Statement of Warren F. Miller, Jr.
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before the
Senate Committee on Energy and Natural Resources on
S. 2052, the Nuclear Energy Research Initiative Improvement Act of 2009
and S. 2812, the Nuclear Power 2021 Act of 2009

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Introduction

Thank you, Chairman Bingaman, Ranking Member Murkowski, and Members of the Committee. I appreciate the opportunity to appear before you and comment on legislation under consideration by the committee, as well as to provide information on where small modular reactors fit in the Department of Energy's portfolio.

Let me start by saying clearly that the administration views nuclear power as an important element in its strategy to increase energy security and combat climate change. As the President said in Prague,"[w]e must harness the power of nuclear energy on behalf of our efforts to combat climate change, and to advance peace and opportunity for all people."

Secretary Chu and I are working hard to advance nuclear power in the United States, and we expect the Department of Energy to award the first conditional loan guarantee for new nuclear plant construction soon.

In the Office of Nuclear Energy, we have developed five imperatives to guide our activities.

First, we are working with industry and the Nuclear Regulatory Commission to extend the lifetime of the existing reactor fleet. The 104 NRC-licensed commercial nuclear reactors produce roughly 20 percent of our nation's electricity but 70 percent of our carbon-free electricity. Whether those plants retire at 60 or, for example, 80 years of age could greatly affect our carbon emissions profile in the future. Research is needed to answer outstanding questions about how long these reactors can safely be operated.

Second, we are engaged with industry to enable new plant builds and improve the affordability of nuclear energy. I mentioned our efforts with respect to loan guarantees, but also some of our research, such as the soon-to-be-implemented Modeling and Simulation Hub, we expect will also help reduce costs.

Third, we are working to reduce the carbon footprint of the transportation and industrial sectors. Nuclear power can supply more low-carbon electricity for increased

electrification of the transportation sector, and provide low-carbon process heat for a range of industrial applications.

Fourth, we are researching ways to create a sustainable nuclear fuel cycle. In particular, we are looking at ways of extending nuclear fuel supplies and reducing the amount and toxicity of waste requiring a permanent repository.

And fifth, we are working to understand and minimize proliferation risks. All nuclear fuel cycles entail some amount of risk, but that risk can be reduced with appropriate technology applications and international guidelines and agreements.

Small Modular Reactors

With that, let me turn to the focus of today's hearing: small modular reactors (SMRs) and their potential benefits.

Let me first define what we mean by "small" and "modular".

To begin with, there is no exact definition for what constitutes a "small" reactor. The International Atomic Energy Agency defines them to be less than 300 MWe as does S.2812. This boundary is based mainly on two factors: (1) liability insurance, and (2) factory fabrication and portability to a site by rail or truck. For liability reasons, reactors above 300 MWe must carry separate indemnification insurance for each unit. Reactors modules that are sized 300 MWe and below can be linked together to form one reactor unit for liability insurance. Reactor modules of this size are conducive to off-site fabrication prior to transportation by rail or truck, rather than by barge, to an approved site for assembly.

The term "modular" implies several things that could create a potential advantage over larger plants. First, modular reactors can be linked together to create a larger power plant. This is potentially advantageous because it allows an owner the flexibility to incrementally increase the size of a plant. As demand increases, the owner can add more modules. Secondly, a smaller plant requires less initial capital outlay or investment. The existing operating modules can then be used to finance future additions. Multiple units are also important during refueling or maintenance because taking a single module offline does not require the shutdown of the entire plant.

The term "modular" can also refer to potentially faster and more efficient construction techniques using factory fabrication. The U.S. defense nuclear shipbuilding industry is an excellent example where modular construction techniques have been proven to be highly successful. These same techniques can be applied to the commercial nuclear industry. This fabrication technique has the potential to make nuclear energy more economical and appealing to investors because it reduces the perceived "risks" associated with new nuclear builds such as construction delays and schedule uncertainty.

There are several reasons why small modular reactors may prove advantageous compared to the Generation III+ nuclear plants in terms of economics, performance, and security.

First, the high capital cost for new nuclear reactors has been a challenge for private entities to finance. Smaller projects would carry lower investment risk and could be more affordable to smaller utilities. This reduction in investment risk also provides an advantage in rate recovery, regardless of whether the licensee is regulated through state public utility commissions or whether it must sell the electricity in unregulated commercial markets.

Second, there are areas in this country – and elsewhere in the world – where large plants are not needed or the existing infrastructure cannot support the larger capacity. Small modular reactors could be used to provide power to these smaller electrical markets, isolated areas or smaller grids. There is both a domestic and international market for small modular reactors and U.S. industry is well-positioned to lead and compete for these markets.

Third, some of the SMR designs may offer significant environmental or safety advantages for siting in industrial settings or where, for example, water for cooling is a problem. Some reactor designs would produce a higher temperature outlet heat that can be used for either electricity or process heat for nearby industries while others use little or no water for cooling.

Fourth, there are also some potential nonproliferation benefits to use of small reactors that could be designed to operate for decades without refueling. These reactors could be fabricated and fueled in a factory, sealed and shipped to the site for power generation, and then shipped back to the factory to be defueled. This approach could minimize the spread of nuclear material.

Fifth, small reactors could also enter into traditionally non-nuclear energy markets for applications beyond electricity production. The possibilities include low carbon process heat for: fossil fuel recovery and refinement, synthetic or biofuel production, water desalination, hydrogen production, and a range of other petrochemical applications.

Finally, while traditional economy-of-scale concepts favor larger nuclear plants, there are a number of reasons why SMRs may have some economic advantages.

As mentioned previously, a sizeable portion of the cost and schedule uncertainty for building large nuclear plants is the amount of work that must be performed on site. Factory production and fabrication, and transport to and assembly onsite can significantly reduce that uncertainty.

Research into small modular reactors could address several of the Office of Nuclear Energy's imperatives: improving the affordability of nuclear power; supplying low-carbon electricity and process heat to the transportation and industrial sectors; and minimizing proliferation risks. More importantly, the advancement of SMRs will

respond to U.S. economic and environmental market conditions for low-carbon energy sources.

Comments on S.2052 and S.2812

It should be clear from the preceding comments that the Department believes that small modular reactors are an important area of research and development.

The Nuclear Energy Research Initiative Improvement Act of 2009, S.2052, gives broad authority to conduct research into small modular reactors, as well as other related issues. The Department is still evaluating the details of the bill.

S.2812, the Nuclear Power 2021 Act, would require the Department of Energy to carry out a program to develop and demonstrate two small modular reactor designs. The Department is still evaluating the details of the bill.

Conclusion

In considering a small modular reactor program, a variety of factors need to be assessed, including issues such as reactor size, industry readiness and responsibilities, and research and development needs.

That concludes my formal remarks. Thank you for the opportunity to testify and I look forward to answering your questions and working with the Committee to achieve the administration's goals of energy security and reducing the nation's carbon emissions.