Testimony Of Joseph Dominguez
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Chairman Manchin, Senator Barrasso, Members of the Committee,

Thank you for the opportunity to appear before the committee today. I am Joseph Dominguez, and I am President and CEO of Constellation Energy Corporation.

My message to the committee today is threefold:

First, nuclear power is critical to the nation's energy security, environmental security, and national security.

Second, the United States is on the verge of a crisis in conversion and enrichment markets; it is critical that we re-shore our capabilities to overcome global dominance by Russia in these areas. We do not have time to wait: In the world of nuclear fuel, 2028 is tomorrow. Congress must authorize and fund a $3.5 billion investment as part of a public-private cost-share partnership with conversion and enrichment providers. It is important that we have both a diversity of supply and a diversity of suppliers.

Finally, the Department of Energy should use their existing authority to accelerate deployment of new enrichment technologies using funds previously made available for High Assay Low Enriched Uranium (HALEU) production. DOE has made one award for HALEU production, and the Department should fund an additional project that uses laser enrichment technology that could also be used to produce low-enriched uranium for the fleet of existing reactors.

Constellation

Headquartered in Baltimore, Constellation is the nation's largest producer of carbon-free energy, providing 11% of America's clean electricity, and is the leading competitive retail supplier of energy products and services for businesses and homes across the United States. Our generation fleet produces enough clean, carbon-free energy to power the equivalent of 15 million homes and is helping to accelerate the nation's transition to clean energy with more than 32,355 megawatts of capacity and annual output that is nearly 90% carbon-free. Constellation has set a goal to achieve 100% carbon-free generation by 2040 by leveraging innovative technology and enhancing its diverse mix of hydro, wind and solar resources paired with the nation's largest carbon-free nuclear fleet. Constellation's commercial business serves approximately 2 million residential, public sector and business customers, including three-fourths of the FORTUNE 100.

Constellation was created a little over a year ago when we spun off from Exelon Corporation and became a stand-alone, publicly traded company. Overall, Constellation is the third largest power generator in the United States, and we own and operate the nation's largest fleet of nuclear reactors, with 21 reactors operating in Illinois, Maryland, New York, and Pennsylvania, and partial ownership of two units in New Jersey. Finally, we are a global leader in nuclear operations. Our 94.8% capacity factor in 2022 marks the seventh year in a row with a capacity factor over 94%, the best in the industry for over a decade. Our 11 refueling outages last year averaged an industry-leading 21 days, matching our fleet record.

Our skilled workforce of approximately 13,370 people nationwide is an essential component of our operations, and allows us to safely run the largest, most reliable and resilient carbon-free energy fleet in America.

Importance of Nuclear Power

The U.S. nuclear fleet provides nearly 20% of the nation's electric generation and accounts for 50% of the nation's emissions-free generation. Nuclear provides an around the clock supply of emissions-free energy, even in severe weather conditions that result in grid emergencies, and is critical to ensuring a clean and reliable grid for the United States.

At the end of 2022, Winter Storm Elliott brought record-setting low temperatures to the PJM region, threatening the reliability of the grid and safety of 65 million of Americans. Always-on nuclear power provided the resiliency and reliability needed by the grid to prevent catastrophic blackouts. During the storm, Constellation's 16 nuclear reactors in PJM operated at 100% capacity while nearly a quarter of PJM generation was knocked offline by extreme conditions, with 90% of that being fossil generation.

State and Federal policymakers are increasingly recognizing the value of nuclear power in the face of disastrous policy decision to shutter nuclear plants before the end of their licensed lives. Germany is a poster child for what happens when short-term political considerations overrule sound policy. Germany mandated a shutdown of nuclear units and tried to replace that generation with renewable resources. Instead, they were forced to rely on high-emitting generation to keep the lights on and saw their power sector emissions jump five percent in 2021. The United States saw similar increases in emissions in states that prematurely closed nuclear plants.

Nuclear power is also vital for national security. The Department of Defense (DOD) notes that small modular reactors (SMRs) and other advanced reactors are ideal for powering bases in remote and austere environments. The partnership between the Idaho National Laboratory and DOD to develop a mobile microreactor in Project Pele offers what Defense officials call a potential "strategic game changer" for the United States.[1] Advanced nuclear technologies can offer still broader national security benefits at home and abroad as such efforts go forward.

Members of this committee have long recognized the importance of clean, affordable, and safe baseload nuclear power, and we thank you for your leadership in ensuring that we won't need to close additional plants prematurely for economic reasons. The Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act (IRA) took concrete steps to begin to put all non-emitting generation, including nuclear, on a level playing field. Mr. Chairman, I particularly want to thank you and Senator Wyden for championing the production tax credit for existing nuclear plants.

For Constellation, these measures are transformational, enabling us to seek to relicense our nuclear units, preserving thousands of jobs and thousands of megawatts of emissions free generation for 20 years. The long-term investment certainty provided by this legislation and initiatives in several of the states in which we operate allowed Constellation to add 2,000 new employees in 2022. Extending the life of Constellation's nuclear units (about a quarter of overall nuclear generation in the U.S.) will create as much clean energy as all the renewable energy built in America over the last 40 years. From a jobs standpoint, extending the licenses of Constellation's plants to 80 years will create over 453 million

[1] Department of Defense, "DoD to Build Project Pele Mobile Microreactor and Perform Demonstration at Idaho National Laboratory," April 13, 2022, https://www.defense.gov/News/Releases/Release/Article/2998460/dod-to-build-project-pele-mobile-microreactor-and-perform-demonstration-at-idah/

person-hours of work in high-paying jobs across the country, making the nuclear energy provisions of the IRA one of the largest creators of family-sustaining wages.

Looking forward, we recently announced plans to invest $800 million in power uprates at two of our nuclear stations that will create 135 additional megawatts –- the equivalent of adding 216 intermittent wind turbines but without using a single additional acre of land. We also have plans to invest $900 million in hydrogen production at one of our nuclear units to create approximately 35,450 tons per annum of clean hydrogen that will help decarbonize other industries. These projects will contribute to our clean energy economy and will create thousands of additional high-paying jobs in our communities. Appropriate implementation guidance on the IRA will be particularly important to ensuring that these investments, and more like them, can be made.

Nuclear Fuel

Given that we have the most nuclear units in the nation, Constellation is the naturally largest consumer of nuclear fuel in the United States. In the coming years, we will spend more than $1 billion annually on uranium, conversion, enrichment, and fabrication. In an average year, our plants require 10 million pounds of uranium, about 4 million kilograms of conversion, and 3 million SWU. Total U.S. demand is roughly 50 million pounds of uranium, 18 million kilograms of conversion, and 15 million SWU annually.

Global events in the last three years, including COVID and Russia's invasion of Ukraine, have exposed critical supply chain gaps in nearly every sector of America's economy, including the nuclear fuel industry. It is imperative that we work together urgently to reestablish the United States as a world leader in providing conversion and enrichment services.

After dominating the nuclear fuel supply sector for the first 40-plus years of the atomic age, the United States largely ceded a presence in the global enrichment market after the end of the Cold War. The enrichment market is now served by four providers: China, Russia, Orano (France) and Urenco (an Anglo-Dutch-German consortium with a U.S. affiliate, LES, operating in New Mexico).

The United States opened nuclear fuel markets to Russia in the early 1990s after the fall of the Berlin Wall. Sales of nuclear fuels served as an important source of income for the nascent Russian Republic. In 1991, an antidumping petition was filed against Russia, which resulted in the Russian Suspension Agreement to cap Russian imports of uranium and nuclear fuel services which was put in place in 1993.

In 1993, the U.S. and Russia signed the landmark United States-Russia Highly Enriched Uranium Purchase Agreement, also known as the Megatons to Megawatts program, which has been hailed as the most successful nonproliferation program in history. Under the program, high enriched uranium from the Russian nuclear weapons program was downblended for use in commercial nuclear reactors in the United States. At the height of the program, material from former Soviet warheads provided half of the nuclear fuel used in U.S. reactors, accounting for 10% of all the electricity generated in the United States. Over the 20-year history of the program, 500 metric tons of Soviet high enriched uranium – enough material for 25,000 warheads, was downblended and used in U.S. reactors.

With the Cold War over and government stockpiles for naval propulsion and the weapons program plentiful, the U.S. government decided to privatize the Department of Energy's uranium enrichment program, creating the U.S. Enrichment Corporation (now Centrus Energy) in 1996 to operate gaseous diffusion plants that were originally constructed for the Manhattan Project. These plants were old and energy intensive first-generation technology, putting them at a competitive disadvantage to French and European companies and state-owned enterprises in Russia and China that use newer, cheaper gaseous centrifuge technology.

The case of Iran notwithstanding, a well-functioning worldwide nuclear fuel market has helped discourage development and deployment of enrichment technology as numerous commercial nuclear power projects come online across the globe. As I mentioned earlier, the scale of Russian access to the U.S. market has been governed by the Russian Suspension Agreement, a government-to-government agreement that was most recently extended in 2020. Russia is currently capped at approximately 20% of the U.S. enrichment market, with that amount scheduled to drop to 15% in 2028. For conversion and uranium, imports are currently capped at approximately 20%, dropping to 5% in 2026.

As the obsolete U.S. plants closed, the United States went from being the world's largest exporter of nuclear fuel to the world's largest importer. Today, Russia has 46 percent of the world's enrichment capacity.[2] There is not enough non-Russian enrichment capacity to fuel the world's reactors, and the gap is large.[3]

The lack of adequate domestic enrichment capabilities poses an urgent national security challenge. Dr. Kathryn Huff, Assistant Secretary of Energy for Nuclear Energy, testified before the committee in December 2021 that "American dependence on Russian uranium threatens our energy security. Energy security is national security and untrustworthy state-sponsored programs have no place in our energy policy."[4] We should begin immediately on the long-lead work necessary to reduce our dependence on Russian uranium, and partner with our allies to build a shared strategy for resilient fuel supplies.

Constellation has long supported domestic suppliers of uranium, conversion, and enrichment as part of our robust risk management strategy to rely on a diversified supply as protection against natural disasters such as earthquakes, transportation risk, and political risk.

On the enrichment front, we have supported all private enrichment capacity projects undertaken in the U.S. Constellation and its predecessor companies signed contracts and made an equity investment in 2003 to support Urenco's LES project in New Mexico; in 2007, we signed contracts to support Orano's Eagle Rock project in Idaho; and in 2009, and we signed contracts to support Centrus's American Centrifuge Project. We have also worked with Global Laser Enrichment for the last 10 years in an effort to bring diversified technology options to market. We are currently in discussion with multiple enrichment providers about signing long-term contracts to support new domestic capacity. We believe it is important to have both new domestic supply and a diversity of domestic suppliers.

Constellation stands with Ukraine against Russia's unprovoked invasion, and we support U.S. and international efforts to end the war. In response to the Russian-Ukraine conflict, our nuclear fuels team has worked diligently over the past 15 months using their deep relationships to secure enough nuclear fuel inventory and future contracts to meet our needs through 2028 even if existing contracted Russian

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[2] Data from the World Nuclear Association website: Uranium Enrichment | Enrichment of uranium - World Nuclear Association (world-nuclear.org)

[3] World Nuclear Association 2019 Fuel Market Report, Table IV.1 Total world enrichment requirements (excluding Russia) are ~48 million SWU/year. Total non-Russian enrichment capacity, including China, France, and URENCO, is ~33 million SWU/year. This leaves a potential supply gap of 15 million SWU/year if Russian supply were removed from the global market. 15M SWU is equivalent to the entire annual enrichment requirements of the United States.

[4] Testimony of Dr. Kathryn Huff, Assistant Secretary for Nuclear Energy and Douglas MacIntyre, Deputy Director for the Office of Petroleum Reserves, U.S. Department of Energy, Before the Committee on Energy and Natural Resources U.S. Senate December 1, 2022, https://www.energy.senate.gov/services/files/145546FD-49A2-4DE9-A9AE-3027A7C6FC8A

fuel supply was disrupted. This inventory build will bridge our new fuel supply from now through 2028, at which point, multiple Western providers have stated they are able to have additional supply online. Not every reactor operator is as well-positioned as Constellation in this regard, and an interruption of supply before new capacity is operating would almost certainly leave some reactors without fuel. In addition, while Western suppliers have said that new capacity could be available as early as 2028, that date could easily slip if legislation to support new capacity is not enacted soon.

I want to underscore the urgency of immediate action to spur additional domestic conversion and enrichment capacity. As I noted in my opening comments, in the world of nuclear fuel, 2028 is tomorrow. Tweaking current capacity to add marginal amounts of production will not be enough; we need new domestic capacity online as soon as possible. We need action today if we are to avoid the potential for a supply shortfall in 2028. To begin production by 2028, enrichers have just five years to secure contracts, obtain financing, receive licensing and permitting approval, construct facilities, and begin operation. It's easy to imagine that process taking 10 years rather than five without immediate bipartisan support.

To the Department of Energy's credit, the Office of Nuclear Energy has been conducting extensive outreach on this issue to determine the extent of the challenges faced by both consumers and producers and to understand the best way to secure new conversion and enrichment capacity. DOE has also worked through its Office of International Affairs to facilitate discussions with foreign utilities that have small amounts of surplus material.

Congress has provided funding to the Department of Energy for the production of High-Assay Low Enriched Uranium (HALEU) to support fuel for advanced reactors, and DOE announced an award to Centrus last month for a HALEU demonstration program. Similarly, DOE could facilitate the deployment of innovative new technologies and diversify domestic enrichment supply capabilities for both low-enriched uranium for existing reactors and HALEU for advanced designs by supporting an effort by North Carolina-based Global Laser Enrichment (GLE) to deploy laser enrichment technology. GLE is currently preparing a commercial-scale pilot demonstration in its Test Loop facility in Wilmington, North Carolina, and with timely and modest cost-share support from DOE, GLE could accelerate commercialization of its next-generation technology and advance its prospective enrichment facilities in Paducah, Kentucky, to 2028. Supporting a demonstration of laser enrichment capabilities would facilitate GLE's ability to move more quickly to supply multiple forms of enriched uranium and natural UF_6 to meet critical nuclear fuel needs in the United States.

The case for federal investment is strong. Indeed, every enrichment plant ever built, anywhere in the world, has been built by governments and state-owned corporations. New domestic enrichment capabilities would advance the public interest in ways that aren't reflected in the market. It would strengthen America's energy security, reduce Russia's leverage in energy markets, and give the United States a stronger hand in global nonproliferation efforts. Finally, the U.S. government will need new enrichment capacity for its own purposes, including important missions in national security, nonproliferation, space exploration, and supporting next generation reactor designs. We must act now.

As we have with past projects, Constellation will do its part: we are in active discussions with potential Western enrichers to sign long-term contracts to give them the certainty they need to secure financing and proceed with the large-scale investments necessary to build these facilities. Enrichers are ready to do their part as well by making large-scale investments of their own, but they need policy certainty and government support as well.

Spent Nuclear Fuel

It has been 40 years since Congress passed the Nuclear Waste Policy Act of 1982 that governs spent nuclear fuel policy in the United States. The law required reactor owners to enter into contracts with the Federal government for the disposal of spent nuclear fuel and required the Federal government to begin removing fuel from reactor sites by January 31, 1998. The Federal government is now 25 years overdue in meeting that statutory obligation to begin removing fuel from sites.

The Federal government's program to site a permanent repository is not broken; it's effectively nonexistent. I believe we owe it to nuclear communities, whether they are commercial reactor sites, national labs, or Federal facilities, to do more than wait for volunteers to step up to host a site. In recent years, Congress has provided DOE with little guidance, and even less funding, to try to address this issue.

It is important to emphasize that while we wait for Federal action to identify a permanent disposal site, reactor owners continue to safely manage and store this used fuel at more than 70 sites in 35 states, including roughly a dozen sites with shutdown reactors.

Nuclear is the only large-scale energy producing technology that takes full responsibility for all of its waste, plans for its eventual disposal, and prefunds plant retirement obligations. When it comes to spent fuel, we know where every gram of high-level waste is located and how it is packaged, tagged, and tracked. Storage of spent fuel, both in spent fuel pools and in dry casks, is regulated by the Nuclear Regulatory Commission.

Nuclear energy is extremely energy dense and produces less waste than other types of energy. For context, all of the spent nuclear fuel produced in the United States from the 1950s until now could fit inside a single Super Walmart.

After the fuel is used to produce energy, it is placed in pools more than 20 feet deep to cool down for several years. The fuel is then placed in 16-foot stainless steel containers that are surrounded by helium gas and then placed in a concrete container that is 20 to 30 inches thick. These casks are designed to withstand earthquakes, storms and projectiles. There has never been any unplanned radiation released from the casks and they are designed to produce less radiation than a frequent flyer receives in a year. While we advocate for a permanent repository, these dry casks are safe for hundreds of years and do not pose a risk to the public.

It has been over seven years since the nuclear industry reviewed and issued principles for used nuclear fuel management. At that time, the industry endorsed the concepts of "a new management and disposal organization outside the Department of Energy (DOE) dedicated solely to executing a high-level radioactive waste program and empowered with the authority and resources to succeed." The full statement of policy principles is appended to my testimony.

In closing, I want to thank the committee for focusing on this critically important topic and I look forward to continued collaboration to ensure that the U.S. nuclear fleet can continue its role as the workhorse of our efforts to decarbonize the electric power grid and other sectors of the economy.

NUCLEAR ENERGY INSTITUTE

Policy Principles for Used Nuclear Fuel Management

The industry supports an integrated used nuclear fuel management strategy, consisting of ten basic elements:

1. A new management and disposal organization outside the Department of Energy (DOE) dedicated solely to executing a high-level radioactive waste program and empowered with the authority and resources to succeed.
2. Access to the Nuclear Waste Fund for its intended purpose, without reliance on the annual appropriations process but with appropriate Congressional oversight.
3. Develop a consolidated storage facility for used nuclear fuel and DOE's high-level radioactive waste in a willing host community and state. Used fuel from shutdown commercial reactor sites without an operating reactor should have priority when shipping commercial used fuel to the storage facility. Assigning priority to shutdown plants shall not affect the right to damages for DOE's failure to perform absent such priority.
4. In parallel with developing a consolidated storage facility, complete the Nuclear Regulatory Commission's (NRC) review of the Yucca Mountain repository license application, followed by construction and operation of the repository and developing a second geologic repository, if necessary.
5. Research, development and demonstration on improved or advanced fuel cycle technologies to close the nuclear fuel cycle, thereby potentially reducing the volume, heat and toxicity of byproducts placed in the repository, recognizing that a geologic repository will be required for all fuel cycles. All funds for this RD&D must come from DOE's budget and not the Nuclear Waste Fund. In addition to RD&D, the Nuclear Regulatory Commission (NRC) should develop a regulatory framework for the licensing of advanced fuel cycle technologies.
6. A legislative determination that, for the period after the licensed term for reactor operation until removal for disposal, no consideration of environmental impacts of used nuclear fuel storage shall be required by the NRC in connection with any reactor licensing.
7. The Nuclear Waste Fund (NWF) fee should not be raised above $0 unless (1) the annual expenses for the program's ongoing projects exceed the annual investment income on the NWF and (2) the projected life-cycle cost demonstrates that the fee must be reinstated to achieve full cost recovery over the life of the program.
8. Communities and states hosting the Yucca Mountain repository and/or consolidated storage facilities shall be eligible for benefits. The Nuclear Waste Fund can be used for these benefits if they are reasonable and do not result in an excessive increase in overall program costs.
9. Standard contract holders should not be required to waive their right to recover damages or settle claims resulting from DOE's breach of contract as a condition of the federal government accepting used nuclear fuel for consolidated storage or permanent disposal.
10. The industry will fulfill its one-time fee obligations consistent with the provisions in the Nuclear Waste Policy Act.