Written Testimony to U.S. House of Representatives Committee on Energy and Commerce

Witness Name: Todd R. Allen, Senior Fellow
Witness Organization: Third Way
Name and Date of Hearing: April 29, 2016
Subcommittee of Jurisdiction: Subcommittee on Energy and Power
21st Century Nuclear Energy Innovation

Major Points

- Third Way supports the further development of the emerging innovation culture that creates and brings to market new advanced nuclear technologies. Well-structured Federal investments and programs can nurture this culture

- What specifically is needed in policy? The language of the Advanced Nuclear Technology Development Act and the intent of the Nuclear Utilization of Keynote Energy Policies Act are positive steps toward creating a more efficient regulatory review process that better reflects the needs of today's energy system. Bipartisan legislation with similar goals has been introduced in the Senate, indicating broad interest and opportunity for Congress to act. The Department of Energy has created the Gateway for Accelerated Innovation in Nuclear (GAIN) program to make the national laboratories more effective partners with the innovation community. Congress should encourage rapid steps from DOE to make GAIN more nimble. ARPA-E is studying the possibility of an advanced fission energy project. Congress should encourage ARPA-E to create this first program in fission. Finally, to ensure that we have a continued stream of new ideas flowing from the researchers, Congress should encourage DOE to fund Innovation Centers as described in a recent Third Way report, co-written with the Idaho National Laboratory. These private-public partnerships in early innovation will allow for greater creativity from our universities and laboratories, focused through interactions with private industry.

Summary

Third Way supports the further development of an innovation culture that creates and brings to market new advanced nuclear technologies. Developing these new technologies is critically important in meeting our ambitious emissions goals. A 2015 Third Way report identified nearly 50 companies, backed by more than $1.3 billion in private capital, developing plans for new nuclear plants in the U.S. and Canada. These companies are creating a growing number of product options of varying sizes and capabilities, intending to build upon the continued success of our current light water reactor fleet, which provides approximately 60% of the carbon-free electricity in the U.S.

How can Federal investments nurture this emerging culture of nuclear innovation? They should encourage a young professional to believe that entrepreneurship in nuclear technology is possible and desired; encourage private-public partnerships in early innovation, generating many ideas, only a fraction of which make their way to commercialization; provide test beds that allow for specialized testing and when needed, demonstration; and promote the sale of advanced technologies internationally. This does require strong federal programs, consistent with private-public partnerships that have previously developed technologies that led to major societal changes such as hydraulic fracking and the internet.

How could DOE research programs stimulate innovation and private investment? They could answer broad technology questions of value to multiple companies, to partner with industry in

early innovation, and to serve as the national test bed for specialized testing and demonstration/deployment. They would want interagency support to compete in global markets.

How could an improved regulatory process stimulate innovation and private investment? Innovators need regulatory signals as the technology becomes more mature. These signals are short of licensing decisions, but are necessary to convince an investment community to place ever-larger bets on a new technology. The regulator needs to maintain staff trained to evaluate concepts that differ from our current light water-cooled reactors and the regulator needs to be funded in a manner that provides flexibility for staff to engage with emerging technologies. Ideally, the pace of regulatory review would support new products for an energy system that is changing rapidly, all while maintaining the traditional exemplary safety record.

What then specifically is needed in policy? The language of the Advanced Nuclear Technology Development Act and the intent of the Nuclear Utilization of Keynote Energy Policies Act are positive steps toward creating a more efficient regulatory review process that better reflects the needs of today's energy system. Bipartisan legislation with similar goals has been introduced in the Senate, indicating broad interest and opportunity for Congress to act. The Department of Energy has created the Gateway for Accelerated Innovation in Nuclear program to make the national laboratories more effective partners with the innovation community. Congress should encourage rapid steps from DOE to make GAIN more nimble. ARPA-E is studying the possibility of an advanced fission energy project. Congress should encourage ARPA-E to create this first program in fission. Finally, to ensure that we have a continued stream of new ideas flowing from the researchers, Congress should encourage DOE to fund Innovation Centers as

described in a recent Third Way report, co-written with the GAIN leadership at the Idaho National Laboratory. These private-public partnerships in early innovation will allow for greater creativity from our universities and laboratories, focused through interactions with private industry.

Detailed Testimony

Energy Use and Nuclear Technology

The world will continue to rely on energy to provide the things that we depend upon for a civil society to function. These functions include water purification, sanitation, irrigation, heating and air conditioning, vaccinations, pharmaceuticals, and our homes.

Examining, over a time period from about 1850 to the present, the way humans use energy shows a natural tendency to use fuels that emit less carbon into the atmosphere. We naturally do that.

This change has taken us from brown coal and firewood to black coal to crude oil, and in recent years, to a strong use of natural gas as our most used energy source. This change in the fuels we use correlates with the energy density of the fuel. We tend to gravitate towards fuels that provide more energy from a fixed amount of fuel. This allows newer power plants to be smaller. Additionally, using less fuel then leaves untouched more of nature and thus is a better way to both provide energy to meet human needs, while also limiting the effects on biodiversity.

The foundation for powering a modern society in a clean manner rests on three components. First, we will likely continue to use our available fossil resources but in ways that have less

impact on the environment. For instance, the trend towards more natural gas will continue but we will also look to advance technologies like carbon capture and storage to mitigate any negative aspects of fossil fuel usage. We will increasingly use more variable renewable resources like solar and wind, but they are unlikely to support all aspects of a clean, robust, and affordable modern energy system. Finally, our future will be strongly supported by nuclear energy as nuclear fuel provides a much larger amount of energy for a given amount of fuel than even natural gas while emitting no carbon dioxide.

Two of these three pathways require "big technology" like carbon capture and storage and nuclear. A review of major shifts in technology use shows a strong history of private-public partnerships in developing "big technology". Examples include hydraulic fracking and the internet. Private-public partnerships have always been an important driver for nuclear technology development and this is true also for the 21st century.

While the focus of this testimony is on moving advanced nuclear technologies to market, it should be noted that our current deregulated markets for electricity do not focus decisions more than a few years beyond today and do not place value on the "big technologies" we will need for a robust, dependable, and clean energy future. We do need to provide some focus soon on how our current market structures discourage long-range planning in energy production.

The Current State of Nuclear Technology

To deploy a nuclear energy technology requires a Nuclear Regulatory Commission (NRC) license. Currently we have one modern U.S. nuclear technology licensed and being built, the Westinghouse AP1000 light water reactor. We have a single water-cooled small modular reactor, the NuScale Integral Pressurized Water Reactor, working through the regulatory process, and we have no advanced reactors actively working to move towards an NRC license. Having a single available option is reminiscent of stories of the Soviet Union, where the one vegetable choice was cabbage. Not satisfying.

Over the past few years, a growing number of privately funded companies have initiated the development of advanced nuclear concepts. A Third Way report released in May of 2015 identified nearly 50 companies, backed by more than $1.3 billion in private capital, developing plans for new nuclear plants in the U.S. and Canada. The mix includes startups with a few employees to well-known investors like Bill Gates, all placing bets on a nuclear comeback, hoping to get the technology in position to win in an increasingly energy hungry, carbon-limited world.

Within this group of companies, we see a growing number of product options of varying sizes and capabilities. These companies are thinking about all of the production, transmission, and distribution functions of modern energy delivery, and starting to imagine an increasing variety of sizes and function that could be supplied using nuclear technology.

Over the last year, in parallel with the technical work on advanced nuclear, the policy community has begun to discuss how to stimulate this burgeoning innovation culture in the nuclear technology community.

We applaud the Congress for the growing number of bills being introduced and the sophisticated discussion being held around appropriations on advanced nuclear technology. This testimony now sketches out a framework that shows what is needed by a company trying to bring a new nuclear technology to market and how these legislative initiatives, complimented by administration initiatives, are starting to align to support an innovation culture.

Establishing Policy to Encourage Innovation in Nuclear Technology

In simple terms, the overall structure of the Federal programs and policies should support taking an early innovative idea all the way to commercialization. They should encourage a young professional to believe that entrepreneurship in nuclear technology is possible and desired; encourage private-public partnerships in early innovation, generating many ideas, only a fraction of which make their way to commercialization; provide test beds that allow for specialized testing and when needed, demonstration; and promote the sale of advanced technologies internationally.

How then might the NRC and DOE work to support a culture that encourages innovation?

NRC engagement needs to occur as the technology advances and becomes more mature. Innovators need to get a sense of the regulatory response (short of licensing) as the technology becomes more mature. This is necessary to be able to convince an investment community to place ever-larger bets on a technology. The regulator needs to exercise a structure that allows it to maintain staff trained to evaluate concepts that differ from our current light water-cooled reactors. Finally, the regulator needs to be funded in a manner that provides flexibility for staff to engage with emerging technologies. In the big picture, we want to help the regulator transition to a pace of review that is appropriate for an energy delivery system that is changing rapidly & demands new products, all while maintaining their traditional exemplary safety record.

Recent reports from the Nuclear Innovation Alliance and Third Way provide suggestions as to how the interface between the regulator and the emerging industry could be improved and many of these ideas are captured in recent legislation arriving in both the House and Senate.

On the research component, the Department of Energy should structure programs to support many ideas in early innovation, a disciplined selection of a small number of the innovative ideas for further demonstration of feasibility, and selection of a small subset of the these demonstrations for deployment. The Department should take strong signals from analysis of future energy needs combined with signals from private investment in establishing its R&D programs executed in the university and national laboratory programs.

The national R&D programs, funded by DOE, can answer broad technology questions of value to multiple companies, partner with industry in early innovation, as well serve as the national test bed for specialized testing and demonstration/deployment. These technology programs can be paralleled with new efforts to improve the communications and engagement around nuclear technology, to remedy communications and engagement mistakes made when nuclear technology was introduced in the 1950s and 1960s. These programs should boldly encourage an innovation community that looks to create new markets for nuclear technology and to be strongly engaged with the specialized or regional needs of various communities.

Some of these changes to R&D program structures are underway. Notably, the DOE announced the creation of the GAIN program to provide better access to the national laboratories by private industry. Recent reports from Third Way provide suggestions as to how to establish early innovation programs, and many of these ideas are captured in recent legislation arriving in both the House and Senate.

In summary, to take advantage of the benefits of nuclear technology requires strong private-public partnerships, led by private sector innovators. The Department of Energy research programs need to be thoughtfully crafted to support these relationships. The Nuclear Regulatory Commission needs to operate at a pace of review that is appropriate for an energy delivery system that is changing rapidly & demands new products, all while maintaining their traditional exemplary safety record.