Testimony for the Record
Nuclear Energy Institute
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I am Maria Korsnick, President and Chief Executive Officer of the Nuclear Energy Institute (NEI). I appreciate the opportunity to testify on the Nuclear Energy Leadership Act (NELA), S. 903.

NELA is a vital piece of legislation that will help enable the development, demonstration, and deployment of advanced nuclear power systems. It is imperative that the federal government and the private sector partner in achieving NELA's goals. The electricity sector in the United States has undergone significant transformation over the last decade and that transformation will continue. Ensuring that advanced reactors are available to the market by the early 2030s is essential to ensuring a secure and resilient electricity sector well into the future.

The United States is no longer the sole supplier of nuclear reactors; we are in a race against other countries to capture a growing international market share. NELA's implementation is critical to positioning the United States for the future both domestically and internationally and will help the United States regain its position as global leader in nuclear energy.

Nuclear power is vital to the electricity system

Currently, 98 commercial nuclear power plants provide nearly 20 percent of America's electricity and more than half of the emissions-free electricity.[1] Because electricity generation from nuclear energy does not release carbon dioxide and other harmful air pollutants, by maintaining a strong nuclear fleet, the United States will not have to choose between the health of its electric grid and the health of its citizens. Nuclear plants run 24 hours a day, 7 days a week producing power with unmatched reliability and have the added benefit of having all their fuel on site for 18-24 months. Nuclear plants are hardened facilities that are protected from physical and cyber threats, helping to ensure we have a resilient electricity system in the face of potential disruptions.

New advanced reactor designs must be commercially available by the early 2030s to meet domestic and global energy needs. This is a challenging task but one that is necessary if the U.S. is to maintain the reliable electricity service Americans now enjoy and meet its clean air commitments. The U.S. Energy Information Administration forecasts the retirement of 140 gigawatts of capacity by 2040 in the U.S.[2] In addition, the EIA estimates that demand for electricity in the U.S. will expand by almost 15 percent during that time. Advanced nuclear plants can be a part of the clean domestic electricity landscape.

[1] U.S. Energy Information Administration – Electric Power Monthly (February 2019).
[2] U.S. Energy Information Administration – 2019 Annual Energy Outlook: Table A8.

Focusing only on the need for additional electricity in the U.S. in the upcoming decades would mistakenly overlook the likelihood of and the need for a significant increase in electricity demand worldwide. There are still nearly 1 billion people in the world without access to electricity.[3] Providing them with a reliable source of electricity will significantly raise their standard of living. In addition, many countries are looking to a rapid expansion of nuclear generation to address their growing electricity needs. Therefore, it is imperative that new U.S. advanced reactors be available soon for both domestic and international deployment.

U.S. national security interests are at stake in the development of advanced nuclear technology

From the dawn of nuclear energy, a dominant position in civilian nuclear power enabled the United States to advance multiple national-security interests. Leadership in nuclear energy allowed the United States to promote the highest global standards for nuclear safety, security and nonproliferation; to protect our friends and allies against energy insecurity and adverse foreign influences; to maintain a healthy domestic supply chain for our nuclear Navy and major DOE programs; and to promote environmental goals through generation of the majority of our nation's carbon-free power, among other critical interests.

In recent decades, Russia and China – guided by strategic goals and backed by strong state support – have displaced the United States as the global leader in nuclear energy. Through its state-owned and state-supported company Rosatom, Russia has brought five reactors online in the past five years and today has six reactors under construction. There are 17 reactors of Russian design under construction worldwide, of which only 6 are being built in Russia. The other 11 reactors are being built in Bangladesh, Belarus, India, Slovakia, Turkey and Ukraine.[4] In just the past five years, China has brought 26 reactors online and today has 13 additional plants under construction. China is aggressively becoming a key supplier to the global market, including engagement in the United Kingdom.

The future of global nuclear leadership is at a crossroads. The lower cost, lower power, inherent safety and wider applications of advanced reactor designs make nuclear power a practical option for many more countries than use nuclear power today. The supplier will forge a special relationship with these counties over the century-long life of its nuclear program – from site characterization to regulatory development, training, engineering and construction, operations and maintenance, security services and finally decommissioning. More broadly, the dominant global supplier will exert considerable influence on nuclear policies and practices.

If the United States is to maintain its leadership in global nuclear safety, security and nonproliferation; if we are to continue helping our friends and allies against foreign leverage through energy supply; if we are to maintain the domestic supply chain that supplies not just our plants but also our nuclear Navy; and if we are to maintain our nation's majority of carbon-free power, then we must lead in the development and commercialization of the next generation of civil reactors.

[3] International Energy Agency - 2018 World Energy Outlook: Electricity Access Database
[4] International Atomic Energy Agency – Power Reactors Information System (PRIS) Database

Nuclear energy is at a crossroads in the U.S.

NEI supports a nuclear future that includes the existing fleet with subsequent license renewals, additional large light water reactors (LWRs) and advanced reactors, including advanced water-cooled small modular reactors (SMRs) and non-light water reactors. Evolutionary LWR designs are already commercially available, with the two AP1000 units under construction at the Vogtle site in Georgia that are expected to come online in 2021 and 2022. Advanced water-cooled SMRs are expected to be available by the mid-2020s and larger advanced non-LWRs are expected to be available in the late 2020s or early 2030s while micro-reactor technology is expected to be commercially available in the mid-2020s.

The domestic nuclear fleet is a central part of our nation's critical infrastructure and should not be taken for granted. In the last six years, seven units that produced 5,300 megawatts of power have closed. Companies that own nuclear plants have announced the scheduled closure of an additional twelve units of 11,000 megawatts capacity. Over the course of a year that amounts to 90 million megawatt-hours of clean generation that will have been lost by the early closure of these units. That would be equivalent to taking offline the amount of electricity used to power 8.6 million American homes. That's more homes than in all of New York, or all of Florida – and a massive quantity of clean, carbon-free energy.

Although the U.S. led the world into the age of nuclear energy, we are losing ground to other countries with substantial, state-funded advanced reactor programs. The Russians are operating two commercial liquid-metal fast-reactors and the Chinese are bringing a commercial high-temperature gas pebble-bed reactor online . By the time the U.S. has an operational pebble-bed reactor, the Chinese will likely have 10 years of operational experience. This is not a comment about the U.S. developer, but rather a comment about the lack of our government's investment in new technologies. To avoid being left behind, we must focus on regulatory reform, R&D infrastructure, and development and deployment of new technologies. NELA is instrumental in this effort.

Planning for the future

The electric utility sector in the United States is rapidly evolving. I believe it is in the best interest of the U.S. that nuclear power remain a significant and growing supply of clean electricity as this evolution continues. Therefore, it is imperative that the commercial nuclear industry in the U.S. continue to rapidly innovate new products and designs so that these products are available when the market needs them. As the electric utility sector in the United States looks to the future, it is interesting to note some long-term plans from a few utilities.

Xcel Energy, on its website, says "We've cut our carbon emissions by 38%, but we're not stopping there. We're aiming to achieve 100% carbon-free electricity by 2050. To achieve this goal, your energy will be a diverse mix of wind, solar, and other carbon-free resources."[5]

[5] Xcel Energy: "Your Clean Energy Future" (https://www.xcelenergy.com/carbon_free_2050)

Southern Company has announced, "We are establishing an intermediate goal of a 50 percent reduction in carbon emissions from 2007 levels by 2030 and a long-term goal of low- to no-carbon operations by 2050."

Furthermore, "over the long term, meeting our goals will require energy policies that support low natural gas prices and the development and deployment of more low- to no-carbon emitting energy resources."[6] Connecting the AP1000s at Vogtle 3 and 4 to the grid in 2021 and 2022 will be essential in meeting these targets.

Utah Associated Municipal Power Systems (UAMPS) states that "the electrical utility industry is in the midst of transformation due to the proliferation of new technologies, changing lifestyles, and new regulations targeting fossil fuels. UAMPS' Carbon Free Power Project encompasses three interconnected parts designed to help members cope with these changes and ensure that UAMPS' future energy supply is safe, clean, secure, stable and adequate for an energy-hungry, growing population. The CFPP provides tools for Energy Efficiency, embraces Distributed Generation (like rooftop solar) with wise rate structures, and is investigating Small Modular Nuclear Reactor technology to provide future baseload supply."[7] UAMPS is considering using NuScale Power's reactor technology.

The Nuclear Energy Leadership Act is vital

The bipartisan Nuclear Energy Leadership Act (NELA) is a vital piece of legislation that will help enable the development, demonstration, and deployment of advanced nuclear power systems and position the U.S. industry for both domestic and international expansion. A robust and vibrant advanced nuclear power industry requires:

- Innovative ideas and technology through private sector development
- An efficient and effective regulatory structure for licensing advanced reactors
- Research and development infrastructure
- Access to fuel
- Market demand
- A committed and vibrant workforce

The U.S. leads the world, hands-down, in innovative and entrepreneurial companies. NEI's members include approximately 20 advanced reactor developers with one or more designs being developed. These companies are developing designs with coolants including water, liquid metal, high temperature gas, and molten salt. The designs range in size from a few megawatt electric (micro-reactors) to a few hundred megawatt electric (small modular reactor) to the large gigawatt class reactor. Advanced nuclear reactor designs have many potential technological advantages (e.g., passive cooling even in the absence of an external energy supply; some designs operate at or near atmospheric pressure, which reduces the likelihood of a rapid loss of coolant; and extended operations between refueling and the potential consumption of nuclear waste as fuel,

[6] Southern Company: "Planning for a Low-Carbon Future" (https://www.southerncompany.com/content/dam/southern-company/pdf/corpresponsibility/Planning-for-a-low-carbon-future.pdf)
[7] Utah Associated Municipal Power Systems (UAMPS) – Carbon Free Power Project

reducing disposal issues). The majority of these companies are privately funded and all have a strong commitment to the development of safe, secure, and economically viable reactors. Public-private partnerships, in different forms, have benefitted many of these companies, enabling them to leverage their own resources and thereby accelerate development of their technologies. NuScale submitted its design certification application in 2017 and NRC is performing the review on schedule. Kairos, Oklo, TerraPower, Terrestrial Energy, and X-energy are all at different levels of engagement with NRC. Continued partnerships with the federal government are essential to the rapid and successful development of these designs.

In order for the advanced reactor community to be successful, the NRC's regulatory structure for licensing advanced reactors must be efficient and effective and the companies must have access to the necessary research infrastructure. The Nuclear Energy Innovation Capabilities Act and the Nuclear Energy Innovation and Modernization Act, both of which have been signed into law, will help address these issues.

The Nuclear Energy Leadership Act is the key to addressing the workforce, access to fuel, and market demand issues as well as reinforcing the need for a robust R&D infrastructure. NELA's policies will address market demand by providing a pathway to demonstration for multiple designs and establishing policies that enable the long-term valuation of power from these reactors.

Nuclear Energy Leadership Act Provisions

The Nuclear Energy Leadership Act does an admirable job of addressing high-priority items such as power purchase agreements, R&D goals including demonstrations, strategic direction for DOE, a new fast-neutron user facility, fuel supply, and workforce development.

Power Purchase Agreements and Pilot Program

Commercial deployment of renewable energy technologies has benefitted from federal and state policies that have created robust renewable energy markets and have attracted considerable private sector investment to complement federal R&D investments. NELA takes an important step toward creating a similar market-inducing policy environment for advanced nuclear energy by authorizing 40-year Federal Power Purchase Agreement (PPA) authorities. These authorities would provide federal facilities the ability to enter into multi-decade PPAs with developers of advanced reactors, to better match the very long operational lifetimes of most nuclear power plant concepts. We heartily endorse this provision and the establishment of a pilot program for PPAs. Requiring the Secretary to enter into at least one PPA by Dec 31, 2023, will be particularly beneficial. Further allowing these PPAs to pay a higher-than-average market rate if the agreement fulfills reliability and resilience requirements will appropriately compensate SMR and other advanced nuclear plants for the full value of the electricity they supply. The reactors being developed today will offer capabilities such as black-start and islanding capabilities that will be valuable to maintaining a secure national infrastructure. The act should permit all PPAs to pay a higher average market rate.

Advanced Nuclear Reactor Research and Development Goals

We applaud NELA's focus on demonstrating advanced nuclear technologies. Historically, the federal government partnered with the nuclear industry to build the first commercial reactors in the United States. Doing so helped prove that the technology was viable and helped establish the market. Partnerships between the federal government and the private sector for advanced reactor demonstrations will also be valuable in establishing market pull for these new designs and will enable potential customers to see the reactors in operation. NELA defines a demonstration project as an advanced reactor operated as (1) generating electricity for an electric utility system or (2) in any other manner that demonstrates suitability for commercial application. This approach provides the developer with the flexibility to create a reactor demonstration that best suits its long-term commercialization objectives. We applaud the aggressive deadlines in NELA for demonstrating advanced reactors:

- To the maximum extent practicable complete not fewer than two advanced nuclear reactor demonstration projects by not later than December 31, 2025
- To the maximum extent practicable establish a program to demonstrate not fewer than two and not more than five additional operational advanced reactor designs by not later than December 31, 2035

It is appropriate that the demonstration program outlined in NELA include diversity in designs including size, coolants, fuel types and neutron spectra. A challenge in crafting a public-private partnership demonstration program is in trying to ensure that the designs being demonstrated will be of interest to potential customers. NELA attempts to address this issue by requiring that the Secretary of Energy ensure that each evaluation of candidate technologies for demonstration is completed through an external review by a panel that includes at least one representative of an electric utility and an entity that uses high-temperature process heat. Including an end-user perspective into the selection of demonstrations will be essential to ensuring that the products being developed are of interest to the market and will maximize the impact of the public-private partnerships.

Nuclear Energy Strategic Plan

NELA requires the Department of Energy's Office of Nuclear Energy (DOE NE) to develop a ten-year strategic plan and update it every two years at a minimum. The development of a strategic plan with appropriate input from stakeholders would guide the Department's actions and provide a clear indication to the developers, the investment community, and the potential end users as to how the DOE is going to support and partner with the industry while outlining its goals. NEI recommends that this strategic plan address all phases of the fuel cycle for advanced reactors and include a clear strategy for supporting the development of High Assay LEU fuel cycle capabilities and infrastructure.

NEI also recommends that within the strategic plan, DOE NE establish a Nuclear Energy Affordability Initiative to focus its R&D program to significantly increase emphasis on reducing the cost and schedule to construct new nuclear plants (particularly advanced reactors, including water-cooled SMRs), and to reduce the operation and maintenance costs for both existing and

new nuclear plants. The Nuclear Affordability Initiative should not become a program, but rather a national initiative focused on driving deployment by setting aggressive affordability targets for nuclear plants and then focusing R&D dollars on areas of research that offer the most promise in meeting those targets. As such, the Initiative should not receive funding separate from other programs, but rather would focus the funding of relevant programs to partnerships with industry, laboratories, universities and others to achieve mutually-agreed goals. Setting aggressive affordability targets within the strategic plan would signal to the developers, the investment community and the end-users that the DOE believes that the cost of new nuclear can be significantly reduced and is committed to achieving this goal.

Versatile Test Reactor

The Versatile Test Reactor (VTR) was originally authorized in the Nuclear Energy Innovation Capabilities Act. The VTR will be a versatile fast-spectrum test reactor; a testing capability that the United States once possessed. Currently U.S. companies that need access to a fast neutron testing capability must utilize a Russian research reactor. However, U.S. researchers and developers encounter multiple barriers when seeking access to the Russian research reactor, including export control concerns, intellectual property rights, and international transportation issues.

Developers need a domestic fast neutron irradiation capability to support the continuous development of new materials and fuels for advanced reactors, particularly as a means to improve future fuel design iterations as has been done with LWR technology in recent decades (e.g., accident tolerant fuel development). In February 2017, the Department of Energy's Nuclear Energy Advisory Committee issued a report recommending "that DOE-NE proceed immediately with preconceptual design planning activities to support a new test reactor (including cost and schedule estimates)." When operational, the Versatile Test Reactor will support both advanced reactor development and the current fleet while also helping to revitalize the U.S. nuclear industry and reestablish U.S. leadership in nuclear.

Advanced Nuclear Fuel Security Program

The current fleet of reactors utilizes uranium enriched to approximately 5% uranium-235. Many but not all advanced reactors being designed and at least one advanced fuel for the existing fleet will need uranium enriched up to 20%. Uranium enriched to between 5% and 20% is referred to as high-assay low enriched uranium (HALEU). Low enriched uranium is defined as uranium with an enrichment of less than 20% uranium-235. Currently the only domestic enrichment facility in the U.S., the URENCO USA facility in New Mexico, supplies enriched uranium up to 5% uranium-235. The development, demonstration, and deployment of many advanced nuclear technologies is in jeopardy since it is unclear whether a HALEU fuel infrastructure will be in place when they are ready to enter the market. That certainly makes an investment into a HALEU fuel infrastructure highly unlikely. We appreciate that NELA recognizes that the federal government is in a key position to accelerate the development of this infrastructure and advanced reactors by providing an interim supply of HALEU fuel and supporting the development of transportation infrastructure. As advanced reactors are developed and deployed, the market

demand for HALEU will increase and the commercial fuel supply infrastructure will be developed.

We appreciate the attention that Congress continues to pay to this issue and the support that has been provided through Congressional appropriations for the processing of spent high-enriched fuel to create HALEU. NELA is essential to ensuring that both advanced reactors and the associated fuel supply infrastructure are developed expeditiously. NELA appropriately instructs the Secretary of Energy to make available specific quantities of HALEU by December 31, 2022, and additional quantities by December 31, 2025. These quantities are generally consistent with the demand outlined in our July 2018 letter to Secretary Perry in which NEI outlined the industry's HALEU needs through 2030. As the domestic enrichment capability is expanded, the associated transportation infrastructure will have to be developed. Currently the transportation packages that are licensed for HALEU can only carry very small quantities of HALEU. NEI appreciates NELA's attention to this issue by requiring the Secretary to establish an RD&D program for the development of NRC-licensed HALEU transport packages. Without the legislative support provided by NELA for the development of a domestic fuel supply infrastructure, the development of advanced reactors in the U.S. will likely be delayed.

University Nuclear Leadership Program

Maintaining a pipeline of young professionals is key to the long-term success of the nuclear energy industry both for the operating fleet and the advanced reactor developers. We appreciate Congress' commitment to developing the workforce through its appropriations support of the Integrated University Program. Establishing the University Nuclear Leadership Program, through the joint efforts of the Secretary of Energy, the Administrator of the National Nuclear Security Administration, and the Chairman of Nuclear Regulatory Commission is another key step toward ensuring that U.S. universities maintain their world-renowned expertise and that a pipeline of young professionals is ready to support the entire range of disciplines in the United States nuclear power enterprise.

Conclusion

The industry is grateful for the bipartisan Congressional commitment to nuclear energy that resulted in the enactment of NEICA and NEIMA. We appreciate and applaud the continued bipartisan support that inspired NELA. With this continued support and the dedication of the industry, I am confident that the U.S. will regain its leadership role in nuclear technology and generation.

On behalf of NEI and its members, I thank the bill's sponsors for introducing this important legislation. Passage of the Nuclear Energy Leadership Act will benefit all Americans by helping to retain the energy diversity and clean air benefits nuclear plants provide. The legislation also will ensure that these economic engines continue to be the backbone of the nation's electric infrastructure. NELA will facilitate the development and deployment of innovative nuclear reactor technologies. We look forward to working with Congress to pass this bill.

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