STATEMENT FOR THE RECORD

by

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to the

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The Nuclear Energy Institute thanks the House Science Committee for its interest in nuclear energy and in addressing the policies that can facilitate deployment of advanced reactors to meet national energy needs and reduce carbon emissions.

My name is Daniel Lipman. I am Executive Director for Policy Development and Supplier Programs at the Nuclear Energy Institute (NEI). NEI is responsible for establishing unified nuclear industry policy on regulatory, financial, technical and legislative issues affecting the industry. NEI members include all companies licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect/engineering firms, fuel cycle companies, and other organizations and individuals involved in the nuclear energy industry. Before joining NEI, I spent 31 years with Westinghouse Electric Corporation, a period that included leadership of the company's program to bring the AP1000 advanced-design nuclear reactor to market. Four AP1000 reactors are now under construction in China, and four are being built in the United States.

My testimony will cover five major areas:

1. The current status of the U.S. nuclear power industry and the value proposition for nuclear energy;
2. The potential domestic market and our conviction that nuclear energy will be a major part of the future U.S. supply portfolio;
3. The global nuclear market and U.S. influence;
4. The potential for Small Modular Reactors and Generation IV designs, and
5. The absolute necessity of effective government-industry cooperation to address financing and regulatory challenges

Before we explore the subject of this hearing – the future of nuclear energy – it's appropriate that we discuss the importance of electricity and review how the nuclear industry arrived at where it is today.

The International Energy Agency, in its World Energy Outlook, emphasizes the importance of energy production:

> "Energy is a critical enabler. Every advanced economy has required secure access to modern sources of energy to underpin its development and growing prosperity. In developing countries, access to affordable and reliable energy services is fundamental to reducing poverty and

> improving health, increasing productivity, enhancing competitiveness and promoting economic growth. This is because it is essential for the provision of clean water, sanitation and healthcare, and provides great benefits to development through the provision of reliable and efficient lighting, heating, cooking, mechanical power, transport and telecommunication services."

The World Energy Outlook 2014 estimates that 1.3 billion people worldwide live without access to electricity. That's about 1 out of every 5 people in the world and larger than the combined population of North and South America. To reduce poverty and to raise the standard of living for all, the world needs to produce more electricity. There is no single technology that can accomplish this task. Nuclear power, which doesn't produce pollutants and is reliable source of baseload electricity, must be a significant part of the electricity mix worldwide.

The history of nuclear power in this country is a remarkable story of leadership, innovation and excellence in reactor design and operation that continues to this day. U.S leadership introduced this technology to the world and is responsible, directly or indirectly, for most of the nuclear programs in the world.

U.S. reactor designs – both pressurized water reactors and boiling water reactors – are the basis for the French nuclear program, the Japanese nuclear program, the South Korean and Chinese nuclear programs. The British, after building a commercial program based on gas-cooled reactors, turned to American-style PWR technology in the 1980s. This tradition of technology leadership continues today, with deployment in China and the United States of U.S. designed AP1000 advanced-light water reactors that incorporate passive safety features – the AP1000 and the ESBWR are the most advanced designs currently available from any nation or any vendor. This tradition of leadership continues with the design and development of small modular reactors (SMRs) and even more advanced reactors, Generation IV (Gen IV) reactors.

In addition to our technological leadership, the United States has the best operating experience in the world, with the U.S. nuclear fleet consistently recording average capacity factors in the 90-percent range, year in and year out, since the late 1990s. Supporting this success is a unique infrastructure – the various programs managed by the Institute for Nuclear Power Operations (INPO) – designed to maintain excellence in operations. The government's review of the factors that led to the Deepwater Horizon disaster and oil spill in the Gulf of Mexico in 2010 pointed to INPO as the best example of an industry organization designed to establish and maintain high standards of operating excellence.

Nuclear energy in the United States is also one of the few energy technologies – if not the only technology – that fully internalizes its costs, including decommissioning and waste management.

Finally, let's remember that the Nuclear Regulatory Commission is widely regarded as the "gold standard" of regulatory agencies worldwide, and that a design certification from the NRC is considered an unimpeachable seal of approval.

This brings us to today. And today, we face serious competition in world markets from Russia, China, South Korea and France. Many of these countries are competing against us with the same technology that we transferred to them in years past. We must adapt to that competition and meet it head-on, recognizing that the major growth in nuclear energy in the near-term will be overseas, and that we must improve our export control process and provide competitive financing, in addition to the best technology.

We must also adapt to fiscal reality, recognizing that federal government dollars are limited. In the early years of nuclear power in America, the Atomic Energy Commission financed reactor development and demonstration directly. As the technology matured, development and demonstration evolved into a cost-shared government-industry effort, like the hugely successful Nuclear Power 2010 program, which gave us the AP1000 and ESBWR advanced reactor designs. Looking forward, we must apply the same innovation to financial engineering, regulatory development, and licensing that we do to reactor engineering, and develop innovative techniques to bring new technologies to market.

We can meet the challenges of the 21st century. We have the tools. We have the resources. We have the technical edge, and an economic system that encourages innovation. And we must succeed, because we cannot afford to cede U.S. leadership in commercial nuclear technology to countries like Russia and China.

I. Current Status of the U.S. Nuclear Power Industry and the Value Proposition for Nuclear Energy

In 2013, nuclear energy produced 19 percent of U.S. electricity supply (789 billion kilowatt-hours). The industry's 2013 average capacity factor was 90.9 percent, compared to 86.4 percent in 2012. This is the highest capacity factor of any source of electric power. The U.S. nuclear energy industry's top priority is, and always will be, the safe and reliable operation of our plants. Safe, reliable operation drives public and political confidence in the industry, and America's nuclear plants continue to sustain high levels of safety and performance.

NEI believes that America's nuclear energy assets provide a uniquely valuable set of attributes:

- Nuclear power plants produce large quantities of electricity around the clock, safely and reliably, when needed. They operate whether or not the wind is blowing and the sun is shining, whether or not fuel arrives daily, weekly, or even monthly by truck, barge, rail or pipeline.
- Nuclear plants provide price stability to the grid.
- They provide "reactive power" – essential to controlling voltage and frequency and operating the grid.
- Nuclear power plants have portfolio value, contributing to the fuel and technology diversity that is one of the bedrock characteristics of a reliable, resilient electric sector.
- Finally, nuclear power plants provide clean air compliance value. In any system that limits emissions – of the Clean Air Act "criteria" pollutants or carbon dioxide – the emissions avoided by nuclear energy reduce the compliance burden that would otherwise fall on emitting generating capacity.

Other sources of electricity have some of these attributes. None of the other sources has them all.

Nuclear plants are also critical to the reliability of the electric grid because they operate continuously and generally independently of weather conditions. For example, during the "Polar Vortex" event, which occurred during the week of January 6, 2014, the nation's nuclear power plants operated at daily average capacity factors of over 95 percent. No other source of electricity approached that level of reliability. In fact, approximately 25 percent of the generating capacity in the PJM Interconnection and 20 percent of the capacity dispatched by the Midcontinent System Operator (MISO) was forced out of service by the severe cold weather (generally because power plants could not obtain fuel or because fuel-handling equipment froze).

Nuclear energy's high reliability will become increasingly important as the nation's electricity system becomes less reliant on coal, and more reliant on gas-fired generating capacity and on renewable technologies that are intermittent and weather-dependent.

Nuclear energy is also America's largest source of low-carbon electricity. In 2013, nuclear energy accounted for 63 percent of America's carbon-free electricity, and prevented 589 million metric tons of CO_2 emissions – three times more carbon-free electricity than hydropower and nearly five times more than wind energy. For perspective, one gigawatt of nuclear generating capacity (out of the 100 GW operating) would avoid more carbon than all U.S. solar energy capacity in 2013 (4,500 megawatts at 17-percent capacity factor). The amount of CO_2 emissions avoided by nuclear energy facilities is equal to the CO_2 emissions from 113 million passenger cars – more than all the passenger cars in the United States.

America's 100 reactors are also a significant Clean Air Act compliance tool. They avoid approximately one million tons of sulfur dioxide and half-a-million tons of nitrogen oxide emissions annually, according to NEI calculations using protocols developed by the Energy Information Administration. Without nuclear energy, U.S. electric sector emissions of CO_2, SO_2 and NO_x would be approximately 25-30 percent higher every year.

II. The Domestic Market: Nuclear Energy A Major Part of the Future U.S. Supply Portfolio

Even at less-than-one-percent annual growth in electricity demand, the Energy Information Administration (EIA) forecasts a need for 350 gigawatts of new electric capacity by 2040 (28-percent growth) in the United States. To satisfy this demand at lowest possible cost without compromising the nation's environmental goals, the U.S. electric power industry must have a portfolio of electricity generating technologies, particularly low-carbon technologies.

Unfortunately, trends are moving in the other direction. America's electric generating technology options are narrowing dramatically:

- Coal-fired generating capacity is declining in the face of increasing environmental restrictions, including the likelihood of controls on carbon, and uncertainty over the commercial feasibility of carbon capture and sequestration. The U.S. has about 300,000 MW of coal-fired capacity, and the consensus is that about 60,000 MW of that will shut down by 2020 because of escalating environmental requirements.[1] In addition, the pipeline of coal-fired projects under development is all but empty.

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[1] This is the estimated coal-fired capacity likely to be shut down due to existing regulation of so-called "criteria pollutants" (e.g., SO_2, NOx, fine particulates, mercury, air toxics). The Environmental Protection Agency's proposed regulation to reduce carbon emissions from existing power plants would lead to an additional 40,000-45,000 MW of coal-fired retirements, by most estimates.

- Natural gas-fired generating capacity is growing dramatically. Since 1995, the United States has built approximately 342,000 megawatts of gas-fired capacity, approximately 75 percent of all capacity additions. Coal and nuclear, the two sources of electricity that can produce electricity around-the-clock at stable prices with virtually no price volatility, represent a scant six percent of the generating capacity added. Clearly, the United States should not continue to build ***only*** gas-fired generating capacity.

- Renewables will play an increasingly large role but, as intermittent sources, cannot displace the need for baseload generating capacity, absent dramatic advances in energy storage.

In this environment, the United States must have as many generating options as possible. A continuing, growing contribution from nuclear energy is essential to produce the baseload electricity that will be needed at stable prices, and to sustain reductions in emissions of carbon and other criteria pollutants. Small modular reactors and advanced reactors are an essential part of the generating portfolio of the future.

The electric power industry is approaching a period – the decade starting in 2020 – when it must consider how to replace the nuclear generating capacity that will reach the end of its 60-year licensed life starting in approximately 2030. (Just over 31,000 MW of nuclear generating capacity, of the approximately 100,000 MW operating in the United States, reaches the 60-year point by 2035.) The capital cost to replace that capacity with new nuclear generating capacity would be many billions of dollars. Some of this capacity will likely seek a second license renewal to operate past 60 years, but some will not. The regulatory framework for second license renewal has not yet been firmly established. Additional capital investment will almost certainly be required to operate past 60 years and, in some cases, market conditions or other factors may not justify that capital investment.

Figures 1 and 2 show the nuclear generating capacity required under two potential scenarios: (1) if all today's reactors operate to 60 years, then retire; and (2) if all today's reactors operate to 80 years. These calculations start with the projections in EIA's 2014 *Annual Energy Outlook*, which assumes 0.7-percent annual growth in electricity demand. Some observations:

Figure 1

New Nuclear Generating Capacity Needed If All Reactors Retire After 60 Years of Operation

Year	Total Electric Generation (bkWh)	Nuclear Capacity (GW)	Nuclear Generation (bkWh)	Nuclear Fuel Share	New Generation Needed to Meet Fuel Share (GW)	
					20%	25%
2025	4,622.3	104.0	820.0	17.7%	13.2	42.6
2030	4,815.1	100.0	788.0	16.4%	22.2	52.7
2035	5,004.3	72.4	570.4	11.4%	54.6	86.3
2040	5,219.7	57.5	453.2	8.7%	74.9	108.0

Data Source: Energy Information Administration, Annual Energy Outlook 2014

- Simply because of load growth, maintaining nuclear energy at 20 percent of U.S. electricity supply would require 13.2 gigawatts (GW) of new nuclear capacity by 2025 (in addition to the Watts Bar 2, Vogtle 3 and 4, and Summer 2 and 3 reactors already under construction).

- If today's nuclear plants retire at 60 years of operation, 22 GW of new nuclear generating capacity would be needed by 2030, and 55 GW by 2035, to maintain a 20 percent fuel share.

- If today's reactors operate to 80 years, 18 GW of new nuclear capacity would be needed by 2030, and 23 GW by 2035, to maintain a 20 percent share of U.S. electricity supply.

- Much larger amounts of new nuclear generating capacity would be needed to drive nuclear energy to 25 percent of U.S. electricity supply.

Figure 2

New Nuclear Generating Capacity Needed If All Reactors Retire After 80 Years of Operation

Year	Total Electric Generation (bkWh)	Nuclear Capacity GW	Nuclear Generation (bkWh)	Nuclear Fuel Share	New Generation Needed to Meet Fuel Share (GW)	
					20%	25%
2025	4,622.3	104.0	820.0	17.7%	13.2	42.6
2030	4,815.1	104.0	820.0	17.0%	18.1	48.7
2035	5,004.3	104.0	820.0	16.4%	22.9	54.7
2040	5,219.7	104.0	820.0	15.7%	28.4	61.5

Data Source: Energy Information Administration, Annual Energy Outlook 2014

Although dates like 2030 and 2040 seem like a far-distant future, in the world of electric power planning, they are not. Given the lead times necessary to license and build new nuclear generating capacity, planning for, and construction of, this capacity must begin in the early 2020s. That leaves the balance of this decade – a relatively short five years – to ensure that the necessary technologies are ready for deployment, and to put in place the policy conditions necessary to enable that deployment.

In addition, it is clear from the simple arithmetic in Figures 1 and 2 that the United States has several major nuclear-related imperatives.

- First, a workable regulatory framework for subsequent license renewal is essential.

- Second, it is essential to reduce the time to market for certified designs. Maintaining a high level of standardization when constructing the large light water reactors (the AP1000 and the ESBWR) already certified by the NRC is essential. With standardization and some reforms to the Part 52 licensing process (based on lessons learned during the licensing and construction of the new Vogtle and Summer units in Georgia and South Carolina), it should be possible to reduce time to market to from 10 years or so to seven years. Absent rigorous adherence to standardization, it will be more difficult to obtain the combined construction and operating license and build these reactors to cost and schedule in the relatively large numbers likely to be required.

- Third, advanced reactors – starting with small modular reactors (SMRs) in the early- to mid-2020s, followed by more advanced Generation IV designs in the 2030s and 2040s – are a strategic imperative. The nuclear industry will need as many technology options as possible. For example, because SMRs allow capacity additions in smaller increments, they may be particularly well-suited to regions of the country with low growth in electricity demand. And they may be the only way – or certainly the easiest way – to finance new nuclear capacity in competitive markets, because they do not require a company or companies to undertake a gigawatt-scale project, a $7-8 billion financing, in a single step.

III. The Global Nuclear Market and U.S. Influence

Today, there are 72 new nuclear power stations under construction worldwide, of which five are under construction in the United States. An additional 172 are in the licensing and advanced planning stages and virtually all of these plants will be built abroad where the demand for reliable, affordable and clean baseload electricity is growing. Electricity from nuclear energy will help developing economies expand and lift hundreds of millions from poverty while having a minimal impact on the environment. For developed economies, nuclear energy is widely recognized as a reliable source of generation that provides significant electricity supplies without emitting greenhouse gases during operation. But with this growing nuclear market comes growing competition from other nuclear supplier nations, which can now provide a full range of products and services.

With the world's largest civilian nuclear energy program, the U.S. industry is recognized for reliability, safety and operational excellence. U.S. firms are making major investments in technology development to continue their tradition of innovation. These investments include development of small modular reactors, advanced technologies for uranium enrichment, advanced reactor designs with improved safety features and advanced manufacturing techniques to improve quality and reduce costs. Coupled with the globally recognized "gold-standard" regulator, the U.S. Nuclear Regulatory Commission, many nations place a high value on cooperation with the U.S. as they develop or expand their civilian nuclear energy programs.

Over the past two decades, new supplier nations have entered the growing global nuclear market, and multi-national partnerships and consortia have been formed to develop nuclear energy facilities. According to a 2010 GAO report, "while the value of U.S. exports of nuclear reactors, major components and minor components have increased, the U.S. share of global exports declined slightly" from 1994 to 2008.[2] Over the same period, the U.S. share in the fuel market declined sharply from one-third to one-tenth of the market.

The growth of nuclear suppliers overseas has increased competition for U.S. firms. International competitors often began as suppliers to their domestic markets and over time expanded their offerings to the global market. For example, France's AREVA and Russia's Rosatom have steadily increased their presence in the global market. Although 12 of the reactors under construction today are U.S. designs, four are French and 16 are Russian.[3] One of the newest entrants in the global nuclear market is the Republic of Korea. In December 2009, Emirates Nuclear Energy Corporation awarded a multi-billion dollar contract to a Korea Electric Power Corporation-led consortium to build the first two nuclear power plants in the United Arab Emirates (UAE). In addition, there has been an expansion of indigenous technologies developed for domestic markets. For example, 20 of the 72 nuclear plants under construction globally are Chinese reactors being built in China.[4]

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[2] "Global Nuclear Commerce: Governmentwide Strategy Could Help Increase Commercial Benefits From U.S. Nuclear Cooperation Agreements with Other Countries", United States Government Accountability Office Report to the Committee on Foreign Affairs, House of Representatives, November 2010.
[3] International Atomic Energy Agency, 2014.
[4] Ibid.

The international market for nuclear power is growing and the U.S. industry has the opportunity to supply a significant portion of this demand with innovative technologies supported by continued investment in research and development.

IV. Potential for Small Modular Reactors and Generation IV Designs

In the electric power business, where technology development, demonstration and deployment is a decades-long exercise, the time to develop and demonstrate new technology is years before it is needed – not when it is needed. As utilities plan for the future they must look beyond the short term and continue to adapt to the changing landscape. Over the next 30 years, a significant amount of existing generating capacity will be retired. Decisions on which technologies will replace these retirements will be made within the next 10-20 years. In the short- to medium-term, light water reactors – large gigawatt-class reactors and SMRs – will remain the dominant and most economic means of electricity production from nuclear energy.

The potential for small modular reactors and advanced reactors is enormous:

- Because they can be built in sequence, SMRs allow generating companies to match construction of new capacity with electricity load growth – particularly important in parts of the country where load growth may have slowed permanently.

- SMRs also provide financing flexibility: The capital investment can be staged as modules are constructed. This could be particularly important for smaller companies – rural electric cooperatives or municipal power agencies, for example – that cannot afford the $6 billion - $7 billion up-front financing associated with a 1,000-megawatt reactor.

- In the U.S., SMRs could be used to replace older fossil-fueled generation that will not meet new EPA clean air requirements. SMRs also provide a clean generation option for municipal and rural co-op utilities whose portfolios are dominated by older, small fossil generation facilities.

- Small reactors have enormous potential for overseas markets, particularly in countries that are developing a nuclear energy industry for the first time.

- Advanced reactors can expand the slate of products provided by a nuclear power plant – to include process heat, for example – or serve a vital role in management of the spent nuclear fuel from today’s light water reactors, thus minimizing the volume of high-level waste requiring permanent disposal.

Advanced (Generation IV) nuclear reactors hold the promise of inherently safe, emission-free, low-cost energy. Advanced reactors are generally understood to be fission reactor designs that represent significant advances from light-water reactor (LWR) technologies, including advanced LWRs, in terms of resource utilization, level of inherent safety, and substantially higher operating temperatures. In addition, advanced reactors have the potential to provide services beyond simply electricity generation.

If utilities are to consider advanced reactors in their future decision-making, significant progress toward commercialization is necessary. A focused, aggressive, coordinated effort by government and industry is necessary to ensure that SMRs and Gen IV reactors are ready for deployment in the United States and overseas as quickly as possible.

Commercialization of advanced nuclear reactors will best be achieved through a heavily industry-influenced research, development and demonstration (RD&D) program. An appropriate RD&D program must be able to identify the most promising technologies, and incorporate a decision-making process to facilitate down-selection, demonstration and deployment. Such an approach will ensure that real options are available when needed and at the scale needed to meet national and global electricity requirements. To focus the industry's perspectives, the Nuclear Energy Institute is establishing an Advanced Reactor Working Group, chaired by Stephen Kuczynski, Chairman, President and CEO of Southern Nuclear Operating Company. The working group, fashioned after NEI's Small Modular Reactor Working Group, will be 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 Gen IV reactors in the 2035 to 2040 timeframe.

V. Government-Industry Cooperation is Essential to Address Financing, Regulatory Challenges

The most significant challenges facing development, demonstration and deployment of SMRs and Gen IV reactors are financing and licensing. The time, uncertainty and cost required to design, license and build a new reactor design is daunting. The United States must develop creative approaches to lower barriers to entry – including industry-government cost-shared programs, investment incentives and innovative approaches to financing design, demonstration and initial deployment, and a more efficient regulatory framework for licensing of advanced reactors.

Financing Challenges. For SMRs, reactor designers are making significant progress in developing SMR designs. The Nuclear Regulatory Commission (NRC) is prepared to license these designs, supported by a cost-shared DOE licensing support program and industry work on generic SMR licensing issues. Customer interest, from the companies that will finance and operate these plants, is strong – notably strong given the economic and financial stress under which the U.S. electric sector is laboring, and the fact that first deployment is not expected until the early 2020s, at best.

Based on growing industry interest in SMRs, the Department of Energy (DOE) issued a Funding Opportunity Announcement (FOA) for a cost-shared industry partnership program in March 2012. The goal of the SMR Licensing Technical Support (LTS) program is to accelerate commercial deployment of SMR technologies. The LTS program is funded on a 50-50 cost-shared basis by DOE and industry participants, with U.S. government support currently capped at $452 million over five years.

This program seeks to replicate the success of the Department of Energy's Nuclear Power 2010 program, which provided development funding for large advanced-design reactor technology, resulting in the design and certification of the ESBWR and AP1000 reactors. Eight AP1000 reactors are now under construction in the United States and China.

Simple business reality dictates that cost-shared programs, with a substantial federal contribution, are essential. In the case of SMRs, the cost-shared government-industry program is necessary because plant designers will not see revenue or positive cash flow for approximately 10 years – longer than most companies can tolerate. Companies like Babcock &Wilcox (B&W), NuScale and others are prepared to absorb a significant share of the technology design and development costs, but the federal government must also play a significant role – particularly given the enormous promise of SMR technology. B&W's Generation mPower joint venture, for example, has already invested $400 million in developing its mPower design; NuScale, approximately $200 million in its design. These are significant sums of money, which will not generate any return for approximately a decade.

Beyond the design and engineering work necessary for design certification, substantial sums of money are required for critical activities essential for deployment. Completion of detailed design beyond the basic design phase is necessary. This will allow the development of specification-level documentation and a detailed design for construction and for procurement.

Current estimates are that the cost to complete enough design and engineering to obtain an NRC Design Certification and a Combined Construction/Operating License (COL) is expected to be approximately $750 million to $1 billion per design. More detailed first-of-a-kind (FOAK) design and engineering – required to develop credible cost and schedule estimates, a prerequisite to utility planning and investment decisions – is expected to add approximately $500 million to the cost of obtaining NRC approvals. Financing this development is a significant challenge.

NEI believes there are approaches that could help address this challenge. In its comments to the Department of Energy on the Quadrennial Energy Review on this issue, NEI recommended that the government consider innovative approaches to close the funding gap, including use of the Title XVII loan guarantee program. For example, the design, engineering and licensing costs could be folded into the cost of the first project(s) and financed through the loan guarantee program. Since the loan guarantee program can cover up to 80 percent of total project cost, this approach could allow project developers and generating companies to use debt (which is always lower cost than equity) to finance a substantial portion of the design, engineering and licensing costs, and to repay those costs over the long period of time typical of debt maturities. This is just one example of an innovative financing technique that, in NEI's view, deserve further exploration.

Regulatory Challenges. Regulatory uncertainty and the cost of obtaining the necessary regulatory approvals are also a challenge. This is not so much because NRC regulations are unnecessarily burdensome, but because the requirements for advanced reactors are not clear, largely because NRC regulations are based on existing large light water reactor technology. NEI believes that the NRC process for licensing advanced reactors could be more efficient – producing the same level of safety, but less uncertainty, time and cost to go from application to license.

In a 2012 report to Congress on the status of its Advanced Reactor licensing activities, NRC reported that its advanced reactor program is focused on preparing the agency for reviews of applications related to the design, construction, and operation of advanced reactors. These efforts include the following major areas:

- Identify and resolve significant policy, technical, and licensing issues;
- Develop the regulatory framework to support efficient and timely licensing reviews;

- Engage in research focused on key areas to support licensing reviews, and
- Engage reactor designers, potential applicants, industry, and DOE in meaningful pre-application interactions and coordinate with internal and external stakeholders.

NRC has demonstrated a willingness to work with stakeholders early, before applications are filed, to resolve key policy and technical issues for advanced reactors. As a result, most of the important issues are well-defined and have been widely-discussed for, in some cases, over two decades. Even so, potential licensees face a "chicken and egg" conundrum that must be resolved – i.e., necessary changes to NRC policies and technical requirements for advanced reactors wait for "real" projects because NRC is reluctant to commit to those changes in the absence of a "real" project, but projects need clarity and resolution on policies and technical requirements before they can become "real."

VI. Conclusion

For decades, nuclear and coal-based technologies have been the bedrock of the U.S. electric supply system. The coal-based options are narrowing, which creates a compelling need to ensure that the nation has available a robust, diverse suite of nuclear technologies. Failure to do so would condemn the nation to larger and larger dependence on one fuel – natural gas – for electricity production.

As America's existing generating capacity, including some portion of its nuclear generating capacity, approaches the end of its useful life, the nation must take steps to establish the portfolio of technologies necessary to produce clean, reliable baseload electricity for the 2030s and beyond. To be operational in the 2030s, this generating capacity must be under construction in the 2020s. To be under construction in the 2020s, federal and state governments and industry must address – in the balance of this decade – the financing and regulatory challenges facing these advanced nuclear generating technologies, both SMRs and Gen IV reactors.

Tackling these challenges successfully will require innovative, creative approaches to ensure availability of capital and the regulatory certainty and closure required. Business as usual will not get the job done.

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