Subcommittee on Energy
Hearing on
"Building a 100 Percent Clean Economy: Advanced Nuclear Technology's Role in a Decarbonized Economy"
March 3, 2020

Maria Korsnick
President and Chief Executive Officer
Nuclear Energy Institute

The Honorable Fred Upton (R-MI):

1. There are a number of advanced reactors designs vying for development;

    a. What is the current most realistic time frame for bringing these new designs to commercial deployment?

    RESPONSE:

    There are many advanced reactor developers that are targeting deployment before the end of the 2020s. UAMPS is working to deploy the NuScale reactor by 2029, and TerraPower and X-energy were both selectees in the DOE Advanced Reactor Demonstration Program demonstration pathway and are planning to have their reactors operating around 2027. All three of these reactors will generate electricity for a commercial utility before the end of the decade. Moreover, Oklo has an application under NRC review for its Aurora Fission Battery and plans to demonstrate its reactor at INL around 2024, and other U.S. companies are working to deploy advanced reactors in Canada by the end of the 2020s. In summary, it is reasonable to expect that many advanced reactor designs may be commercially available by the end of the 2020s and other developers are actively working to develop and deploy their designs in a similar time frame.

    b. How does that work with utility policy planning, especially when driven by state and federal policy? Is there a risk that integrated resource planning will lock in other technologies before the nuclear units are deployable? How do policymakers address this?

RESPONSE:

Several NEI member utilities have identified small modular reactors or other next-generation nuclear energy technologies as one of a small handful of candidate technologies that can meet their future need for firm carbon-free generation to complement generation from increased shares of wind and solar power. Broadly speaking, our members have identified the decade of the 2030s as the likely timeframe during which new firm carbon-free generation will be required. This timing underscores the need to deliver initial demonstrations of next-generation reactors in the late 2020s and early 2030s, consistent with the Department of Energy's current plans for the Advanced Reactor Demonstration Program and the Advanced Small Light Water Reactor Program.

2. There are a number of U.S. companies pursuing advanced reactor technologies. How does this match up to what other nations are doing, especially China and Russia?

RESPONSE:

Both China and Russia are aggressively pursuing development of advanced reactor technologies, including Small Modular Reactors. Both countries have built or are constructing new technologies. For example:

- Russia's Rosatom has recently commissioned two RITM-200 (50 MW) units aboard the icebreaker Arktika, which completed trial operations in October. Additional units are in various phases of development. Based on the RITM-200 design, Rosatom has announced plans for a land-based SMR. In addition, two KLT-40 (35 MW) units have been installed on a floating reactor platform that is slated to start operation next year. Additional designs are also under development, including a VVER-300.
- China is constructing an ACPR50S (60 MWe) unit and its first commercial high-temperature gas reactor, the (105 MWe) HTR-PM. The HTR-PM is a two-unit demonstration plant that will form the basis for the multi-unit HTR-PM 600.

a. What are the prospects for U.S. small modular reactors and other advanced reactors making inroads into developing nations ahead of these adversaries, and resurrecting U.S. leadership?

RESPONSE:

U.S. nuclear competitiveness in developing nations is at an inflection point. Both Russia and China are aggressively pursuing nuclear cooperation with developing countries through government-to-government advocacy and engagement based on their national interests and geopolitical considerations. State-owned national champions enjoy significant support from their national governments throughout the project development life-cycle from early-stage engagement to developing in-country infrastructure, feasibility studies, and human capital to later stage support in terms of export financing and direct investment in the project. For example, Russia's Rosatom recently signed an agreement with the African Commission on Nuclear Energy to cooperate on nuclear projects.

However, the U.S. industry expects to soon deploy a suite of technologies that would be well suited to developing country needs. These include a range of advanced technologies from 1 MWe to several hundreds and several sizes in between. Further, with its broad experience that could be applied to help develop nuclear infrastructure in new-to-nuclear countries, the U.S. has the capability to be the preferred partner in nuclear energy development. By taking a "whole of government" approach in partnership with industry that recognizes the strategic value of U.S. nuclear cooperation and commercial supply, and coupling it with the new technologies that will be available in the near term, U.S. nuclear energy leadership in developing countries can be restored.

b. What is your experience for developing nations wanting to work with the United States?

RESPONSE:

In NEI's experience, there is significant interest from developing nations in partnering with the U.S. Those that we have interacted with have expressed interest in U.S. technology and expertise as they consider nuclear projects. However, there are barriers that need to be addressed. Many developing countries may need assistance to develop the necessary infrastructure to deploy nuclear technologies responsibly as described under the IAEA's milestones approach, including human-capital development. Technical assistance specific to the development of a nuclear project may also be required, such as for a feasibility study or the planning necessary to integrate a nuclear generating station on an electrical grid. Many developing countries do not have nuclear cooperation agreements under Section 123 of the Atomic Energy Act, which is a prerequisite for full-scope cooperation. Competitive financing is also critically important,

which is why both Ex-Im's and DFC's support for nuclear energy projects play crucial roles. As mentioned above, a "whole of government" approach in partnership with industry would go far to overcome many of these obstacles.

3. Can you talk about the importance of completing the licensing process at NRC for Yucca Mountain, for not only the future of the nuclear industry but also for the development and deployment of advanced nuclear technologies? How will this inform public concerns about the safety of the repository?

RESPONSE:

Nuclear energy is America's leading source of carbon free energy. One of the unique advantages of nuclear energy is that its primary waste byproduct – the radioactive remnants of the nuclear reactions that produce all of this energy – remain inside the fuel in which they were generated. And we have been safely storing this used fuel for the entire 60-year history of the U.S. commercial nuclear industry. As America now prepares to bolster its clean energy future by building the next generation of advanced nuclear reactors (and we thank this Committee for its leadership in that regard), the American people should have confidence that used fuel will be permanently disposed of.

Scientists around the globe have long agreed that deep geologic disposal, in repositories such as the one envisioned at Yucca Mountain, is the ultimate solution to the long-term management of used fuel. Every nation in the world with a significant inventory of used fuel is pursuing deep geologic disposal in one form or another. Finland has licensed and is now constructing its national repository. Sweden, France, Switzerland, and Canada are making significant progress towards the same goal. The fact that the United States has been on the sidelines for the past decade not only undermines public confidence in nuclear energy, but it damages U.S. leadership in nuclear technology.

As you know, in 1987 Congress amended the Nuclear Waste Policy Act and identified the Yucca Mountain site as the only site to be characterized for suitability to host a repository for spent nuclear fuel and other high-level radioactive wastes. Following an extensive evaluation of the site, in 2008 the U.S. Department of Energy submitted a license application to the U.S. Nuclear Regulatory Commission to construct a repository at Yucca Mountain. In 2010 the DOE sought to withdraw the application, and it has now been more than a decade since Congress last appropriated funds to continue the Yucca Mountain licensing process. In the meantime, funds collected from nuclear energy generators to pay for construction and operation of a repository have sat unused in the Nuclear Waste Fund, with a balance now exceeding $45 billion.

This long-standing impasse must be resolved if nuclear energy is to achieve its full

potential as part of an increasingly clean U.S. energy system. We stand ready to work with Congress and the Administration to get the nuclear waste program back on track. To your specific question, NEI has long believed that completing the licensing process will give us science-based answers to the questions that have been raised about the proposed repository at Yucca Mountain. These answers will help inform future decision-making, regardless of whether the U.S. government decides to resume the Yucca Mountain project or chooses another path, and will add to the growing international body of evidence that supports the ultimate solution for managing the byproducts of this important form of carbon-free energy.

The Honorable Robert E. Latta (R-OH):

1. There has been a lot of talk about different proposals that would put the United States on a path to complete decarbonization.

    a. For the record, do you believe it is possible to get to 100% decarbonization by 2050 without nuclear power?

    RESPONSE:

    The grid can be decarbonized by (or before) 2050 by enacting aggressive, technology-neutral carbon-reduction targets, accompanied by state and federal clean-energy incentives that create demand for all of the necessary carbon-free energy technologies. Numerous studies have shown that the most affordable and reliable paths to a decarbonized grid will rely on a combination of firm low-carbon generation (e.g., nuclear energy, fossil fuels with carbon capture); variable carbon-free generation (e.g., wind, solar); and energy storage (e.g., batteries, pumped-hydro storage, hydrogen production). And unlike many other carbon-free energy technologies, nuclear energy can supply high-temperature process heat to enable decarbonization of a wide range of industrial processes, which will be a key enabler in eliminating carbon emissions across non-electric energy use sectors.

    b. How important has nuclear power been in meeting baseload capacity demands, and what innovations are being made with advanced nuclear technologies to meet this demand in the future?

    RESPONSE:

The 24/7 carbon-free electricity supplied by nuclear energy has been an essential component in meeting electricity needs while avoiding the emission of carbon dioxide and air pollutants. As we look to the grid of the future, the addition of increasing shares of wind and solar power will only increase the value of the firm, carbon-free generation provided by nuclear energy. Next-generation nuclear energy systems will also offer an increased ability to vary their output in response to changing demand or other conditions on the grid, and many will be designed to produce alternate energy products (such as hydrogen or stored heat) instead of electricity as conditions warrant.

The Honorable Bill Johnson (R-OH):

1. The Department of Energy (DOE) is responsible for reviewing the transfer of nuclear technology to foreign owners, under the Atomic Energy Act. This is the so-called Part 810 process, which you have testified about in the past.

   In the last Congress we enacted into law some reforms to this process, from legislation I developed, that would help streamline DOE decisions, and make it a little easier to export nuclear technologies and enhance U.S. competitiveness.

   One of the purposes of the Part 810 process is to prevent sensitive nuclear technology from getting into the wrong hands and to minimize nuclear proliferation risks.

   a. Can you speak to the nuclear proliferation risks of some of the new technologies? Are they being designed to minimize those risks?

      RESPONSE:

      Different reactor designs come with different requirements. Developers of the new designs take safeguards and security seriously and are addressing these considerations early in the design process. Nonproliferation experts have examined the proliferation risks of new designs and concluded that although work remains to be done, no insurmountable challenges stand in the way of safeguarding the reactor designs now under development.[1] NEI is committed to

[1] "Advanced Nuclear Reactors Can be Safeguarded, Representing Progress Toward Commercialization: Report by international panel of experts is first in-depth review of advanced reactor technologies and their role in climate change and global security," Global Nexus Initiative, June 3, 2019, Advanced Nuclear Reactors Can be Safeguarded, Representing Progress Toward Commercialization – GNI (globalnexusinitiative.org) (last accessed December 12, 2020).

working with the U.S. Department of Energy to maintain the highest standards in the world for nuclear security and nonproliferation.

b. To the extent they are low proliferation risk. Does it make sense to pursue additional reforms to streamline DOE reviews of low proliferation risk technologies?

RESPONSE:

Yes. First, DOE must implement the welcome changes that were enacted with your leadership. DOE has yet to implement the authority granted to the Secretary to delegate approval for Part 810 specific authorizations.

Second, we do believe that additional reforms merit implementation. An excellent idea that you proposed but was not enacted was to create a fast-track general authorization for non-sensitive technologies. Non-sensitive technologies pose a lower proliferation risk and it makes no sense to subject them to the same specific authorization requirements as required for uranium enrichment, used-fuel reprocessing, and heavy water production. That intermediate approach – between specific and generation authorization – already exists in Part 810 for certain deemed exports. The fast-track general authorization that you proposed would default approval for Part 810 applications following a set duration unless DOE raises an objection.

Another needed reform concerns the treatment of encrypted data under Part 810, which currently creates unnecessary risk for the entire industry. Simple adoption of the Department of Commerce approach would enable DOE to achieve its goals without imposing an excessive regulatory burden on industry.

c. How will this help our ability to compete?

RESPONSE:

We applaud the progress that DOE has made in reducing process times for Part 810 specific authorizations, and its recent efforts to educate the advanced reactor community about the regulation. But there remains a significant difference in the speed and predictability of the U.S. export authorization process and the equivalent processes of other nuclear supplier nations. This difference represents a competitive disadvantage for U.S. nuclear suppliers that would be reduced by

further reforms.

The Honorable Bill Flores (R-TX):

1. Several panelists today talk about the importance of the Nuclear Energy Leadership Act, which among other important provisions directs the Secretary to provide a supply of High Assay, Low Enriched Uranium, or HA-LEU advanced fuels for advanced technologies. I agree with the goals of those legislation.

    a. I'd like to ask about the model of a public-private partnership for development of HA-LEU. In HR 1760, the Advanced Nuclear Fuel Availability Act, which this Committee has successfully moved through the House twice, we create a public-private consortium to help inform development of a market for advanced fuels, and thus ensure taxpayer support is well spent. Do you think a consortium like this can help augment the provisions in NELA for creating a supply of HA-LEU?

    RESPONSE:

    Most but not all advanced reactors will require HALEU, including both selectees in the DOE Advanced Reactor Demonstration Program demonstration pathway. These selectees will require HALEU by 2024 or 2025 in order to be ready for power generation by 2027. The DOE is in a strong position to ensure that HALEU is available to these and other advanced reactors while helping encourage the establishment of a domestic enrichment capability that can eventually fulfill the HALEU needs of the advanced reactor industry both domestically and internationally. It is essential that taxpayer support be provided in an expedited, efficient, and well-thought-out manner. Obtaining input from the fuel cycle industry, including end-users, whether through a consortium or other less formal mechanism will help ensure this outcome and help ensure that taxpayer support is spent appropriately. It should be noted that establishing a consortium could have legal implications that could delay the interactions between DOE and the industry. DOE should ensure that this does not occur.

2. Another provision of the Advanced Nuclear Fuel Availability Act directs the Secretary to develop, in consultation with NRC, criticality benchmark data for HA-LEU to assist the licensing and regulation of fuel fabrication facilities and certification of transportation packages.

a. If the objective is to get to build, to get the fuel infrastructure in place, would you agree we should place a priority on developing the licensing and regulatory framework for the fabrication facilities and transportation canisters?

RESPONSE:

Enrichment and fuel fabrication facilities along with transportation packages must be reviewed and approved the NRC. Ensuring that this regulatory process is efficient and effective is key to establishing a HALEU fuel fabrication infrastructure in the U.S. in a timely manner to support advanced reactor deployment.

NEI appreciates the focus, in H.R. 1760, on developing additional criticality benchmark data to assist in the licensing of facilities and transport packages. Criticality benchmark data is utilized in the licensing process to validate the computer codes. As the uranium enrichment increases toward 20%, the quantity of applicable criticality benchmarks data decreases. The industry is confident that there is sufficient data to license facilities and transportation packages. However, additional conservatisms, likely resulting in reduced capacity, may be necessary for licensing. Additional criticality benchmark data would enable a more efficient licensing process and eliminate unnecessary conservatism in the package and facility design.

b. NELA focuses on R&D for transportation packages, but the Advanced Nuclear Fuel Availability Act focuses on developing the regulatory infrastructure. Would you agree we should include focus on the regulations if we are going to meet the timelines?

RESPONSE:

Transport packages currently exist for enriched uranium in many forms. However, transport packages that can ship large quantities of HALEU for commercial fuel fabrication do not exist. R&D is not necessary to design and license new transport packages. Financial support and a focus on regulatory efficiency, as outlined in H.R. 1760, will expedite the industry licensing and deploying transportation infrastructure and establishing a HALEU fuel fabrication infrastructure in the U.S. in a timely manner to support advanced reactor deployment.

c. What other regulations should be addressed to make sure a fuels market develops?

RESPONSE:

The NRC regulations are adequate for licensing fuel-cycle facilities and transportation infrastructure. Continued focus on the efficiency and timeliness of the regulatory process is essential and we appreciate the Committee's support in this area, as this will help provide the certainty industry needs to develop the market.

The Honorable Richard Hudson (R-NC):

1. While I am excited to see where advanced nuclear technology propels us into the future, we cannot get there without maintaining the current fleet of reactors we have now. I believe in order for us to remain a global nuclear powerhouse, we must continue to invest in our nuclear facilities while developing nuclear technologies for the future. As you know, North Carolina is home to five Nuclear reactors that deliver substantial safe, clean and reliable energy to communities across my district.

    a. Ms. Korsnick, our existing Nuclear fleet represents over half of the country's non-emitting generation. And that is secure, base-load generation that can be relied upon day in and day out. If we are going to be serious about fighting climate change, would you agree Congress should adopt policies that support the existing fleet of reactors like the Nuclear Powers America Act?

    RESPONSE:

    Absolutely. Decarbonizing our electric grid has to start with preserving our nation's 94 operating reactors. These reactors produce more than half of our nation's clean electricity, around the clock and through all types of weather, and are the best firm carbon-free resource available to complement increased generation from wind and solar power as we work to address climate change.

    b. Would you agree the benefits of ensuring a robust existing fleet go beyond the climate benefits and involve national security benefits?

    RESPONSE:

    Absolutely. First, a strong civil nuclear sector is important to America's global nuclear leadership, to our influence on nuclear safety, security and

nonproliferation, and to wider U.S. foreign policy interests. The prominence of U.S. suppliers in global commercial nuclear markets has allowed the United States to set international rules for using nuclear technologies and keep nuclear materials out of the hands of bad actors. Reactor exports allow the U.S. to form 100-year strategic relationships around the world that span the construction, operation and decommissioning of a plant. Today, the global landscape has shifted. Russia and, more recently China, have made great strides to develop their nuclear industries, both domestically and for the export market. With this expansion, they are poised to take leading roles in the establishment of global nuclear norms and standards in the future.

Second, nuclear keeps the grid online when disaster strikes. Nuclear power plants are among the most robust elements of U.S. critical infrastructure. Because of the industry's comprehensive safety procedures and stringent federal regulations, nuclear plants offer a level of protection against natural and adversarial threats that goes far beyond most other elements of our nation's electrical grid. They are built to withstand extreme weather, as shown during recent hurricanes and freezing temperatures driven by polar-vortex events.

Nuclear plants generate electricity 24/7. When other energy sources are stressed or unavailable, nuclear keeps the lights on. Unlike most energy sources, nuclear plants have up to two years of fuel stored securely on-site. That makes nuclear power plants hardened against fuel-supply disruptions.

Finally, nuclear energy powers national defense. We have the world's largest nuclear-powered navy, and it's supported by the U.S. commercial nuclear energy industry. Allowing nuclear plants and fuel facilities to shut down will adversely affect a shared nuclear supply chain and our regional economies. Since the U.S. Department of Defense depends on the grid to power 99 percent of its installations, nuclear energy's reliability supports the nation's ability to defend itself. The Pentagon, with Congress' encouragement, is considering micro-reactors to enhance domestic defense installations. A changing climate has been identified by the national security community as a national security risk, and carbon dioxide emissions from other forms of electricity production contribute to changes in our climate. Nuclear energy is by far our nation's largest source of emissions-free generation.