

Testimony of Edward G. McGinnis
Principal Deputy Assistant Secretary for Nuclear Energy
U.S. Department of Energy
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Chairman Upton, Ranking Member Rush, and Members of the Subcommittee, it is a true honor to appear before you to discuss the very important matter of nuclear energy.

The United States pioneered the development and peaceful use of nuclear power to produce around-the-clock, emission-free electricity. As a result of U.S. leadership in nuclear energy, American citizens have benefitted from this truly unique source of electricity for the last 7 decades. Nuclear energy has delivered reliable, predictable, emission-free power from plants that can operate in round-the-clock, rain, sleet, or snow, and in other extreme conditions, 7 days a week at full power for nearly 2 years at a time without stopping. These nuclear power plants have served as bedrocks to communities across the country, providing high-paying, skilled jobs to hundreds of thousands of Americans. Our nuclear energy capabilities have also served to support and reinforce our nation's energy security as well as national security, both in global nuclear nonproliferation goals and supporting our nuclear navy in a way no other energy sector has done.

Today, nuclear energy generates nearly 20 percent of our nation's electricity, representing 1 out of every 5 American homes¹. It provides 60 percent of our nation's emission-free electricity, making nuclear energy America's largest source of clean energy – in fact, over three times as much as all other U.S. renewable sources of electricity combined. According to a Nuclear Energy Institute analysis, nuclear energy also supports approximately 475,000 jobs throughout our great nation, \$10 billion in federal taxes, and \$2.2 billion in state taxes each year.²

This Administration recognizes the vital role nuclear energy plays in support of American jobs, our communities, economy, security, prosperity, and environment. It is an essential element of our nation's electricity sector, grid reliability and resiliency, and national security. However, the Administration also recognizes that the U.S. nuclear energy sector is under historic downward pressure, has lost a tremendous amount of its once dominant global market share, and has seen a significant degradation in our manufacturing base. In response, the President, on June 29, 2017, announced that we would conduct a complete review of U.S. nuclear energy policy to help find new ways to revive and expand this crucial energy resource. This Civil Nuclear Review is

¹ https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_1_01

²

https://www.nei.org/CorporateSite/media/filefolder/Policy/Wall%20Street/Nuclear_by_the_Numbers.pdf?ext=.pdf

currently underway, and the outcomes will inform how the Administration can best enable this important revitalization.

Having led the Department's international nuclear energy policies and activities for more than 10 years and having served at the Department for a total of 26 years, I can say that the President's announcement and direction could not have come at a more important and vital time for the U.S. nuclear energy sector and our nation.

The Department of Energy (DOE) is now vigorously working to implement the President's direction. In fact, the Secretary has already taken a number of decisive actions, supporting the latest generation of nuclear power facilities by conditionally committing additional loan guarantees to Vogtle Units 3 & 4, the only new nuclear reactors under construction in the United States today. The Secretary also took action to support a resilient, reliable, and affordable electricity sector by initiating a Notice of Proposed Rulemaking with the Federal Energy Regulatory Commission to address potential risks to our nation's electricity grid, in part due to the historic number of nuclear and other baseload plant closures. DOE recognizes the vital role of Congress, including in particular this Committee, in addressing the challenges faced by our nuclear energy sector, and is committed to, and looks forward to, working closely with Congress on this critical matter to revitalize and expand our nuclear sector.

Within the Department's Office of Nuclear Energy (NE), we focus our work in three major mission areas; the nation's existing nuclear fleet, the development of advanced nuclear reactor concepts, and fuel cycle technologies. Utilizing our greatest strengths, we are emphasizing early stage research and development, mobilizing our unique national laboratory capabilities, and implementing targeted R&D partnerships with the U.S. nuclear industry.

Revitalizing the Existing Nuclear Fleet

The Department is working aggressively and with a sense of urgency with nuclear industry partners to support the continued health and vitality of our nuclear reactor fleet. For example, we are partnering with industry to develop the technical basis for the continued safe and economic operation of the current fleet of nuclear plants through subsequent license renewal from 60 to 80 years. Recently, the Light Water Reactor Sustainability program completed irradiation of Reactor Pressure Vessel (RPV) materials at Idaho National Laboratory's (INL) Advanced Test Reactor. Preliminary data from this experiment indicate that RPV steels currently used in a majority of the U.S. pressurized water reactor fleet should safely support continued reactor operations through 80 years.

The Department is also developing technical solutions to further enhance the economics, performance, and safety of nuclear power plants by supporting the development of technologies such as accident tolerant fuels. Accident tolerant fuels is a technology that has the potential to significantly increase the performance of our nation's current fleet of reactors, while also reducing costs. We expect multiple nuclear power plants to begin installing lead test rods and

assemblies in their commercial power plants beginning as early as this year. This is a crucial step in the development and qualification of advanced fuels and could support industry's desire to implement this technology in the 2025 timeframe or earlier, if possible.

Preserving and improving our commercial nuclear fleet is fundamental to our domestic energy security, economic prosperity, environmental sustainability, and global security objectives. By continuing to support improvements to the efficiency, productivity, and operating lifetimes of our nation's nuclear fleet through technology R&D, the Department is helping industry realize its full potential in contributing to our nation's emission-free, reliable electricity supply.

Supporting the Advanced Reactor Pipeline

The Department is also working to advance our nation's next generation of advanced nuclear reactors, including potentially game-changing advanced Small Modular Reactors (SMRs), through targeted early-stage R&D investments and cost-shared technical partnering on R&D projects to ensure a strong domestic industry now and into the future. The Department has a long history of nuclear power technology development, specifically in innovative technologies that have the potential to improve our economic and energy security. In fiscal year 2018, the Department will actively support nuclear energy innovation through early-stage, cross-cutting research, R&D technical partnering, general advanced reactor design development, to improve the cost and schedule for accelerated development of U.S. advanced reactors.

Advanced reactor concepts have a variety of features that have the potential to result in improved performance and efficiency, reduced costs, enhanced resource utilization and waste minimization, and enhanced flexibility to include non-electric applications. Modularity and size variation across designs may make them attractive for specialized applications that are not suitable for gigawatt-scale reactors. Across all areas of nuclear reactor technology, we are now seeing a considerable focus by American industry to invest in the development of innovative nuclear reactor concepts—almost 50 companies and institutions are working on nuclear innovation. Dozens of developers are seeking to deploy innovative advanced reactor concepts in North America. According to an analysis by Thirdway, a DC-based think tank, these developers are backed by almost \$2 billion in private investment. In fact, one could arguably say that the U.S. is indeed leading the world in innovative and advanced nuclear reactor designs.

In order to preserve American technical leadership and competitiveness, DOE is executing a number of R&D initiatives to help enable industry to realize the advanced reactor pipeline in the United States.

For instance, the Department recently published a multi-year funding opportunity announcement to support early-stage research and development of advanced nuclear energy technology. This funding opportunity makes up to \$30 million available in FY 2018 awards, and will remain open for a five-year period. This industry funding opportunity is intended to provide efficient, versatile, and flexible ways by which DOE can effectively implement R&D partnerships to

support our U.S. nuclear industry leaders. We recently received the first round of proposals for cost-shared early-stage R&D projects to develop innovative, industry-driven reactor designs and accompanying technologies with high potential to advance nuclear power in the United States.

Nuclear power plants provide critical reliable, resilient, clean baseload energy for the national electric supply, and SMRs could play a game-changing role with walk-away safe designs; in-ground reactors that offer unique security benefits; a high degree of flexibility, scalability, and distributed power generation; and the potential to be largely factory built. Further research and analysis is needed to better understand the potential of all advanced designs, including SMRs.

The Department is exploring other innovative and win-win approaches to supporting our nation's next generation of advanced reactors through the most resource-efficient ways to conduct early-stage nuclear research and development (R&D) activities. One area of exploration is R&D on advanced nuclear reactor designs for hybrid nuclear/renewable uses. A commercially-owned reactor of this nature would have the potential of leveraging state-of-the-art, advanced commercial nuclear platforms in a cost-effective manner.

The commercial development and deployment of advanced nuclear reactor technology is a complex and resource-intensive undertaking. The Department recognizes this and is committed to helping ensure U.S. nuclear industry technology developers and related industry stakeholders have effective access to the necessary infrastructure and capabilities to move innovative nuclear energy technologies toward commercialization. The Gateway for Accelerated Innovation in Nuclear (GAIN) is establishing effective private-public partnerships to leverage technology advancements and focus federal investments on priority early-stage research and capability needs that are intended to result in the acceleration of game-changing nuclear energy technologies. Recognizing the key role played by the NRC as an independent regulator, DOE and the NRC entered into a Memorandum of Understanding on GAIN, where the NRC is responsible for providing to DOE accurate, current information and training on the NRC's regulatory and licensing processes, which DOE can then share, as appropriate, with prospective applicants for new or advanced reactor designs.

Finally, the Department's Advanced Reactor Technology (ART) program collaborates with industry to identify and conduct early-stage, essential research to reduce technical risk associated with advanced reactor technologies and systems, with the goal of supporting industry's demonstration of advanced reactor concepts within the next 10 to 15 years. In addition, the Nuclear Energy Enabling Technologies (NEET) program provides funding opportunities and U.S. industry access to unique government research facilities to address key challenges affecting nuclear reactor and fuel cycle development. There is a focus on crosscutting reactor materials, advanced methods for manufacturing, and new instrumentation and sensor technologies. By focusing on the development of innovative advanced reactors and leveraging private-public partnerships and our world-class national laboratory system, we can support a strong domestic industry now and into the future.

U.S. Nuclear Fuel Cycle Technology

The U.S. pioneered the development of what we know as the civilian nuclear fuel cycle. Despite its near monopolistic beginnings, there is no enrichment capability using U.S. technology operating in the world today. The U.S. no longer has an operating U.S.-owned (or U.S.-technology-based) enrichment facility or fast spectrum test reactor. While the Department still maintains world-class nuclear fuel cycle capabilities, we continue to make improvements that can help strengthen our nation's nuclear fuel cycle technologies.

We recently took an important step toward revitalizing our fuel cycle R&D capabilities when INL resumed operations at the Transient Reactor Test Facility (TREAT), which had been shut down since 1994. TREAT is designed specifically to test nuclear reactor fuels and materials under extreme conditions. It can produce sudden bursts of energy that are more than five times more powerful than a commercial power plant—allowing scientists to examine fuel performance. INL will take another important step in the operation of TREAT this year, performing the first new transient experiments in the United States in decades. This capability is an important asset to nuclear scientists and engineers as they work to increase the safety and performance of current and future nuclear reactors.

The Department is also conducting research and development activities that would be necessary for the development of a versatile fast test reactor. While a decision whether or not to deploy an advanced fast spectrum test reactor has not been made, such a reactor would accelerate innovation in advanced fuels and materials for U.S. vendors and pave the path to U.S. global leadership in advanced nuclear R&D by reestablishing this capability.

Many advanced reactor concepts and the potential DOE versatile fast test reactor would need high-assay low-enriched uranium (LEU) for fuel development and reactor operation. High-assay LEU is uranium that is enriched to more than 5% U-235 but less than 20% U-235. No existing commercial enrichment capability produces uranium that is enriched above the 5% U-235 level used by commercial light water nuclear power plants. While current enrichment plants could be modified to produce high-assay LEU, it is unlikely that a commercial high-assay LEU capability will be developed without further indication of progress toward deployment by advanced reactor vendors.

As part of the Department's R&D efforts to support development of innovative reactor designs in the United States, NE is collaborating with industry groups to refine estimates of near-term R&D needs of advanced reactor designers, which includes consideration of high-assay LEU needs, quantities, timing, and forms. NE is also working with the National Nuclear Security Administration to better understand options for enrichment capability and other approaches that could support both U.S. advanced reactor and potential DOE test reactor high-assay LEU needs. DOE is also participating fully in the White House-led nuclear policy review directed by the

President. The review will examine issues including U.S. nuclear energy enrichment capabilities and needs.

Reestablishing U.S. Global Nuclear Energy Leadership

The health and vitality of the U.S. nuclear energy sector is increasingly dependent on a healthy and robust U.S. nuclear export market, including our U.S. nuclear reactor vendors, fuel fabricators, and related nuclear products and services. Maintaining strong U.S. nuclear energy exports and global nuclear energy commercial leadership supports U.S. jobs and manufacturing benefits, our nation's ability to address our global nuclear nonproliferation priorities and interests, our ability to contribute to global nuclear safety, and broader U.S. strategic interests.

In 2016 the U.S. Department of Commerce estimated the global civil nuclear market to be valued between \$500 and \$740 billion over the next 10 years and to have the potential to generate more than \$100 billion in U.S. exports and thousands of new jobs.³ When these large nuclear reactor deals are secured, they represent long-term strategic relationships that could extend for up to 100 years.

The global market represents a tremendous opportunity to enhance our nation's economic prosperity, but without a reenergized domestic supply chain our companies will likely lose out to international state-owned competitors. When U.S. nuclear companies successfully compete in foreign markets, we often see win-wins for U.S. jobs, the economy, and nuclear sector health, as well as energy security for our nation and our allies. The Department's decades-long work in Ukraine is a prime example. As a result of Ukraine seeking U.S. help to diversify its nuclear energy fuel supply and spent nuclear fuel storage, which was completely dependent on monopoly supply arrangements with Russia, innovative U.S. private-public partnering resulted in a U.S. supplier providing approximately half of all of Ukraine's nuclear fuel supply for its 15 nuclear reactors. Another global U.S. nuclear company is poised to complete Ukraine's national spent nuclear fuel storage site in 2019. This will greatly alleviate Ukraine's concern over Russia taking back most of its spent nuclear fuel. This is just one example of U.S. nuclear companies providing both economic and strategic energy security to the U.S. and our international allies.

Conclusion

The Administration is fully committed to nuclear energy as a vital component of our nation's energy system. I firmly believe that with sustained, focused and innovative approaches—working closely and thoughtfully together with key U.S. stakeholders, and Congress and this Committee—we can indeed begin to revive, revitalize, and expand our nation's nuclear energy sector and restore our global nuclear energy leadership. By leveraging private-public partnerships and our national laboratory system, we can support the development of a new class of U.S. advanced nuclear reactors; an innovative and responsive nuclear energy supply chain;

³ https://www.trade.gov/topmarkets/pdf/Civil_Nuclear_Executive_Summary.pdf

and advanced nuclear energy fuel cycle technologies, positioning the U.S. for dominance in the 21st century. By taking these actions, we can help ensure that future generations continue to benefit, as we have, from this emission free, reliable, and secure power source for our nation.

Thank you very much and I look forward to answering your questions.