TESTIMONY OF DR. JOHN C. WAGNER
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Leveraging the Department of Energy National Laboratories to Unleash American Energy Dominance

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Chairman Babin, Ranking Member Lofgren, Subcommittee Chair Weber, Subcommittee Ranking Member Ross, and distinguished members of the subcommittee, thank you for your interest in the U.S. Department of Energy's (DOE) 17 national laboratories and for the opportunity to be here today. My name is John Wagner, and I am the director of the Idaho National Laboratory (INL), the nation's nuclear energy research and development center. In this role, I lead a DOE national laboratory with approximately 6,300 scientists, engineers and support staff and multiple nuclear and non-nuclear experimental facilities, focused on changing the world's energy future and securing our nation's critical infrastructure.

I hold a Bachelor of Science degree in Nuclear Engineering from the Missouri University of Science and Technology and Master of Science and Doctorate degree in Nuclear Engineering from Penn State. My first professional experiences were summer internships at Oak Ridge and Los Alamos National Laboratories, which had a profound effect on the career. My first position following graduate school was with a private company designing and licensing spent nuclear fuel storage and transportation systems. I then returned to Oak Ridge, where I worked from 1999-2016, holding various positions of increasing responsibility, ultimately becoming director of the Reactor and Nuclear Systems Division. In February 2016, I joined INL as the chief scientist for the Materials and Fuels Complex, before becoming the associate laboratory director for the Nuclear Science and Technology Directorate. I am the author and co-author of more than 170 refereed journal and conference articles, technical reports, and conference summaries. I am a Fellow of the American Nuclear Society and the American Association for the Advancement of Science.

I am currently serving as chairman of the National Laboratory Directors' Council (NLDC). The NLDC consists of the directors of the 17 DOE laboratories. As Energy Secretary Chris Wright recently wrote in a memo, DOE's "R&D enterprise is the envy of the world." Our national laboratories have achieved multiple breakthroughs that have literally changed the

path of human history, improved the quality of life for people across the world, and unleashed American energy innovation. The DOE mission is critical to American security and prosperity. Our system of national laboratories are key drivers of that mission and set the United States apart from other nations.

The National Laboratory System

The origins of the national laboratory system can be traced to the Manhattan Project. By bringing together our best minds, taking an integrated approach to large-scale, interdisciplinary research, and developing world-class facilities, our nation won the race to develop atomic weapons and ensured freedom across the globe. From this successful enterprise, and supported by significant government investment, emerged a model for a national laboratory system that has played a crucial role in driving the U.S. economy and bolstering our national security.

The list of national laboratory accomplishments is extraordinary and long[1], but a few notable achievements include first demonstration of nuclear power, which now provides approximately 10% of electricity around the world and nearly 20% in the United States, and development of nuclear propulsion, which has played a key role in establishing U.S. naval military dominance. Both took place at Idaho National Laboratory.

Astonishing accomplishments in basic science, including decoding DNA, detecting neutrinos and discovering dark matter also trace their origins to our national labs. National labs have advanced supercomputing and are at the forefront of exascale and quantum computing. They help power NASA spacecraft with plutonium-238. They invent new materials that enhance industry and improve lives, and they have discovered 22 elements.

More recently, the fusion ignition at Lawrence Livermore National Laboratory was a landmark achievement, with significant implications. Our nation has built an unequaled innovation ecosystem with the 17 DOE national laboratories, and they are prepared to continue to unleash American energy, ingenuity, and innovation.

By working in partnership, our nation's private sector, academic sector, and the DOE laboratories have ensured American science and technology dominance, retaining and even expanding upon our historic position as the world leader in ideas, ideals, economic output, and security. The national laboratories are uniquely positioned and singularly capable of meeting today's challenges to our science and technology preeminence.

[1] https://www.energy.gov/articles/75-breakthroughs-americas-national-laboratories-0

Innovative breakthroughs in energy and national security are made possible by unique scale and scope of the national laboratory system: our world-leading research facilities and world-class workforce; our commitment to use mission-driven basic research; our pre-competitive applied energy research that compliments industry's efforts; and our partnerships with the private sector, utilities, and developers of innovative energy technologies. An important aspect of ensuring American exceptionalism today and into the future is making sure our research, facilities, and capabilities are secure and thriving.

The national laboratories draw on talent from around the world to work with U.S. citizens performing groundbreaking science while also gaining critical insights into the capabilities of both our allies and adversaries through international collaboration and engagement. DOE and its national laboratories use a managed research environment to balance the risks and benefits of this international scientific collaboration, and to protect taxpayer-funded research and intellectual property from foreign exploitation and exfiltration. We have a strong and time-tested process that effectively screens entry, manages access to key information, monitors activities, and manages risk.

World Class Facilities and Capabilities

Our labs conduct Big Science that is not possible anywhere else. They design and operate first-of-a-kind science instruments that enable a greater understanding of the origins of the universe, fundamental properties of material, behaviors of biological systems, and development and delivery of pharmaceuticals. The labs steward an unparalleled collection of world-class facilities, including supercomputers, nuclear reactors, light and neutron sources, colliders and many others as a direct result of strategic needs assessments and long-range planning carried out by the DOE.

The unrivaled infrastructure of the DOE national laboratories gives the U.S. a competitive advantage and enables extraordinary achievements that drive our economy, ensure national security, and improve the standard of living for all Americans. The national laboratories know how to successfully build and operate large, complex facilities that enable the achievement of exceptional science. Critical investments in DOE facilities and capabilities, including the world's fastest supercomputers, have made life better for all Americans.

The National Labs Will Enable U.S. Leadership for a Prosperous Future

Mastery of today's new technologies is vital to future global leadership. We must, as a nation, understand and be first in finding answers to questions that will determine how future generations live. Questions such as:

- How do we leverage abundant American energy resources to power prosperity?
- How do we innovate to ensure durable, stable energy dominance through fission, fusion, and other technologies?
- How do we harness AI, exascale computing, and quantum computing to provide breakthroughs and solutions that benefit American people and industry?
- How do we ensure domestic production of strategic and critical minerals and materials for supply chain security?
- How do we secure our grid and other critical infrastructure for the reliable delivery of necessities like energy and water?
- How do we ensure U.S. national security, at home and abroad?

And while the experts at our national laboratories are hard at work finding solutions to these pressing challenges, they are also constantly looking ahead, over the horizon, to be prepared for future challenges. Our nation has invested billions of dollars into this ecosystem, allowing the United States to grow a national laboratory complex that is both the envy of the world and our path to a more prosperous and secure future.

Those of us fortunate enough to work at a national lab understand what a privilege it is to be entrusted with finding solutions to the nation's most pressing science, energy, and security challenges. We are grateful for the investments made by our fellow citizens and the opportunity to change the world for the better through science, learning, and innovation. And we understand the importance of continued investments into national laboratory research, and the incredible results that can be achieved on behalf of the American people.

Ensuring American Energy Dominance

Within the DOE national laboratory system, there are three applied energy laboratories: Idaho National Laboratory (INL), National Energy Technology Laboratory (NETL), and National Renewable Energy Laboratory (NREL). The applied energy labs play a crucial role in driving innovation and ensuring the United States remains competitive in the global energy landscape. Our nation's applied energy laboratories are uniquely positioned to play critical roles in achieving the American energy dominance goals outlined by Energy

Secretary Chris Wright in a memo to DOE leaders, specifically advancing energy addition, unleashing American energy innovation, strengthening grid reliability and security, and unleashing commercial nuclear power in the United States.

The labs drive innovation and achieve positive results for the American taxpayer in an incredible variety of ways, often in partnership with private companies. By conducting research that makes the extraction, processing, and utilization of fossil fuels and other critical resources more efficient. By supporting development of advanced nuclear reactors and fuel cycles. By helping modernize the electric grid and advancing energy storage solutions. By improving the efficiency and sustainability of transportation systems.

At Idaho National Laboratory, we are rising to this challenge and providing leadership in energy development and critical infrastructure cyber-physical security. We have a long history of helping our nation develop the energy needed to power economic prosperity and bolster national security. Today, INL is helping maintain and extend the lives of America's high-performing nuclear reactor fleet while working with industry to demonstrate and deploy the next generation of nuclear power.

Longtime nuclear leaders, like Westinghouse, General Electric, Holtec, and Southern Company, and a growing number of nuclear startups, like TerraPower, X-energy, Oklo, Kairos, Radiant, Aalo Atomics, Antares, Lightbridge, and many others are collaborating with national laboratories on innovative reactor designs, fuel development, and associated technologies to address an expanding variety of energy use-cases. Our advanced reactor test beds are nearing completion and in the next few years will enable multiple private-sector reactor demonstrations – de-risking these technologies to support commercial adoption and deployment. Also in the next few years, INL will begin operating three new nuclear systems on our site, including: the Microreactor Applications Research Validation and EvaLuation, or MARVEL, microreactor; Project Pele, a mobile microreactor being developed by BWXT for the Department of Defense; and the Molten Chloride Reactor Experiment, or MCRE, an experiment being developed in partnership with Southern Company and TerraPower.

INL plays a crucial role in ensuring the resilience and security of our nation's most critical infrastructure, conducts groundbreaking hydrogen and biomass research, and is developing an Energy Technology Proving Ground that will enable industry partners to demonstrate at-scale technologies and accelerate the transition of innovations from the laboratory to the marketplace while providing a cultural foundation of excellence and collaboration, guiding decision-making and strategic execution.

The next horizon – Artificial Intelligence and Machine Learning

One of the things that national laboratories do best is collaborate, leveraging capabilities and expertise across multiple labs, to address big problems with important outcomes for our nation. AI is an opportunity for the labs to do just that. Frontier AI has potential to transform DOE's national security, energy security, and scientific mission areas. The nation that masters frontier AI will have a competitive advantage technologically, economically, and militarily for decades to come.

The national laboratories have long been America's leader in solving complex challenges that fall beyond the capabilities of industry alone, bringing teams together to unlock groundbreaking technologies. In 2017, Google's invention of transformers propelled a new class of generative AI technologies that has led to tools such as OpenAI's ChatGPT across broad engineering, scientific, academic, and household use. Work through DOE's Exascale Computing Program led to the development of critical components of the GPU chips now essential for advanced simulations and AI.

America has leveraged its lead in semiconductor and software engineering to achieve breakthroughs across the field of AI, balancing large data and computer infrastructures, with new reasoning technologies such as test-time compute available in ChatGPT O1. However, our technological lead is rapidly shrinking.

Recently, China's DeepSeek R1 model shocked major media organizations around the world, as the model reached parity across many benchmarks when compared to the latest American production AI models, putting American leadership under threat. Chinese advancements in generative AI technology have been progressing over the last year.

The United States must further accelerate its advances in AI to maintain our competitive advantage. DOE's AI initiative provides an opportunity to unlock transformative, advanced energy technologies to propel America's energy dominance. Advanced frontier AI systems can dramatically reduce costs, accelerate deployment schedules, and semi-automate regulation to quickly dominate world-wide energy generation.

AI and machine learning have the potential to transform energy innovation by optimizing system performance, enhancing predictive maintenance, and accelerating the development of cutting-edge technologies. By integrating AI/ML with high-performance computing, DOE labs are unlocking efficiencies across the energy sector and expediting the creation of advanced materials.

An AI partnership

The nation's applied energy laboratories are leveraging their existing collaborative partnerships to develop frontier AI systems at forefront of American technological capabilities. These laboratories have a long history of partnering with the energy industry, computational industry, government regulators, and the university ecosystem to solve national energy challenges. By leveraging the innovation ecosystem of the applied energy labs to advance AI for energy dominance we can accelerate research in key areas to:

- Secure and automate grid operations, autonomously balancing energy supply and demand, ensuring disaster recovery and remediation of all hazard events in energy delivery systems.
- Transform the design and discovery of new energy materials.
- Discover new sources of critical minerals and natural resources needed for natural gas, coal, advanced semiconductors, nuclear energy, and other advanced technologies.
- Accelerate the deployment of nuclear energy systems to propel AI and data center communities.

There is also an incredible opportunity to accelerate the deployment of nuclear energy to power data centers and meet the dramatically increased energy demand of our technology sector[2]. Focused AI efforts to accelerate the development and deployment of new reactors at the speed and scale to meet our nation's energy demands will include:

- Autonomous Design, Development, and Licensing
- Autonomous Operations
- Nuclear Energy Research and Development
- Proof of Concept First Deployment of an Advanced Reactor with a Data Center at a National Laboratory

This initiative holds the potential to significantly reduce nuclear power plant costs at all phases of design, construction, licensing, and operation, transforming American

[2] http://eta-publications.lbl.gov/sites/default/files/2024-12/lbnl-2024-united-states-data-center-energy-usage-report.pdf

leadership in nuclear energy and ensuring dominance of both nuclear energy and AI for another generation.

A crucial moment in history

We live in a period of great competition between nations. Innovation is essential to maintaining America's economic, technological, and military leadership. To meet this challenge, we will need to move faster, which requires us to evaluate our current operational model and look for increased efficiency and productivity. We must lean into our strengths as a nation to compete with our adversaries and advance U.S. leadership across the world. One of these strengths is a system of national laboratories considered by many to be one of our nation's crown jewels.

The national laboratories have shown they must play a crucial role in ensuring American exceptionalism. I believe that our 17 national labs are a primary difference maker, our nation's "ace in the hole," that will enable us to win this competition between nations, enhance our standing as the world leader in energy and technological innovation, and ensure economic prosperity and security for future generations of Americans.

I believe that, working together, we can accomplish our goals and, through an acceleration of innovation, strengthen the reliability and security of our nation's energy system, ensure American energy dominance at home and abroad, and enhance our national security.

I appreciate the opportunity to testify, and I want to thank the subcommittee for its interest in the labs and the important work they do for our nation. I look forward to your questions.