget.

External watchdogs are also key. Inspectors general are known for a high return on investment, with an average return of about $17 for each taxpayer dollar invested into that watchdog community.[15] Oversight provides great benefits to taxpayers, but it is often the first thing agencies cut when they need to make budget cuts.[16] Cuts to inspectors general budgets were on the table during the Trump administration, with a proposal to "cut more than $63 million from the IG offices at five agencies."[17]

While staffing issues are a real problem, the existing procurement and oversight workforces also lack tools they need to buy smart and review that spending. If government officials are going to buy in the dark without sticker prices and the oversight community has trouble looking at invoices, wasteful spending runs rampant.

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[12] "FedScope," Office of Personnel Management, https://www.fedscope.opm.gov/employment.asp. (In the June 2021 dataset, select "DN-Department of Energy" in the "Agency" field. In the "Occupation" field, select "White Collar," then select "11xx-Business and Industry," and then select "1102-Contracting" or "1109-Grants Management" to see results.)

[13] "FedScope," [see note 12]. The range for the "contracting" code was 590 to 639 employees and the "grants management" code was 60 to 72 employees since 2012.

[14] "Spending Over Time, FY 2020, All Contracts and All Grants, Energy Department," USAspending.gov, https://www.usaspending.gov/search/?hash=4354cc10c066369deab0967d9dd0553b (Click the "Time" tab to see the FY 2020 total obligations amount); "Assistance from Dept. of Energy (FY 2000)," FedSpending.org, https://www.fedspending.org/fpds/fpds.php?sortp=r&maj_agency_cat=89&detail=-1&datype=T&reptype=r&database=fpds&fiscal_year=2000&submit=GO; "Contracts from Dept. of Energy (FY 2000)," FedSpending.org, https://www.fedspending.org/faads/faads.php?sortp=r&maj_agency_cat=89&detail=-1&datype=T&reptype=r&database=faads&fiscal_year=2000&submit=GO.

[15] *Top Management and Performance Challenges Identified Government-wide by the Inspector General Community: Hearing before the House Committee on Oversight and Government Reform*, 115th Cong. 2 (April 18, 2018) (testimony of Department of Justice Inspector General Michael E. Horowitz, Chair, Council of the Inspectors General on Integrity and Efficiency, and National Science Foundation Inspector General Allison C. Lerner, Vice Chair, Council of the Inspectors General on Integrity and Efficiency), https://oig.justice.gov/sites/default/files/2019-12/04-18-2018_0.pdf.

[16] Rebecca Jones, "Knowing Their Worth: President's Budget Sought Big Cuts to Inspectors General," Project On Government Oversight, August 23, 2018, https://www.pogo.org/analysis/2018/08/knowing-their-worth-presidents-budget-sought-big-cuts-to-inspectors-general/.

[17] Jory Heckman, "Inspectors general fear staff cuts, less oversight under Trump budget plan," *Federal News Network*, August 17, 2018, https://federalnewsnetwork.com/budget/2018/08/inspectors-general-fear-staff-cuts-less-oversight-under-trump-budget-plan/.

Then-Senator Harry S. Truman (D-MO), member of the Military Affairs Committee, famously stated in 1941, "I have never yet found a contractor who, if not watched, would not leave the Government holding the bag."[18]

To strengthen the federal spending administrations and oversight workforce, Congress should:

1. Ensure agencies have appropriate people and tools. Agencies should have a large enough cadre of contract and grant specialists with appropriate tools to compete awards, obtain fair and reasonable prices, administer contracts and grants, and hold awardees accountable for overruns, schedule delays, and poor performance.
2. Require contractors to provide cost or pricing data to the government for all contracts, except those where the actual goods or services being provided are sold in substantial quantities in the commercial marketplace.
3. Provide enforcement tools to prevent, detect, and remedy waste, fraud, and abuse in federal spending, including more frequent pre-award and post-award audits.
4. Eliminate the Right to Financial Privacy Act requirement that inspectors general notify contractors prior to obtaining the companies' financial records. This requirement tips off contractors and can harm the government's ability to investigate federal contracts.
5. Realize that auditors and accountants are worth the investment.
6. Enhance the procuring workforce through improvements in hiring, pay, training, and retention.
7. Hold agencies and contractors accountable when small business contracts are diverted to large corporations and when small business dollars don't reach their legally intended targets.

Executive branch officials and entities receiving taxpayer money have claimed ensuring government and awardee accountability are burdensome and unnecessary. This perception needs to be replaced with one that recognizes that accountability measures are essential to protecting taxpayers. Oversight should be seen as an acceptable cost of doing business with the federal government.

Enhancing Transparency to Expose Mismanagement and Corruption

The government spends trillions of dollars each year, and taxpayers should know that spending will be reported completely, accurately, and with enough detail that we can rigorously evaluate it. Our current system is broken and incomplete, but it doesn't have to remain that way — we can fix current reporting requirements, fill reporting gaps, and track new data points.[19]

Currently, the federal contracting and grant-making system is opaque. The government lacks rules to ensure that the contracting and grant-making processes are open and visible to the public. To rebuild public faith in federal spending, the government must proactively provide the public with contract and grant information, including records from the pre-award stage to contract or

[18] Senator Harry S. Truman, speaking on defense spending, on February 10, 1941, 77th Cong., 1st sess., *Congressional Record*, 837, https://www.govinfo.gov/content/pkg/GPO-CRECB-1941-pt1/pdf/GPO-CRECB-1941-pt1-24-1.pdf.
[19] Sean Moulton, "Blueprint to Fix Reporting of Federal Spending," Project On Government Oversight, August 2, 2021, https://www.pogo.org/analysis/2021/08/blueprint-to-fix-reporting-of-federal-spending/.

grant close-out, and at the subcontract or subgrant level.

Additionally, companies with hidden ownership structures are a serious global problem, and in many instances those entities are involved in international corruption. As POGO's previous work has shown, such anonymous companies have been involved in a wide variety of illicit activities, ranging from "public corruption to government and defense contract fraud, organized crime, intellectual property theft, money laundering, terrorism financing, and the opioid crisis."[20]

The following actions should be taken to provide the public with comprehensive spending information:

1. Improve USAspending.gov so it becomes the one-stop shop for all federal spending information. This means including actual copies of contracts, delivery or task orders, modifications, amendments, other transaction agreements, grants, and leases. Proposals, solicitations, award decisions and justifications (including all documents related to contracts awarded with less than full and open competition and single-bid contract awards), audits, performance and responsibility data, and other related government reports should also be incorporated into USAspending.gov.
2. Strengthen the beneficial ownership identification law to enable government officials and the public to learn more about the real owners of companies. This step would enable the government to ensure that taxpayer dollars are going to law-abiding contractors and grantees rather than to companies engaging in fraud or posing national security risks.

It is disturbing that the public, the media, and even congressional offices must send request letters or use the Freedom of Information Act to access government contract and grant records. While USAspending.gov and the System for Award Management have been revamped through the years, additional reforms are needed so that spending records are publicly available. Let's not forget that "Sunlight is said to be the best of disinfectants."[21]

Low Risk Spending

While it is easy to point a finger at contractors and grantees when federal programs or projects go wrong, federal policies, procedures, and practices are often part of the problem. So too are federal officials and their spending decisions, including what to buy and how to buy it.

Taxpayer dollars can be protected by proper contract and grant requirements in the pre-award phase, multiple bids and data that allows genuine negotiations during the award phase, and appropriate administration and oversight of the spending post-award. Conversely, bad requirements, a lack of competition, the wrong contract type, improper vendor vetting, a lack of transparency, accelerated payments, and deficient administration and oversight can shift risk away from those we hired to provide the goods or services and onto agencies and taxpayers.

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[20] Tim Stretton, "Defense Bill Includes Two Landmark Transparency Provisions," Project On Government Oversight, January 21, 2021, https://www.pogo.org/analysis/2021/01/defense-bill-includes-two-landmark-transparency-provisions/.

[21] Louis D. Brandeis, *Other People's Money and How the Bankers Use It* (New York: Frederick A. Stokes Company, 1914), 92, https://www.google.com/books/edition/Other_People_s_Money/uCpMAAAAIAAJ.

There have been numerous spending methods that promise to speed up the process and to attract small businesses and non-traditional companies. POGO's warnings about some of those industry-promoted concepts started over 20 years ago,[22] and they continue to this day.[23]

Unfortunately, our concerns turned out to be right, and the promise that these new systems would attract new companies hasn't panned out. In fact, it's the traditional or incumbent companies that have been doing business with the government for years that continue to get federal business,[24] often with awards that circumvent the normal rules.[25]

The federal government is also buying goods and services labeled as commercial, but which have no real or actual sales in the commercial market.[26] Additionally, government procurement systems have shifted the rules, and excessive overcharges are the sign of a widespread problem in the process that hamstrings the ability of the government to negotiate fair and reasonable prices.[27]

While the government must accept some risk in its business dealings, federal agencies are taking an outsized share, at the cost of mission, programs, and taxpayer dollars. Bad deals and wasted money are the frequent result when too much of the burden and risk shifts to the government.

Federal agencies must:

1. Compete spending opportunities to the fullest extent practicable.
2. Avoid risky spending vehicles, including cost-reimbursement, time and material, commercial items, and other transactions, which place substantial risk on the government and can make it difficult for agencies to control costs.
3. Substantially revise the Truth in Negotiations Act (TINA) to restore it to the commonsense requirements that were in place prior to the "acquisition reform" era of the

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[22] *Defense Waste & Fraud Camouflaged As Reinventing Government*, Project On Government Oversight, September 1, 1999, https://www.pogo.org/report/1999/09/defense-waste-fraud-camouflaged-as-reinventing-government/; *Pick-Pocketing The Taxpayer: The Insidious Effects of Acquisition Reform*, Project On Government Oversight, March 11, 2002, https://www.pogo.org/report/2002/03/pick-pocketing-taxpayer-insidious-effects-of-acquisition-reform/; "Written Testimony of POGO's Danielle Brian on DoD's Use of 'Commercial' Acquisition and 'Other Transaction Authority' before the Senate Armed Services Committee, Airland Subcommittee," Project On Government Oversight, March 15, 2005, https://www.pogo.org/testimony/2005/03/written-testimony-of-pogos-danielle-brian-on-dods-use-of-commercial-acquisition-and-other-transaction-authority-before-senate-armed-services-committee/; Mandy Smithberger and Scott Amey, "Thornberry Buying Industry Commercial-Item Policies," Project On Government Oversight, April 28, 2015, https://www.pogo.org/analysis/2015/04/thornberry-buying-industry-commercial-item-policies/.

[23] Mandy Smithberger, "Commercial Item Contracting Scam Continues," Project On Government Oversight, June 25, 2021, https://www.pogo.org/analysis/2021/06/commercial-item-contracting-scam-continues/; Scott Amey, "Other Transactions: Do the Rewards Outweigh the Risks?" Project On Government Oversight, March 15, 2019, https://www.pogo.org/report/2019/03/other-transactions-do-the-rewards-outweigh-the-risks/.

[24] Scott Maucione, "As OTAs grow, traditional contractors are reaping the benefits," *Federal News Network*, July 17, 2018, https://federalnewsnetwork.com/contracting/2018/07/as-otas-grow-prime-contractors-are-reaping-the-benefits/.

[25] Congressional Research Service, *Department of Defense Use of Other Transaction Authority: Background, Analysis, and Issues for Congress*, R45521 (2019), 8-10, 13-14, https://crsreports.congress.gov/product/pdf/R/R45521.

[26] Smithberger, "Commercial Item Contracting Scam Continues" [see note 23].

[27] Mandy Smithberger and Scott Amey, "In for a TransDigm, Out for Billions," Project On Government Oversight, May 29, 2019, https://www.pogo.org/report/2019/05/in-for-a-transdigm-out-for-billions/.

1990s. Specifically, all contract awards over $500,000, except those where the goods or services are sold in substantial quantities to the general public in the commercial marketplace, should be subject to TINA. This small step would result in enormous improvements in contract pricing, negotiation, and accountability, and would save taxpayers billions of dollars per year.

4. Allow protests or challenges to ensure that bidders are on an even playing field, and that agency award decisions can be justified in a way that will instill public confidence.

POGO supports cutting buying costs, buying faster, encouraging innovation, and bringing nontraditional companies to the government table. But our current system is allowing cut corners and worst practices that can result in noncompetitive awards, crony capitalism, bad deals, and wasteful spending.

Thank you for inviting me to testify today. I look forward to working with the subcommittees to further explore how the government should improve federal spending oversight to better protect taxpayers, and I welcome any questions that you may have.

POGO
PROJECT ON GOVERNMENT OVERSIGHT

Scott Amey is the general counsel at the Project On Government Oversight (POGO) in Washington, D.C. He handles legal matters for the organization, directs its contract oversight and ethics investigations, and promotes policy reforms.

Mr. Amey testifies before Congress and federal agencies, submits public comments on proposed regulations, provides insights to the media, and authors articles and reports on contracting and ethics issues.

POGO is a nonpartisan independent watchdog that investigates and exposes waste, corruption, abuse of power, and when the government fails to serve the public or silences those who report wrongdoing. The organization champions reforms to achieve a more effective, ethical, and accountable federal government that safeguards constitutional principles.

Mr. Amey earned his J.D., magna cum laude, from the University of Baltimore School of Law in 2001 and his B.A. from the University of Pittsburgh in 1993. He clerked for the Honorable James A. Kenney, III, in the Court of Special Appeals of Maryland from 2001-2003. Mr. Amey is licensed to practice law in Maryland.

Chairman FOSTER. Thank you.

And at this point we will begin our first round of questions. If time and Member interest permit, we may have a second round of questions. The Chair now recognizes himself for five minutes.

Dr. Huff, my first questions involve the Carbon Free Power Plan, a project that has the laudable goal of demonstrating the economics of mass-producing and operating a significant number of small modular reactors (SMRs) for power generation. Now, in November of last year, about three weeks after the DOE announced that it would provide $1.4 billion to help deploy 12 of 60 megawatt reactors, their private partner in this project, NuScale, announced that it planned to uprate the SMR design from 60 megawatts to 77 megawatts. This is a significant design change, and it was made almost immediately after the contract award, which I find concerning.

Now, I know you weren't there when this award was made, but, to your knowledge, did NuScale and the Carbon Free Power Project disclose to DOE prior to the contract award that it had plans to change the reactor design?

Dr. HUFF. Thank you for your question. I, too, understand the concerns that this would raise. This award was indeed granted in the previous Administration, and I can't comment on what was known when or what was incorporated, but I understand that decisionmaking at the time did incorporate the existing knowledge. And something important and relevant to note here is that we have communicated to the CFPP awardees at this time an award modification that would enable them to leverage the uprated sixpack version of the NuScale technology would be allowable. But we are currently analyzing how that change in project scope might impact the cost components of the award with some recognition, of course, in the development of and assurance that that will serve the taxpayer, recognize the important accountability that our office needs to implement in that context. The potential impacts of that uprate on the schedule of CFPP have been analyzed by NuScale, UAMPS, and the DOE at this time.

Chairman FOSTER. Yes, well, thank you. You know, obviously when you uprate a reactor design, you have to re-examine all the design margins, make sure they're still adequate, then go back to the Nuclear Regulatory Commission to get the new design certified at the higher power level, which will take time, potential design changes, and money. And so how far are you from having mapped out together the impact on the overall cost and schedule of this design change, including the relicensing, licensing of the new design?

Dr. HUFF. Absolutely. So the award that NuScale is operating in on its own outside of the UAMPS experience is nearing completion. And while a slight extension of their milestone will enable their uprate over the course of the next few months, we expect that there's no question that it will reach completion with the NRC expeditiously because it will rely on that first application and their design certification, which was successful through NRC with our original award to NuScale. And so we're very hopeful that it should have very minimal impact on the schedule and in fact, in the context of UAMPS, it should have limited or no impact on the schedule.

Chairman FOSTER. OK. Well, when you get all that worked out, I'm sure our Committee staff will be interested in having a look at the updated design.

I also understand the CFPP made a modification request so that the project would only deploy six of these larger units rather than 12. So part of that reduction simply reflects the power uprate, but still, the six slightly larger units would only produce 460 megawatts down from the 720 megawatts that—in the original contract. And so we'd also obviously learn less about the economies of scale from building multiple identical SMRs. So is it—first off, is it correct that CFPP and DOE are now negotiating a modification to produce less power right now?

Dr. HUFF. Yes. We have received a request to modify the award and are analyzing what modifications can improve the likelihood of that project's success without increasing the risk exposure to the Federal Government and the taxpayer. We have clarified with the awardee that communication regarding such issues need to take place early, frequently, and transparently moving forward. But indeed in the context of leveraging that improvement in the uprate, we have communicated to the CFPP awardees that an award modification that would enable them to leverage that uprated sixpack version of the NuScale technology will be allowable but are currently analyzing the project scope and impact on components of the cost of the award.

Chairman FOSTER. Are you currently contemplating that the DOE will still contribute the same amount of money, $1.4 billion, even though the overall power produced by the project is going to be smaller?

Dr. HUFF. That analysis is ongoing, and of course, you know, the—exactly those concern is within our scope of exploration as we conduct our analysis in terms of what will be allowable and appropriate to ensure that the award does not overexpose the government for—to risk.

Chairman FOSTER. All right. Thank you. And it looks like my time is expired, so I'll now recognize Representative Obernolte for five minutes.

Mr. OBERNOLTE. Thank you, Chairman Foster. I will continue the line of questioning with Dr. Huff.

In your oral testimony, you acknowledge the concerns that the Committee has with the sole-source awards. And in your written testimony you detailed the four sole-source awards that the Committee has asked about, but nowhere has there been a discussion of the rationale that was followed in determining that sole-source was the appropriate method of awarding these. And so I'm hoping that—I realize that you were not with the agency when these contracts were awarded, but, I mean, certainly, a majority of the staff of the Office of Nuclear Energy was, and so I'm hoping that there's some institutional memory there that they can tell us in those four instances why sole-source was the better option.

Dr. HUFF. Thank you very much for your question. I am indeed—I do indeed understand the concern, and yes, while I was not there, there are of course staff that were there when these decisions were made, and I will assure you that it is my understanding that these awards were prepared in accordance with the applicable regula-

tions and governing Federal acquisitions and cooperative agreements were thoroughly reviewed and approved by the DOE's Office of Management, as well as our Office of General Counsel and that they were documented and executed legally. But indeed, the sort of rationale and justification that are documented are the—that's the information that I also have.

And I will say that I certainly agree that, moving forward, fair and open competition is recognized within this office culturally both by me and by the staff as the best practice for Federal procurement and financial assistance, so we are committed to early and open expressions of interest by the Department moving forward to ensure the greatest number of market competitors and participants in any competition.

Mr. OBERNOLTE. OK. Well, thank you. I saw that in your testimony. The—to be clear, what I'm asking is not whether or not the law was followed. I mean, I think it's clear that you're asserting the law was followed and, you know, we're not questioning that. What I'm interested in knowing about is the specific rationale in those four circumstances that led the office to conclude that sole-source was in the best interest of taxpayers.

Dr. HUFF. Yes, for the really detailed response that you need for each of those awards, I will refer to the DNFA (Determination of Noncompetitive Financial Assistance) justification documents, and I would—if you would be willing, I'd be happy to take that question for the record and give you a more detailed and accurate response.

Mr. OBERNOLTE. OK. I would appreciate that.

Dr. HUFF. All right? Thanks.

Mr. OBERNOLTE. And following up on what you had just said a moment ago about the Office of Nuclear Energy's belief that fair and open competition is the best practice for Federal procurement, can you talk about moving forward what the office's stance will be on sole-source awards and the circumstances under which you think a sole-source award would be more appropriate than a competitive award?

Dr. HUFF. Yes, thank you. I really appreciate that question. Recognizing upon my arrival that this was a concern in the context of our relationship with Congress, I have directed the Office of Nuclear Energy to temporarily pause any new sole-source awards and execute all of its contracts and financial assistance awards competitively, including any related to the pending legislation should it be enacted into law. And we have already, during the last few months, halted multiple sole-source award processes in order to initiate competitive processes instead. Some are very small and would be really straightforward cases for a sole-source contract, for example, where we have relationships with entities that are capable of liaising between us and our tribal working groups. Those kinds of contracts, there are very few entities that are capable of conducting those activities. In fact, in most regions, only one, right, so that is a very clear case for sole-source, but we are competing similar awards of this nature as a cultural exercise and a full stop to that activity so that we can evaluate our ability to compete any and all types of awards, regardless of their sole-source status in the near-term.

Mr. AMEY. Ranking Member Obernolte, may I jump in for a quick second and just add one point? And that is this has to be more than just a check-the-box exercise. I haven't seen a lot of information on these contracts, and I haven't—but what I have seen, especially on the Centrus contract and on the CFPP contract is this almost looked like an earmark. Proprietary information—I think NuScale was mentioned in the documents I saw and so was Centrus—what is it, the AC–100M product. When you name products like that and only one person has the proprietary rights to those, you're limiting competition automatically. And so it's—that's why I say this can't just be a check-the-box exercise. They need to make sure—NE needs to make sure it goes back and it's looking at the requirements for all these contracts and making sure that they're as open as possible to lure in as much competition that they can. And so we want as many people at the table, but if you limit it with—and name proprietary products, you're going to limit it—you're going to limit who you get to the table.

Mr. OBERNOLTE. Yes. Well, I see my time is——

Chairman FOSTER. Yes——

Mr. OBERNOLTE. But, Dr. Huff, I'm looking forward to getting the justifications. Just to make the point, I mean, I don't want you to take—have the takeaway of being—from this Committee hearing being that sole-source is never—should never be pursued and, you know, that the Committee will always question any sole-source contract. But, as Mr. Amey has said, sunshine and transparency is, you know, the best application of this. And so moving forward, I think, you know, as long as we're transparent with each other and your department is very transparent with the rationale for awarding those contracts, I think we can avoid this kind of difficulty in the future.

But I yield back, Mr. Chairman. Thank you.

Chairman FOSTER. Thank you. And we'll now recognize Representative Bonamici for five minutes.

Ms. BONAMICI. Well, thank you so much to the Chairs and the Ranking Members and especially to our witnesses.

I want to start by saying that because of long-standing, unresolved issues with the management of spent waste, sustainability, and overall safety issues, I remain concerned about expanding our current nuclear fleet with existing commercial technologies. But small modular reactors, SMRs, have the potential to complement the use of renewable energy sources and support decarbonization if safety, security, and disposal concerns are addressed.

And I also want to note that this oversight is critical, and it's very important that we're getting these questions answered because I do look forward to our continued efforts and the efforts by the Office of Nuclear Energy to carefully develop this technology. And I want to note again the importance of getting these questions answered because I do hope that NuScale, which is headquartered in Oregon in the district I represent, and has partnered and worked closely over the years with Oregon State University, I hope they can lead the way.

So I want to start with questions for Mr. Amey. I'm concerned about how the Department of Energy treated cost share in its recent noncompetitive grant to Exelon to upgrade to digital controls

at its Limerick Generating Station in Pennsylvania. So DOE and demonstration projects must secure no less than 50 percent of funds from non-Federal resources, and research and development projects on the other hand must meet a 20 percent cost share threshold. So DOE argued that it did not have to meet the statutory 50/50 cost share for demonstration because the Limerick project is both research and demonstration.

So, Mr. Amey, a couple of questions here. The DOD has regulations that clearly distinguish cost share requirements for research and development projects versus demonstration projects. The Office of Management and Budget (OMB) of course has similar guidance. So should DOE consider updating their departmentwide guidelines and regulations related to cost share requirements? And would this help avoid cost share confusion and guarantee greater funding transparency going forward?

Mr. AMEY. Yes, thank you for the question. I think the easy answer is certainly. I think DOE should go back and take a look at the blueprint that DOD and OMB have laid out and possibly create a hybrid. I mean, there may be research and development projects that also become demonstration projects, and so they may need a different formula for those types of projects, but cost-sharing is a problem and waivers to the cost-sharing principles are also problematic because it's, you know, obviously putting a lot of risk on the taxpayers to come up with a lot of frontloaded money.

Ms. BONAMICI. Absolutely. And I want to take this opportunity, even though not directly related to oversight but a really critical issue to ask Dr. Huff a question.

We happen to have in Oregon at Reed College in Portland a research reactor. It's been there since 1968. It's the only reactor operated primarily by undergraduate students. They only license up to 40 at a time. And it's a pretty unique opportunity for students. But in your testimony, Dr. Huff, you mentioned the importance of supporting a strong nuclear workforce, so could you please speak to any challenges that the office is facing in attracting and retaining talent? I'm on the Education and Labor Committee. I care a lot about workforce issues, especially as we transition to a clean energy economy. So what are the current overall challenges in workforce facing the industry, understanding that the 40 undergraduate students at Reed College aren't going to be able to meet the needs across the country?

Dr. HUFF. Thank you so much for this question. As a former professor, currently on unpaid leave of absence from the University of Illinois, nothing is more important to me than university education just like that that you're describing at Reed College at their very unique research and test reactor. There used to be quite a lot more of those research and test reactors actually across the United States, and over time, as R&D funding and particularly enrollment in the university system declined in the sort of 1980's that we had a decline in those facilities.

Interest in nuclear energy has increased dramatically over the last few decades as the promise for its use in climate technology has increased, and that new workforce is—has not been met and—with the same kinds of hands-on technologies to support the research and training that these research reactors represented. And

so there's a growing and widening gap in that hands-on training, which I think my office has the opportunity to fill with the kinds of authorities to support university-directed R&D that the *Energy Act of 2020* has enabled my office with, as well as another—a number of other opportunities. You know, we'll have some exciting announcements soon hopefully in this direction, and I really look forward to communicating with Congress on their best implications.

Ms. BONAMICI. Thank you so much, Dr. Huff. And as I yield back, I want to reiterate to the Chairs and Ranking Members and Committee Members, I look forward to working with you on answering these important oversight questions going forward, and I yield back the balance of my time.

Chairman FOSTER. Thank you. And now Ranking Member Weber will be recognized for five minutes.

Mr. WEBER. Thank you, Mr. Chairman. Before I start with my questions, I appreciated your point about maybe a second round of questions because I do have a list of questions I'd like to submit for the record. I'd like to also echo the sentiments of your previous speakers. We are ultimately the stewards of the American taxpayer dollar. So with unanimous consent, I'd like to submit those questions just in case we don't get to that second round.

Chairman FOSTER. Yes, without objection, all Members are authorized to submit additional questions for the record.

Mr. WEBER. OK. Thank you, sir.

Dr. Huff, throughout my years on the Science Committee, I have supported robust funding for the versatile test reactor to ensure that the United States has the ability to validate and test the next generation of nuclear fuels, materials, and reactor designs. We've spoken about some of those here this morning. I would opine if you will that if we were serious about our clean energy future and want to decrease our dependence on competitors like China and Russia for advanced nuclear R&D, we must commit to our investment in this essential research infrastructure.

As I mentioned in my opening statement, I was proud to lead the push to authorize substantial funding for the versatile test reactor, VTR, in the *Energy Act of 2020*. Monitoring the progress of this project is a huge priority for me in Congress. So I know you're new, but, Dr. Huff, can you share an update on the status of VTR, and how will you push for that project to receive the necessary support to ensure it's completed and operational in time for our researchers to avoid missing the proverbial boat?

Dr. HUFF. Thank you for this question. I, too, believe that the versatile test reactor is an essential tool for the United States to regain its global nuclear energy leadership role in the development of advanced reactors. It's really imperative and urgent that we make progress in revitalizing a strong commercial nuclear energy sector, and VTR will provide U.S. industries and scientists a critical tool.

In terms of an update, you know, the work is ongoing with the VTR. The environmental impact statement work has been completed, and that statement will soon be released. The—in an exciting sort of forward movement, of course, we are—we have requested full funding for the VTR project to move forward, and we certainly do appreciate HSST's (House Committee on Science,

Space and Technology's) proposal to potentially fund that going forward, but we will pursue appropriate funding insofar as it is possible to move that project forward because it is a really urgent need to make progress in revitalizing commercial nuclear energy sector leadership here.

Mr. WEBER. Well, thank you for that response. And on any given night that you have insomnia and you need some nighttime reading, let me refer you to Amy Roma's testimony about how important this is because she lays out a very strong case of why it is so important.

This question will be for multiple witnesses. As part of my efforts to support advanced nuclear energy development, I have repeatedly emphasized the risk of our international competitors who are outpacing us. And it's all—obviously the reason for the VTR. So I'd like to ask each of our witnesses to answer this question. What happens—what does it mean to the United States if we cede leadership in the field of advanced nuclear technology to our competitors? I'll go back to you to start, Dr. Huff, but what does that mean if we lose that position?

Dr. HUFF. Our leadership enables us to assist in international nonproliferation goals, in commercializing our technology designed here to be built abroad. It also underpins our ability to stand strong in long-term conversations and relationships around the development of nuclear technology worldwide. And without that leadership, we have decreasing influence over those conversations.

Mr. WEBER. Glad to hear that you recognize that. Ms. Roma, I'm going to come to you next.

Ms. ROMA. Thank you. I cannot understate how important increasing U.S. competitiveness overseas is because, you know, it's easy to villainize Russia and China and just always say it's Russia and China's fault. Here, it is actually Russia and China. Russia has 60 percent of the global market for nuclear power—new nuclear power plants outside of its own country, 60 percent. Behind that is China. China's Belt and Road Initiative is the largest infrastructure plan that the world has ever seen, and they plan on building nuclear power plants if they can, if they can get these bids, all around the world.

One of the objectives of the BRI is not just economic, right? Both China and Russia stand to make hundreds of billions of dollars by getting these contracts for advanced reactors abroad. But one of the stated objectives of both of these projects is—under the BRI it's so that countries continue—instead of looking to the West, will look to the East for friendship, for business plans, for influence. Same with Russia. You know, they are developing these programs because of the huge economic benefits that they can reap but also the significant geopolitical influence.

And I think everybody right now is probably attuned to the energy crisis that we see emerging in Europe, right? And so right now when we look at, you know, the clean energy transition and how we're going to decarbonize the electricity sector, we also have to look at how do we ensure we have grid stability that we can turn the lights on and we get power and we have to look at how do we have energy independence and security? Every country has to take that into consideration. In Europe, which relies a huge amount of

its electricity on natural gas that's coming in from Russia, they really do have an energy independence problem.

And so underscoring how important this issue is I cannot put enough stress on. From an economic perspective, from an innovation perspective, from a national security perspective, it is absolutely critical that we maintain and promote our leadership on the global market.

Mr. WEBER. Well, I'm going to take it that you're in favor of that.

Ms. ROMA. Yes.

Mr. WEBER. So, Mr. Chairman, I'm going to yield back. Thank you.

Chairman FOSTER. Thank you. And we'll now recognize Representative McNerney for five minutes.

Mr. MCNERNEY. Well, I thank the Chair for holding this hearing.

I'm in favor nuclear energy because we're going to need it, but it's got to be done right, and that includes nuclear waste. But that's a topic for another discussion.

The *Energy Act of 2020* established a program on advanced nuclear fuel availability within the Office of Nuclear Energy. This is based on legislation that I led. The program directs the Department of Energy to create a strategy on advanced nuclear fuel like HALEU, including a survey of the needs of domestic commercial use. However, the first HALEU production contract went to Centrus before this survey was completed. So, Dr. Huff, what is the Office of Nuclear Energy's status on this survey of needs? And will it be completed in time for subsequent advanced nuclear fuel production contracts?

Dr. HUFF. Thank you. Yes, we plan to release a request for information (RFI) soon to solicit really broad stakeholder input on the various activities associated with HALEU availability, authorized under the *Energy Act of 2020,* so thank you, including the formation of a consortium for HALEU availability. Response to that RFI, as well as other stakeholder outreach, will inform the approach for consortium membership organization in governments, and our current plans, subject to appropriations, is to take actions to proceed beyond the completion of the AC–100M demonstrations in a competitive manner consistent with our commitment to competing work.

Mr. MCNERNEY. Thank you. The first HALEU production contract was awarded through a sole-source contract. However, the *Energy Act of 2020* also contain guidance for the DOE on milestone-based competitive award processes which would require certain technical and financial milestones be met before awarding a grant or contract. Dr. Allen, what are the benefits to using a milestone-based approach to award service selection rather than a sole-service—sole-source contract arrangement?

Dr. ALLEN. Yes, thanks for the question. I think the advantage is it allows you over time, right, to recalibrate the relationship and see if you're making progress. I mean, my colleagues at the Nuclear Innovation Alliance did a nice paper that looked at how this was used in the space program, right, and when you think about the awards that we have with commercial companies, we approach them at different levels, right? Companies that we think are closer to deployment, we invest more in. But all that can change, so you

want to be seeing are you meeting your milestones? Is your financial support consistent with the original agreement? And I think you're just going to end up with better outcomes over time that follows what you would see in normal commercial competition if you have the milestone approach. And so I think it's very important.

Mr. MCNERNEY. Well, thank you. Ms. Roma, do you have anything to add to that?

Ms. ROMA. Yes. So in the—you know, in the private sector space, this is—the milestone approach or tranche funding is actually very common. It allows you to invest kind of lower amounts of capital and that when somebody proves they can meet a stated clear objective, that kind of gives them access to the next tranche of money. And so you significantly de-risk your investment, but at the same time, you allow the money to continue to progress as those milestones are achieved.

It's actually also pretty flexible. I've kind of had to write up milestones for a number of VC (venture capital) investments kind of in the private sector space, and you can tailor it around regulatory accomplishments, technical accomplishments, business accomplishments such as having like land transferred over to the new entity, lining up a customer. And so you can really tailor it to each specific project, but it significantly de-risks the investment for taxpayers.

Mr. MCNERNEY. OK, good. Mr. Amey, how does the milestone-based approach make better use of government resources? And what would be the best practices for DOE to follow up on to ensure success at this point in the game?

Mr. AMEY. Well, as I think Ms. Roma just said, I mean, it allows you to move forward incrementally and pass off risk as you're moving forward, so I think that is a good step. We've all heard of the company SpaceX, and when the Air Force was trying to do launch vehicle contracts, SpaceX wasn't in—even in the market and—but the Air Force wanted to do a long-term lock buy and kind of lock in, and that was, you know—at that time Senator McCain pushed back on that approach and said, well, wait a second, these companies may not be viable, but they may be viable in the course of this contract. Why don't we just let them at the table? And eventually now look what SpaceX is doing. We're sending people into space, low orbit. They're getting now, you know, very large Air Force contracts. And I think that kind of getting people to the table and that kind of incremental milestone approach is the best way for the Department of Energy to go.

Mr. MCNERNEY. Well, thank you. I spent many years in industry, and although we didn't get government contracts, there's no way we would have sole-sourced our supply chain to—it just wouldn't work in the long run. So thank you for that output—input, and I yield back.

Chairman FOSTER. Thank you. And we'll now recognize Representative Bice for five minutes.

Mrs. BICE. Thank you, Mr. Chairman, and thank you for the Ranking Members and Committee Chairs putting this together today.

My question is for Dr. Huff. My State produces a lot of natural gas, which has served as an energy source working to reduce carbon emissions. Do you see a role for advanced nuclear reactors to

provide the high temperature heat needed in the steam methane reforming process that converts natural gas into clean hydrogen?

Dr. HUFF. Yes, absolutely. There is a strong role for the uniquely clean thermal energy produced by nuclear reactors to support previously fossil-fueled thermal energy applications like you have described.

Mrs. BICE. I like hearing that. OK. As a follow up question, does the Office of Nuclear Energy collaborate with the Office of Fossil Energy and Carbon Management (FECM) as a part of this effort? And if so, how?

Dr. HUFF. We are beginning a lot of conversations around how to collaborate with FECM. I'll tell you, breaking down those stovepipes internal to the Department of Energy and in fact across the interagency is one of the things I've been most excited about taking on this job. And I'll tell you the conversations that we're already having with FECM cover all kinds of aspects around coal-to-nuclear transitions for those unabated coal plants, as well as topics around hydrogen, for example, in the context of, you know, methane reforming, as we discussed.

Mrs. BICE. Great. Mr. Amey, do you have any recommendations on how the Department could better insulate itself against the risk of financial loss in the unique case of these sort of cutting-edge one-off projects?

Mr. AMEY. Well, wonderful question, thank you. It is—I mean, workforce issues came up earlier, and it sounded as if that was, you know, taking a look at what experience we can get from the outside market, but this is also about the Department of Energy ramping up its workforce and retention to make sure that it has the capabilities to analyze the technologies that are coming forward and enter the best agreements. I mean this is not just the contracting grant workforce or the oversight workforce or the IGs but this is also the program workforce to make sure that we have the right people in place. And, you know, hiring the workforce has been difficult for certain agencies. There's been some caps, and so that may be something you have to take a look at.

But overall, I think it is making sure that, again, we spend money wisely, we have competition, we have the administrative support that we need, the oversight, the accountability, you have the transparency that's there. I mean, it's pretty difficult to find any information about these contracts other than some summary data that's on the SAM system, the System for Award Management, or for the USAspending site.

And so, you know, I would also recommend that NE goes back and makes all these agreements and contracts available so we can see what's actually in them. What are the statements of work? What are the terms and conditions to make sure that we're getting the best bang for the buck?

Mrs. BICE. Do you think that's—that jeopardizes the maybe classified or maybe information that they're providing that's specific to the project that's maybe not public record?

Mr. AMEY. Well, there are certainly concerns that you have with privacy and with——

Mrs. BICE. Proprietary.

Mr. AMEY [continuing]. Proprietary trade secrets and classified information, and that can be redacted and should be, you know, redacted to the most limited extent, the least common denominator that it can be. So, you know, that's always possible, not asking for everybody to put everything out there that should not be publicly available, but it can be done, and it should be done so that we can learn a lot more about this, which will also bring in competition. It will also bring in innovation. I mean, the more people that see what's happening, the more people will think, and that's where you want the competitive, you know, private sector to kind of take over and say, well, they're taking it here, can we take it somewhere else?

Mrs. BICE. Well, I think that I hope to work with Representative Bonamici on some of the workforce challenges because that is of interest to me as well.

So finally, Dr. Huff, in your written testimony you state that any invest in RD&D that the private sector or other nongovernment stakeholders are unable or unwilling to perform due to uncertainty, cost, scale, or timeframes, how does the Office of Nuclear Energy minimize the risk to taxpayers when supporting projects involving substantial uncertainty?

Dr. HUFF. Yes, thank you for this question. I, too, feel strongly about ensuring that we do our homework and turn our homework in on time, as was said earlier, in terms of this sort of specific analysis. So the way that this typically works is we do real analysis of the exposure of the government during the process of awards, as well as during the approach to their completion. And programmatic oversight does pay attention to contract award procedures, accountability, and standards for risk on taking by the government through our PICS:NE system and, as was mentioned earlier, some of these other accountability systems within reporting requirements within the office. And we generally strive to ensure successful completion of these projects while simultaneously minimizing government exposure to risk by leveraging these kind of best practices for financial agreements when we do the contracting. Yes, we commit to making—moving forward decisionmaking based on really rigorous analysis underpinned by scientific fact, mitigation of government risk, and a focus on the benefit to the taxpayer.

Mrs. BICE. Perfect. Thank you so much to the panelists today. And, Mr. Chairman, I yield back.

Chairman FOSTER. Thank you. We will now recognize Representative Lamb for five minutes.

Mr. LAMB. Thank you, Mr. Chairman, and thank you to all the witnesses.

Dr. Huff, are you familiar with the provision of the bipartisan infrastructure bill that passed the Senate, hopefully soon to pass the House, that includes some money for DOE to use to preserve existing nuclear reactors that are threatened to shut down for economic or other reasons?

Dr. HUFF. Yes, I am. The Civil Nuclear Credit Program, which we're internally calling Grants for Plants, and we are preparing a plan to ensure that the oversight and distribution of those grants, if the bipartisan infrastructure bill passes, will be executed in a timely manner with a great deal of oversight on the calculation of

needs and risks of those companies and applicants that are interested in benefiting from those grants. And so we're working with a number of offices within DOE, contractors with relevant experience in industry, as well as in the interagency to ensure that we have a solid plan moving forward for how to implement that activity.

Mr. LAMB. Great. You know, given the number of reactors we have in the United States and how old they are, could you say anything about what you think a reasonable time period is that we should be trying to preserve these plants and whether—I think it was $6 billion in the Senate bill—sort of how that measures up to what you perceive the need to be? I know you probably can't be exact but just in general terms whatever you can share with us.

Dr. HUFF. Thank you. I appreciate the question, and I will resist the urge to attempt to be exact. It is a complicated challenge. The existing plants have—many of them have successfully applied for and received lifetime extensions from their original somewhat arbitrary 40-year lifetime extension—lifetimes to 60 and now some 80 years. And recognizing that the Department of Energy plays a role in ensuring that the research and development is done to ensure that those lifetime extensions are based on scientific fact, I believe that I see no real strong reason that those lifetime extensions can't continue quite a while into the foreseeable future for many or most of those plants. And the Nuclear Regulatory Commission will continue to review those lifetime extension applications to the extent that they are applied for.

Now, in terms of whether $6 billion is sufficient, you know, we've identified quite a number of at-risk plants that have faced competition in the markets in which they operate, and the number of plants is large enough where $6 billion will not be enough to ensure for certain that all existing reactors will continue to operate to the extension of their lifetime, but we will continue to evaluate that and implement all of the funding that is available and directed by Congress as it becomes available.

Mr. LAMB. Great, thank you. But, I mean, I think it's reasonable to assume that we're going to be having a life extension discussion for a decade or more from now, right? Because, I mean, these advanced reactors, as great as they are, may take us a while to build and test and prove and ultimately expand.

Dr. HUFF. Yes.

Mr. LAMB. Yes, OK. On the—just one question about the advanced modular reactor design and what you know about it. Our State, Pennsylvania, is a pretty large manufacturing hub for the current model of existing nuclear plants. I think we may actually have the highest number of companies and employees in the supply chain in the country. We're certainly up there. Do you know of any efforts at DOE that are designed to prepare companies and workers like the ones we have in our State to be ready to compete to be in the supply chain for the next design of reactor?

Dr. HUFF. Yes, as we in the Advanced Reactor Demonstration Program support the companies that have reactor concepts, part of that program does fund some of the supply chain efforts. And the Federal Government, of course, is undergoing a sort of broader effort to identify key supply chain risks, and our office is deeply en-

gaged, especially within the current DOE evaluation of those supply chain risks. And as we look toward the supply chain risks, they are an opportunity for jobs just like the rest of the energy transition. And I know our Office of Clean Energy Jobs is deeply engaged in that activity.

Mr. LAMB. Great. Well, I would encourage you in any way that you possibly can to try to make use of the experience and resources that exist within the firms that are doing this work already even with the new designs, and it's something we can stay in touch about. So thank you very much for your service and your presence with us here today. Mr. Chairman, I yield back.

Chairman FOSTER. Thank you. And we will now recognize Representative Garcia for five minutes. Or we will at least attempt to recognize Representative Garcia. And failing that, Representative Meijer, if you're willing to take over, you're—you'll be recognized for five minutes.

OK, I guess we'll have to find a way to warn them online.

And at this point I will, I think, proceed with Representative Stansbury if she is available.

Ms. STANSBURY. Good morning.

Chairman FOSTER. At this point I'd really like Members to please, you know, make themselves visible in the—if they think they're about to be up. It makes it much easier for staff and frankly for me. Thank you. Proceed, Representative Stansbury.

Ms. STANSBURY. Thank you, Mr. Chairman, and thank you for convening today's panel.

This hearing is all about good government and ensuring appropriate oversight over Federal agencies, their procurement practices, and ensuring that the taxpayers' dollars are being spent appropriately. The DOE contract in question today raises serious concerns. The Treaty of Washington prohibits foreign-owned businesses from producing unencumbered uranium that is fungible between civilian purposes and defense purposes. DOE's Office of Nuclear Energy has a strictly civilian mission, and, as such, unless they are directed to work with the DOD or NNSA (National Nuclear Security Administration), I believe that they should work solely within and on nuclear energy for nondefense purposes and that all companies that have facilities with those capabilities in DOE deciding that their HALEU production contracts could be used for defense-related applications raises a number of questions that must be addressed. And I'm glad to hear that the Department is taking this seriously.

So, Dr. Huff, my first question is actually for you. Did DOE's National Nuclear Security Administration or the Department of Defense contribute anything to the $115 million award DOE gave to Centrus?

Dr. HUFF. No, ma'am. To my knowledge, they did not.

Ms. STANSBURY. And, Dr. Huff, did NNSA or DOD ever formally ask the DOE to help make more unencumbered uranium available to support their future needs?

Dr. HUFF. I will have to get back to you to whether any such conversation may have happened, but my understanding is that we are in constant communication with NNSA and DOE about uranium, as it's a shared resource, and attempt to have a unified ura-

nium strategy, but I will—if you would permit me, I'd like to respond to that question for the record with the help of my staff.

Ms. STANSBURY. That would be wonderful, thank you. We will submit that as a question for the record.

And, Ms. Roma, you're familiar with the statutory mission of DOE's Office of Nuclear Energy. Does this office have a defense mission?

Ms. ROMA. No, I don't believe it does.

Ms. STANSBURY. And do you think it is appropriate for the Office of Nuclear Energy to be cornering the attribute of unencumbered uranium without DOE or NNSA helping to pay for it?

Ms. ROMA. Well, I think that probably is a better question for Dr. Huff, but I can say that to my knowledge that there should be no reason while—why the Office of Nuclear Energy, for its purpose, is worried about the encumbrances on uranium. The encumbrances on uranium restrict what it can be used for for largely defense purposes, but from a commercial sector if you're looking at fuel, it doesn't really matter.

Ms. STANSBURY. Thank you.

Dr. Huff, I appreciate your commitment for future HALEU production to be competitive, and I look forward to maintaining clear and open communication with the Office of Nuclear Energy and this Committee going forward to ensure that our taxpayers' money is being wisely spent and appropriately spent, and we'll submit some questions for the record.

And with that, Mr. Chairman, I appreciate the opportunity.

Chairman FOSTER. Thank you.

And, Representative Meijer, if you are prepared, you'll be recognized for five minutes. But absent that, I will then recognize Representative Casten.

Mr. MEIJER. Thank——

Mr. CASTEN. Thank you, Mr. Chairman. I appreciate you all being here.

My question is for Dr. Huff, and I apologize for being a little bit wonky. I'm an energy project finance guy by background, and I'd like to understand a little bit of the financing structure, the Carbon Free Power Project. First off, do I understand that that project is a 50–50 DOE private-sector joint venture? Is that right? And I think—go ahead.

Dr. HUFF. So it's important to note that there is an R&D component and a demonstration component to this award and so the cost share utilizes a formula that captures the R&D component with its appropriate level of government cost share and the demonstration component with its appropriate level of cost share.

Mr. CASTEN. Well, let me then just reframe my question. Of the $1.4 billion that we've approved so far, can I assume that that's matched with roughly $1.4 billion of money provided by the CFPP LLC (limited liability company) entity?

Dr. HUFF. Roughly, yes.

Mr. CASTEN. OK. All right. Do you know anything about the debt equity structure of CFPP LLC? And if you don't, that's OK. I'm just curious.

Dr. HUFF. I know a little bit, but in great detail I would refer to my staff.

Mr. CASTEN. OK. But they do have some level of equity participation?

Dr. HUFF. Yes.

Mr. CASTEN. OK. Does the Department of Energy or the U.S. taxpayer have any equity exposure in the project, or is it just a grant?

Dr. HUFF. I think we should—I should be very clear about this because there's a distinction between various kinds of grants that I would like to make sure are captured cleverly.

Mr. CASTEN. I guess what I'm wondering is if the future cash-flows of the project were to change, does the taxpayer have any downside exposure or upside gain from those change in future cash-flows?

Dr. HUFF. Yes. So it should be the case that while over time in each budget period there's a differing amount of cost share between the government and CFPP. The total project area, which ends in 2029, is less than 50 percent cost share by the government. In fact——

Mr. CASTEN. But I'm——

Dr. HUFF [continuing]. I think it's closer to 20——

Mr. CASTEN. But I'm talking about once—but I'm talking about once the project is fully operational. I realize that we're on the hook for the money going in, but to the extent that we make decisions right now that affect the long-term revenue of this project, I'm assuming that that all flows to CFPP LLC and not to the taxpayers. Is that a safe assumption?

Dr. HUFF. Right.

Mr. CASTEN. OK. So I ask that because now we've made this decision. As you know, we had $10 million that was appropriated for the jump reactor, that this 12th reactor was going to be a research and development. That, as you know, in the summer of 2020 was changed, and now that 12th reactor is a power-producing reactor. I'm assuming, all else equal, that that either increases the equity returns or in some fashion at least reduces the equity risk to CFPP LLC. And if I'm understanding what you've said so far, there's no incremental economic gain just from that decision to the government. Do I—I see you nodding. Is that—for the record, would you agree with that?

Dr. HUFF. Yes.

Mr. CASTEN. OK. So what did we lose when we took out—because the expectation was that that 12th reactor was going to be there for research purposes. I think it would be the first place in the world we would have been—you know, the INL researchers would have had the ability to tinker and learn in real time and in operating a next-generation nuclear facility. What did we lose in exchange for essentially de-risking the equity from CFPP LLC?

Dr. HUFF. Well, we did lose that opportunity to utilize the jump module for that research, which, you know, could have contributed to some research of interest to Idaho National Laboratory. But in general I think my understanding is that this was an acceptable pathway moving forward and was communicated fairly clearly to Hewden Suit at the time during the decisionmaking process.

Mr. CASTEN. OK. So we lost some long-term benefit for the taxpayer but we provided some short-term benefit for the private participants.

Was the decision on that tradeoff made in consultation with Congress, in consultation with any Federal oversight authority since the initial appropriation did contemplate that, or was that made unilaterally with DOE and private partners?

Dr. HUFF. As I was not there, I will need to go back to my staff and understand the timelines somewhat bit better in terms of their communications with Hewden Suit and the appropriators and whatnot, as well as the rest of Congress.

Mr. CASTEN. OK.

Dr. HUFF. But my understanding is that they did do a number of briefings with Hewden Suit on this topic, but I'm not sure exactly the order of operations——

Mr. CASTEN. OK.

Dr. HUFF [continuing]. So if you will permit me, I'd like to answer that question——

Mr. CASTEN. That would——

Dr. HUFF [continuing]. For the record.

Mr. CASTEN. That would be great. And last quick question before I run out of time, do you know if the decision to move that 12th reactor into commercial service was in any way required by the financing of CFPP LLC, you know, to meet some loan covenant or otherwise? In other words, did the DOE have a choice to keep the project going but for that change, and do you have any visibility into that decision?

Dr. HUFF. I do not know if that was the reason for that decision. I will—we can answer that question for the record.

Mr. CASTEN. That would be helpful. Thank you very much, and I yield back.

Chairman FOSTER. Thank you.

And now in order to return to proper bipartisan balance on the order here, we will be recognizing Representative Garcia for five minutes, followed by Representative Meijer. So, Representative Garcia, you are recognized.

Mr. GARCIA. Thank you, Chairman. I appreciate the opportunity here. I appreciate all the witnesses' testimony. I think we're all in concurrence that nuclear energy is a critical piece of the puzzle here moving forward. As someone who has lived a couple years of my life on a nuclear-propelled boat, I understand the benefits of it, as well as the low risk associated with it when it's done correctly.

Dr. Huff, if we can, I'd like to just put a bow on the sole-source award conversation if we can. Obviously, DOE and NE are subject to Federal acquisition regulations just like any other government. You mentioned there was a J&A (justification and approval) done. I'm assuming the J&A went through FAR (Federal Acquisition Regulation) 6.302, which are the reasons for a sole-source justification (SSJ), as well as FAR 6.303, which is the requirements for that J&A to go out the door before it goes out the door and substantiates the sole-source justification. I just want to follow up on my colleague Obernolte's questions and make sure that we're asking for the right artifacts. You will be providing to us the J&A with the reasons and the rationale behind the SSJ documents that ultimately led to the awards to us, is that correct?

Dr. HUFF. The DNFA documents that were requested by the Committee I think we already provided, but we will go back and

make sure that all requested DNFA documentation requested by the Committee is provided.

Mr. GARCIA. OK, thank you. I had a question on your opening statement and then a question—my actual question I wanted to get to, so I'll be brief. You mentioned that Biden's plan has a significant percentage of nuclear capability within it. Can you give us in a real quick sentence or two what is our current percentage of energy production as a result of nuclear relative to what the end state goals of this Administration are?

Dr. HUFF. Fifty percent of our—over 50 percent of our clean energy, clean electricity, is generated by nuclear. That's about 20 percent of our electric grid. The Biden Administration has not identified specific percentages of nuclear in terms of its long-term plan but recognizes nuclear as a key component in the strategy to reach our climate goals.

Mr. GARCIA. OK. All right. We don't need to do a deep dive on that, but I just want to recommend if you could shape that to have a meaningful metric or goal to attain. Otherwise, it's just a talking point. That's not attributed to you. I just—I think in our own interest we all need to have a goal to try to strive for.

So on the baseline conversations here, the recycling side of the house seems to be an opportunity where we can realize some gains. We've got about 85,000 metric tons, I believe, of nuclear waste out there. I've seen technologies being pitched that would take a lot of this waste, recycle it. Some of it gets reused and the distillates become less toxic for shorter—much shorter half-lives. Is this something that you guys have been looking at? And then I guess what is DOE looking to do in this field, and what sort of opportunities can we realize there in the short term with, say, studies? How can we help on the funding side? I—you know, I sit on Appropriations as well, and money is always a long pole in these types of things. But where can we help you, and what are the—what is the art of the possible moving forward on the recycling of waste side?

Dr. HUFF. Thank you very much for your question. You know, actually I have an—kind of interest is—my research is in nuclear fuel cycles, especially advanced nuclear fuel cycles and advanced reactors, so it's certainly a topic of extraordinary relevance and interest to me. As we look forward into the Advanced Reactor Demonstration Program reactors, we are very interested in ensuring that the fuel cycle is underpinning those reactor demonstrations, will be fully supported by the research ongoing within our fuel cycle R&D program within DOE NE, and sufficient support to ensure that the labs, you know, expert bench is deep over time alongside the progress of those advanced reactor demonstration awards is really critical to ensuring that, you know, as needed, fuel cycle research and development can be supported and experts are available at the national laboratories to——

Mr. GARCIA. Can I ask a clarifying question? When—you're saying fuel cycle research and development. Is that—that includes the recycling element on the backside, correct? OK. Sorry——

Dr. HUFF. That's right. Cycles include both the ones through fuel cycle, as well as closed fuel cycles that incorporate recycling like what you're discussing.

Mr. GARCIA. Got you. Got you, got you. OK. Very good. And I certainly would be interested off-line if we can get whatever information, if my office can coordinate with you to see sort of what the state-of-the-art and the art of the possible in this regard.

Dr. HUFF. We'd be thrilled to give you a briefing.

Mr. GARCIA. Thank you all for your service, and I yield back, Mr. Chairman.

Chairman FOSTER. Thank you. And we'll now recognize Representative Meijer for five minutes.

Mr. MEIJER. Thank you, Mr. Chairman, and thank you for our panelists who are gathered here today and for holding this hearing. I guess I also want to specifically welcome Dr. Allen from Michigan State University. Glad to have another Michigander here in the room.

I have a couple of more specific questions that I want to get to in a second, but briefly, Dr. Allen, could you just briefly comment on the role that the nuclear academic community can play on ensuring the success of public-private partnerships?

Dr. ALLEN. Yes, I think it's very important. You'll notice if you dig into the history of some of these companies that are—you're now talking about new products. Those came from academic institutions, right? So I think we play a role in workforce development, which we've already talked about. I think innovating so that maybe the generation after this one is even better, like we view that this is just the first step in a long number of advanced nuclear technologies. And so I think anywhere from innovation, workforce, getting people to use our facilities to support these companies are all important. So we do more at the front—at the innovation side, but we support end-to-end.

Mr. MEIJER. And then obviously NuScale came out of that kind of academic environment and a lot of which——

Dr. ALLEN. Right.

Mr. MEIJER [continuing]. Good, close collaboration with the Department of Energy as well.

And I guess, you know, getting back to NuScale, are there any domestic nuclear reactor manufacturers—I mean, NuScale is coming online with their small modular reactor, but is it—is there anyone but, you know, Westinghouse, who's obviously in a bit of a tenuous position?

Dr. ALLEN. So at the moment you have a number of U.S. companies that support parts, so Westinghouse clearly, but GE, BWXT does work, and then you've got an entire set of innovators that we—you'll see partnerships between them and some of these companies so there's more than just Westinghouse.

Mr. MEIJER. OK. But is it fair to say it's a quite concentrated industry at the moment?

Dr. ALLEN. It is. And I think the vision of the future is that you're expanding into new products, new business models, then that becomes a much more broad and important part of a clean energy economy.

Mr. MEIJER. No, I think—and that's where I'm excited to see, you know, where we are right now and that, you know, expanded approval and, you know, supporting an entrepreneurial process so that we can diversify, what I think—getting back to what Mr. Gar-

cia was saying is a widespread agreement on the need to incorporate nuclear energy into our future, kind of carbon-free electrical generation.

I guess shifting briefly to Dr. Huff, you know, I—you know, along with our Chairman and Mr. Casten, you know, I cosponsored—and Mr. Gonzalez as well cosponsored H.R. 4606, the *Energizing Technology Transfer Act.* Can you touch briefly upon how the Office of Nuclear Energy coordinates with the Department's Office of Technology Transitions (OTT), you know, to help those reach the market? And referenced, you know, NuScale earlier, so if that's a helpful analogy. You know, I mean, how can we best smooth that adoption so we get it from decades to years?

Dr. HUFF. Thank you for the question. I really appreciate that. And the Office of Technology—OTT and NE work really closely together, especially recently. The energy in that office is really exciting right now as we look toward a clean energy transition.

We are working to ensure that our TCF, the Technology Commercialization Fund, activities are incorporated in a sort of bigger vision for the future, and we also have been working to ensure that their best practices and ideas for technology transition can help us in projects like NuScale to ensure that an order book of future reactors follows our investment in the first of a kind in these devices, not just with NuScale but also with the ARDPs and the risk reduction awardees and ARC–20 awards. It's important for our strategy to coordinate with OTT, and we're doing so as much as possible.

Mr. MEIJER. Thank you. And then I neglected—I apologize, Dr. Allen, I did not realize you were also a University of Michigan grad, so I apologize for throwing a Spartan reference your way.

Dr. ALLEN. Thank you. Twitter probably is going to be a lot nicer to me now you corrected that, so I appreciate it.

Mr. MEIJER. But I, you know, just appreciate the opportunity to discuss on this, and I think, again, warm receptivity of—among the Subcommittee on how we can best support all of these components. So with that, Mr. Chairman, I yield back.

Chairman FOSTER. Thank you. And we'll now recognize Representative Perlmutter for five minutes of trash-talking.

Mr. PERLMUTTER. Thank you, Mr. Chair. And this is our second day in a row talking about nuclear physics and nuclear everything, so yesterday was about nuclear electricity propulsion and nuclear thermal propulsion, which is going to be a key component for us getting our astronauts to Mars by 2033.

I guess I go with you, Mr. Amey. I mean, obviously, we always want to default to competition because that brings more robust thought and innovation, but from time to time sole source is appropriate. So I'm not—I don't have a knee-jerk reaction against the sole source, but I do if the rules of engagement were not followed. So if in fact people were not following the rules—and, Dr. Huff, you think that based on your review of the record—you weren't there at the time—you think the sole-source approach was followed appropriately in this instance?

Dr. HUFF. That is my understanding.

Mr. PERLMUTTER. OK. Has there been much of an investigation into it?

Dr. HUFF. I have asked my staff to ensure that this was the case, as well as our procurement office and contracting office, and they of course follow all procedures and feel that it was executed neatly.

Mr. PERLMUTTER. OK. All right. But I think from sort of the perspective of others, they're—they rely on budgets that are set by the Department. They rely on the budgets that are set by Congress. So this is for you, Dr. Allen. The Nuclear Energy University Program (NEUP) is an important funding mechanism for nuclear engineering programs at universities like the Colorado School of Mines in my district. And for Ms. Bonamici, I don't know if she's still on the line, but the School of Mines has access to a nuclear reactor, which is owned by the Department of the Interior and the USGS (United States Geological Survey), so I want you to know there are other students who have access to a nuclear reactor, not just your people at Reed College, OK?

So the research being performed at the School of Mines and other universities represent the lifeblood of American innovation. However, to cover the cost of the 2019 Centrus award, DOE withdrew nearly 1/3 of the Nuclear Energy University Program's budget in the middle of its funding cycle. So, Dr. Allen, as the Chair of the Nuclear Energy Department Heads Organization, how did this episode unfold for your university or other university nuclear programs?

Dr. ALLEN. Yes, great question. I think it actually caused quite a bit of turmoil. It happened at the very last second after people had done a lot of work. It appeared to be out of nowhere, right? I mean, the universities would understand the importance of the high-assay, low-enriched uranium program. There wouldn't be an argument about that need. But the fact that suddenly the money was pulled out to do that contract just seemed like an issue that could have been—that it was coming, right, the need for HALEU was known.

And so in a lot of ways I think this caused a bit of a lack of trust between the university community and the DOE. I think to her credit Dr. Huff is trying very hard, right, to bring that relationship back to working well together, but it—yes, it was a very bad, and it's caused a lot of negative repercussions.

I will say though that I think that it's forcing a lot of people to understand how we do the university programs, so we'll make some good out of that bad. But at the time it was horrible. It cutoff opportunities for faculty who had spent a year preparing proposals.

Mr. PERLMUTTER. OK. Well, and I think that—I want to give department heads, folks at DOE, Dr. Huff as much discretion as possible, but they also have to understand with that discretion they have a responsibility to make sure they fulfill prior commitments. So I just appreciate the panel's testimony, and any help you can get our astronauts to Mars by 2033 would be appreciated because it's clear that nuclear propulsion is going to play a role. Thank you. I yield back.

Mr. AMEY. Congressman Perlmutter, if I may jump in on your previous question, and it was something [inaudible] when Congresswoman Stansbury also asked a question about—on the competition front. And I said it earlier. Holding a competition isn't just a check-the-box exercise, and so they could have done everything

according to [inaudible]. They could have—you know, they put out their notice of intent to sole source the contract. You know, they held it open for a few weeks, and then they—you know, they did J&A. All those things checked the box and it appears it's fine. But when you analyze these justifications and approval for sole-source contracting, there are some red flags that pop up.

And again, I mentioned [inaudible] proprietary products that only one producer can then work with, and so are they limiting competition in that way? On the defense-related issue, I mean, I saw that that was mentioned in the justification and approval for the Centrus contract, and that that meant it had to be U.S.-owned and U.S.-controlled company that can only bid on it. What was——

Mr. PERLMUTTER. So, Mr. Amey, my time is expired, but you're right. Any good lawyer who wants to try to refine it down to just one potential applicant can do that, so——

Mr. AMEY. Right.

Mr. PERLMUTTER [continuing]. That's why we want to default toward competition. And I agree with you on that. But I guess what I was saying sometimes sole source is OK in my opinion.

Mr. AMEY. Right.

Mr. PERLMUTTER. But with that, I'll yield back to the Chair.

Mr. AMEY. Thank you.

Chairman FOSTER. Thank you. And we'll now recognize Representative Feenstra for five minutes.

Mr. FEENSTRA. Thank you, Chairman Foster and Chairman Bowman and Ranking Members. I want to echo my colleagues' support for nuclear energy as it is an important piece of energy future. It is important that we make sure that we do our due diligence when directing funding and selecting nuclear R&D projects to make the most productive investments. And thank you to each one of the witnesses for their testimony and sharing their extensive research and experience with us.

Dr. Huff, over the past few decades the Office of Nuclear Energy typically spends a large percentage of its budget on program direction and facility operations. Why is this portion so large compared to the DOE's other energy offices such as fossil and renewable energy? Can such expenses be reduced in your estimation?

Dr. HUFF. Thank you for the question. We have the privilege and honor to oversee the operations of the Idaho National Laboratory, which is quite large comparatively to a lot of the other national laboratories overseen by similar offices. And I think you'll find that the vast majority of our infrastructure work is in a security and a class level of technological safety that require an expensive facilities management approach.

In terms of program direction, I'm actually—my understanding is that our program direction is comparable, but I will look into it and try to understand better the source of this question that you have.

Mr. FEENSTRA. Dr. Huff, I appreciate that. And do you think the Office of Nuclear Energy spends an appropriate amount of funds on nuclear energy development in contrast to our geopolitical allies and, more importantly, adversaries?

Dr. HUFF. It's a wonderful question from this perspective of, you know, where we need to go. And I'll tell you I don't have full transparency into how much our competitors are spending, but I would

say that the implication that I've seen on the international stage is that, you know, we will need to work hard not to fall behind in comparison to these competitors, so I hope that answers your question.

Mr. FEENSTRA. I appreciate those comments.

Dr. Allen, you may know that China brought online the world's first gen-IV reactor, a small pebble bed reactor that utilizes TRISO fuel and is a helium-cooled. The United States and U.K. developed this fuel in the 1960's and 1970's and had been pursuing these reactors. Despite over hundreds of millions of spending on TRISO fuels and half a billion in spending on the next generation nuclear plant in the 2000's for pebble bed gas reactors, how has China beaten us to the punch when it comes to this front?

Dr. ALLEN. I think they did some things that we're now catching up on, right? For years if you look at the U.S. approach, it's been very much a research-and-development approach. So we did a lot of work to improve TRISO fuels and things. We didn't have as sophisticated an approach toward getting commercial deployment, right? So the Chinese made this commitment, right? It's more of a State-run program, but they're going to build a demo, right? Whereas here, we're relying on our domestic commercial sort of entrepreneurial firms to help drive that for us. I think that's smarter. I think our industry is better at developing commercial products than researchers like myself. But I think they took this step of starting to see the importance of having a program that looks at all the elements, infrastructure, early innovation all the way up to deployment. I think we're catching up a little bit there. We set the structures now. We just have to execute them smartly.

And I do think, to finish your question, if you look at the things they do, we have a lot more types of products and things, right? Where we fail is we get ahead of them and then we let them catch up.

Mr. FEENSTRA. Yes. And I tend to agree with you. And I sometimes think our regulatory environment sort of hold us back. And I think that can be a significant concern. I mean, do you sort of see that also?

Dr. ALLEN. Well, I think that our regulatory system is good in the sense that it forces public consultation in a very open system and making sure we regulate. I do think that our regulatory system gets very focused and knowledgeable in light water reactors, right? And we're sort of starting to see that transition to being able to do advanced reactors but it's another area where we're needing to catch up.

Mr. FEENSTRA. I appreciate, Dr. Allen, your comments. And thank you to each one of you, and I yield back my time.

Chairman FOSTER. Thank you. And we'll now recognize Representative Stevens for five minutes.

Ms. STEVENS. Dr. Huff, when did you get to the Department of Energy?

Dr. HUFF. May 10th of this year.

Ms. STEVENS. So where were you when this sole source was going on with HALEU?

Dr. HUFF. I was an assistant professor at the University of Illinois applying for, in fact, NEUP awards in my research area of ad-

vanced reactors and fuel cycles, which included a large number of prepared proposals in the areas that were cut for that Centrus activity. And I——

Ms. STEVENS. And where are you—you're acting right now. Where are you in terms of a confirmation? Have you had hearings or do you have any insight into when you're going to get officially confirmed, or are we waiting for an official announcement that you're going to be the Assistant Secretary? Apologies for not knowing this.

Dr. HUFF. No nomination has been made for the Assistant Secretary in DOE.

Ms. STEVENS. Well, thank you so much for your service to our country and for leaving a very prominent post. You know, I say this as a Michigander, but we certainly have a lot of respect and admiration for the University of Illinois Urbana-Champaign. I've worked with many scientific researchers at that university over the years.

And certainly I think Dr. Allen, you know, mentioned your understanding and appreciation for the role of the universities in this effort, and certainly your background speaks to it. And I think my questions were intended to codify for the record because I understand you are answering a lot for things that happened before you arrived at the Department of Energy.

And certainly, you know, reflecting today, you know, in 2016 we observed the 50-year mark from, you know, where I call home, the metro Detroit, Detroit area since the Detroit Edison Fermi's nuclear plant suffered a partial meltdown caused by a piece of floating shrapnel inside the container vessel.

And so, Dr. Huff—and also maybe Ms. Roma wants to get involved in this, too, and thank you all for your amazing testimonies. But how do you think the Office of Nuclear Energy will successfully utilize this—the large increase in funds to ensure safe engineering in the industry—in the nuclear industry, and how do you plan to measure that success?

Dr. HUFF. Safety is absolutely paramount in the context of nuclear energy, and our consistent relationship with the Nuclear Regulatory Commission, as well as our very serious and safety-conscious oversight of our DOE authorizations around nuclear safety are both absolutely paramount to our forward movement, our strategy, and our core metrics. Safety incidents are consistently measured, watched, and responded to within my office at the national laboratories we're involved with and through our collaborations with industry and the universities.

Ms. STEVENS. Yes.

Ms. ROMA. I would just briefly add to that that none of the benefits of nuclear power, the carbon-free benefits, the economic, the national security, none of those happen if we can't operate plants safely. And, you know, one of the benefits that we have in the United States is we have the best-run nuclear fleet. We have one of the strongest nuclear regulators in the world that is one of the most respected nuclear regulators in the world. And for both the existing fleet and for the emerging advanced reactor fleet, that needs to continue to be the case in order for this to be a success.

Ms. STEVENS. Great. And, Dr. Allen, you talked about in your testimony that the Office of Nuclear Energy should include community input and engagement from the earliest stages of technology design to ensure that technologies being developed will ultimately be adopted by communities. Could you share a little bit about what that looks like and why this is so important and any example of how work in places like Michigan, which not only are you a professor at U of M, Dr. Allen, but you are also a Michigan native, we're very proud of you, so, you know, just places where, you know, similar to Michigan are—obviously where we call home where this has been an example. And I guess I'm at 30 seconds, so give it your best go.

Dr. ALLEN. Yes, well, I think in short, right, traditionally, the nuclear engineering field has concentrated on technology, right? But a lot of getting any product placed is how do people accept it, how much do they want it, what's the value versus risk to them? And so I think we need to be much more sophisticated from how we do design, how we talk to communities about new technologies in a way that we just haven't done in the past, right? And I think at every level, early research up through deployment. And if we wait to the last minute, we wait till the product is done, and we pick a site, and then we start a conversation, we're less likely to be successful.

And to give Dr. Huff credit, for the first time since I've been around, there are research grants in these areas available this year. So we're taking it seriously. And I think it's important to the long-term success of our technology.

Ms. STEVENS. Now, we are certainly really lucky to have Dr. Huff doing what she's doing right now. And while I'm out of time, count me in, Dr. Allen, on that community engagement in any way I can be helpful to you on the ground in Michigan.

Dr. ALLEN. Yes, glad to engage on that. Appreciate it.

Ms. STEVENS. Thanks. Thanks. And, Mr. Chair, I'll yield back.

Chairman FOSTER. Thank you. And we'll now recognize Representative Gimenez for five minutes.

Mr. GIMENEZ. Thank you. Thank you, Mr. Chairman.

Dr. Huff, I believe you have extensively studied thorium fuel cycle and molten salt reactor technology in your career. Your predecessor in the Obama Administration, Dr. Peter Lyons, testified to this Committee in 2014 that thorium reactors are not an option that the United States should be pursuing. He was also instrumental in implementing an MOU (memorandum of understanding) between the Chinese Academy of Sciences and the U.S. Department of Energy.

The report from the first executive committee meeting under that MOU mentions sodium-cooled fast reactors once, gas-cooled reactors are mentioned three times, but thorium molten salt reactors are mentioned some 30 times. China is spending about $3 billion on these reactors. The first of them is—should be coming online sometime later this month. I think it's in Wuwei. Reports suggest that China intends to export these reactors as part of their Belt and Road Initiative. What should the DOE be doing to respond to these developments in China?

Dr. HUFF. Thank you for the question. You know, in—DOE NE funds molten salt reactors in multiple ways. Some thorium molten salt reactor companies are interested in that work because the current sort of funding that we've implemented in the context of the risk reduction awardees includes at least one device that can be fueled by either uranium or thorium. We do research in the fuel cycle area in molten salt reactor fuel cycles that can leverage either uranium or thorium.

When we think about the sort of Chinese example that you described, something I often think about—comes back to an earlier question—but we demonstrated this kind of reactor in the earliest days of our research reactor program in the 1950's and 1960's and have since determined that the thorium fuel cycle is not economic in the United States at this time. So additional research to ensure that such a fuel cycle becomes economic might enable those companies to move forward, but, generally speaking, our view is that such an approach would not be economic at this time, given the amount of supply chain surety that we have in uranium instead.

Mr. GIMENEZ. But that—we shut that demonstration project in the 1960's or 1970's, right? It was shut down, is that correct?

Dr. HUFF. Yes, sir. You'll be excited to know that one of the risk reduction awardees is a collaboration between Southern Company and TerraPower on a molten fluoride reactor experiment that we're really excited about seeing revive that activity in a new and more modern technological direction.

Mr. GIMENEZ. Are the Chinese doing—are they utilizing advances in technology in the last 40 years in order to make this more economical?

Dr. HUFF. Yes, as will our risk reduction awardee project.

Mr. GIMENEZ. OK. And in light of the fact that they're moving forward, if it proves to be successful, would the United States be following suit or are we going to go some other direction?

Dr. HUFF. That's a great question that we'll have to determine at a later time. I'll say that it's certainly the case that there are other motivations for molten salt thorium reactor fuel cycles that are closer to proliferation concern that China or—you know, may be interested in and we may need to factor that into the sort of possible motivations.

Mr. GIMENEZ. OK. Let me—OK. Last question, when was the last nuclear, you know, facility in the United States put into operation?

Dr. HUFF. The completion—I'd have to get the year dates. Maybe Todd remembers the most recent when——

Dr. ALLEN. Yes, I think it was about—within the last decade, right? The plant in Tennessee——

Dr. HUFF. Right.

Dr. ALLEN [continuing]. And it had been started and then stopped, and then they refinished it. So we had a long stretch where we had completed all the light water reactors and we had none and roughly—I don't have the date in front of me, but roughly 10-ish years ago we completed one. And now we've got two in Georgia that are getting close to completion.

Mr. GIMENEZ. Well, the reason I ask the question is that I, you know, had extensive conversations with people in the power indus-

try, and they said—and the one in Georgia was way over budget, way out, you know, beyond its time, and that power companies are just not looking at a nuclear power as a viable option in—because of whatever reason. I mean, maybe regulatory reasons, et cetera. But we need to do a better job of incentivizing this because this is the way that we can get that to a zero carbon—or, you know, electricity production and energy production in the future.

Renewables are great, but they're not predictable, and so we need something predictable. And the only thing that I know of that produces electricity with zero emissions that is completely predictable is nuclear power, and so we really need to do a better job as a country of trying to move this along. Thank you, and I yield back my time.

Chairman FOSTER. Thank you. And we'll now recognize Representative Gonzalez for five minutes.

Mr. GONZALEZ. Thank you. And I want to thank the Chairs and Ranking Members for holding this important hearing. I also want to thank our witnesses for taking time out of their busy schedules to join us.

As many of my friends on this Committee know, I have been adamant that if the United States wants to claim to be a global climate leader, nuclear energy has to be a major priority. Here's what we know: First, nuclear generates energy with no carbon output. In fact, the only carbon it does emit is from the ancillary use of fossil fuels used during construction, mining, and maintenance. When we close nuclear plants, we aren't shifting to other sources of clean energy. In nearly every case we shift back to fossil fuels such as natural gas, oil, and coal. We've seen this happen in Germany, in California, and most recently in New York.

Second, nuclear operates at a significantly higher capacity than renewable energy sources or fossil fuels and takes up significantly less land. We don't talk nearly enough about that. It takes 150 times more land to produce the same amount of energy from solar as it does nuclear. It takes 750 times more land to produce the same amount of electricity from wind as nuclear. All of that, the materials required, the steel, the concrete, all the things that you worry about as an environmentalist, five to seven times more of them are required for wind and solar than nuclear.

And lastly, we've made substantial progress over the last few decades in nuclear waste disposal programs. Thanks to the opening and operation of the Waste Isolation Pilot Plant in New Mexico, we've learned deep geological disposal is a safe solution for nuclear waste for defense activities, but we do need greater international and stakeholder engagement in the future. These programs make clear that we can effectively resolve the commercial nuclear waste challenge.

The question with nuclear is ultimately how we solve the economics, which has been a problem. From my perspective, the answer is rooted in establishing an incentive structure that not only drives innovation but also ensures the new technologies developed make it to market and are deployed, and that's where the DOE and our universities step in.

So, Dr. Allen, I want to start with you, and I want to thank you for your support of my legislation, H.R. 4819, the *National Nuclear*

University Research Infrastructure Reinvestment Act. And I'd be remiss if I didn't also express my gratitude for your efforts at NEDHO (Nuclear Engineering Department Heads Organization) to develop our Nation's nuclear workforce in advanced critical R&D.

In your testimony you mention a sort of disconnect between industry, laboratories, and research institutions. As you know, my bill would set up a partnership framework between these communities to help advance the research needs of advanced reactors. Can you speak more to the importance of these partnerships in determining the success of DOE nuclear programs?

Dr. ALLEN. Yes, thanks. Thanks a lot. And thanks for your support on your resolution. We in the university community appreciate that.

Yes, I think the point I was trying to make is, as we move toward being more supportive of nuclear energy and we've been thoughtful about how do we give access of these commercial companies to the laboratories, how do we connect to university research into the flow of everything else that to a certain extent the programs we've developed, while useful elements, don't talk to each other well, right? And that's where I think we're lacking. And I think we could make this more efficient in the way that we spend your funds.

And that's the point I was trying to get at. I mean, if I look at things like the Advanced Reactor Demonstration Program structure, it looks like it makes sense, right? You invest more in companies that seem closer to deployment, less than others. The questions just are then how do you flow research to them? How do you make it easy for them to get access to our national lab capabilities, right? And I think those are the try—the points I was trying to make. I think the elements all make sense. And if you compare where we are now to where we were 5 years ago, we are moving ahead so much faster, right? It's really just a question of do we get sophisticated in the way we execute programs that equals the programs that we're developing?

Mr. GONZALEZ. Yes. And I appreciate that. I think the goal is not only we are doing better but we need to do three times, four times, five times as well. I almost have an endless appetite for this.

Dr. Huff, I only have a minute left, so rather than ask a question, I'm just going to kindly request that your staff and—that you and I get a chance to sit down, and I'd love to just hear your perspective more on how we as Congress can support your work at the DOE. I think it's enormously important. Last—or yesterday we were in a hearing—and I see Mr. Casten is still on. He mentioned Ontario as having 90 percent renewable energy, which is great. Sixty percent of that baseload is nuclear. And, you know, I think if we're going to hit our climate targets, if we're going to hit our targets and do it in a way that's responsible, nuclear has to be at the forefront. It just does. I don't see any other way around it. So I kindly request a meeting. Our staff will follow up with yours, and I yield back. Thank you, Mr. Chair.

Chairman FOSTER. Thank you. And so before we bring this hearing to a close, I want to thank our witnesses for testifying before the Committee. You know, this—you know, the message that I think—I hope came clearly through is how much there is real bi-

partisan enthusiasm for making sure that we have a healthy and well-executed program of nuclear research and deployment. And I, too, will look forward to a briefing on the specific items of interest for—coming from my office.

And so the record will remain open for two weeks for any additional statements from the Members or any additional questions that anyone on the Committee may ask of the witnesses.

So the witnesses are hereby excused, and the hearing is now adjourned.

[Whereupon, at 12:12 p.m., the Subcommittees were adjourned.]

Appendix

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by Dr. Katy Huff

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QUESTIONS FROM CHAIR EDDIE BERNICE JOHNSON

Q1. The Government Accountability Office, or GAO, is reviewing the Department of Energy's management of several large carbon capture demonstration projects over the last decade. And I believe that there are important lessons that the Office of Nuclear Energy can learn from these past projects.

The first GAO finding I'd like to discuss is about the project selection processes. GAO found that DOE fully committed to certain projects from the start, and in some cases without any competition. In fact, 7 of the 8 projects that DOE selected in this manner failed or withdrew. In contrast, 2 of the 3 projects that DOE selected using multiple phases ended up being built. In such a process, DOE chooses several awardees at the start, and then more promising projects are selected to continue to receive funding into the next phase.

Q1a. Dr. Huff, did the Office of Nuclear Energy consider using a competitive, multi-phase process when selecting the recipients of its recent sole-source awards, and if not, why?

A1a. When the Office of Nuclear Energy (NE) determines that it is appropriate to enter into a cost shared, public-private, technical partnership with industry, its default position is to pursue a competitive award process. However, in some recent cases, NE, in consultation with Department of Energy (DOE) leadership, determined that it was in the public interest to pursue non-competitive project awards.

For example, in February 2020, DOE and NuScale Power entered into a non-competitive financial assistance cooperative agreement to finalize the NuScale small modular reactor (SMR) design and complete certification/licensing of a standard plant while also completing a state of manufacturing and supply chain readiness, and operational planning. The award is nominally a 50/50 cost share, but as overall project costs have grown, the government's agreed-to $263 million (M) contribution has remained fixed, resulting in a currently planned 40 percent (%) cost share for the government. This multi-year award includes the full schedule, cost, scope, and major milestones required to

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position NuScale to commercialize its reactor design. The award also informs Congressional appropriators, DOE and the Office of Management and Budget of outyear funding requirements to complete the project.

NuScale Power received its initial award to develop this reactor technology through a competitive award process in fiscal year (FY) 2014 under the NE SMR Licensing Technical Support (LTS) program. A similar competitive SMR LTS award was made in FY 2012 to B&W to develop its mPower Reactor (Note: B&W later discontinued development of mPower). NE made two additional competitive awards to NuScale for SMR design in FY 2018 and 2019 via the NE Industry Funding Opportunity Announcement.

In October 2019, it was determined to be in the public interest to define and complete the remainder of the NuScale SMR design project via the current award without further competition. This decision process included approval by senior DOE leadership and consultations with Congressional appropriations staff.

Also, in October 2020, DOE entered into a non-competitive financial assistance cooperative agreement with the Carbon Free Power Project (CFPP), LLC to provide public support to the first commercial demonstration and deployment of the NuScale SMR standard plant at the Idaho National Laboratory (INL) site. This project is led by CFPP, a wholly owned entity of Utah Associated Municipal Power Systems (UAMPS), which is a political subdivision of the state of Utah. The original award agreement supported obtaining a Combined License from NRC to construct and operate a 12-module, 720 megawatts-electric (MWe) standard NuScale SMR at the INL site. The agreed to $1.3 billion government contribution, subject to future appropriations, represented a 23% government cost share to the overall project cost. This non-

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competitive selection of the CFPP project to demonstrate a NuScale SMR was made consistent with language and funding provided by Congress under the Advanced SMR Research, Development and Demonstration (RD&D) program, which was expanded in FY 2020 and 2021, both in scope (adding Demonstration) and funding after consultations with Congressional appropriations staff to clarify distinctions made in language between companies receiving Advanced SMR RD&D funding and those eligible to receive Advanced Reactor Demonstration Program (ARDP) funds.

DOE entered into the CFPP award non-competitively because: 1) it was in the public interest; 2) NuScale and any partner it selected were ineligible to participate in the major competitive opportunity offered through ARDP; and 3) no other entities were known to be interested in deploying a first-of-a-kind NuScale Plant. Details on these reasons are documented in the October 2020 Determination of Non-Competitive Financial Assistance (DNFA), which was reviewed and approved by the Deputy Secretary of Energy. This process and the DNFA documentation were discussed with Congressional appropriations staff prior to and after award.

Finally, NE entered into a non-competitive award with Exelon in September 2021 to complete the Nuclear Industry Safety System Digital Upgrade project due to an established, well publicized collaboration and an aggressive timeline to meet the next scheduled outage at the designated pilot project nuclear power plant in Pottstown, Pennsylvania. Prior to the award, significant outreach was conducted with leading industry utilities to gauge interest in leading a project of this magnitude. Each utility addressed their support of the technology advancement but reiterated their desire to be a second mover to incorporate any lessons learned from this initiative. Exelon Generating Company was the only utility to step forward and indicate interest in being the first mover. Since the initial feasibility studies were performed, NE, INL and Exelon have

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presented their work and project plans at multiple industry meetings and working groups and reconfirmed industry's interest in closely monitoring the project's accomplishments.

Q1b. Do you plan to use this more deliberative selection process going forward?

A1b. NE intends to utilize a competitive selection process to select the highest qualified applications for future awards. Going forward, NE will carefully consider the methods used to execute financial assistance awards and use competitive vehicles whenever possible to assure fairness and to provide opportunities for the U.S. industry in meeting the goals of Congress and the Department.

Q1c. Are there any other sole-source awards that DOE NE is currently considering?

A1c. NE is sensitive to the concerns of Congress regarding the use of sole-source versus fully competitive processes and has eliminated any plans to execute additional sole-source awards, with one exception. The only sole-source award currently being considered by DOE NE are two cooperative agreements with the Shoshone-Bannock Tribes. They are the only local tribes in the area and have ancestral lands on the Idaho National Laboratory. The cooperative agreements are based on the DOE/Shoshone-Bannock Tribes Agreement in Principle (AIP), which is based on the Fort Bridger Treaty of July 3, 1868. These Agreements are applicable to actions and operations of DOE and its contractors on the lands of the INL that affect original ancestral territory and Tribal lands. One cooperative agreement is for the Tribal Office of Environmental Management and the other is for the Tribal Office of Emergency Management. Both cooperative agreements are estimated at $5.1M for five years.

Q2. The second GAO finding of interest is about project management. GAO found that DOE increased risks to taxpayers by skirting around established milestones on several struggling projects, resulting in the Department spending hundreds of millions of dollars

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on projects that were never built. The lesson here is to not only establish milestones in project agreements, but if those milestones aren't met, be open to cancelling the project.

Q2a. Dr. Huff, what performance milestones has DOE built into recent awards to decide whether to continue projects, or terminate them and minimize losses?

A2a. Every project the Office of Nuclear Energy awards has defined performance milestones built into the award to ensure project status can be tracked. Continued invoice payments are dependent on a determination of adequate project progress on milestones as determined by the program manager and technical project officer. In addition to those milestones, a continuation application is required to be submitted to DOE for approval at least 90 days before the end of each budget period. The applications are required to include the progress towards meeting the objectives of the project, including any significant findings, conclusions, or developments, and an estimate of any unobligated balances remaining at the end of the budget period. If it is determined that the project is not meeting the objectives of the project, appropriate action is taken to remediate that deficiency or terminate the project.

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QUESTIONS FROM CHAIR BILL FOSTER

Q1. The three-year HALEU demonstration contract issued by the Office of Nuclear Energy in 2019 is scheduled to wrap up in June of next year.

Q1a. Will you commit that any future spending to support HALEU production will be underpinned by independent and rigorous quantitative analysis of future market demand for HALEU?

A1a. Yes, it is important that future spending to support HALEU production is underpinned by independent and rigorous quantitative analysis of future market demand for HALEU. There are multiple ways that the Department is planning to analyze future market demand. On December 14, 2021, the Department published a Request for Information in the Federal Register that seeks industry input on future market demand and how the HALEU Availability Program should be designed considering that demand. Subject to appropriations, the Department also plans to initiate a survey of stakeholders and a HALEU Consortium as authorized by the Energy Act of 2020. These efforts will provide further input to identify future market demand. The Department also holds frequent discussions with industry through the Advanced Reactor Demonstration Program and meetings with other firms pursuing advanced reactor concepts that require HALEU.

Q2. The Office of Nuclear Energy Class Patent Waiver W(C) 2020-002 states that DOE retains patents to innovations conceived or made using NE funding unless the interests of the United States and the general public will best be served by DOE waiving its right to title.

Q2a. Does DOE have any plans to issue an advance waiver of patent rights to its contractor or any subcontractor on the Nuclear Industry Safety System Digital Upgrade for any inventions that might result from that project?

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A2a. Yes, DOE intends to waive its patent rights to Exelon and Westinghouse Electric Company on the Nuclear Industry Safety System Digital Upgrade project under the Office of Nuclear Energy Class Patent Waiver, W(C) 2020-002, or under an Advance Waiver as provided under Title 10 of the Code of Federal Regulations Part 784 in view of cost sharing by the awardees and potential U.S. economic benefits.

Q3. Independent science advisory committees often provide advice to offices, helping to ensure integrity and purpose in spending. The Nuclear Energy Advisory Committee (NEAC) last met in March of 2019 and DOE disbanded NEAC entirely a few months later.

Q3a. Will you help to ensure DOE moves quickly to reconstitute NEAC?

A3a. My office is fully engaged and far along in the process of updating the NEAC charter and reconstituting the committee. The charter will be renewed with the publication of the new committee members.

Q3b. Once new membership is established will you take care to solicit and review the advice that NEAC provides for the Office of Nuclear Energy, as is now statutorily required per the Energy Act of 2020?

A3b. DOE recognizes NEAC's critical role in providing independent advice in helping plan, manage, and implement its nuclear energy program. It has identified the need to revise the existing structure to streamline and focus NEAC into a proactive and agile group of energy experts who can advise on current priorities rather than reviewing projects and initiatives that have already been completed. Once reconstituted, the Office of Nuclear Energy will convene the members of NEAC for regular meetings, and make sure to carefully consider the advice and recommendation of the committee.

Q4. In order to gather the funds needed for the Centrus award, DOE withdrew $23 million from the Nuclear Engineering University Program (NEUP)– nearly one-third of its

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budget – in the middle of a funding cycle. NEUP is a critical annual opportunity for nuclear engineering programs at universities. The research being performed at U.S. universities represent the lifeblood of American innovation for this industry.

NEUP was formally authorized as part of the Energy Act of 2020 to help prevent NEUP funds from being reallocated in the future, largely thanks to support from the Nuclear Engineering Department Heads Organization.

Q4a. What is the progress of the implementation of this provision?

A4a. The Energy Act of 2020 was enacted as part of the Combined Fiscal Year (FY) 2021 Appropriations Act. Accordingly, NE worked closely with the authorization and appropriation committees to develop a FY 2021 NEUP execution plan that resulted in nearly $60 million (M) awarded to U.S. universities to conduct 93 research and infrastructure improvement projects and student education grants, as well as $11.5M in U.S. university research reactor fuel services. NE will complete similar execution planning and competitive awards to U.S. universities following final FY 2022 appropriations.

The Department fully supports the NEUP program and well understands the critical role it plays in advancing the prospects of the U.S. nuclear industry.

Q5. DOE was given guidance in the Energy Act of 2020 on how to carry out demonstrations as milestone-based, which would require particular technical and financial milestones to be met before a participant is awarded grants by the Department through a competitive award process. More specifically for the Office of Nuclear Energy, this guidance was provided as an optional mechanism for the Advanced Reactor Demonstration Program. I understand that the nuclear industry has expressed interest in using this mechanism, and Congress is generally supportive of this idea because it reduces financial risk for the government.

Q5a. Does DOE have plans to utilize this mechanism for any projects? Are there any barriers which prevent DOE from utilizing this mechanism?

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A5a. The nuclear industry has expressed interest in utilizing the Department's Other Transaction Authority (OTA) as a more flexible agreement alternative on cost-shared demonstration projects, including the ability to use payment for milestone approaches accompanied by less burdensome cost accounting requirements. At the time that the Department was preparing to execute the Advanced Reactor Demonstration Program supported in the fiscal year 2020 appropriation, the Department's Other Transaction Authority (OTA) was due to lapse on September 30, 2020, creating substantial uncertainty of the ability to leverage the flexibilities afforded with OTA instruments. Accordingly, the Office of Nuclear Energy (NE) implemented the Advanced Reactor Demonstration funding opportunity announcement, which was largely executed prior to the passage of the Energy Act of 2020 in December 2020, using cost-reimbursable financial assistance and cooperative agreements that were readily available under 2 CFR 200. While milestone-based payments are permitted in the cooperative agreement, the same cost accounting standards apply as for any cost reimbursable award, thereby shifting risk to the award recipient without accompanying benefits of less burdensome financial management systems. With the reinstatement of the Department's Other Transaction Authority provided in Section 9006 of the Energy Act of 2020, the Department is exploring opportunities to apply these partnership mechanisms to future nuclear demonstration projects.

Q6. Dr. Huff, the Energy Act of 2020 was signed into law in December last year. It represents the culmination of years of work on both sides of the aisle in this Committee and we're looking forward to seeing it carried out.

Q6a. What is the status of Office of Nuclear Energy's efforts to implement its directions from the Energy Act?

A6a. The Office of Nuclear Energy (NE) has been hard at work implementing many of the nuclear energy programs called out in the Energy Act of 2020 and views such implementation as

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important to ensure that nuclear energy is a key element in meeting our aggressive climate goals. The Department has implemented a variety of activities where new budgetary authority is not required and has requested funding to carry the additional activities in the Department of Energy FY 2022 Congressional Budget Request.

Q6b. Can you describe the processes the office is taking to implement these changes?

A6b. The Department is continuing forward with the Advanced Reactor Demonstration Program (ARDP), the Versatile Test Reactor (VTR) project, and the Integrated Energy System subprogram within NE, following the direction under Title II of the Energy Act. In addition, the Department worked to implement, to the maximum extent practicable, the 20 percent nuclear energy research and development funding for the Nuclear Energy University Program. The International Nuclear Energy Cooperation program has been restored as a standalone program. The President's Budget for Fiscal Year 2022 requested funding to formally start new programs, such as the High-Assay, Low Enriched Uranium (HALEU) Availability program. NE released a Request for Information (RFI) to solicit broad stakeholder input on the various activities associated with HALEU availability authorized under the Act, including the formation of a consortium. Response to the RFI, and other stakeholder outreach will inform the approach for consortium membership, organization, and governance.

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QUESTION FROM REPRESENTATIVE ANTHONY GONZALEZ

Q1. One program that DOE very wisely initiated in 2019 was the HALEU enrichment demonstration program, which is deploying U.S. technology and will be America's first-ever NRC-licensed source of HALEU enrichment to support our emerging advanced reactor industry. I applaud DOE for its foresight in initiating this HALEU demonstration and look forward to an expansion of the new HALEU Availability Program.

Q1a. Do you agree that securing a domestic supply of HALEU is a top priority for the Department?

A1a. DOE agrees that securing a domestic supply of HALEU is a priority for the Department.

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QUESTION FROM REPRESENTATIVE MICHAEL WALTZ

Q1. In 2016, the Department of Energy (DOE) issued the Secretary of Energy Advisory Board Report of the Task Force on the Future of Nuclear Power (report).

That report estimated that the federal government's cost of advanced reactor development was going to be approximately $5.25B spread out over four phases carried out over a decade or more. The first phase was to have an ongoing process to down select technologies for the next phases. Phase-II was to de-risk the development and prep the designs for demonstration with 50% cost share from the private sector. The third phase was reactor demonstration, again with 50% cost share.

With ARDP, however, the DOE has skipped past down selection, and selected two reactors for demonstration, five for de-risking, and three more for potential development.

Q1a. With this inverted approach, how do we secure taxpayer dollars if the reactors selected for demonstration do not turn out to be economically competitive?

A1a. The Advanced Reactor Demonstration Program (ARDP) was established by Congress in the fiscal year 2020 appropriation and required that two advanced designs be designed, licensed, and achieve commercial operations in a seven-year window Congress also directed selections of two to five additional, less mature advanced reactor concepts that could be demonstrated in the ensuing decade. To identify the safest, most economical advanced reactor designs to pursue, NE executed a competitive partnership process with the domestic nuclear industry through the Advanced Reactor Demonstration Funding Opportunity Announcement (ARD FOA). Upon receipt of applications, DOE made merit-based selections based on detailed criteria, including affordability for full-scale construction and cost of electricity generation, and considering detailed evaluation of Demonstration applications by a significant number of independent experts, consistent with Congressional guidance. The ARD FOA also included a category for less mature technologies that could be developed in the next decade. These opportunities are referred to as Advanced Reactor Concepts 2020 (ARC-20) projects, funded from the Advanced Reactor Technologies subprogram, and three diverse designs were selected in this category.

U.S. House Committee on Science, Space, and Technology
Subcommittee on Investigations and Oversight
Subcommittee on Energy
October 21, 2021 Hearing
"NE Oversight of Funding and Large Sole-Source Awards"
Questions for the Record Submitted to Dr. Kathryn Huff,
Principal Deputy Assistant Secretary for the Office of Nuclear Energy

The financial assistance cooperative agreements established for the two selected Demonstration projects require a 50 percent cost share from the recipient teams that include utility partners throughout all phases of the awards. The awards will be subject to continuation applications for each budget period and ongoing substantial DOE involvement and oversight to ensure that the award objects are met. Successful completion of these projects will yield substantive benefits in terms of reducing regulatory uncertainty for advanced reactor deployments and stimulating the supply chains needed for broader adoption of advanced reactor technologies in meeting the nation's carbon reduction goals.

U.S. House Committee on Science, Space, and Technology
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Principal Deputy Assistant Secretary for the Office of Nuclear Energy

QUESTION FROM REPRESENTATIVE RANDY WEBER

Q1. Dr. Huff, we understand DOE has been working on an RFI regarding consent-based siting for spent nuclear fuel. We also understand the RFI was rumored to be released in July.

Q1a. Do you know when we can expect to see the RFI released?

A1a. The Request for Information was released in the Federal Register on December 1, 2021 and can be found at www.federalregister.gov on Using a Consent-Based Siting Process To Identify Federal Interim Storage Facilities.

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October 21, 2021 Hearing
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Questions for the Record Submitted to Dr. Kathryn Huff,
Principal Deputy Assistant Secretary for the Office of Nuclear Energy

QUESTION FROM REPRESENTATIVE MELANIE STANSBURY

Q1. The Department of Energy issued a sole-source contract to Centrus in 2019 to demonstrate production of high-assay, low-enriched uranium (HALEU). DOE made the award on a sole-source basis because DOE described a need for HALEU that could be used for both civilian and defense purposes, a decision which excluded other companies from eligibility.

Q1a. In the two years prior to the sole source award DOE issued to Centrus in 2019, did the National Nuclear Security Administration or Department of Defense ever formally ask the Office of Nuclear Energy or the Office of the Secretary of Energy to help make more unencumbered uranium available to support their defense purposes?

A1a. Neither the National Nuclear Security Administration nor the Department of Defense has formally asked the Office of Nuclear Energy or the Office of the Secretary of Energy to help make more unencumbered uranium available to support their defense purposes. The HALEU Demonstration Program was not intended to be used to produce any quantities of HALEU for the Department of Defense or defense applications.

Responses by Ms. Amy Roma

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON INVESTIGATIONS & OVERSIGHT
SUBCOMMITTEE ON ENERGY

Responses to Questions for the Record Submitted to Ms. Amy Roma, Founding Member, Nuclear Energy and National Security Coalition, Atlantic Council, and Partner, Hogan Lovells, dated November 29, 2021

Submitted by Representative Bill Foster

1. **DOE was given guidance in the Energy Act of 2020 on how to carry out demonstrations as milestone-based, which would require particular technical and financial milestones to be met before a participant is awarded grants by the Department through a competitive award process. More specifically for the Office of Nuclear Energy, this guidance was provided as an optional mechanism for the Advanced Reactor Demonstration Program. I understand that the nuclear industry has expressed interest in using this mechanism, and Congress is generally supportive of this idea because it reduces financial risk for the government.**

    a. **Will you comment on the use of a payment for milestone type contracting mechanism?**

Milestone based funding is a common tool in private capital investment, particularly venture capital. This tool was also used by NASA for the Commercial Orbital Transportation Services (COTS) program, e.g., by replacing straight funding payments from the government with payments tied to the recipient achieving milestones. In fact, NASA looked to venture capitalists to advise on, help design, and implement the program, and it is a successful example of how to reimagine a private public partnership.[1]

Milestone based funding permits investors to see determined progress before committing increasingly more money in a project. Specifically, milestone based investment allows an investor to split their total investment into multiple "tranches," under which they provide incremental money over time instead of all at once. And they only continue to provide more money as the project progresses and milestones are achieved. The milestone/payment commitments are set forth contractually, under which a specified payment is made when an established milestone is reached. The milestones vary, and can be linked to a range of developments—e.g., technological, regulatory (e.g., licensing), or business.

Additionally, milestone based funding protects the investor, by putting less money at risk upfront, and only putting in more money as the project risk dissipates and the project progresses through the determined milestones.

For the NASA COTS program, the milestone based funding enabled transparency of objectives; reduced U.S. government resources used for compliance and program oversight; and provided a clear path for ending funding based on failure to meet milestones.[2]

Submitted by Chair Jamaal Bowman

1. **You've had your finger on the pulse of U.S. nuclear innovation for a long time. We saw DOE start providing grant support for NuScale almost a decade ago. Since 2013, DOE has**

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[1] *In Search of SpaceX for Nuclear Energy*, by Matt Bowen, PhD, Nuclear Innovation Alliance (May 2019), at 3 available at https://www.nuclearinnovationalliance.org/sites/default/files/2019-10/5b05b3_bdbc49c10e3c4f4a811421b4a627b785.pdf

[2] *Id.* at 2.

committed at least $2.025 billion in taxpayer funds directly to NuScale and the Carbon Free Power Project. We all have high hopes for NuScale, but must consider that each of these investments are made at the expense of other meritorious priorities.

a. Back in 2013, were there many other advanced nuclear flowers blooming? Was NuScale the only game in town?

There were a number of advanced reactor companies in 2013. For context, in June of 2015, Third Way released a report identifying 48 companies and research institutions across the country developing advanced nuclear technology. It is important to note that the report covered a range of private sector companies in advanced fission, fusion, and advanced fuel, as well as universities and research institutions working on advanced reactor issues. However, many of the same companies noted in the report, including a number of advanced reactor vendors, were around in 2013 and are still active today.[3] In 2013, these companies were at varying degrees of development, with some further along than others.

b. What about now, are there other promising advanced nuclear proposals on the street? Do we have a portfolio of technologies in various phases of development? And can we give some credit to DOE for what they've done to make any progress possible?

There are also a number of promising advanced reactor companies now, and, as noted, this portfolio of companies are in various stages of development. DOE Office of Nuclear Energy (DOE-NE) is supporting a number of these ventures under the DOE-NE's Advanced Reactor Demonstration Program (ARDP), mentioned extensively in my written and oral testimony. As also mentioned in my testimony, DOE-NE also offers other critical support for nuclear innovation, R&D, our universities, the Department of Defense Project Pele program, high-assay low enriched uranium (HALEU) fuel development, and international collaboration and engagement. These activities further enable advanced reactor development and deployment.

c. At the same time, does DOE no longer have an excuse to skip the competition when they spend money on development and demonstration of advanced reactors?

Given the number of advanced reactor developers, this area appears well suited for competitive awards for both development and demonstration.

d. It seems as though the Office of Nuclear Energy tends to extend awards, sometimes multiple times, to "get the job done" as projects evolve over time. Is this generally a good practice?

With any technical innovation venture, project flexibility can be important. Scientific understanding is being developed and applied to actual devices in real time and there should be room for discovery, reassessment, and the development of best practices. And other factors, such as business considerations, can change over time as well. Therefore, funding awards should be carefully scrutinized to ensure the specific project and award program continue to be aligned, while also permitting some flexibility. The benefits of a program using milestone based funding, as discussed more in response to the question above, is that it generally permits flexibility—assuming goals are not too prescriptive—at the same time it would help ensure the project is progressing as intended, and minimizing risk to the investor (here, the taxpayer).

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[3] *See* Report, The Advanced Nuclear Industry, Third Way (Jun. 15, 2015), available at https://www.thirdway.org/report/the-advanced-nuclear-industry.

Responses by Dr. Todd Allen

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON INVESTIGATIONS & OVERSIGHT
SUBCOMMITTEE ON ENERGY

Questions for the Record to:
Dr. Todd Allen
Department Chair of Nuclear Engineering and Radiological Sciences
University of Michigan
Submitted by Chair Bill Foster

1. In order to gather the funds needed for the Centrus award, DOE withdrew $23 million from the Nuclear Engineering University Program (NEUP)– nearly one-third of its budget – in the middle of a funding cycle. NEUP is a critical annual opportunity for nuclear engineering programs at universities. The research being performed at U.S. universities represent the lifeblood of American innovation for this industry.

    a. You are the chair of the Nuclear Energy Department Heads Organization (NEDHO). How did this episode unfold for university nuclear programs? How did the sudden loss in funds affect those researchers?

The episode caused specific harm to the individual faculty who had applied to the grant programs that were terminated. This removed their opportunity to support their research programs and to pay their students. Because of the last-minute timing of the cancellation, these faculty had no way to recover and had to wait another year for their next opportunity. The episode also created a huge lack of trust between the universities and DOE NE that still tempers the relationship.

2. NEUP was formally authorized as part of the Energy Act of 2020 to help prevent NEUP funds from being reallocated in the future, largely thanks to support from the Nuclear Engineering Department Heads Organization.
    a. What is the progress of the implementation of this provision?

The authorization of NEUP in the Energy Act of 2020 appears to have stabilized the university research programs under DOE NE. Combined with new leadership in DOE NE that is engaging with NEDHO, the program appears on track to grow and be more effective. There is the hope that DOE NE will now consider a number of recommendations NEDHO has made to improve the program execution.

3. DOE was given guidance in the Energy Act of 2020 on how to carry out demonstrations as milestone-based, which would require particular technical and financial milestones to be met before a participant is awarded grants by the Department through a competitive award process. More specifically for the Office of Nuclear Energy, this guidance was provided as an optional mechanism for the Advanced Reactor Demonstration Program. I understand that the nuclear industry has expressed interest in using this mechanism, and Congress is generally supportive of this idea because it reduces financial risk for the government.

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a. Will you comment on the use of a payment for milestone type contracting mechanism?

Using milestones is a smart way to ensure cost share funds are best used. This was demonstrated when NASA used milestones in their execution of the commercialization programs for space flight. These milestones can be technical, financial, social, or regulatory. Using milestones makes it more likely that the government does not commit to multi-year awards with no checks or off ramps.

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SUBCOMMITTEE ON INVESTIGATIONS & OVERSIGHT
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Questions for the Record to:
Dr. Todd Allen
Department Chair of Nuclear Engineering and Radiological Sciences
University of Michigan
Submitted by Chair Jamaal Bowman

1. In your testimony you detail the importance of centering principles of equity and justice in the RD&D process and in deployment of advanced reactors. You also noted that historic efforts to develop nuclear technologies have created inequities that disproportionately effect communities of color – especially indigenous communities.

    a. With the next generation of nuclear technologies how can we ensure that equity is considered throughout the research, development, and demonstration process, and not tacked on as an afterthought?

The Department of Energy needs to treat equity as an equal branch of research along with the traditional technical subjects. They should encourage (financially) equitable engineering principles be taught in engineering schools.

    b. What steps can the Office of Nuclear Energy take to further this goal?

When pursuing demonstration projects, they should look beyond just technical proof of principle to also examining deployment consequences, risks, and benefits. They should include equity as a design element in the earliest stages of technology design. Consent based siting principles should be used in determining spent fuel disposition sites and in determining deployment sites for new nuclear energy projects.

    c. What reparative measures should be undertaken?

Cleanup of sites left from uranium mining, notably those affecting tribal lands, should be expeditiously completed.

2. You've had your finger on the pulse of U.S. nuclear innovation for a long time. We saw DOE start providing grant support for NuScale almost a decade ago. Since 2013, DOE has committed at least $2.025 billion in taxpayer funds directly to NuScale and the Carbon Free Power Project. We all have high hopes for NuScale but must consider that each of these investments are made at the expense of other meritorious priorities.

    a. Back in 2013, were there many other advanced nuclear flowers blooming? Was NuScale the only game in town?

NuScale competed with three other water-cooled SMR concepts during the time they received their award.

b. What about now, are there other promising advanced nuclear proposals on the street? Do we have a portfolio of technologies in various phases of development? And can we give some credit to DOE for what they've done to make any progress possible?

There are many more privately-funded advanced nuclear concepts under development than in 2013, covering a wide range of development readiness. DOE has now created the Advanced Reactor Demonstration Program (ARDP) that treats the concepts as a pipeline, with concepts at differing stages of development. This is a much more healthy state than in 2013. If this pipeline is managed using the milestones approach, it could provide a good mechanism for allowing the best concepts to rise to the top.

c. At the same time, does DOE no longer have an excuse to skip the competition when they spend money on development and demonstration of advanced reactors?

There is no reason to skip competition and using milestones in executing a nuclear energy research, development, demonstration, and deployment pipeline.

d. It seems as though the Office of Nuclear Energy tends to extend awards, sometimes multiple times, to "get the job done" as projects evolve over time. Is this generally a good practice?

Not generally. Continued funding should be based on execution against milestones.

Responses by Mr. Scott Amey

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON INVESTIGATIONS & OVERSIGHT
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Questions for the Record to:
Mr. Scott Amey
General Counsel and Executive Editorial Director
Project on Government Oversight
Submitted by Chair Bill Foster

1. In justifying several large non-competitive awards it has issued in recent years, the Office of Nuclear Energy described some urgency in the timeline on the part of the grant or contract winner.

    a. In general, is urgency on the part of a contractee or grantee transferrable to urgency on the part of the U.S. taxpayer?
    b. Is urgency on the part of a contractee or grantee one of the criteria in the Federal Acquisition Regulations that justifies a non-competitive contract? And do the OMB Guidelines for grants consider this a legitimate justification?

In the case of the Centrus contract, DOE NE awarded the sole source award based there only being only one responsible source. As I stated in my testimony, NE is likely guilty of narrowly tailoring requirements to steer the contract to Centrus. Specifically, the mention of proprietary systems and "defense-related" applications restricted competition, which isn't a contracting best practice.

Urgency on the part of a contractee or grantee isn't transferable to federal agencies or the U.S. taxpayer. In fact, FAR Subpart 6.302-2 allowing for "other than full and open competition" in circumstances of "unusual and compelling urgency" specifically states that the authority can only be used "[w]hen the agency's need for the supplies or services is of such an unusual and compelling urgency that the Government would be seriously injured unless the agency is permitted to limit the number of sources from which it solicits bids or proposals, full and open competition need not be provided for....This authority applies in those situations where-(1) An unusual and compelling urgency precludes full and open competition; and (2) Delay in award of a contract would result in serious injury, financial or other, to the Government." (*See also* 2 CFR 200.320(c)(3) "The public exigency or emergency for the requirement will not permit a delay resulting from publicizing a competitive solicitation").

That said, some federal agencies are well known for protecting the industrial base and bailing out industries and companies. The revolving door to and from the government and the private sector also creates cozy dealings that often help contractees and grantees at the risk of agencies and taxpayers. The Office of Nuclear Energy should fully answer for the previous sole source awards and hold open competitions for all future awards.

I do not have in depth knowledge of OMB's grant guidelines.

2. DOE was given guidance in the Energy Act of 2020 on how to carry out demonstrations as milestone-based, which would require particular technical and financial milestones to be met before a participant is awarded grants by the Department through a competitive award process. More specifically for the Office of Nuclear Energy, this guidance was provided as an optional mechanism for the Advanced Reactor Demonstration Program. I understand that the nuclear industry has expressed interest in using this mechanism, and Congress is generally supportive of this idea because it reduces financial risk for the government.

    a. Will you elaborate on the importance of establishing clear milestones for long-term technology demonstration projects? What would be the best practices you would want DOE to follow in order to both ensure these projects succeed and to make sure the taxpayers are getting their money's worth?

Milestone-based awards are the best way to spur innovation and protect taxpayers. There is always risk in contract and grant making, but the government must protect itself and taxpayers by practicing low-risk spending, especially for new and infant technologies. Performance, technical, and financial milestones level the playing field, ensure results, and protect DOE and taxpayers from failed efforts, or projects that are overbudget and behind schedule.

U.S. HOUSE OF REPRESENTATIVES
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Questions for the Record to:
Mr. Scott Amey
General Counsel and Executive Editorial Director
Project on Government Oversight
Submitted by Representative Randy Weber

1. There is no doubt that the U.S. has fallen behind some allies and, perhaps most concerningly, our geopolitical adversaries in the pursuit of advanced reactors. This has important implications to setting global policies with respect to nuclear power and nuclear nonproliferation.

    a. Considering the DOE's wide mandate, and given that nuclear energy is a unique technology with important environmental and national security implications, would you support removal of nuclear energy development from the DOE and the creation of a separate federal agency that would be responsible for development of reactors and promotion of nuclear energy?

While a separate agency is an option, I think that DOE working with the Nuclear Regulatory Commission is more than adequate. If rules are followed, oversight and administration is provided, transparency shines a light on the entire process, and low risk spending techniques are employed, DOE can capably work with small modular reactor contractees and grantees. If, however, DOE and Congress don't mind the store, we could see fraud, waste, abuse, and corruption, and DOE NE on a forthcoming Government Accountability Office high-risk list.

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