TESTIMONY OF

DR. MARK PETERS, LABORATORY DIRECTOR

IDAHO NATIONAL LABORATORY

BEFORE THE

U.S. SENATE COMMITTEE ON ENERGY & NATURAL RESOURCES

"Full Committee hearing on U.S. Leadership in Nuclear Energy and to Receive Testimony on NELA."

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Chairwoman Murkowski, Ranking Member Manchin, and members of the committee, it is an honor and privilege to be with you today. My name is Mark Peters, and I am the director of Idaho National Laboratory. I'm grateful for the opportunity to testify on S. 903, the Nuclear Energy Leadership Act (NELA). I want to thank the bipartisan coalition that sponsored this bill, including the senators from my home state, Senators Risch and Crapo. It is gratifying to see Members of Congress from both parties acknowledging, through NELA and two other pieces of legislation passed and signed into law within the last year, nuclear energy's significant contributions to American prosperity and security.

The United States has for decades amassed an unsurpassed record of nuclear reactor safety, security, reliability, resiliency, and efficiency. Nuclear energy powers nearly one-fifth of our nation's homes, hospitals, schools, and businesses. It also produces, by far, America's largest percentage of zero-carbon electricity, 56.1 percent, more than hydro, wind, solar, and geothermal combined.

America's 98 nuclear power plants prevent the release of nearly 550 million tons of carbon dioxide into the atmosphere every year. That's the equivalent of taking 117 million passenger cars off the road. As the only carbon-free, scalable energy source that produces electricity 24-7-365, nuclear energy is one of the most effective tools we have to combat climate change, in the U.S. and across the world. Because of the growing concerns about climate change, groups historically skeptical of nuclear energy are beginning to think differently, including the Union of Concerned Scientists and Nature Conservancy, to name two.

In the 1960s, the U.S. emerged as the leader in global nuclear reactor development and commercialization, laying the groundwork for the commercial nuclear industry. Because of that, the vast majority of reactors around the world are based on American technology. Our safety and nonproliferation approaches are the world's standards. As a result, a strong nuclear energy industry is an important component in ensuring U.S. national security.

Nuclear energy stabilizes the U.S. power grid by producing reliable and affordable electricity under even the worst weather conditions. When hurricanes hit Texas and Florida, nuclear power plants provided electricity to customers in their time of need. When the Midwest and East Coast experienced polar vortexes, nuclear energy heated homes and businesses.

Finally, nuclear energy is a major driver of the U.S. economy, contributing $60 billion annually to the nation's gross domestic product and supporting more than 100,000 direct jobs.

Over the last three decades, however, our nuclear energy leadership role has been allowed to atrophy. A variety of factors – high capital costs, the long time frame of licensing and construction, subsidies for other forms of electricity generation, the low cost of natural gas, and our inability to deal with waste and used fuel – has led to premature nuclear plant closures and abandonment of new projects.

We remain among the world leaders, but our advantage is shrinking. In the worldwide energy race, our competitors, specifically China and Russia, are rapidly making up ground. When the U.S. domestic nuclear energy industry languishes, our export ability and international leadership role is adversely affected. That provides openings for our competition. According to the Nuclear Energy Institute, Russia has orders valued at more than $300 billion for 34 nuclear power plants in 13 countries. Russia also holds the largest share of the multibillion-dollar global market for uranium fuel enrichment services once dominated by the U.S. The Russian government is pursuing an aggressive nuclear export strategy because it understands the long-term influence that results from building a nuclear power plant in another country.

Nor should we cede world leadership to China. The Chinese government understands nuclear energy can help power its own country and mitigate its pollution problems. China also sees an opportunity to increase its influence across the world while reducing ours.

The state-sponsored nuclear energy industries in Russia and China represent a serious challenge to our historic leadership in this vital arena. But we have a tremendous tool at our disposal: bold entrepreneurs across the private sector working collaboratively with the best minds at our universities and national laboratory system to design, develop, demonstrate, and deploy advanced reactors. As the nation's nuclear energy research and development laboratory, Idaho National Laboratory plays a major role in the effort to make sure America remains a world leader in nuclear energy research, development and deployment. On our 890-square-mile Site, the U.S. government and private sector built, tested, and demonstrated first-of-a-kind reactors that were later deployed around the world.

A core mission of the DOE Office of Nuclear Energy is to maintain and extend the lives of the nation's high-performing nuclear reactor fleet. Laboratories within the DOE complex, including INL, support this core mission. INL is working with utilities to modernize control rooms, and provide support in the license renewal process. Licensing, however, is but part of the equation. Understanding the economic challenges confronting the nuclear energy industry, DOE's Light Water Reactor Sustainability (LWRS) program, which is led by INL, also is collaborating with the private sector to help utilities reduce operating costs.

In alignment with the goals of NELA, INL also is working with the private sector to develop, demonstrate, and deploy the next generation of nuclear reactors. More than 50 advanced nuclear companies across North America are examining a number of advanced reactor concepts, often in partnership with INL and other DOE national laboratories. Among other things, they are looking at:

- How to make reactors smaller and modular – small enough even to be mass-produced in factories.
- How to use coolants other than light water.
- How to operate at normal atmospheric pressure.
- How to use physics in addition to engineering to keep reactors safe.
- Some designs can even use recycled nuclear waste as fuel.

Private sector innovation and partnerships with the public sector, national laboratories, and universities is driving the future of nuclear energy. Look at the UAMPS/NuScale project, for example. The Utah Associated Municipal Power Systems is a consortium that provides electricity to more than 40 cities in six Western states. The centerpiece of its Carbon Free Power Project is a small modular reactor designed by Oregon-based NuScale Power. INL has been involved with NuScale from the beginning, providing technical support and guidance. Construction on the world's first small modular nuclear reactor could begin at the INL Site in 2023. The NuScale Power reactor, consisting of 12 60-megawatt modules, could begin producing electricity for UAMPS in 2027.

The innovative design of these small, modular reactors promises to enhance safety, reduce costs, and increase adaptability with renewables such as wind and solar. And, as part of an agreement between UAMPS and DOE, one module will be used for research at INL. A second will be used to provide electricity to the INL Site.

But some utilities – and the U.S. Department of Defense – are thinking even smaller. Westinghouse, NuScale, General Atomics, Oklo, X-energy, and others are working on microreactor designs. These 2- to 20-megawatt reactors could provide electricity for military bases and remote communities that run their electrical grids on imported diesel. Microreactors also are a good option for off-grid industrial and mining operations, and large energy consumers in developing nations. Quoting from Senator Murkowski's recent op-ed: "Microreactors could provide the energy necessary to run a mine, an oilfield, or any number of projects – again at a far lower cost and no emissions, with less land usage and a simpler permitting process." Finally, think of microreactors in islanded microgrids that allow Puerto Rico to continue producing electricity after a hurricane, or to be safely shipped to areas recovering from devastating storms and natural disasters.

Microreactors could be built in a factory and transported. They are a clean power source designed to serve a range of energy applications. Best of all, we are on track to develop and demonstrate, in partnership with the federal government and private sector, a microreactor at INL within the next five years.

Next generation reactors will not be entirely focused on electricity production. Process heat, steam, or other thermal transport/media from nuclear reactors have the potential to revolutionize our transportation systems and manufacturing processes. We can produce hydrogen for use in vehicles and industry, and electrify significant portions of the transportation sector. We can make great strides in desalination and water purification, chemical processing, metal and glass refining, biomass, and much more.

We can only do all this after we develop and demonstrate new technologies. The Nuclear Energy Innovation Capabilities Act (NEICA), passed by Congress last year and signed into law by President Trump, will help us do that. NEICA calls for establishment of a National Reactor Innovation Center (NRIC) to support advanced reactor development and demonstration. In many ways, this approach harkens back to the decision in 1949 to establish the National Reactor Testing Station at what is now INL. Our predecessors built and operated 52 original test reactors, laying the foundation for a U.S. commercial nuclear energy industry that has helped drive American prosperity and ensure national security.

We see the NRIC as a place where government and private companies can come to INL to develop, test, and demonstrate new reactor designs, as well as materials, fuels, and other nuclear energy technologies. The NRIC at INL will include:

- Sites for testing and demonstration of new and novel reactors;
- Facilities that support research and development of advanced materials and fuels through unique R&D facilities for fuel fabrication, irradiation, and characterization;
- Integration of high-performance computing capabilities with experimental capabilities to create a new digital engineering approach to nuclear reactor development; and
- Laboratory, industry, and university partnerships to support the future workforce through training and education.

But if we're going to deploy advanced reactors, we need to build one. We need to get started. Given the advances made by Russia and China, we need to act with urgency. The race is being run and our competitors are strategic and aggressive. That sense of urgency is evident in the approach taken by Congress and the Trump Administration. In just the past year, with broad bipartisan support, Congress passed and the president signed into law, two groundbreaking pieces of legislation: the aforementioned NEICA and the Nuclear Energy Innovation and Modernization Act (NEIMA), which will provide the regulatory framework needed to develop advanced nuclear reactors capable of powering our homes and businesses, transportation systems, and manufacturing processes. Thanks to everyone involved in passage of those bills, because they were important steps in reducing technical and regulatory barriers to development of the advanced reactors that will allow us to meet growing energy demands while mitigating the effects of climate change.

NELA is the third leg of this stool. Here's why I say that:

1) NELA sets aggressive goals for advanced nuclear reactor research, development, and demonstration.

   NELA calls for completion of two advanced nuclear reactor demonstration projects by the end of 2025, and from two to five additional operational advanced reactor designs by Dec. 31, 2035. We applaud those goals, recognizing they are aggressive, because they will drive the necessary prioritization and sense of urgency. We do need to have a robust and inclusive process for selection of technologies and designs that accounts for economics, technology maturity, potential markets, and other factors. This will need to be guided thoughtfully by the government, with strong input and guidance from the private sector. The nation's nuclear energy research and development laboratory – and our partner national laboratories – are prepared to help the nation achieve those goals.

   Moreover, all of this requires robust federal support for science and innovation, and we are eager to work with our colleagues across the national laboratory system to implement Senator Alexander's New Manhattan Project for Clean Energy Independence. Finally, we appreciate Senator Manchin's effort to facilitate commercialization of R&D technologies from the national laboratories, another key enabler for future advanced reactors.

2) NELA, along with NEICA, offers to the national laboratories tools they will need to help the private sector develop, demonstrate, and deploy advanced reactors.

   That includes authorization of a versatile, reactor-based fast neutron source or Versatile Test Reactor (VTR). A fast neutron test reactor is needed to support testing of advanced fuels, materials, instrumentation, and sensors. Importantly, this is a capability the U.S. does not possess. Development and construction of this fast test reactor will eliminate reliance on Russia for these irradiation tests and reposition the U.S. at the forefront of developing and improving new nuclear energy systems.

   A VTR will be available to U.S. companies, national laboratories, and universities for testing of advanced fuels, materials, instrumentation, and sensors. This capability will play a critical role in helping develop advanced fast reactors that generate as much as 10 times the power of existing reactors, use less water, and produce waste that is easier to handle and which remains highly radioactive for a shorter period of time.

   Consistent with NEICA, the Department of Energy has approved a Critical Decision 0 (CD-0) for the VTR, identifying the mission need and initiating work on R&D, prototyping, conceptual designs, management plans, and cost and schedule estimates.

3) NELA allows the federal government to partner with industry and demonstrate new nuclear energy technologies.

   Earlier, I referenced DOE purchasing power from UAMPS. The Joint Use Modular Plant (JUMP) program is essential to the completion of UAMPS' Carbon Free Power Project. By authorizing long-term power purchase agreements – and establishing a long-term nuclear power purchase agreement pilot program – NELA offers significant, potential assistance to demonstrate and deploy advanced reactors.

4) NELA addresses a fuel supply issue that threatens to limit deployment of advanced reactors.

   The availability of high-assay, low-enriched uranium (HALEU) is an important factor in determining the future of the advanced nuclear energy industry. Many advanced reactors will require HALEU to operate. A commercially available supply is absolutely necessary if the U.S. wants to lead the world in development and deployment of advanced reactors.

   NELA addresses this challenge in two important ways: by establishing a program to provide a minimum amount of advanced reactor fuel until a long-term domestic supply is developed; and by facilitating development of HALEU-appropriate transportation equipment. Options for near-term supply being evaluated by DOE, the national laboratories, and the private sector include reestablishing domestic enrichment, accelerating processing and treatment of EBR II spent fuel, and processing and treatment of Highly Enriched Uranium (HEU) fuels.

5) NELA takes the long view, and seeks to ensure that a highly skilled, world-class workforce is available to develop, deploy, regulate, and safeguard the next generation of nuclear reactors.

   America's 98 nuclear power plants provide community-sustaining careers. The plants of the future, featuring as NELA requires, "a diversity in designs," have the potential to provide hundreds of thousands of Americans jobs that pay well above the median salary, provide excellent benefits, and allow their employees the satisfaction of knowing they are serving their communities and nation.

   The UAMPS SMR project in Idaho is an excellent example of the economic and social benefits that come with advanced reactor projects. Plant construction will create more than 1,000 jobs during the three-year peak. Upon completion, the NuScale plant will support roughly 300 jobs with an average salary of $85,000. For perspective … the median household income in Idaho is $48,275.

   We need to accelerate the process of training our young people for the jobs of the future. The University Nuclear Leadership Program envisioned by NELA is a positive step forward in meeting future workforce needs.

   In summary, as the nation's nuclear energy laboratory, INL feels a special responsibility to help reverse the trend of the last three decades. We have ceded ground to Russia and China, but the race is not over. We are at a critical juncture, a turning point. Decisions made today will determine if the U.S. continues to lead the world in nuclear energy innovation and production, or if we are destined to fall back into the pack.

Still, I remain optimistic.

I remain optimistic because of the daily innovations coming out of our national laboratories, universities, and private sector. We have the finest facilities, most developed capabilities, and best minds.

I remain optimistic because of the bipartisan support for nuclear energy in Washington, D.C., and in statehouses across the nation. A growing number of policymakers from across the political spectrum are recognizing nuclear energy's importance to our power grid, economy, environment, and national security.

I remain optimistic because of our history. America has an historic role in inventing many energy technologies in use around the world, from the lightbulb to the nuclear reactor.

And, I remain optimistic because the historic partnership between government and industry has laid the foundation for our successes. We know what it will take because we have done it before.

NEICA and NEMA were important steps in the effort to make sure the U.S. is a world leader in advanced reactor research, development, licensing, and deployment. NELA will help us complete that journey, and ensure that our nation can meet future energy demands, combat climate change, ensure national security, grid reliability and safe operations, and jump-start our economy.

Thank you for your attention to this important issue. I look forward to your questions.