Written Testimony of
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Clean Air Task Force

Before the Subcommittee on Energy
Committee on Science, Space, and Technology
U.S. House of Representatives

The Future of Nuclear Energy

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<u>Summary of Testimony</u>

Chairman Lummis, Ranking Member Swalwell, and distinguished members of this subcommittee, thank you for holding this hearing and for giving me the opportunity to testify. My name is Ashley Finan, Project Manager for Energy Innovation at the Clean Air Task Force. Clean Air Task Force is a non-profit environmental organization dedicated to catalyzing the development and deployment of low emission energy technologies through research and analysis, public advocacy leadership, and partnership with the private sector.

Climate change is an enormous challenge. To have the greatest chance of success, CATF believes we will need all of the low-carbon energy technologies available, including nuclear power.

While nuclear technology has made big incremental improvements in the last decade and is suitable for deployment, it still faces obstacles. Advanced reactors can address those by reducing cost and construction time, enhancing safety, and better managing wastes. The US has an exciting opportunity to continue to be a world leader in nuclear technology. We have some of the world's best innovators, a tremendous asset in the DOE and the national lab system, investors ready to invest in advanced designs under the right conditions, and a regulator that is considered the global "gold standard."

As with any energy technology, the development and commercialization of advanced non-light water reactors requires a suite of supportive policies from early research through demonstration and adoption. I will focus on two elements that need more attention: First, a testing facility that would enable private companies to build prototypes in a DOE-supervised environment; and second, a clear and predictable regulatory pathway for licensing advanced reactors.

Historically, the Atomic Energy Commission developed and demonstrated new reactors with full public funding on government sites. Since that level of public support was scaled back, the US has not seen the successful commercialization of a

major breakthrough in nuclear reactor technology. That is not for lack of ideas. We need a new model that better incorporates private investment, while taking advantage of the important role that DOE plays.

A test bed facility at a DOE site would provide technology-neutral support through public private partnership arrangements. DOE has safety oversight authority, unique capabilities, experts, and experimental facilities that could dramatically reduce the barriers, costs, and delays involved in nuclear demonstrations. By controlling and defining many of the costs and unknowns, the test bed site would enable private investment in prototype reactors and pre-commercial projects. Not only could this unlock a great deal of private capital, it would enable US innovators to move forward domestically, rather than turning to foreign partners.

In addition to demonstration activities, another crucial step in commercialization is licensing with the US Nuclear Regulatory Commission. The NRC's experience base is with light water technology, and it has established a clear pathway for licensing a light water reactor. The process for an advanced reactor is far less established, and thus introduces a level of uncertainty that can be paralyzing to private investment. Advanced reactors don't need a shortcut or less stringency, but they need a well-defined predictable process.

This is another area where the model could be adjusted to enable more private and venture investment. One such adjustment would be introducing stages of licensing. The current NRC certification process is "all or nothing," without interim levels of approval or acceptance. By comparison, the FDA has orderly stage-gates, starting with pre-clinical trials, Phase I, II, and III trials, and finally a new drug application. A drug can pass or fail at each stage, and this provides a clear signal to investors that a technology is meeting or failing criteria set by the regulator.

It certainly isn't trivial to "stage" NRC licensing – the NRC would need resources and will. But it would provide a more workable process for investors in new technologies. In developing such a staged pathway, it would be important to collaborate closely with the innovators and investors who would use this process.

There are a variety of other actions that DOE and NRC could take to develop a risk informed and technology neutral licensing framework that would be more applicable to advanced reactors. NRC and DOE have both taken steps in that direction, but more resources and a clear mandate would ensure more timely action.

Nuclear power could play a very large role in addressing climate change as well as other global air emissions concerns. Private investors recognize that and are ready to move forward with advanced reactors, if we can modernize the commercialization model.

Thank you for this opportunity to testify. I would be pleased to respond to any questions you might have, today or in the future.

Full Written Testimony

Chairman Lummis, Ranking Member Swalwell, and distinguished members of this subcommittee, thank you for holding this hearing and for giving me the opportunity to testify. My name is Ashley Finan, Project Manager for Energy Innovation at the Clean Air Task Force. Clean Air Task Force is a national non-profit environmental organization dedicated to catalyzing the development and global deployment of low emission energy technologies through research and analysis, public advocacy leadership, and partnership with the private sector.

Climate change is an enormous challenge. To have the greatest chance of success, CATF believes it will be necessary to deploy all of the low-carbon energy technologies available, including nuclear power.

Nuclear Energy Innovation

Working with partners, CATF helped to assemble an informal group of advanced reactor stakeholders called the Nuclear Innovation Alliance.

The Nuclear Innovation Alliance was established to develop and advocate for new federal policy initiatives and private financing to develop and commercialize advanced nuclear reactors encompassing a broad range of new and innovative designs, fuel cycles, materials, and waste characteristics. The Alliance's specific near-term objectives include adjustments that maintain rigor while making the US nuclear licensing process workable for a range of advanced reactors; public financial support for advanced reactor development and testing; and innovative private financing alliances to support advanced nuclear reactor development and commercialization. The Alliance includes environmental organizations, academic and other independent nuclear energy experts, developers of innovative nuclear reactors, and other stakeholders.

While I'm not representing the Nuclear Innovation Alliance in this testimony, the work of that group has been instrumental in developing the ideas that are described here, and I want to acknowledge the contributions of time made by all of the participants.

Climate change is a global issue, since most of the future energy demand growth and emissions will come from the developing world. The US has an obvious role in leadership, but also a crucial role in driving technology innovation so that competitive, scalable, low carbon technologies are available for global export and use.

While nuclear technology has made major incremental improvements in the last decade and is suitable for deployment, it still faces obstacles. Advanced reactors[1] can address those obstacles by reducing cost and construction time, enhancing safety, and better managing wastes. The US has an exciting opportunity to continue to be a world leader in nuclear technology. We have some of the world's best innovators, a tremendous asset in the DOE and the national lab system, investors ready to invest in advanced designs under the right conditions, and a regulator that is considered the global "gold standard."

As with any energy technology, the development and commercialization of advanced non-light water reactors requires a suite of supportive policies from early stage research through demonstration and adoption. I will focus my comments on two elements that need more attention: First, a testing facility that would enable private companies to build prototype reactors in a DOE-supervised environment; and second, a clear and predictable regulatory pathway for licensing advanced nuclear reactors.

Historically, the Atomic Energy Commission developed and demonstrated new reactor technologies with full public funding on government sites. Since that level of public support was scaled back, and essentially since the light water reactor was developed, the United States has not seen the successful commercialization of a major breakthrough in nuclear reactor technology. That is not for lack of ideas. We need a new model that better incorporates private investment, while taking advantage of the important role that DOE plays.

<u>A Test Bed Facility for Private Investment in Reactor Prototypes</u>

A test bed facility at a DOE site would provide technology-neutral support through public private partnership arrangements. DOE has safety oversight authority, unique capabilities, experts, and experimental facilities that could dramatically reduce the barriers, costs, and delays involved in nuclear demonstrations. By controlling and defining many of the costs and unknowns, the test bed site would enable private investment in prototype reactors and related pre-commercial projects. Not only could this unlock a great deal of private capital, it would enable US innovators to move forward domestically, rather than turning to foreign partners.

Specifically, the services and facilities that could be provided by a DOE test bed facility might include: safety oversight, water and power supply, transportation and

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[1] In this document, the term "advanced reactors" refers to those technologies that do not use conventional water as a coolant and moderator. Small Modular LWRs occupy a commercialization stage intermediate to large LWRs and advanced non-light water reactors. They do have a few challenges in common with advanced reactors, but require minimal technological development and relatively modest regulatory adjustments. However, resolving the regulatory issues faced by small modular reactors will also assist advanced reactor developers in some ways.

security infrastructure, fuel handling, seismically characterized sites, post-irradiation testing facilities, expert consultation, etc. Which services would be provided, and at what cost, would need to be worked out among the partners. A feasibility study is needed to lay out the options for implementation, ownership, and fee structure, and to estimate the costs of building and operating such a "test bed" facility. The study should be undertaken by a consortium of the DOE, the advanced nuclear industry, potential investors, the national labs, and perhaps others, in order to ensure that all relevant perspectives are incorporated.

Advanced Reactor Licensing Developments

In addition to prototyping and demonstration activities, another crucial step in commercialization is licensing with the US Nuclear Regulatory Commission. The NRC's experience base is with Light Water Reactor (LWR) technology, and it has established a clear pathway for licensing a light water reactor. The process for licensing an advanced reactor is far less established, and thus introduces a level of uncertainty that can be paralyzing to private investment. Advanced reactors don't need a shortcut or less stringency, but they need a well-defined predictable process.

In the past, DOE has provided funding and support to help LWRs navigate the NRC licensing process, for example with the AP600 and AP1000. This same strategy might be a practical way to help advanced reactors, but it is not technology-neutral.

This is another area where the model could be adjusted to enable more private and venture investment in nuclear technology. One such adjustment would be introducing stages of licensing. The current NRC design certification process is "all or nothing," without interim levels of approval or acceptance. By comparison, the FDA has orderly stage-gates, starting with pre-clinical trials, Phase I, II, and III trials, and finally a new drug application. A drug can pass or fail at each stage, and this provides a clear signal to investors that a technology is meeting or failing criteria set by the regulator.

It certainly isn't trivial to "stage" NRC licensing – the NRC would need resources and will. But it would provide a more workable process for investors in new technologies. Over the past 25 years, the NRC developed and demonstrated a new regulatory process under 10 CFR Part 52. This "Part 52" process created separate independent approvals for the Site Permit and the Design Certification and Operating License. The stages that would help to enable advanced reactor licensing would be within the design review and operating license processes, and might be introduced into the older "Part 50" process, the Part 52 process, or a new risk-informed, technology neutral process. This is something that the NRC could pursue on its own, if it had funding to do this work,[2] or it might be something that DOE

[2] The NRC operates on a 90% fee recovery basis, and it isn't appropriate to use fees recovered from operating LWRs to support NRC research into advanced reactor regulation. Congress would need to appropriate funds, either to NRC under one of

could partner on, either as an extension of the NGNP licensing effort, or as an expansion of the current Advanced Reactor Licensing Initiative. In either case, in developing such a staged pathway, it would be important to collaborate closely with the innovators and investors who would use this process. The test bed site might provide a good platform for the NRC to learn about the advanced technologies and to test new licensing frameworks on an existing facility that is built and operated under DOE authority, but work to improve the licensing process should not wait for test facilities – it should begin right away.

There are a variety of other actions that DOE and NRC could take to further develop a risk informed and technology neutral licensing framework that would be more applicable to advanced reactors. NRC and DOE have both taken helpful steps in that direction,[3] but more resources and a clear mandate would ensure more timely action.

Nuclear power could play a very large role in addressing climate change as well as other global air emissions concerns. Private investors recognize that and are ready to move forward with advanced reactors, if we can modernize the commercialization model.

Thank you for this opportunity to testify. I would be pleased to respond to any questions you might have, today or in the future.

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the exemptions to the fee-recovery requirement, or to DOE (as an NRC customer), to fund work on regulatory research. Cost estimates will need to be developed by the NRC, but we think that as little as $5-10 million annually would provide the resources to make great progress in this work.

[3] For example, through the NGNP program, the Advanced Reactor Licensing Initiative, the SMR licensing efforts, and NRC's 2012 publication: NUREG-2150 "A Proposed Risk Management Regulatory Framework."

Biography

Dr. Ashley Finan serves as senior project manager of the Energy Innovation Project at Clean Air Task Force. In that role she manages CATF's advanced nuclear energy project, coordinates studies on energy innovation policy and on advanced energy technologies. She works with the CATF team to develop and implement strategies that facilitate the commercialization of promising energy technologies.

Ashley earned her Ph.D. in Nuclear Science and Engineering at the Massachusetts Institute of Technology. Her doctoral work focused on energy innovation investment and policy optimization, both in nuclear and renewable energy technologies. She has played a key role in studies of the use of advanced nuclear energy to reduce greenhouse gas emissions in several applications, including hydrogen production, coal to liquids processes, and oil production methods. Ashley has worked as a strategy and engineering consultant, primarily on nuclear energy applications. She also contributed to an analysis of the techno-economic potential of energy efficiency improvements in the residential and commercial sectors and several related topics. Ashley holds an SB degree in Physics as well as SB and SM degrees in Nuclear Science and Engineering from MIT.