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Southern Company

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DOE Modernization: Legislation Addressing Development, Regulation, and Competitiveness of
Advanced Nuclear Energy Technologies
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Good morning Chairman Upton, Ranking Member Rush and Members of the Subcommittee. Thank you for the opportunity to appear before you today. My name is James Nicholas (“Nick”) Irvin, and I am the Director of Research and Development (R&D); Strategy, Advanced Nuclear, and Crosscutting Technology at Southern Company. It is an honor to appear before this Subcommittee to share my views on advanced nuclear technologies and the four pieces of legislation affecting these technologies before the Subcommittee today. This is an area that is pivotal to our nation’s future and worthy of this Subcommittee’s interest and attention. In my role as Director of R&D at Southern Company, I am responsible for the evaluation, development, and demonstration of innovative technologies to support Southern Company’s operations, including advanced nuclear technology. I lead an internal portfolio of cross-cutting R&D programs, as well as representing Southern Company in many external alliances, including energy R&D collaborative programs with the Electric Power Research Institute (EPRI). I also serve as a representative to the Policy Committee of the Generation IV Nuclear International Forum on behalf of the U.S. nuclear industry, in addition to numerous other industry committees. In my testimony today, I will discuss Southern Company’s efforts to develop advanced nuclear technologies. I will also share my personal perspectives on prospects for advanced nuclear reactors and the merits of continued governmental and private sector interest and investment.

Southern Company

Southern Company is a natural gas and electric utility holding company headquartered in Atlanta, Georgia, with executive offices also located in Birmingham, Alabama. The nation’s premier energy company, Southern Company provides clean, safe, reliable, affordable energy to 9 million gas and electric utility customers in 11 states. Southern Company is developing the full portfolio of energy resources, including carbon-free nuclear, advanced carbon capture

technologies, natural gas, renewables, energy efficiency and storage technology, and creating new products and services for the benefit of customers.

Innovation is a central part of our strategy. We foster a culture that seeks to make transformational changes and understand that innovation and technology are engines of American greatness. This belief is demonstrated by Southern Company's 50-year commitment to the research, development and deployment of emerging energy technologies. We actively collaborate with the U.S. government, other utilities, universities and technology developers and remain at the forefront of technology development for the production, delivery and end-use of energy. It is within this context that Southern Company is investing in advanced reactor technology R&D and looking ahead toward the steps needed to promote the licensing, construction and utilization of these technologies.

Southern Nuclear

Southern Nuclear, a subsidiary of Southern Company, currently operates six nuclear reactors: Units 1 and 2 at Plant Farley near Dothan, Alabama; Units 1 and 2 at Plant Hatch near Baxley, Georgia; and Units 1 and 2 at Plant Vogtle near Augusta, Georgia.¹ We have been in the nuclear power business for almost 50 years, dating back to Southern Company's decision in 1967 to build Plant Hatch, our very first nuclear power plant, which began commercial operation in 1975. Together, Plants Farley, Hatch and Vogtle provide approximately 20% of the electricity used in Alabama and Georgia. This is made possible by our talented and committed workforce of more than 4,000 men and women working at our fleet of nuclear power plants and corporate offices, all of whom are also part

¹ Plant Farley is owned by Alabama Power Company. Plants Hatch and Vogtle are co-owned by Georgia Power Company, Oglethorpe Power Corporation, the Municipal Electric Authority of Georgia, and Dalton Utilities.

of the larger Southern Company team of over 32,000 employees who are building the future of energy for the customers they serve.

Nuclear power is a leading source of affordable, reliable, clean, American energy that powers our economy, protects our national security, preserves the environment, and provides high-paying jobs for thousands of our fellow citizens. Southern Nuclear's top priority is the safety and health of the public and our employees. We are committed to the safe operation of our nuclear generating facilities with equipment and systems that meet rigorous safety and design regulations.

Delivering the Next Generation of Nuclear Power

Southern Company is leading the nation by constructing first of a kind new nuclear units at Plant Vogtle. Taken together, these state-of-the-art Westinghouse AP1000 units are projected to supply over 2,200 megawatts (MW) of new, baseload, zero-emission electric generation, creating more than 5,000 total construction jobs and 800 permanent jobs.

An important stimulus for the Vogtle project has been the consistent support of Congress and the Department of Energy (DOE) in fostering a central role for nuclear power in the nation's energy policies. The Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007 sought to expand the commercial utilization of nuclear energy in the United States, while also reducing emissions and ensuring affordable, reliable, and clean domestic energy for Americans. Those acts made substantial investments in programs designed to promote the development and deployment of modern nuclear reactors and to improve the nuclear licensing process. These policies, combined with an innovative and constructive state regulatory environment, were a catalyst for the construction of new reactors at Plant Vogtle, and support for the continuation of the loan guarantee program, tax benefits, and licensing reforms for advanced

nuclear, among other policies, by DOE and subsequent Congresses has been essential to the survival of that project.

However, even as we make significant progress toward commercial deployment of “Generation III+” reactors like the AP1000 at Plant Vogtle, we are already exploring the next generation of nuclear technologies commonly referred to as “Generation IV” (or “Gen-IV”) reactors. Our Advanced Nuclear R&D program is a robust program designed primarily to support the evaluation and development of new technology. Through these activities, which are with a wide variety of technologies including liquid metal cooled fast reactors, high temperature gas reactors, as well as molten salt reactors, we provide our perspective and expertise on technology requirements and developmental strategies garnered from our over 40 years of operating and R&D experience.

A specific example of close collaboration with an emerging technology developer is our work with TerraPower and the Department of Energy. On January 15, 2016, the Department of Energy through its Advanced Reactor Concepts program selected a Southern Company-led proposal as one of two recipients of approximately \$40 million, 5-year program to explore, develop and demonstrate advanced nuclear reactor technologies. Our partners in this public-private partnership are TerraPower, Oak Ridge National Laboratory (ORNL), EPRI, and Vanderbilt University. The technology research activities of our project will bolster the development of molten chloride fast reactors (MCFR), an advanced concept for nuclear generation under development by TerraPower.

In addition to our R&D activities, Southern Company subsidiary Southern Nuclear Development (SND) provides program management consultation to technology and project development partners. Specifically associated with the Advanced Reactor Concepts program

mentioned above, SND is supporting X-Energy, the other DOE award recipient, on conceptual design for its high temperature gas-cooled pebble bed reactor.

As a company, we are proud to be afforded these opportunities and we look forward to seeing additional collaboration to strengthen this partnership through delivering results for our partners, DOE, and the American taxpayers.

As I noted earlier, nuclear energy enjoys tremendous advantages over other forms of electric generation: zero emissions, capacity factors exceeding 90%, safety records that exceed those of other energy sources, as well as affordability over the long term without the price swings common to other fuels. The AP1000 design adds even more layers of safety redundancies and with a simplified plant design. We believe the next generation of advanced reactors will build on these advantages, with even more advanced safety systems, less byproduct materials, and greater cost efficiencies. Gen-IV reactors will use non-light water reactor technologies with higher temperature output and size variations ranging from rather small electric generators to massive power plant reactors exceeding the size of many of the largest nuclear power plants in operation today. Further, these designs afford opportunity for nuclear energy to extend into other sectors of the economy including industrial process heat and transportation fuels, offering the same benefits of zero emissions and security of supply for generations to come.

Innovation Requires Collaboration

. Within our own company, we take great pride in our culture of innovation and desire for step-up performance improvement in all facets of our business. We also believe that our federal government partners have the capability to create the right environment for innovation in the

nuclear technology arena to flourish, and allow the market to respond. This includes public-private partnerships that can harness the power of collaboration.

In much the same way, we cannot achieve sustainability in innovation by ourselves. Collaboration among private sector, governmental, academic, and international actors is key.

The NEI's Advanced Reactor Working Group (ARWG) was created with the understanding that decisions as to what technologies will replace recent and upcoming nuclear reactor retirements will be made within the next 10–20 years. In the short- to medium-term, light water reactors will remain the dominant and most economic means of electricity production from nuclear energy. If utilities are to consider advanced (Generation IV) non-light water reactors in their future decision making, significant progress toward commercialization is necessary.

With this reality in mind, the ARWG is charged with developing an industry vision of a long-term sustainable program that will support the development and commercialization of advanced reactors, ultimately supporting the commercial availability of advanced reactors for utilities or other entities in the 2035–2040 timeframe.

Achieving this will require this kind of collaboration, resulting in innovative policies, licensing frameworks, and regulatory structures that facilitate the efficient and predictable deployment of these new technologies and encourage private investment. I believe it will also require our federal partners to share the cost of state-of-the-knowledge improvements. DOE, universities, vendors and our centers of knowledge will need to leverage the best talent our nation has to offer.

Public-private partnerships are, in the context of advanced reactors, uniquely necessary as these technologies are subject to an extensive and expensive regulatory regime requiring complex technical work necessary to build the safety case for new reactors. These endeavors also require

new fuel types to be developed and tested, the development of supply chains for new kinds of equipment, design and testing of prototypes and, ultimately, the design, approval, construction, and operation of a first-of-a-kind commercial reactor. We are already seeing increased private sector investment in proposed new reactor startups and systems reaching, by some estimates, more than \$1 billion. Nonetheless, because of the expense, regulatory uncertainty, and timeframes involved, continued public sector investment will be necessary to make the leap from the laboratory to commercial deployment.

Additionally, as was true in the early days of nuclear technology development, we need to work with our national labs to safeguard our nation's significant investment in nuclear technology and to demonstrate newer, more advanced nuclear technologies, to ensure we remain the world leader in this area. I greatly appreciate the work of the Idaho National Lab, which, as DOE's lead Nuclear Energy Laboratory, is doing phenomenal work in the area of nuclear energy technologies. The DOE Office of Nuclear Energy, in conjunction with the Idaho, Argonne, and Oak Ridge National Laboratories, has a program called "Gateway for Accelerated Innovation in Nuclear" (GAIN), which is intended to "provide the nuclear energy community with access to the technical, regulatory, and financial support necessary to move new or advanced nuclear reactor designs toward commercialization while ensuring the continued safe, reliable, and economic operation of the existing nuclear fleet." A key element of the GAIN initiative is to provide all nuclear stakeholders with a "single point of access" to the host of federal assets and programs, including the DOE complex and national labs.

Southern is proud to be partnering with Oak Ridge National Laboratory and TerraPower on the DOE-awarded research project involving the MCFR technology and we commend ORNL's

role in supporting the use of nuclear technology for the nation's security as well as commercial interests.

As a range of technology options are explored, we will advocate for and encourage similar industry-led collaboration with DOE, vendors, utilities, universities and national labs to leverage capabilities and share some of the risks. We will continue to monitor, and assist where appropriate, the complete range of technology options, to ensure the highest probability of success for this critical suite of technologies.

Modernizing the Licensing Framework for Advanced Reactors

Our current regulatory framework for the licensing of nuclear power plants has its roots in the federal government's initial efforts to promote commercial nuclear power after the passage of the Atomic Energy Act of 1954 (the "AEA") when the Atomic Energy Commission (AEC) began to encourage the development of commercial nuclear power production in the private market. The federal government helped spur innovation and investment in nuclear power production through research and development efforts such as test reactors and laboratories that would eventually share information with the private nuclear power industry. At the same time, the federal government provided economic assistance to those private companies willing to take the first steps to construct and license nuclear power plants. The AEC and the private sector researched and experimented with several different types of reactors, including light-water reactors, salt-cooled reactors, and fast-breeder reactors.

Prompted by the backing of the AEC, the commercial nuclear power industry started to take shape, and the United States led the way in nuclear power innovation as the nuclear power industry grew rapidly throughout the 1960s. Eventually, the AEC and the industry focused on light-water reactor technology. The reactor licensing framework and process grew up around the

need to license the light-water reactor designs the industry planned to construct and was, therefore, molded to fit the needs of licensing nuclear power plants with light-water reactor designs. This tailoring of the regulation to the dominant technology resulted in a more efficient licensing process and one in which the nuclear power industry could remain generally assured of the regulatory framework for its investment, for the time being.

With the passage of the Energy Reorganization Act of 1974, the AEC was abandoned, and its dual functions of regulating the nuclear power industry while simultaneously promoting nuclear power to the private sector were split among the Nuclear Regulatory Commission (NRC) and the Energy Research and Development Administration (ERDA), respectively. In 1977, ERDA's functions were transferred to the Department of Energy (DOE), an agency deserving of credit for much of the innovation in commercial nuclear power after the passage of the Act. Because the DOE is charged with the promotion of commercial nuclear power, most of its nuclear facilities and programs are exempt from NRC regulation, allowing it to research and develop technologies that may otherwise remain unexplored. Consequently, much of the research and development in the nuclear power industry hinges on decisions of the federal government.

NRC's adoption of, and Congress's later codification of (in the EPAct of 1992), a more efficient regime in 10 CFR Part 52 and incentives in the EPAct of 2005 were major drivers in the development of the only nuclear power plant under construction in the United States, but they have not to date been sufficient to achieve the nuclear renaissance predicted early in this century. Construction of large light water reactors is still an expensive and time-consuming proposition. In order to retain the benefits of the current fleet of nuclear power plants as aging plants are decommissioned over the next thirty years, the federal government, state and local governments, and private industry will have to continue to work together to develop technologies that can be put

into commercial use more quickly and with less expense, while still retaining or improving on the safety and environmental benefits of the current fleet and Gen III+ designs like the AP-1000.

So, the nuclear power industry stands at yet another crossroads. Commercial nuclear power is expanding across the world yet the United States is not currently at the center of the technological innovation driving much of the expansion. In April of this year, China began loading fuel into a Westinghouse AP-1000 reactor—one of 4 under construction in that country, with larger designs in the planning stages. In contrast, at this time, the only active advanced nuclear construction project in the U.S. is at Southern Company’s Vogtle site.

While the new Part 52 one-step licensing process has proved beneficial to the industry, the fact that it, like the initial two-step licensing process, is based on light-water reactor technology limits its efficacy for the licensing of the next generation of advanced nuclear reactors. While possible using a patchwork approach with many exemptions, licensing advanced nuclear reactors that do not use light-water reactor technology in the current regulatory scheme remains ineffective, creating a barrier against engagement of the private sector in the required public-private partnership. The introduction of a new regulatory scheme that effectively addresses the needs associated with licensing non-light-water reactors will signal to the industry that it can invest in research and development of advanced reactors knowing that the licensing environment does not favor a single technology.

As Congress recognized in 1992, an efficient, predictable, licensing framework is imperative to the success of advanced reactors in the United States. Safety must remain a key focus, although the regulatory framework should be performance-based, risk-informed, and allow for various kinds of technologies to be developed and licensed. When developing a licensing framework that can work for advanced reactors, I would endorse the “triple A” approach. That is,

where existing regulations are appropriate, “adopt” them; where simple changes are needed to modify existing rules in order to make them a better fit for advanced reactors, “adapt” them; and where the characteristics of advanced reactors require new regulatory structures and programs, “advance” them. In all respects, the safety regulator (NRC) should determine the required safety performance metrics, while the industry and its partners should focus, through consensus standards organizations, on developing the “how” to comply with performance standards and design requirements. By doing so, we can prevent stagnation in the development of advanced reactor designs and ensure that the newest, safest, and most efficient nuclear reactors will be built in the United States.

To this end, the Licensing Modernization Project (LMP) is a Southern Company-led effort, cost-shared with the DOE, to develop foundational elements of a modernized technology-inclusive regulatory framework. Such a framework uses a risk-informed and performance-based methodology to set technical requirements for design and licensing of advanced non-LWRs. As such it incentivizes innovative approaches to safety improvements by leveraging these enhancements to reduce regulatory complexity and by removing unnecessary burden. The work also allows the regulator to be able to be better prepared for structured conversations with a number of developers who are developing spectrum of technologies and designs. Nuclear Regulatory Commission plans to endorse the LMP proposals via a regulatory guide in 2019.

To this end, I commend the House for passing the Advanced Nuclear Technology Development Act of 2017 (H.R. 590), cosponsored by Congressmen Latta, McNerney, Fleischmann, Doyle, Hudson, and Tonko. This bill would encourage cooperation between DOE and NRC to develop a new framework for licensing advanced nuclear energy technologies and directs the NRC to develop an efficient, risk-informed, technology-neutral framework for advanced reactor designs.

Encouraging a more technology-neutral, performance-based and safety-focused regulatory process would reduce unnecessary regulatory burden, reduce licensing and operating costs, and improve the economic viability of these newer technologies.

H.R. 1320, Nuclear Utilization of Keynote Energy Act

H.R. 1320, Nuclear Utilization of Keynote Energy Act, co-sponsored by Congressmen Kinzinger and Doyle, would mandate a long-overdue reform of the NRC fee structure. As the testimony previously provided to this Committee by Maria Korsnick, on behalf of the Nuclear Energy Institute, indicated, the nuclear industry believes that H.R. 1320 provides a more rational fee recovery process for the NRC that limits spending on corporate support and caps annual fees on operating reactors, while continuing to provide sufficient funding for the Commission's public health, safety and security missions. Notably, the bill does not affect "fee for service" activities such as the resident inspector program and other safety and security inspections and reviews, and provides vital resources for the development of a regulatory infrastructure for advanced reactor licensing. The industry also supports the reforms contained in H.R. 1320 that would fight "regulatory creep" by focusing licensing reviews on areas that are safety-significant.

H.R. (Discussion Draft) Nuclear Energy Competitiveness

As noted in previous testimony before this Subcommittee, the nuclear industry supports efforts to streamline the requirements of 10 C.F.R. 810 with regard to the export of non-classified nuclear technology. Requiring individual DOE approval for each application has put U.S. suppliers at a distinct disadvantage with regard to overseas

competitors. Nuclear technology is a global market, and the United States is in imminent danger of ceding leadership to our international competitors, as China and Russia and others aggressively pursue market opportunities in the developing world. These overseas markets, and the export of clean, safe American nuclear technology, would provide efficiencies of scale that would support a nuclear manufacturing and engineering infrastructure that can simultaneously create American jobs and improve national security by allowing the U.S. to continue to influence worldwide nuclear safety, security and nonproliferation policies. We greatly appreciate your attention to our request for review of Part 810; systematic reform of the export approval process will allow U.S. suppliers to compete in international markets and restore the U.S. to a position of leadership with regard nuclear technology.

H.R. _____ (Discussion Draft) Report on Pilot Program for Micro-Reactors

Construction of advanced reactors at DOD and DOE facilities is another way to “harness the power of collaboration” that I referenced above, and will support the development and commercialization of advanced nuclear technologies while enhancing the resilience of our national security infrastructure. The type and size of reactors that are likely to be utilized in this service will allow for agile and efficient deployment, providing for early experience in the regulatory processes necessary to support deployment of larger, utility scale technologies in the coming years. If we can successfully combine the purchasing power of the Department of Defense, the technological expertise of the Department of Energy and the innovation and agility of the private sector, the whole truly will be greater than the sum of its parts. Another word for this is “synergy.” Sometimes overused, Webster’s tells us that the term is based on the Greek

word “sunergos” which translates as “work together.” Because these technologies are so new, our recommendation is that DOE be allowed some flexibility with regard to both the type and size of the reactors that qualify for the program.

H.R. _____ (Discussion Draft) Advanced Nuclear Fuel Availability Act

Many of not all of the advanced reactor concepts rely on a new or innovative fuel design, often requiring High Assay Low Enriched Uranium (between 5% and 20% enrichment) for commercial deployment. Further, and perhaps more critically from a timeliness perspective, many of the demonstration scale reactors will also require HALEU. It is imperative that the DOE and private sector initiate programs to support not only the supply of HALEU, but also the infrastructure requirements necessary for its transport and regulation.

Conclusion

I applaud this Subcommittee and the Congress, as a whole, for its support of advanced nuclear technologies. I would also stress our appreciation for the DOE’s and the Administration’s continued support for nuclear innovation. We face a pivotal moment for the nuclear industry in the United States. Congress, DOE, the nuclear industry and other stakeholders must to work collaboratively to create a technological and regulatory framework that will allow advanced reactor technologies to become a commercial reality. The legislation before the Subcommittee today would make significant strides toward that goal. The benefits to American citizens in terms of U.S. national security, global leadership, global economic competitiveness, technological superiority, development of high paying jobs, and the environment are vast and justify a strong federal role.

Thank you for allowing me to appear before this Subcommittee today. I will be glad to answer any questions you might have.