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HEARING TO EXAMINE A DISCUSSION DRAFT BILL, S. 4897, THE AMERICAN NUCLEAR INFRASTRUCTURE ACT OF 2020

HEARING

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

UNITED STATES SENATE

ONE HUNDRED SIXTEENTH CONGRESS

SECOND SESSION

AUGUST 5, 2020

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COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

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SECOND SESSION

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C O N T E N T S

HEARING TO EXAMINE A DISCUSSION DRAFT BILL, S. 4897, THE AMERICAN NUCLEAR INFRASTRUCTURE ACT OF 2020

WEDNESDAY, AUGUST 5, 2020

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

The Committee, met, pursuant to notice, at 10:05 a.m. in room 406, Dirksen Senate Office Building, Hon. John Barrasso (Chairman of the Committee) presiding.

Present: Senators Barrasso, Carper, Capito, Cramer, Braun, Rounds, Sullivan, Ernst, Cardin, Whitehouse, Booker, and Van Hollen.

OPENING STATEMENT OF HON. JOHN BARRASSO, U.S. SENATOR FROM THE STATE OF WYOMING

Senator BARRASSO. Good morning. I call this hearing to order.

Clean, reliable nuclear energy is a cornerstone of America's energy infrastructure. Nuclear provides over half of our Nation's emission-free power. Today's nuclear reactors can run up to 2 full years without needing to be refueled.

America's nuclear engineers and scientists also support our national security. Nuclear energy powers our Navy's aircraft carriers and our submarines. Nuclear technology is fundamental to meeting our energy, environmental, economic, and national security goals.

Since America's first nuclear engineers worked on the Manhattan Project to win World War II, the United States has led the world in developing new nuclear technologies. For the last 75 years, our nuclear energy industry has been the world's leader in safety as well as performance. We must ensure that our leadership endures.

The draft bill we are discussing today, the American Nuclear Infrastructure Act of 2020, will do just that. The legislation will ensure we maintain the United States' historical position as the global nuclear energy leader.

Our foreign competitors, specifically China and Russia, seek to undermine America's nuclear industry for their own advantage.

President Trump's recent Nuclear Fuel Working Group Report unequivocally states that Russia weaponizes its energy supplies to advance their strategic goals. I agree with this assessment. Time and again, Vladimir Putin has used energy as a geopolitical weapon.

It is well documented that Russians have withheld its vast natural gas supplies to bully energy dependent foreign neighbors to

achieve their geopolitical aims. Even in the United States, Russia has been deliberately trying to dump uranium into our energy markets. This undercuts American uranium production, and it drives our American companies out of business.

The Administration report describes the dire situation facing our Nation's uranium producers. America is on the brink of finding ourselves completely reliant on foreign uranium to power our homes and our businesses.

Wyoming is the leading uranium producer in the United States. Production is down significantly. The Energy Information Administration recently reported that last year's American uranium production was at an all time low. It is dangerous, and we must reverse this trend.

The draft legislation establishes a uranium reserve to receive and revive and strengthen our uranium production. American mined uranium would fill the reserve. The material would be available in the event of a supply disruption.

This strengthens our energy security, and it preserves critical uranium mining jobs around the country. If we lose our ability to mine uranium, it would take a generation to rebuild it. Establishing a uranium reserve preserves good jobs and protects our national security. It is a win-win situation.

I applaud the Trump administration for their efforts to protect our uranium industry. I support the Department of Commerce's actions to extend an agreement to limit how much Russian uranium can enter the United States.

If those efforts succeed, Congress will establish those Russian importation caps into law. If we fail, it will lead efforts to set the needed caps in law.

The draft legislation takes other important steps to maintain America's leadership on nuclear energy. The bill directs the Nuclear Regulatory Commission to coordinate with foreign nuclear regulators to enable the safe use of innovative nuclear designs.

The draft builds on Nuclear Energy Innovation and Modernization, an act that we have gone on, which is authorized by members of this Committee to expand nuclear energy to advance nuclear technologies.

The draft legislation also modernizes environmental permitting requirements to address the needs of new technologies. The bill identifies regulatory barriers that limit the safe deployment of new nuclear technologies.

These new technologies are capable of radically reducing carbon emissions. It is time to remove regulatory roadblocks for the next generation of nuclear reactors.

This discussion draft would preserve America's existing nuclear power plants by authorizing temporary, targeted financial credits to reactors at risk for closing. It will help develop advanced fuels needed to power cutting edge reactors.

The draft will also help reduce construction costs to build advanced nuclear reactors.

Finally, it reauthorizes critical training programs to bolster our nuclear work force.

The American Nuclear Infrastructure Act is a blueprint to revitalize our nuclear energy industry. I would like to thank Senators

Whitehouse and Booker and Crapo and Carper for working with me on this draft. The policies in this draft legislation will keep the United States on track to remain the undisputed international nuclear energy leader for the next 25 years.

I would now like to turn to Ranking Member Carper for his opening statement.

OPENING STATEMENT OF HON. THOMAS R. CARPER, U.S. SENATOR FROM THE STATE OF DELAWARE

Senator CARPER. Mr. Chairman, thanks so much for holding today's hearing.

To our witnesses, the two that are here live and in person, we welcome you.

To the witness who joins us from afar, thank you for doing that.

Mr. Chairman, as the United States continues to battle a deadly respiratory pandemic that has tragically claimed the lives now of more than 159,000 Americans, emerging evidence continues to show that people living in places with greater, longer term exposure to air pollution are experiencing far worse health outcomes. So at a time when breathing clean air is paramount to public health and quality of life, it is only appropriate that we talk about the potential for nuclear power.

Today, nuclear power is our Nation's largest source of clean, reliable, carbon-free energy. That is why when I think about nuclear power, I think about clean air.

I also think about economic opportunity and the potential we have as a Nation to lead the world in advanced nuclear technologies. In fact, there was a time not long ago when the United States did lead the world in nuclear manufacturing, nuclear construction, nuclear production.

By supporting the next generation of advanced nuclear technologies that are being developed here at home, technologies that are safer, that produce less spent fuel, that are cheaper to build and to operate, and that provide good paying manufacturing, construction, and operating jobs for Americans, the U.S. can lead the world again.

I believe that Congress, and this Committee in particular, have an important role to play in ensuring that our Nation invests wisely in nuclear energy while maintaining our focus on safety to ensure cleaner air for our people and this planet we call home.

That is why, in the last Congress, I was proud to work with you, Mr. Chairman, and with a number of our colleagues on this Committee and off this Committee to enact the Nuclear Energy Innovation and Modernization Act, known as NEIMA. Among many things, NEIMA directs the Nuclear Regulatory Commission to develop a new framework to accept and process license applications for advanced nuclear technologies.

These changes are already being implemented at the NRC today, resulting in greater efficiency, greater transparency in the licensing process. With NEIMA, we are moving closer than ever before to making advanced nuclear power a reality in this country, and we are doing so without jeopardizing safety.

The draft legislation before us today represents the Chairman's efforts to build on NEIMA's success, and it attempts to move us even closer to that reality.

A number of us on this Committee, and that certainly includes me, share our Chairman's enthusiasm for supporting advanced nuclear technologies. Let me be clear in saying that I support the broader goal of what this legislation aims to achieve.

That being said, I would be remiss if I didn't hasten to add that I have several serious reservations with the legislation as it is currently drafted, and I suspect that some of our colleagues, both on and off this Committee, share several of those reservations.

Let me just mention a couple of them here this morning. I am particularly concerned with the additional changes to the permitting process, which I believe could result in unintended adverse consequences for environmental quality, for public safety, and for public health.

We only recently made a number of necessary changes to the NRC's regulatory structure for advanced nuclear technologies through NEIMA. I fear that making additional, unwarranted changes at this time could seriously disrupt the regulatory process in a way that threatens the safety reviews of these new technologies.

We have seen the damage that nuclear power can inflict if proper safety precautions are not in place, are not kept up to date, or are not followed. Safety has been and must always remain a top priority in the operation of nuclear reactors, and oftentimes, regularly conducting these safety reviews is a critical part of ensuring the safety that we all seek.

It is also critically important that the NRC remains the world's gold standard of nuclear regulatory agencies. I believe we all agree that a strong, independent NRC is essential to ensuring a safe nuclear industry.

A safe nuclear industry is essential to ensuring public confidence, and maintaining public confidence in this vital industry is absolutely essential to ensuring that nuclear power can continue to play the vital role that it plays in this country, and I believe, around the world.

If we want to lead the world in advanced nuclear technologies, and I believe that many of us do, we must be careful, very careful, not to jeopardize the still promising future of the nuclear industry by further streamlining safety regulations, largely for the sake of streamlining.

Colleagues, if we do not proceed with genuine caution on this front, shortcuts on safety will do more to harm this industry in the long run, not help it.

I am not going to dwell on this this morning, but I also have several concerns about the Environmental Protection Agency's incentive program for the existing nuclear industry that is included in this bill, especially in light of the recent cuts to EPA's budget.

We need to keep in mind that the proposed Federal budget for fiscal year 2021 calls for cutting EPA's budget by 27 percent, a reduction of $2.4 billion from the appropriation we enacted for the current fiscal year. By creating this new program at EPA without

new funding, we run the risk of asking the agency to do even more with, quite possibly, far fewer resources.

With those cautionary notes in mind, Mr. Chairman, let me thank you again for holding today's hearing. I appreciate very much the opportunity to discuss those concerns further with you and our colleagues and our witnesses, both today and in the days to come.

I also appreciate the opportunity for us to focus, as well, today, on the potential that nuclear power still holds for our country, and what it can still mean for our air quality, our economy, and our global competitiveness.

When it comes to nuclear power, we have a real opportunity here. If we are smart about it, we will seize the opportunity, and we will do so without foregoing safety.

And if we are smart about it, we will enable our country to reap the economic, the environmental, and public health benefits that flow from realizing that opportunity. America will be a world leader in nuclear energy once again, while helping to make Planet Earth a safer, healthier home for us all.

I am going to stop my prepared remarks there, Mr. Chairman.

I can't leave this hearing today without expressing my dismay at the news that a couple of utilities in this country have been, apparently, caught bribing two States to implement State programs to support this industry. One of those is in, I think it is in maybe in Illinois, ComEd, a subsidiary of Exelon was charged, I think, $200 million by the Federal Government for bribery in Illinois. First Energy is involved in a $60 million bribery case in Ohio.

In addition to that, we have the new construction of the AP1000 reactors in the Georgia Vogtle site that continue to face billions of dollars in overruns, in costs, in years of delays.

I have been wearing a special mask this week, and it is a mask of my favorite baseball team. How a kid born in West Virginia, grew up in Virginia, went to Ohio State, could end up as a lifelong Detroit Tigers fan is a long story, but I am.

The Tigers are not playing this week; they are supposed to be having a four game series, I think, with the Cardinals. That series has been canceled because six of the Cardinals came down with the coronavirus. About a half-dozen of the folks who work in the clubhouse came down as well. They canceled the series.

This past weekend, on Sunday, there was a very special game. The Tigers played Cincinnati. Cincinnati walked off to a three-nothing lead, I think, in the third inning, and the Tigers brought in a young relief pitcher named Tyler Alexander that most people in this country, even in Detroit, had never heard of. Tyler Alexander struck out the first nine batters he faced.

That has never happened but maybe once in the history of baseball. Nine. That day, he brought his best, very best, to the mound and to the game, and we need to bring our very best to this game.

This is not a game; this is serious business. I will just say to the industry itself whose efforts we support and have for years, you have got to bring your best game. You have got to bring your very best game, as well.

Thank you.

Senator BARRASSO. Well, thank you very much, Senator Carper, for your continued leadership on this and so many other topics related to this Committee.

I also want to thank Senator Whitehouse for his significant involvement in putting this draft together, and I ask and invite Senator Whitehouse, if you would like to say a few words.

OPENING STATEMENT OF HON. SHELDON WHITEHOUSE, U.S. SENATOR FROM THE STATE OF RHODE ISLAND

Senator WHITEHOUSE. I would be delighted to, Chairman.

Let me thank you for the way you have had this Committee work in a really good, bipartisan fashion, both on the Nuclear Energy Innovation Capabilities Act, which is the collaboration bill between the national labs and the industry and academia, and also on the Nuclear Innovation and Modernization Act, which put together a new regulatory framework to solve what I said was the problem of, how do you get a Tesla through regulatory procedure that requires the testing of its carburetor.

By analogy, we have to change the regulatory framework for nuclear innovation to adapt to the fact that these are going to be innovations. Both have passed, both are underway, both are successful, and I appreciate it very much.

I think that two of the big issues we need to address here, one is, how do you deal with the fact that the nuclear energy industry is financially burdened by the fact that it doesn't get compensated for the carbon-free nature of its power? It makes no damn sense to shut down a safely operating nuclear plant to open up a gas fired plant that actually costs more, but gets away with actually costing more because the carbon differential doesn't factor into the equation.

This bill works in that space in ways that I think are very helpful, very close to what we did on 45Q. We also have this problem of spent fuel, nuclear waste, for which we have no solution.

Some people say we are going to put it in Nevada. Good luck with that. I don't think so. I don't think we have a solution.

As we steer nuclear innovation forward, I want to make sure that we make it a really important strategic priority to have that innovation focus on the potential, the Holy Grail, of dealing with that terrible burden of spent fuel and actually turning that burden into an asset.

Senator Braun is here; he comes with a business perspective. If we were a company, that spent fuel would be a liability on our books, and every single member of that board of that company would be saying, Oh, my God, how do we get that liability off our books?

If we have a million dollar liability, we have a $999,000 incentive to get it off your books. But it just sits there, and this bill actually creates some incentives and some reporting to kind of get it onto America's books so we pay attention.

So, I thank the Chairman for both of those. We have work to do before I can fully support this bill on the environmental review side, on what we call streamlining, and with respect to foreign investment. That is what is keeping me from being on this bill at this point, but I think the Chairman and the members of the Com-

mittee know that I have been a good partner on these issues, have worked in good faith and in good bipartisan spirit.

I expect that we are going to get there on this bill as well. I pledge that I will work as hard as I can to make sure that we do get there.

And I thank you, and I want to give a particular shout out to Armond Cohen, one of our witnesses today. You may not notice, but many, many, many, many years ago, my first job as a new kid in the Rhode Island Attorney General's Office was the job nobody else wanted. You are the last one in, you get public utility regulation.

Armond Cohen and I and Mary Kilmarks, now not with us any longer, and a few others, worked together, and in Rhode Island, we made the first conservation based electric rates in the United States of America.

With our little utility, Narragansett Electric, which is now a part of the great national grid empire, and with a wonderful start, Armond's work in that was super important, and we have this long, long, long tradition. So it is really wonderful for me to see him in this Committee hearing after all those many years of good work, now multiple decades ago.

I think we started something with those conservation based rates, and they are all over the country now.

Thank you, Chairman.

Senator BARRASSO. Well, thank you very much, Senator Whitehouse, for your continued partnership. You really have been a good faith partner with us and an honest broker. We appreciate your commitment, too, and I believe we will get to that same point that we are all aiming for.

We will now hear from our witnesses. We have Ms. Amy Roma, who is here, Founding Member of Atlantic Council's Nuclear Energy and National Security Coalition.

We have Mr. Paul Goranson, who is the President of Uranium Producers of America.

And as Senator Whitehouse just said, Mr. Armond Cohen, who is the Executive Director of the Clean Air Task Force, and Mr. Cohen is joining us remotely via Webex from Boston.

I would like to remind the witnesses that your full written testimony will be made part of the official hearing record today. Please keep your statements to 5 minutes so we that may have time for questions. I look forward to the testimony.

Ms. Roma, please proceed.

STATEMENT OF AMY ROMA, FOUNDING MEMBER, NUCLEAR ENERGY AND NATIONAL SECURITY COALITION, ATLANTIC COUNCIL; PARTNER, HOGAN LOVELLS

Ms. ROMA. Thank you.

Good morning. My name is Amy Roma, and I am a founding member of the Nuclear Energy and National Security Coalition at the Atlantic Council and a nuclear regulatory lawyer at Hogan Lovells. Thank you for the opportunity to testify at this hearing in support of the draft, American Nuclear Infrastructure Act of 2020, or ANIA, for short. My testimony today represents only my views and observations.

ANIA is a great step forward for ensuring that U.S. nuclear capabilities will be preserved and expanded, providing America with clean and reliable energy, tens of thousands of jobs, and billions of dollars in foreign trade opportunities for U.S. companies, while protecting U.S. interests.

In 1954, at the dawn of nuclear power, President Eisenhower delivered his famous "Atoms for Peace" speech, offering to share U.S. nuclear energy technology with other nations who committed not to develop nuclear weapons.

This program resulted in three important economic and national security objectives. One, it prevented the spread of nuclear weapons; two, it made the U.S. a leader in nuclear power, ensuring that the U.S. maintained dominance in nuclear safety and security, nuclear technology development, and nuclear trade; and three, it ensured the U.S. benefited from the geopolitical relationship that goes with such significant assistance with a foreign country's power supply.

President Eisenhower's historic move has paid dividends for decades, and the U.S. was well positioned as a global leader in commercial nuclear power as well as safety and non-proliferation.

While the U.S. still leads the world with the biggest nuclear power program and 95 reactors providing 20 percent of the U.S.'s electricity and the best run plants, we have seen our international roles sharply decline, replaced largely by Russia, with China close behind, who have identified building nuclear power plants and nuclear trade as national priorities, promoted by the highest levels of government and backed by state financing and state owned enterprises.

Russia now dominates nuclear power plant construction around the world, using it as a tool to exert foreign influence and reap significant economic benefits.

With $133 billion in orders for nuclear reactor exports, nuclear energy is also a component of China's "Belt and Road" initiative, with China estimating it would build as many as 30 foreign reactors by 2030, with an estimated value of $145 billion. China further estimates that capturing just 20 percent of the "Belt and Road" market could create 5 million Chinese jobs.

The U.S. nuclear power industry competing against foreign governments for new projects has quickly been sidelined on the foreign stage with no orders for new reactors abroad.

While we have ceded the mantle at the moment, we have a chance to regain it when it comes to the next generation of nuclear technology, such as advanced reactors. ANIA will close the gap between U.S. potential and execution of these technologies, further supported by actions to preserve the operating nuclear fleet and support nuclear infrastructure.

While there are many helpful provisions in ANIA, I would like to specifically note two examples and explain how they could help. One, the environmental review provisions set forth in Section 201; and two, the investment by allies provision set forth in Section 304.

To the first example, over the years, the National Environmental Policy Act, or NEPA, has brought forth immense environmental health and safety benefits. Nonetheless, both sides of the aisle have recognized that NEPA reviews can be lengthy and create delays, all

driving up project costs without making environmental reviews any better.

By regulation, NEPA reviews should be concise, clear, and to the point. But when implemented at the agency level, the concise and clear elements often get lost. With no change in the law, NRC modern environmental reviews for new reactors can be a thousand pages longer than they were with the last wave of nuclear power plant construction for projects with less environmental impact.

While the NRC has spent significant energy in the last few years trying to right size its safety focused technical reviews of advanced reactors, it has paid little attention to applying a right size practical approach to environmental reviews. Importantly, ANIA asks the NRC to do just that: Evaluate and consider how to conduct its reviews more effectively, leveraging existing resources, lessons learned, and evaluating the ways the reviews can be improved.

To the second example, ANIA offers a refreshing revisit to the cold war era foreign owners restriction in the Atomic Energy Act, which was implemented at a time when U.S. policy focused on closely guarding nuclear technology without the national security safeguards we have in place today. Notably, it was implemented before the Committee on Foreign Investment in the United States, or CFIUS, was established, which now polices significant foreign investment into the U.S. nuclear industry.

While it is unclear whether the foreign ownership restriction ever served any national security benefit, it has been very problematic in recent years when applied to the NRC, resulting in projects being canceled, impeding investment, creating huge regulatory uncertainty, and costing billions of dollars to the commercial U.S. nuclear power industry.

The NRC unsuccessfully requested that Congress remove this restriction 20 years ago, and recently, this Committee received a letter from 10 former NRC commissioners, again urging Congress to remove this restriction.

ANIA would amend this restriction to permit investment by certain U.S. allies, while the investment would still be subject to a CFIUS review, and the NRC's own non-inimicality finding, to ensure it does not harm U.S. interests. This is a simple change, but it can open the door to significant investment in this industry.

Thank you. I am happy to discuss these or other provisions of ANIA or answer any other questions you may have.

[The prepared statement of Ms. Roma follows:]

Written Testimony of Amy C. Roma

Founding Member, Nuclear Energy and National Security Coalition (NENSC), Atlantic Council;
Partner, Hogan Lovells US LLP

Before the Senate Committee on Environment and Public Works

Hearing on Discussion draft bill, S.____, the American Nuclear Infrastructure Act of 2020.

Wednesday, August 5, 2020, 10:00 a.m.

My name is Amy Roma and I am a founding member of the Nuclear Energy and National Security Coalition at the Atlantic Council and a nuclear regulatory lawyer at Hogan Lovells. Thank you for the opportunity to testify at this hearing in support of this important piece of legislation. My testimony will discuss the state of the nuclear energy industry today and the ways in which this bill rightfully supports U.S. interests and national security. This testimony represents my observations and in no way represents the views of the Atlantic Council, Hogan Lovells or its clients.

The American Nuclear Infrastructure Act of 2020 (ANIA) is a great step forward for ensuring that U.S. nuclear capabilities will be preserved and expanded, providing America with clean and reliable energy, tens of thousands of jobs, and billions of dollars in foreign trade opportunities for U.S. companies. But a strong civilian nuclear power industry also brings with it significant national security benefits ANIA would support, which include promoting U.S. leadership in foreign nuclear trade—and ensuring the highest levels of safety and nonproliferation standards—supporting the infrastructure needed for the U.S. Navy's nuclear-powered aircraft carriers and submarines, and positioning the U.S. to stay at the forefront of next generation nuclear technologies, like advanced reactors and fusion.

I. Introduction

Commercial nuclear power and the United States government share a long history that is intertwined with the global struggle for peace and security.[1] Soon after the end of the Second World War, the U.S. government understood that its monopoly on nuclear weapons and nuclear technology would be short lived. In particular, the Soviet Union was catching up with the United States and could share the information with other countries to benefit its own geopolitical aims and undermine U.S. influence, safety, and policy of nonproliferation.[2]

[1] Michael Wallace, Amy Roma, and Sachin Desai, *Back from the Brink: A Threatened Nuclear Energy Industry Compromises National Security*, Center for Strategic and International Studies (Jul. 2018) (*available at* https://www.csis.org/analysis/back-brink-threatened-nuclear-energy-industry-compromises-national-security).
[2] Peter Lavoy, *Arms Control Today, The Enduring Effects of Atoms for Peace*, Arms Control Association (Dec.1, 2003) (*available at* https://www.armscontrol.org/act/2003_12/Lavoy) ("U.S. officials feared that the Kremlin would score a huge propaganda victory, especially in the developing world, if the United States did not alter its own nuclear export policy.")

In response, the U.S. government in the 1950s saw the value that peaceful use of nuclear power could bring not just for the world but for its own security. President Eisenhower presented a bold proposal to the United Nations: The U.S. would share its nuclear energy technology with other nations if the receiving nation committed to not use the technology to develop nuclear weapons.[3] This program, known as "Atoms for Peace," resulted in three important economic and national security objectives: (1) it prevented the spread of nuclear weapons because it would lead and thus have oversight over global nuclear development; (2) it made the U.S. the leader in nuclear power, ensuring the U.S. maintained dominance in nuclear safety, security, nuclear technology development, and nuclear trade; and (3) it ensured the U.S. benefitted from the geopolitical relationship that goes with such significant assistance with a foreign country's power supply.

President Eisenhower's historic move has paid dividends for decades. With the United States at the forefront, the Atoms for Peace policy gave rise to many of the most important safety and nonproliferation standards of today's nuclear world.

Remarkably, the same arguments used to support the U.S. government's decision to bring nuclear power to the world in the 1950s are still just as relevant today—that is, the United States should lead in nuclear trade because if we do not, another country will, which will undermine U.S. influence, as well as U.S. safety and nonproliferation standards. At the same time, Russia and China have identified building nuclear power plants and nuclear trade as national priorities promoted by the highest levels of government and backed by state financing and state-owned enterprises. As a result, Russia now dominates nuclear power plant construction around the world, using it as a tool to exert foreign influence and reap significant economic gains. Nuclear energy is also a component of China's "Belt and Road" initiative.[4] The struggling U.S. nuclear power industry—competing against foreign governments for new projects abroad—has quickly been sidelined on the foreign stage.

Russia and China are responsible for constructing over 60% of the world's new nuclear plants.[5] Russia has more than 50 reactors either under construction, planned, or proposed in 19 countries. China has over 20 reactors in 12 countries. Russia has a $133 billion order book for new foreign reactors. Russia estimates every 1 ruble of nuclear export contributes 2 rubles to national GDP.[6] China has aspirations similar to, if not greater than Russia. China estimates that it could build as many as 30

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[3] Address of Dwight D. Eisenhower, President of the United States of America, to the 470th Plenary Meeting of the United Nations General Assembly (Dec. 8, 1953) (*available at* https://www.iaea.org/about/history/atoms-for-peace-speech).

[4] *China could build 30 'Belt and Road' nuclear reactors by 2030: official*, Reuters (Jun. 20, 2019) (*available at* https://www.reuters.com/article/us-china-nuclearpower/china-could-build-30-belt-and-road-nuclear-reactors-by-2030-official-idUSKCN1TL0HZ).

[5] Atlantic Council, *U.S. Nuclear Energy Leadership: Innovation and the Strategic Global Challenge, Report of the Atlantic Council Task Force on U.S. Nuclear Energy Leadership* (May 2019) (*available at* https://www.atlanticcouncil.org/wp-content/uploads/2019/05/US_Nuclear_Energy_Leadership-.pdf); *see* World Nuclear Association, Nuclear Power in Russia (last updated July 2020), *available at* https://www.world-nuclear.org/information-library/country-profiles/countries-o-s/russia-nuclear-power.aspx.

[6] See Reuters, *Russia's Rosatom sees foreign revenues, new products fueling rapid growth*, by Katya Golubkova and Gleb Stolyarov (June 24, 2019), available at https://www.reuters.com/article/us-russia-rosatom-strategy/russias-rosatom-sees-foreign-revenues-new-products-fuelling-rapid-growth-idUSKCN1TP1LI.

foreign nuclear reactors through its involvement in the "Belt and Road" initiative over the next decade, earning Chinese firms as much as $145.5 billion by 2030.[7] It further estimates that capturing just 20% of the market for proposed new reactors in the Belt and Road countries will create 5 million Chinese jobs and generate billions of dollars for Chinese companies.[8]

The U.S. has no orders for new nuclear reactors abroad.

Russian energy policy, in particular, expressly recognizes the export of energy technologies as a geostrategic tool to promote Russian national security, and provides financial backing to its energy exports accordingly. Lower-cost "turnkey" projects offered by the Russians and Chinese—which include state-supported financing packages—shuts out the United States.[9] As China and Russia succeed in the deployment of their nuclear energy technologies in emerging economies, they gain critical geopolitical influence in these countries by effectively controlling baseload power and the fuel cycle (and spent fuel byproducts) to run these nuclear units.[10] This influence runs for the long-term, at least for the life of the project and plant which can stretch to 100 years, with long-term implications for the geopolitical balance of power and economic influence, potentially threatening U.S. peace and security. For example, Egypt and Russia recently finalized a $21 billion contract for the Russians to supply four reactors in Egypt.[11] A few months later, Egypt and Russia announced a preliminary agreement to allow Russian military jets to use its airspace and bases. The agreement will give Russia its deepest presence in Egypt since 1973.[12]

While we have ceded the mantle currently, we have a chance to regain it when it comes to the next generation of advanced reactors. The U.S. leads the world in the development of advanced reactors and fusion facilities. If the United States leads in implementing this new technology wave, safety will improve, our geopolitical relationships will strengthen, and non-proliferation will remain strong. However, if U.S. companies do not receive more support these benefits will fall to the wayside and other countries will emerge as leaders. We currently are well-positioned to deliver this new technology but are increasingly yielding our advantage to China and Russia. The American Nuclear Infrastructure Act of 2020 will help close the gap between U.S. potential and our ability to execute on that potential at home and abroad.

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[7] Reuters, *China could build 30 'Belt and Road' nuclear reactors by 2030: official*, by David Stanway (June 30, 2019), available at https://www.reuters.com/article/us-china-nuclearpower/china-could-build-30-belt-and-road-nuclear-reactors-by-2030-official-idUSKCN1TL0HZ.

[8] *Id.*

[9] Wallace, *supra* note 1.

[10] *Id.*

[11] *See* Al-Masry Al-Youm, *Construction of First Nuclear Reactor at Dabaa Station to Start after Christmas Holidays*, Egypt Independent (Dec. 13, 2017) (*available at* http://www.egyptindependent.com/construction-first-nuclear-reactor-dabaa-station-start-christmas-holidays/). The article notes that of the $21 billion price tag for the four new reactors, Russia will fund 85 percent of the plant through a loan, and the rest will be financed by Egypt. The deal was finalized in September 2017.

[12] *See* David D. Kirkpatrick, *In Snub to U.S., Russia and Egypt Move toward Deal on Air Bases*, New York Times (Nov. 30, 2017) (*available at* https://www.nytimes.com/2017/11/30/world/middleeast/russia-egypt-air-bases.html.) ("The United States has provided Egypt more than $70 billion in aid in the four decades since, at a rate of more than $1.3 billion a year in recent years. The cost is often justified in part by the argument that it secures the use of Egypt's airspace and bases for the U.S. military.")

II. Nuclear power provides significant benefits to the United States

Nuclear power is an effective solution to help combat greenhouse gas emissions, while also producing more energy than alternative renewable sources and requiring far less land to produce a comparable amount of energy. About 55% of zero-carbon emission electricity in the U.S. is generated by nuclear power, and the utilization of nuclear energy has prevented the emission of 528 million metric tons of carbon dioxide emissions.[13] Nuclear power is an important tool in the toolbox of no- and low-carbon electricity. Moreover, while renewable energy sources like solar and wind may play an important role in our clean energy framework, nuclear energy provides a more efficient solution. Nuclear power operates with a capacity factor of 92.2%, which is more than double the capacity of solar and wind plants, which have capacity factors of 27% and 37%, respectively.[14]

A recent report estimates that based on future carbon mitigation goals, the U.S. nuclear market revenues could amount to $1.9 trillion over the next 30 years.[15] Moreover, according to the Department of Commerce, over the next ten years, the international market for nuclear equipment and services will yield about $740 billion, and every $1 billion of exports by U.S. companies will support anywhere from 5,000 to 10,000 jobs domestically.[16] Nuclear power requires lots of skilled labor that is highly compensated—job opportunities in nuclear energy include reactor designers, service and maintenance professionals, and those working in fuel cycle facilities to mine, mill, and enrich uranium. Additionally, tens of thousands of STEM jobs are required to support nuclear plant operation. These positions open the door for highly skilled domestic employees, many of whom come to the field from the Navy or after pursuing extensive university programs.[17]

Aside from the benefits of increased domestic employment opportunities, spreading U.S. nuclear technology and standards will help ensure high standards for safety and nonproliferation globally.[18] The United States has historically used its technological leadership in nuclear energy to promote nonproliferation objectives worldwide. This started with Eisenhower's "Atoms or Peace" speech in 1954 and continued with the negotiation of the Non-Proliferation Treaty (NPT) in 1968—where the world's nuclear powers agreed to share civilian nuclear technology with non-nuclear states who agreed to forego

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[13] Nuclear Energy Institute, Climate webpage (*available at* https://www.nei.org/advantages/climate) (last accessed Aug. 1, 2020).
[14] U.S. Energy Information Administration, *Electric Power Monthly, with Data for February 2018*, Table 6.7.B (Apr. 2018) (*available at* https://www.energy.gov/policy/initiatives/quadrennial-energy-review-qer/quadrennial-energy-review-second-installment). Nuclear power plants also operated at a much higher capacity factor than even coal and natural gas combined-cycle plants, which in 2017 operated with capacity factors just above 50 percent. *Id.* at Table 6.7.A.
[15] UxC, LLC, *Global Nuclear Market Assessment Based on IPCC Global Warming of 1.5° C Report* (Jul. 2020) (*available at* https://www.nei.org/CorporateSite/media/filefolder/resources/reports-and-briefs/UxC-NEI-(IPCC-2050-Nuclear-Market-Analysis-PUBLIC)-2020-07-01.pdf).
[16] Nuclear Energy Institute, *Nuclear Exports & Trade Overview* (*available at* https://www.nei.org/advocacy/compete-globally).
[17] *See, e.g.*, Department of Energy, *Nuclear Energy University Program* (*available at* https://www.energy.gov/ne/nuclear-reactor-technologies/nuclear-energy-university-program). Since 2009, the Nuclear Energy University Program has awarded "approximately $290 million to 89 colleges and universities in 35 states and the District of Columbia to train the next generation of nuclear engineers and scientists in the United States and continue U.S. leadership in clean energy innovation."
[18] Atlantic Council, *supra,* note 5.

nuclear weapons. The United States has required each country with whom it has worked to sign and enforce strict commitments on the sharing of nuclear technology (i.e., U.S. 123 Agreements); adopt U.S. operational safety standards (e.g., those promulgated by the U.S. Institute of Nuclear Power Operations); and set forth a global fuel supply framework that reduces risk of proliferation (e.g., 2007 U.S. Assured Fuel Supply Program).

Furthermore, nuclear power plant export collaborations between nations create strong geopolitical ties and long-term partnerships that can last 100 years. In fact, our core strategic allies—i.e., Japan, United Kingdom, and Korea—are also our main strategic nuclear generation partners. Other alliances that are less mature, such as that with the United Arab Emirates, have been solidified through more recent nuclear cooperation agreements.[19] Many key U.S. allies and areas of geostrategic importance lack domestic energy reserves and are highly dependent on foreign energy imports making them dependent on other countries to support their energy needs. Nuclear power plants provided by the U.S. can reduce our allies' dependence on potentially unstable energy sources, and deepen U.S. ties. Besides national security, investing in the nuclear sector also adds value to the U.S. research mission by providing engineers' and scientists' resources for research.[20] The research resulting from nuclear reactors at leading U.S. universities has numerous spin-offs for other disciplines, such as superconductors, polymers, metals, and proteins.[21] Nuclear technology also aids in determining quality control for aerospace, automotive, and medical components. Nuclear power itself is a key component of extra-orbital space research. For example, the Voyager spacecraft[22] and the Mars rover, Curiosity, use Radioisotope Thermoelectric Generators (RTGs) to continue to function.[23]

III. The existing domestic nuclear operating fleet is generally struggling to stay open and emerging new technologies are struggling to gain a foothold

As recently as 2013, the U.S. had 104 operating domestic nuclear power reactors—today there are 95, and about 1/3 of them are facing economic hardships. These reactors generate electricity at relatively low long-term operational costs, and generate thousands of high-paying jobs.[24] They are designed and able to operate up to 60 and 80+ years, if they are permitted to do so. Maintenance, refueling, and upgrades will keep nuclear experts employed and nuclear suppliers with contracts. With roughly half of the nuclear fleet operating in "merchant" markets priced for the short term, the low price of natural gas is making nuclear plants temporarily uncompetitive. At the same time, however, certain critical benefits of nuclear power plants—e.g., reliability, grid stability, low-carbon energy source, national security asset—go largely uncompensated.[25]

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[19] Wallace, *supra,* note 1.
[20] U.S. Nuclear Regulatory Commission, *Backgrounder on Research and Test Reactors* (last updated May 5, 2020) (*available at* www.nrc.gov/reading-rm/doc-collections/fact-sheets/research-reactors-bg.html).
[21] *Id.*
[22] NASA, *Voyager Spacecraft* (*available at* www.voyager.jpl.nasa.gov/mission/spacecraft/).
[23] NASA, *Radioisotope Power Systems* (*available at* www.rps.nasa.gov/).
[24] Wallace, *supra,* note 1.
[25] *Id.*

Nuclear power plants cannot be "mothballed"—shutting down during bad economic times and then restarting when the economics are better. When nuclear power plants shut down, regulatory requirements essentially mean that the shutdown will be permanent. If the global reactor lifetimes only average 50 years, with decommissioning and shut-down plans, the current nuclear capacity of around 405 GWe could be halved.[26] To maintain the current fleet and reduce the need for new construction, the current fleet's lifecycle must be extended 20 to 30 years.[27] Several expert views suggest that within the next decade or two, commercial nuclear plants may face shutdown or be tagged with a near-term date for shutdown.[28] The loss of commercial nuclear power plants also creates decline in the supporting infrastructure—especially in the fuel cycle supply chain, human supply chain, and the military to civilian workforce pipeline—further jeopardizing not only our domestic ability to support our domestic fleet, but also our ability to supply and assist at nuclear reactors abroad.

The U.S. currently leads in advanced reactor design and, while traditional nuclear reactors may be the greatest source of nuclear power in the near-term, advanced reactors are projected to become most prevalent moving forward.[29] There are about 75 domestic ventures in next-generation nuclear technologies and new opportunities are being created every day.[30] These endeavors of innovation take many forms. Some hope to use liquid metal coolants, some want to use gaseous helium, and some want to greatly improve current light water reactor designs. Some want to have liquid uranium (or thorium) fuel, and some want to use nuclear waste as fuel. Some propose to cut out fission altogether and move straight to nuclear fusion. Nearly all of them offer modular designs that can start small and scale with customer needs. TerraPower, a molten salt reactor design that proposes to use spent nuclear fuel as feedstock, is supported by Bill Gates, and has garnered multiple rounds of financing and is moving toward development of a demonstration plant. In recent years, TerraPower tried to move overseas to develop its technology in China due to a more supportive government and faster regulatory approval process, but has since terminated these activities at the direction of the U.S. government due to the U.S. government's concerns over the national security risks associated with China's diversion of commercial technology for military uses and misappropriation of U.S.-origin intellectual property.[31]

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[26] UxC, LLC, *supra,* note 15.
[27] *Id.*
[28] *See* Wallace, *supra,* note 1.
[29] UxC, LLC, *supra,* note 15.
[30] Third Way, *Keeping Up with the Advanced Nuclear Industry* (Jan. 2018) (*available at* https://www.thirdway.org/graphic/keeping-up-with-the-advanced-nuclear-industry). This number shows a marked increase from the previous year, so the advanced reactor field is currently growing. *See also* Third Way, *The Advanced Nuclear Industry: 2016 Update* (Dec.12, 2016) (*available at* https://www.thirdway.org/infographic/the-advanced-nuclear-industry-2016-update).
[31] U.S. Department of Energy, National Nuclear Security Administration, *U.S. Policy Framework on Civil Nuclear Cooperation with China* (*available at* https://www.energy.gov/sites/prod/files/2018/10/f56/US_Policy_Framework_on_Civil_Nuclear_Cooperation_with_China.pdf); Hogan Lovells New Nuclear Blog, *US Government Clamps Down on Nuclear Exports to China*, by Amy Roma and Sachin Desai (Oct. 12, 2018) (*available at* https://www.hlnewnuclear.com/2018/10/us-government-clamps-nuclear-exports-china/).

Another company, NuScale, which promotes a factory-built-and-shipped small modular reactor design, is nearly at the end of its U.S. Nuclear Regulatory Commission (NRC) design certification application review. Another company Oklo, just submitted an application to the NRC for a combined construction permit and operating license for its microreactor design. And recently, three companies—X-energy, Westinghouse, and BWXT—were selected by the Department of Defense to move forward with preliminary designs for microreactors that can be used to power forward operating bases for the U.S. military. And along with the advanced fission reactors under development, there are also a number of fusion ventures looking to demonstrate and commercialize fusion power technologies.[32]

To that end, the U.S. Department of Energy has provided considerable first-round funding in support of initial research and development of advanced reactors. Continued development of all of the foregoing technologies likely will provide further opportunities for flexible, carbon-free commercial power. Yet, after initial research is done domestically, the U.S. regulatory regime and financial challenges drive nuclear ventures to look abroad as they move to the test and demonstration stage, as was the case with TerraPower.

However, the necessity for nuclear innovation and technology development is not solely for commercial purposes. New nuclear reactors and technologies will be needed to support the U.S. military, such as the U.S. Navy's nuclear propulsion program, the Department of Defense's microreactor project for forward operating bases, energy independence for U.S. military bases, and future air and space travel. For example, the U.S. Navy has a command of the sea that affords the United States unrivaled international influence. For decades, its size and sophistication have enabled leaders in Washington to project American power over much of the earth, during times of both war and peace.[33] If the U.S. expects to maintain a strong naval presence, then it must prioritize new reactor designs that are likely to move naval vessels faster and more efficiently; otherwise, the U.S. risks falling behind other countries that are already working on such developments.

In comparison, China is building a molten salt reactor (a new type of advanced nuclear reactor) for potential application on aircraft carriers and flying drones.[34] Because molten salt reactors can be much smaller and safer than conventional pressurized light water reactors, and require less maintenance, the United States risks Chinese naval warships and offensive/defensive air systems quickly outpacing those of the United States. Both Russia and China are developing nuclear powered ice breakers for use in the arctic, an area of growing strategic importance for great power competition.

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[32] *See* Amy Roma and Sachin Desai, *The Regulation of Fusion – A Practical and Innovation-Friendly Approach* (Feb. 2020) (*available at* https://www.hoganlovells.com/~/media/hogan-lovells/pdf/2020-pdfs/2020_02_14_hogan_lovells_the_regulation_of_fusion_a-practical.pdf?la=en).

[33] *See* Council on Foreign Relations, *Sea Power: The U.S. Navy and Foreign Policy* , by Jonathan Masters (Aug. 19, 2019) (*available at* https://www.cfr.org/backgrounder/sea-power-us-navy-and-foreign-policy).

[34] Wallace, *supra* note 1.

Both China and Russia are developing floating nuclear power plants to move from one location to another to support emerging electricity needs. China, in particular, plans to build a number of floating nuclear reactors to provide power to the artificial islands that it is building in the South China Sea.[35]

As Russian and Chinese governments recognize the geopolitical and economic benefits to building new nuclear projects abroad and staying at the forefront of emerging nuclear energy and propulsion technologies, the U.S. should take action to ensure U.S. interests are protected.

IV. We are at a critical time to support nuclear power, not only in saving thousands of jobs and a key carbon-free baseload power source, but also to support the promising advanced reactor industry. That is why I am supporting the American Nuclear Infrastructure Act of 2020 (ANIA).

The U.S. needs a nuclear energy framework that is effective, agile, and responsive to the needs of U.S. economic and national security interests in the twenty-first century. ANIA targets three key areas to support these interests: (1) supporting advanced reactor development; (2) supporting the existing fleet; and (3) supporting nuclear infrastructure development.

(1) Advanced reactor development

The current U.S. nuclear regulatory regime is geared toward the current light water reactor fleet, because that is what it has worked with for the past four decades. As a result, rather than maintaining a flexible licensing regime to accommodate new plant designs, the U.S. nuclear regulator—NRC—has codified by rule a number of requirements that only make sense for large light water reactors. Although the NRC states that it is ready to review and license an advanced reactor design today, the reality is that it will take significant time and resources to bring the NRC up to speed with any non-light water reactor technology.

Under these facts, the business case for a new nuclear technology developer becomes very challenging if left only to the private-sector commercial market. Previous recent legislation, including the Nuclear Energy Innovation and Modernization Act (Public Law No: 115-439), which requires the NRC to develop and implement strategies for the use of risk-informed, performance-based techniques and guidance for licensing advanced nuclear reactors, significantly helps in this regard.

ANIA will help further streamline the NRC licensing process and create incentives for innovation in nuclear technology, to better ensure a predictable and environmentally-conscious advanced reactor development. At this time, the United States leads in the next generation of advanced reactor designs, which tend to be smaller, more scalable, safer, and more secure than their large-scale cousins. These designs include nuclear fission and fusion and they present huge potential, such as the capability to generate power for 20 years without refueling; provide off-grid power for remote communities and military installations; use nuclear waste as fuel; power space vehicles and stations;

[35] *See China's Risky Plan for Floating Nuclear Power Plants In The South China Sea,* The Diplomat, by Viet Phuong Nguyen (May 10, 2018) (*available at* https://thediplomat.com/2018/05/chinas-risky-plan-for-floating-nuclear-power-plants-in-the-south-china-sea/).

and propel a faster fleet of ships fielding more powerful weapons—including nuclear submarines and aircraft carriers—across the world's oceans.[36]

The ANIA incentivizes development in the form of a prize award equal to licensing regulatory fees to the private company that receives the first operating or combined permit from NRC for an advanced nuclear reactor.[37] A similar prize can be awarded to a private company that is first to receive approval of an advanced nuclear fuel. One of the biggest impediments to investments in advanced reactor investment is regulatory uncertainty and costs. Improving regulatory framework and guidance for advanced reactors—including through the development of a technology neutral, risk-informed framework—is critical. Furthermore, ANIA consolidates nuclear export activities within NRC. It will require NRC to coordinate with various entities, such as national labs and the private sector, when developing technical standards and legal frameworks for international activities.[38] Equally important is the NRC's timing and budget certainty. While Congress and the NRC's internal actions have improved the NRC's timing for conducting reviews, I would further recommend the Committee consider implementing NRC budget accountability measures to ensure that projects are completed not only on time but do not come at the cost of destroying the NRC's own estimate budget for project review. For example, the NRC could be required to submit a report to Congress when costs exceed the NRC's own budget by more than 30% for the various aspects of the project. This would not prevent the NRC from undertaking the work it needs to ensure a thorough licensing review, but would provide more accountability and transparency to ensure completing a project on time does not come at the expense of budget predictability and discipline.

Another roadblock in the NRC licensing process lies with the daunting and, sometimes, financially crippling requirements of environmental reviews. The National Environmental Policy Act (NEPA) requires environmental review of "major Federal actions significantly affecting the quality of the human environment."[39] These environmental reviews generally come in the form of an Environmental Impact Statement (EIS) and is a major part of NRC licensing. While environmental reviews for new nuclear projects are important, there is room for improving their efficiency without decreasing their quality. ANIA takes steps toward this improvement. ANIA instructs that the NRC use analysis and findings from existing EIS for construction or combined permits to create a Supplemental EIS.[40] Furthermore, ANIA requires that information used during the licensing process of existing nuclear projects is re-used when considering new projects at the same site.[41]

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[36] Wallace, *supra,* note 1.
[37] Discussion Draft, American Nuclear Infrastructure Act of 2020, Section-by-Section (*available at* https://www.epw.senate.gov/public/_cache/files/f/3/f320cf1e-67d7-45b4-a9c5-cd323500429a/3F5714E9050FE4BBA8C044163FA63E82.discussion-draft-american-nuclear-infrastructure-act-of-2020-section-by-section.pdf).
[38] *Id.*
[39] National Environmental Policy Act, 42 U.S.C. §§ 4321 *et seq*. (1969).
[40] Discussion Draft, *supra,* note 26.
[41] *Id.*

While these measures help streamline the regulatory process, there may be additional steps that can be taken. The development of an EIS commonly requires about a third or more of agency staff effort and is often times the same length or longer than the NRC's substantive technical evaluation, found in its Safety Evaluation Report.[42] This proves to be a waste of resources and delays beneficial projects that have the potential of greatly improving environmental quality.[43] With advanced reactor designs being created by small or mid-size companies with limited resources, the burden of a lengthy and repetitive EIS process could significantly impede development.[44] Nuclear entrepreneurs in the U.S. will be unable to compete with developers abroad whose countries do not place significant regulatory burdens on innovation.

I would suggest that the NRC establish a "Generic Environmental Impact Statement" (GEIS) for High-Assay Low-Enriched Uranium (HALEU) fuel, and expand its current effort to develop a GEIS for Advanced Reactor generic issues. This should significantly streamline subsequent environmental reviews for Advanced Reactor applications, especially ones using HALEU. I would also recommend that NRC reconsider the presumption that an EIS is required under NEPA for environmental review. NEPA also allows for an Environmental Assessment (EA), which is a shorter, more efficient analysis that may be appropriate for advanced nuclear with the industry's inherent safety and zero-carbon emissions.[45] Finally NRC should consider its own precedent performing safety and environmental reviews for research reactors and commercial non-power reactors, which have historically been much more straightforward.[46] The time for Congress to act on these NEPA issues is ripe with the recent promulgation of the final NEPA rule implementing regulations on July 16, 2020.[47]

(2) Supporting the existing fleet

ANIA will help maintain existing plants and save jobs, while providing carbon free power to the masses. The law provides for targeted credit programs to keep existing plants running and modernizes rules to encourage investment in nuclear. ANIA updates the Atomic Energy Act's restriction on foreign, ownership, control, or domination (FOCD) of nuclear reactors. Updating the FOCD provision aligns the 1950s with modern times, including the global nuclear marketplace and new national security reviews from the Committee on Foreign Investment in the United States (CFIUS).

These changes recognize the importance of foreign investment in U.S. nuclear energy while also protecting the U.S. from foreign threats. Revisiting the Atomic Energy Act's FOCD provisions to reflect modern times has been the subject of a number of recent articles and a July 28, 2020 letter to this

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[42] Nuclear Innovation Alliance, *Streamlining NRC NEPA Reviews for Advanced Reactor Demonstration Projects While Safeguarding Environmental Protection* (Sept. 2019) (*available at* https://docs.wixstatic.com/ugd/5b05b3_e661eba94a224b28aac2a7e11d60e0c6.pdf).
[43] *Id.*
[44] *Id.*
[45] Atlantic Council, *supra,* note 5.
[46] *See* Environmental Impact Statement for the Construction Permit for the SHINE Medical Radioisotope Production Facility, U.S. NRC (Oct. 2015) (*available at* www.nrc.gov/docs/ML1528/ML15288A046.pdf).
[47] Update to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act, Council on Environmental Quality, 85 Fed. Reg. 43304 (Jul. 16, 2020).

Committee and the House Energy and Commerce Committee signed by 10 former NRC Commissioners urging Congress to remove the FOCD provision.[48]

The FOCD Provision was established at the start of the Cold War, when only a few countries were nuclear powers, and thus foreign involvement in nuclear power was viewed with great skepticism. This restriction was not a problem in the early history of U.S. nuclear power, as reactors were built and owned by local utilities, with limited direct foreign involvement. However, today international partners play a key role in the U.S. nuclear industry and have large stakes in U.S.-based reactor designers and fuel cycle companies (such as uranium enrichment companies and fuel fabricators).

Foreign investment from our allies, far from being viewed with skepticism, is instead critical for the U.S. civilian nuclear industry to succeed.[49] U.S. allies are interested in supporting U.S. advanced reactor vendors, and often have higher tolerance for these investments than their U.S. counterparties.[50] However, instead of safeguarding American interests, the FOCD provision is more likely to push advanced reactor developers out of the country to demonstrate their technologies and will stifle investment in those that remain, harming U.S. nuclear technology leadership, U.S. nuclear export prospects (as there will be fewer U.S.-designed and built plants to thereafter export abroad), and overall nuclear security.

(3) Supporting nuclear infrastructure development

A strong civilian nuclear energy infrastructure is a fundamental strategic national asset for any major nation—and the United States is no exception. ANIA helps ensure that the U.S. can continue to meet our domestic nuclear needs through government support of nuclear infrastructure. ANIA aims to support HALEU, the fuel of many advanced reactor technologies, by ensuring adequate technical expertise for development of these fuels. It also requires the NRC to develop a report on the advanced methods of manufacturing and construction for nuclear applications that examines, among other things, licensing issues, requirements for the use of nuclear grade components for advanced nuclear applications, and potential safety issues, which will further assist the nuclear industry.[51]

V. Conclusion

Thank you for the opportunity to provide my support for this important piece of legislation. I have spent two decades working in the nuclear regulatory field. I care deeply about the topic, and the impact of effective regulation on our nation's economy and national security. For the reasons set forth herein, I urge the Committee to support ANIA in order to protect and promote U.S. interests.

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[48] *See also* Columbia Center on Global Energy Policy, *Strengthening Nuclear Energy Cooperation between the United States and Its Allies*, Dr. Matt Bowen (Jul. 2020); Nuclear Innovation Alliance, *U.S. Nuclear Innovation in a Global Economy: Updating an Outdated National Security* (Jul. 2020) (*available at* https://nuclearinnovationalliance.org/updating-outdated-national-security-framework).
[49] Nuclear Innovation Alliance, *supra,* note 47.
[50] *Id.*
[51] *Id.*

Senate Committee on Environment and Public Works
Hearing entitled, *"Hearing to Examine a Discussion Draft Bill, S.____, American Nuclear Infrastructure Act of 2020."*
August 5, 2020
Questions for the Record for Amy Roma
Submitted on September 2, 2020

Chairman Barrasso:

1. **New nuclear reactor technologies can be smaller, safer, and more efficient compared to today's reactors. What are some opportunities for the Nuclear Regulatory Commission (NRC) to align the safety regulations for advanced reactors commensurate with the risk and performance of advanced nuclear technologies?**

While the Nuclear Regulatory Commission's (NRC's) has been evaluating its regulatory framework for advanced reactors, its current reactor licensing framework is still tailored for large-scale light water reactors, not advanced reactors. In addition to differences in technology, advanced reactors are usually much smaller and introduce a much less significant risk portfolio than their large-scale cousins. They can include features such as passive and inherent safety features, accident and proliferation resistant fuel, underground construction, and simple or automated systems that require little or no operator action to ensure safety. Moreover, many designs are intended to operate continuously for long periods of time between refueling.

There are a variety of opportunities for the NRC to align the safety regulations for advanced reactors commensurate with the risk and performance of advanced nuclear technologies. For example, many advanced reactor designs are significantly smaller than the current fleet of operating reactors—10MW or less--and the NRC could look to the licensing and regulation of research reactors and commercial non-power reactors to support "right sizing" the safety regulations for advanced reactors.

As another example, many advanced reactor designs, such as micro-reactors, will have very small radionuclide inventories and safer and simpler designs, with very low potential for consequences that could impact public health and safety. As a result, the NRC should consider permitting these types of applicants more flexibility in using alternative design approach and demonstrating non-applicability of regulations than currently permitted under the existing regulatory framework. Relevant areas could include NRC oversight and inspection, emergency preparedness, security, operator requirements, and aircraft impact assessments. The NRC has already started to evaluate many of these issues for advanced reactors, but certain areas—for example, how to approach non-applicable Part 50 regulations—i.e., regulations that cannot or should not apply for a certain technology—for advanced reactors need further work.

In addition to "right sizing" the regulatory framework for advanced fission reactor technology, the NRC will also need to establish the applicable regulatory framework for fusion in the near future. A thoughtful approach to a regulatory regime for fusion is warranted given

the unique considerations and potential benefits of fusion energy and its significant differences from fission reactors.[1]

2. **Entrepreneurs are looking to apply advanced manufacturing and advanced construction techniques to develop and deploy advanced nuclear technologies. Using modern manufacturing approaches would meet both necessary safety regulations and provide an opportunity to reduce cost and the length of time to build a reactor. What sort of regulatory issues must the NRC address to allow nuclear companies to use advanced manufacturing and construction technologies?**

Advanced manufacturing technologies, such as additive manufacturing and powder metallurgy, and hot isostatic processing (PM-HIP), have not traditionally been used in the U.S. nuclear industry, but are becoming more applicable with advanced nuclear technologies and other areas of the nuclear industry.[2] The use of advanced manufacturing techniques could help lower the cost and time required to develop nuclear parts for both the existing fleet and with advanced nuclear. Advanced manufacturing techniques could also drastically shorten the time required to produce replacement parts for the existing fleet and could produce complex parts using favorable materials for new and existing nuclear designs.[3]

Advanced manufacturing methods should be incorporated in the regulatory framework so companies are able to utilize these useful tools in developing advanced technologies. One option is for the American Society of Mechanical Engineers (ASME) to incorporate advanced manufacturing and construction methods in its ASME Boiler & Pressure Vessel Code and for the Nuclear Regulatory Commission (NRC) to subsequently adopt accept the code for use. To expedite the process, an applicant could include method qualification and component qualification data in its license application for NRC consideration. For example, NuScale Power utilizes advanced manufacturing technology like PM-HIP, Electron Beam Welding, and Diode Laser Cladding in its Reactor Pressure Vessel.[4] NuScale incorporates the ASME code in various components of its application, such as in its "Application Of The Single Failure Criterion To NuScale Power LLC's Inadvertent Actuation Block Valves."[5]

3. **The Nuclear Energy Innovation and Modernization Act (NEIMA) reformed the NRC's budgeting process to increase transparency and predictability for today's operating reactors. Your testimony suggests adding a provision to the discussion**

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[1] Amy Roma and Sachin Desai, *The Regulation of Fusion – A Practical and Innovation-Friendly Approach* (Feb. 2020) (*available at* https://www.hoganlovells.com/~/media/hogan-lovells/pdf/2020-pdfs/2020_02_14_hogan_lovells_the_regulation_of_fusion_a-practical.pdf?la=en).

[2] Allen Hiser, Christopher Hovanec, et al., U.S. Nuclear Regulatory Commission, *Regulatory Perspectives on Advanced Manufacturing Technology* (Mar. 13, 2019) (*available at*, https://www.nrc.gov/public-involve/conference-symposia/ric/past/2019/docs/abstracts/hisera-w22-hv.pdf).

[3] Randy Beatty, Oak Ridge National Laboratory, *Energy Overview of Advanced Reactor and Advanced Manufacturing Program Activities* (*available at* https://nucleus.iaea.org/sites/INPRO/df15/Member%20States/USA.pdf).

[4] *Id.*

[5] Policy Issue (Notation Vote) from Margaret M. Doane to The Commissioners on *Application of the Single Failure Criterion to NuScale Power LLC's Inadvertent Actuation Block Valves* (Apr. 11, 2019) (*available at* https://www.nrc.gov/docs/ML1906/ML19060A081.pdf).

draft to establish financial accountability in the NRC's review of advanced nuclear reactors.

a. Will you please describe why this is important to license, deploy, and regulate advanced nuclear technologies?

While certain internal actions within the Nuclear Regulatory Commission (NRC) have improved the Commission's review schedules, the NRC still seems to struggle with staying within the budget that the NRC provides applicants while meeting these important deadlines. Additionally, requests for additional information (RAIs) are often overly cumbersome and unnecessary, which further drives up costs when applicants are billed by the hour by NRC staff and contractors. Better oversight over RAIs by NRC management and more accountability for remaining within budget could lower costs substantially, but often does not happen. One of the most significant impediments to advanced reactor projects moving forward is cost overruns and regulatory uncertainty, which includes regulatory cost uncertainty.

Most advanced reactor development efforts are smaller programs or companies without major profitable assets, and cannot readily accommodate budget overruns of two or three times the NRC's original estimate. In fact, even large companies would struggle with budget contingencies this great. Some of these companies will fail for other reasons, which is a function of the market and the technology development process; however it should not be a function of regulatory inefficiency or poor regulatory management.

b. How would you propose to achieve this goal?

I propose that American Nuclear Infrastructure Act of 2020 include a required report to Congress by the NRC on each occasion where an advanced reactor licensing fee exceeds budget by 30% for the various aspects of the project or when RAIs exceed a certain number of questions. Additionally, NRC should be required to set standard/target review fees and report those fees to the industry for feedback.

4. **Micro-reactors are a unique class of advanced reactor that may be very similar to research and test reactors. Are there aspects of micro-reactors that may require special consideration within the NRC's regulatory framework?**

Micro-reactor technologies are gaining momentum in the United States. As mentioned in my testimony, Oklo recently submitted an application to the Nuclear Regulatory Commission (NRC) for a combined construction permit and operating license for its microreactor design. Additionally, three companies—X-energy, Westinghouse, and BWXT—were selected by the Department of Defense to move forward with preliminary designs for microreactors that can be used to power forward operating bases for the U.S. military.

As noted in an earlier response, for micro-reactors, the NRC could look to the licensing and regulation of research reactors and commercial non-power reactors to support "right sizing" the safety regulations for advanced reactors. Research reactors are usually in the 2 MW range, more like a micro-reactor size.

As also noted in an earlier response, micro-reactor will have very small radionuclide inventories and safer and simpler designs, with very low potential for consequences that could impact public health and safety. As a result, the NRC should consider allowing these types of applicants more flexibility in using alternative design approach and demonstrating non-applicability of regulations than currently permitted under the existing regulatory framework. Relevant areas could include NRC oversight and inspection, emergency preparedness, security, operator requirements, and aircraft impact assessments. The NRC has already started to evaluate many of these issues for advanced reactors, but certain areas—for example, how to approach non-applicable Part 50 regulations—i.e., regulations that cannot or should not apply for a certain technology—for advanced reactors need further work

5. **In your written testimony, you mention that "a roadblock in the NRC licensing process lies with the daunting and, sometimes, financially crippling requirements of environmental reviews."**

    a. **Based on recent experiences, what is a general estimate of the financial costs and time it takes for current National Environmental Policy Act (NEPA) reviews for nuclear projects?**

Advanced nuclear has the potential to be a critical contributor in addressing climate change. Ironically however, one challenge to addressing this environmental crisis resides in an environmental statute—the National Environmental Policy Act (NEPA)—and its practical application by the Nuclear Regulatory Commission (NRC). Since its inception, NEPA has generated immense benefits. However, there are times when its execution raises roadblocks contrary to its underlying purpose.

As explained in my testimony, the purpose of NEPA is to "prevent or eliminate damage to the environment," by having federal agencies take a "hard look" at the environmental impacts of their actions before they take them. Critically, NEPA does not set substantive standards—the statute instead provides a process to help agencies *consider and disclose* the consequences of their actions. NEPA reviews should be "concise, clear, and to the point."[6] However, when implemented at the agency level, the concise and clear nature of NEPA reviews sometimes get lost. Critic after critic—from both sides of the aisle—have discussed the well-known "ratcheting up" of NEPA reviews over the years, and in 1997, the White House Council of Environmental Quality (CEQ) noted that agencies were trying to generate "litigation-proof" NEPA reviews, increasing costs and time but not necessarily quality.

For the NRC, it is common that the agency's NEPA documentation, memorialized in an Environmental Impact Statement (EIS), *is the same length or longer than* the NRC's substantive technical evaluation, documented in a Safety Evaluation Report (SER). NRC NEPA reviews can require about a third or more of agency staff effort for licensing a new reactor project. For an agency charging applicants by the hour, the costs are in the several millions of dollars per application for a NEPA review. While some of these costs cannot—and should not—be avoided

[6] President Carter, Executive Order 11991, *Relating to Protection and Enhancement of Environmental Quality*, 42 Fed. Reg 26967 (May 24, 1977).

in order to comply with the statute, there are significant opportunities to make the process more efficient.

From a timing perspective, NRC practice also indicates that NEPA can be the same if not more time-consuming than the NRC's safety evaluation of a project, especially for novel licensing actions. For example, during the processing of three 10 CFR Part 52 Early Site Permit applications submitted by Exelon, Dominion, and Entergy for new AP1000 and ESBWR nuclear reactors in the early 2000s—the first of these types of applications—the NRC's EISs were issued roughly 5-6 months after the staff completed the safety review, despite the safety and environmental reviews commencing within a month of each other. The chart below shows the time taken to receive a final EIS and final SER for these three early site permit applications:[7]

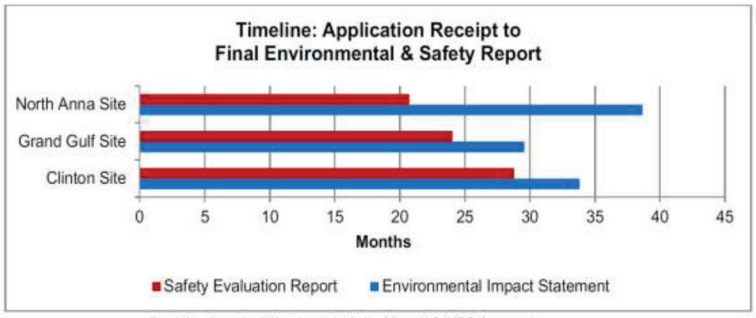

Chart developed by NIA using data derived from U.S. NRC documents

b. How do the cost and length of time to complete recent NEPA reviews compare to NEPA reviews for reviews conducted immediately following the enactment of NEPA?

In practice, NEPA reviews have increased in size over the years even though the statute's requirements have remained the same since NEPA was enacted in 1970. For example, in the early 1980s, the NEPA review documentation for construction and operation of the Palo Verde Nuclear Power Plant—a greenfield 3-unit power plant, the *largest in the U.S.*—numbered roughly 700 pages including appendices and responses to comments. By comparison, the NRC's NEPA documentation for the recently licensed Vogtle nuclear power plant, a smaller 2-unit expansion on an already existing nuclear plant site, numbered well over 1500 pages—that is *more than 1000 pages longer*—for a project with a much smaller environmental impact. The chart below shows an illustrative comparison between the length of EISs for four different projects—two recent and two older:[8]

[7] Nuclear Innovation Alliance, *Streamlining NRC NEPA Reviews for Advanced Reactor Demonstration Projects While Safeguarding Environmental Protection* (Sept. 2019) (*available at* https://docs.wixstatic.com/ugd/5b05b3_e661eba94a224b28aac2a7e11d60e0c6.pdf).
[8] *Id.*

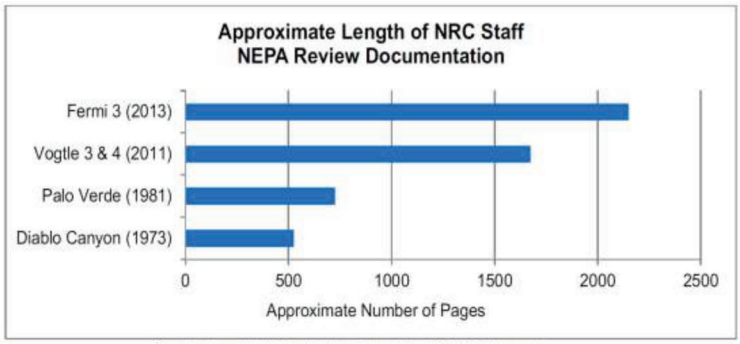

Chart developed by NIA using data derived from U.S. NRC documents

c. What is the trend for cost and time of NEPA reviews?

As seen in the response above, the trend is toward longer NEPA reviews, both in duration of the review and length of the document.

d. What is the benefit of a different approach for environmental review for new, advanced nuclear technologies compared to today's operating nuclear power plants?

Based on the NRC's current trend, NEPA reviews for small advanced reactor project may be comparable in size to large-scale nuclear power plant projects in the 1980s—for projects with substantially smaller environmental impacts. For example, the NRC's NEPA analysis for a recent medical isotope facility, the SHINE facility, is concerning. The number of pages for the SHINE EIS for its construction permit alone was nearly the same size of the 1980's Palo Verde EIS for the entire facility (both construction and operation)—and SHINE is not constructing a power reactor, but instead a far smaller medical isotope facility. In comparison, Palo Verde is the largest nuclear power plant site in the United States.

The NRC should act to streamline NEPA reviews for advanced reactors to ensure they are pragmatically proportionate to the project size and its potential environmental impact, and do not result in time, money, and resources wasted on regulatory reviews that do not achieve the objectives of the NEPA statute. Again, as explained in this response to Question 5, the NRC can still comply with NEPA's requirements while making the process more efficient.

e. How can NRC increase the efficiency of environmental reviews for advanced reactors, while maintaining environmental standards?

There are a number of measures the NRC could employ to make its NEPA review more efficient. For example, the NRC should reevaluate the presumption that advanced reactor projects require an Environmental Impact Statement (EIS), especially for prototype designs.

Some types of reactors, such as research and test power reactors (non-power reactors), do not require an EIS per se and instead the project is evaluated on a case-by-case basis to determine whether a lower level of review would be sufficient in light of the low impact of the project on the environment. Furthermore, NRC can consider mitigation strategies, as indicated in modern NEPA guidance, to determine if an EIS is necessary.

As another example, the NRC should tailor the scope of NEPA reviews for demonstration projects or even for applications for facilities co-located with other nuclear power plants. The selection of alternatives and "collected actions" requirements can be time consuming and burdensome. The NRC and Congress could eliminate design alternatives from NEPA reviews and site alternatives when a project is sited at a national laboratory or Department of Defense facility. NRC should also separate NEPA analysis of the fuel cycle from the demonstration project by limiting connected action analysis. Instead the nuclear fuel cycle should be addressed once the full-scale commercial facilities are before the NRC.

As a final example, a generic environmental impact statement (GEIS) could be used to address common advanced reactor issues. Never before has the NRC been faced with licensing so many different types of nuclear reactor designs. At the same time, many of these reactor designs share similar characteristics that could lead to increased use of GEISs (or their analog, Programmatic EISs ("PEISs"), often used for wind and solar projects) to manage common issues. Many of the nuclear reactor designs have similar environmental characteristics shared among different advanced reactor designs that could be evaluated in a GEIS, including the following:

- Fabrication, use, and storage/disposal of High-Assay Low-Enriched Uranium (HALEU);
- Fabrication, use, and storage/disposal of spent nuclear fuel of several varieties including TRISO, uranium-metal, and liquid salt-based fuel;
- Modular construction and installation; and
- Use of new coolants such as molten salt, gas, and liquid metal.

The NRC has proven that GEISs, which take a long-term approach to shared environmental issues, can add significant efficiency to the site-specific environmental review process. A GEIS would ensure that environmental standards are upheld while also streamlining the overall NEPA process.

f. Does the American Nuclear Infrastructure Act of 2020 (ANIA) discussion draft eliminate or weaken environmental review standards?

The American Nuclear Infrastructure Act of 2020 (ANIA) discussion draft does not eliminate or weaken environmental review standards. In fact, the draft bill does not change the environmental review standards in any way. Rather the bill would help ensure that the environment is protected while also encouraging innovation in nuclear technologies by directing the NRC to evaluate whether it could conduct its reviews for effectively. While environmental reviews for new nuclear projects are important, there is room for improving their efficiency without decreasing their quality. ANIA takes steps toward this improvement. ANIA instructs that the NRC use analysis and findings from existing EISs for construction or combined permits

to create a Supplemental EIS. Furthermore, ANIA requires that information used during the licensing process of existing nuclear projects is re-used when considering new projects at the same site.

6. **Advanced nuclear reactor technologies will need advanced nuclear fuels, known as high-assay, low-enriched uranium (HALEU). You recommend that the NRC establish a generic environmental impact statement (GEIS) for HALEU.**

    a. **What issues would such a GEIS resolve to make the development and use of HALEU more predictable and timely?**

The Nuclear Regulatory Commission (NRC) has proven that a Generic Environmental Impact Statement (GEIS), which take a long-term approach to shared environmental issues, can add significant efficiency to the site-specific environmental review process. The most notable example is the NRC GEIS concerning the storage and use of spent nuclear fuel (SNF) (called the "Continued Storage GEIS"). Through one GEIS, the NRC has evaluated and considered the complex and highly litigious issue of SNF for every reactor's site-specific NEPA review, saving tens of millions of dollars and countless hours of NEPA review time during its review of individual applications. The NRC's GEIS for power reactor license renewals also greatly sped up the license renewal process and reduced site-specific litigation on common issues.

A GEIS for High-Assay Low-Enriched Uranium (HALEU) fuel could significantly streamline subsequent environmental reviews for advanced reactor applications relying on HALEU fuel. If the NRC drafted a HALEU fuel GEIS, then each individual applicant using HALEU fuel would need to prepare a site-specific supplement to the GEIS, maintaining environmental quality while increasing efficiency of regulation and reducing project costs.

    b. **How would this help deploy advanced nuclear reactors?**

According to a February 2020 policy paper by the NRC, a GEIS for advanced reactors could reduce both the length of time required for an environmental review and the cost associated with the review by 25%.[9] Furthermore, a GEIS would streamline the environmental review process and provide consistency across environmental reviews. It would prevent duplicative reviews and efforts and deliver a result that is both beneficial to the environment and also does not stifle innovation in nuclear development.

7. **Mr. Cohen's written testimony states that "additional streamlining of environmental regulations such as the National Environmental [Policy] Act (NEPA) is not helpful for the nuclear industry or our goals for decarbonization." However, it also notes that "high cost and delays" are of the foremost challenges facing the nuclear industry.**

[9] Policy Issue (Notation Vote) from Margaret M. Doane to The Commissioners on *Results of Exploratory Process for Developing a Generic Environmental Impact Statement for the Construction and Operation of Advanced Nuclear Reactors* (Feb. 28, 2020) (*available at* https://www.nrc.gov/docs/ML2005/ML20052D175.pdf).

a. Are there significant differences in safety and performance between today's operating reactors and advanced reactors currently are under development? Please explain why or why not.

Yes, there are significant differences between traditional nuclear plants and advanced reactors under development. There are inherent design benefits of advanced reactors, which can reduce or eliminate offsite environmental impacts and reduce generation of spent nuclear fuel. They can be constructed modularly, sited at brownfield locations, and use less material and space than traditional nuclear plants. Moreover, demonstration projects can be tailored to further reduce impact. The Nuclear Regulatory Commission (NRC) does not currently take these differences into account when requiring in-depth environmental reviews under National Environmental Policy Act (NEPA).

b. Do you think all infrastructure projects should be subject to the same environmental review process (note this is not asking whether projects should be subject to the same environmental review standards) regardless of the size, operation, and/or safety features of the project?

A one-size-fits all process does not work for every type of infrastructure project because of the vast differences in potential environmental impacts. It is evident across a variety of sectors that this is the case. For example, certain larger projects in eligible project sectors may be covered under the FAST-41 process, which created an alternate process for NEPA permitting and environmental review process.[10] In terms of nuclear, the current fleet of power plants, due to its large size and power required for operation would have a greater environmental impact than advanced nuclear reactors, which are inherently safer and smaller design.

c. Are there opportunities for the nuclear industry to work to reduce costs and delays while still maintaining environmental standards? If so, please elaborate on how this may be accomplished.

The industry should push for the NRC to streamline NEPA reviews to ensure that they help inform about potential environmental impacts of a project, but do not result in a waste of time and resources. Advanced reactors have a different environmental impact than large-scale light water reactor plants. Among other things, for example, advanced reactors employ passive safety features and can shut down automatically, keeping radioactive material safely contained indefinitely without any need for outside support. Some advanced reactor designers propose using molten salt as a fuel, which would harden into a solid in case of a power loss or coolant failure, trapping the nuclear materials safely in the fuel itself. Such systems dramatically reduced the threat of most major accidents. Please refer to question 5(e) for a discussion on how to conduct environmental reviews with efficiency, while also maintaining environmental standards.

8. **The world is looking to develop new nuclear technologies. As the international community sets the new safety and security rules for advanced nuclear reactors,**

[10] Memorandum from Shaun Donovan and Christina Goldfuss on *Guidance to Federal Agencies Regarding the Environmental Review and Authorization Process for Infrastructure Projects* (Jan. 13, 2017) (*available at* https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2017/m-17-14.pdf).

international collaboration is more important than ever. American interests are stronger when the United States is seated at the head of the table. How will the draft bill keep the United States as the global leader for nuclear safety regulation?

The U.S. leads the world in the development of advanced reactors. If the U.S. leads in implementing this new technology wave, safety will improve, our geopolitical relationships will strengthen, and non-proliferation will remain strong. However, if U.S. companies do not receive more support these benefits will fall to the wayside and other countries will emerge as leaders. We currently are well-positioned to deliver this new technology but are increasingly yielding our advantage to China and Russia. The American Nuclear Infrastructure Act of 2020 will help close the gap between U.S. potential and our ability to execute on that potential at home and abroad.

Notably, it is critical to support the deployment of advanced reactors to ensure the technologies do not die on the vine—that includes making sure the U.S. has effective regulatory reviews of designs and applications to build and operate facilities. These measures are critical to ensuring U.S. competitiveness. If we cannot demonstrate and deploy in a timely manner, or if doing so is cost-prohibitive, the technologies will not develop from their nascent stages and the international community will turn to other countries to fulfill the need.

9. **Ten former members of the Nuclear Regulatory Commission wrote a letter that supports removing investment restrictions on our nuclear energy sector. Those restrictions, knowns as "foreign ownership, control, or domination" (FOCD) are codified in sections 103 and 104 of the Atomic Energy Act.**

   The draft legislation removes those restrictions from countries that are members of the North Atlantic Treaty Organization (NATO), Japan, and the Republic of Korea.

   a. **How do the current FOCD restrictions hinder America's ability to preserve and expand the use of nuclear energy?**

As explained in my testimony, the "foreign ownership, control, or domination" (FOCD) provision is a product of the early Cold War, when nuclear technology was primarily limited to the U.S. and Soviet Union, globalization had not yet occurred, and the regulatory framework focused on preventing the sharing of nuclear technology. As applied by the Nuclear Regulatory Commission (NRC), this outdated provision of the Atomic Energy Act creates significant investment uncertainty. At best, it restricts corporate governance and oversight requirements on many types of foreign investments in reactor license applicants, even if the investments are from long-time U.S. partner such as Canada and Japan. At worst, it can result in a license being denied and a project terminated—like UniStar's Calvert Cliffs Unit 3 project—because of the foreign investment. Maintaining this outdated law is more likely to push advanced reactor developers out of the country to demonstrate their technologies and will stifle investment in those that remain, harming U.S. nuclear technology leadership, U.S. nuclear export prospects (as there will be fewer U.S.-designed and built plants to thereafter export abroad), and overall nuclear security.[11]

[11] Nuclear Innovation Alliance, *U.S. Nuclear Innovation in a Global Economy:*

b. What other approaches or characteristics (i.e. members of the Nuclear Suppliers Group) could be applied to limit the applicability of the FOCD on a country-specific basis?

I believe we could eliminate the FOCD provision altogether, relying instead on Committee on Foreign Investment in the United States (CFIUS) and other mechanisms, such as export control laws.[12] In the event the provision is not eliminated entirely, then it could be lifted for certain countries—as is proposed with American Nuclear Infrastructure Act of 2020. A number of other approaches or characteristics could be utilized, such as membership in NATO, the Organization for Economic Co-operation and Development, or the Nuclear Suppliers Group.

c. If the FOCD restriction is removed for certain countries, would the Committee on Foreign Investment in the United States (CFIUS) review foreign investment in nuclear energy projects? Does a CFIUS review provide for a full review of the United States' national interests?

The U.S. government has developed many other tools to monitor and protect against impermissible investments in the U.S. nuclear industry. At the forefront is the Committee on Foreign Investment in the United States (CFIUS), which polices all significant foreign investments into the nuclear industry and was recently strengthened by Congressional action. This interagency review process is better suited to evaluate investment and national security implications compared to the NRC, a safety regulator composed largely of scientists and engineers.[13]

CFIUS is a multi-agency committee, led by the Treasury Department, which has the ability to review foreign investments that pose a threat to national security. Under the current law, CFIUS is able to review transactions that allow a foreign entity to gain "control" over a U.S. business connected to a national security risk—including U.S. businesses holding or involved in critical infrastructure and critical technologies, which includes nuclear power. CFIUS works aside a separate, complex nuclear export control regime to police efforts by foreign powers to infiltrate critical infrastructure and technologies in a manner harmful to U.S. national interests.[14]

A CFIUS review is far-reaching and provides a full review of U.S. national interest and is therefore an adequate tool absent FOCD. This year's CFIUS final regulations expand CFIUS' jurisdiction to include non-controlling investments and create a mandatory declaration process. CFIUS' jurisdiction was originally limited to reviewing transactions where a foreign entity would acquire a controlling investment in the U.S. entity. However, the final regulations expanded CFIUS' reach by creating review protocols for both direct and indirect non-controlling

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Updating an Outdated National Security (Jul. 2020) (*available at* https://nuclearinnovationalliance.org/updating-outdatednational-security-framework).

[12] *See id.*

[13] *See id.*

[14] *See The Committee on Foreign Investment in the United States (CFIUS)*, U.S. Dept. of the Treasury (last visited Aug. 31, 2020).

investments. Furthermore, while traditionally filings with CFIUS were purely voluntary, the Foreign Investment Risk Review Modernization Act of 2018 and CFIUS' implementing regulations now require mandatory CFIUS filings in multiple situations.[15]

Senator Whitehouse:

10. **It's a danger and a liability to have nuclear waste stored at our facilities. There is value to finding a way to solve that problem. As we embark on nuclear innovation, how can we make sure that the innovators see the value of pursuing advanced nuclear technologies that re-use spent nuclear fuel?**

Many reactor designers imbed the re-use of spent fuel and spent fuel management considerations into their designs, and the Department of Energy (DOE) and the advanced reactor industry continue to explore these issues. For example, a sodium-cooled fast reactor, which boasts a fast neuron spectrum, can be designed with the capability to reuse spent fuel.[16] Reactors, like Oklo's Aurora, use High-Assay Low-Enriched Uranium (HALEU) fuel that is derived from spent nuclear fuel (SNF).[17] DOE is exploring solutions to the growing demand for HALEU fuel as the advanced nuclear industry advances. Some methods of creating HALEU include electrochemical processing and a process known as hybrid zirconium extraction (ZIRCEX), which involves recycling used nuclear fuel from government-owned research reactors.[18] The capability to produce HALEU will grow with the industry demand and it will be apparent that investing in advanced nuclear technology will include recognizing the value of re-using SNF. Financial support for reactor designs that reuse spent fuel could help support their development.

11. **The 45Q tax credit provides a carbon payment for avoided emissions from carbon capture projects. A provision included in this draft bill would translate this idea for the existing nuclear fleet. Right now, our nuclear reactors are not compensated for their carbon free power and many are being prematurely retired and replaced with fossil fuels.**

    - **Do you support the inclusion of this existing nuclear credit program?**

There are a number of ways to compensate the nuclear fleet for its carbon free power, whether it's be something similar to a "ZEC" (zero emission credit program) or a tax credit.

- **Do you have suggestions no how we could improve the provision?**

I do not have suggestions on how we could improve the provision at this time.

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[15] *See id.*

[16] *3 Advanced Reactor Systems to Watch by 2030*, Dept. of Energy (Mar. 7, 2018) (*available at* https://www.energy.gov/ne/articles/3-advanced-reactor-systems-watch-2030).

[17] Daniel Oberhaus, *Recycled Nuclear Waste Will Power a New Reactor* (Feb. 27, 2020) (*available at* https://www.wired.com/story/recycled-nuclear-waste-will-power-a-new-reactor/).

[18] *What is High-Assay Low-Enriched Uranium (HALEU)?* Dept. of Energy (Apr. 7 2020) (*available at* https://www.energy.gov/ne/articles/what-high-assay-low-enriched-uranium-haleu).

12. **This draft bill includes a new requirement that DOE report to Congress each year on the cumulative lifecycle costs to store, manage, and dispose of spent nuclear fuel. It also requires that DOE provide recommendations on how to better account for the lifecycle costs of the nation's nuclear waste stockpile.**

    - **What can Congress do to improve the financial accounting of nation's spent nuclear fuel?**

An impediment to the financial accounting of the nation's spent nuclear fuel (SNF) seems to be that people's attention is often not focused on this matter. The draft bill's provision to require DOE to report to Congress each year on the cumulative lifecycle costs to store, manage, and dispose of SNF, and to require that DOE provide recommendations on how to better account for the lifecycle costs of the nation's nuclear waste stockpile should help in this regard. Another recommendation to consider would be to provide support for DOE funding of programs that would reduce spent fuel inventories or associated hazards, such as through technological developments. That way, while Congress works to resolve where nuclear waste should be disposed, potentially the volumes and hazards of the waste could be addressed further in some manner.

Senator Van Hollen:

13. **Given the proliferation risks of using HALEU fuel and plutonium-based fuel for advanced nuclear reactors, do you believe that it is necessary to require that foreign countries have in place an Additional Protocol with the International Atomic Energy (IAEA) as a precondition for the purchase of such technologies?**

The U.S. Government has already joined with the IAEA to urge all countries to bring an Additional Protocol into force, and a large majority of countries with IAEA Comprehensive Safeguards Agreements have an Additional Protocol in place. While an Additional Protocol is not a requirement for the conclusion of a nuclear cooperation agreement with the U.S. as set forth in Section 123 of the Atomic Energy Act, the U.S. has not in recent years negotiated a bilateral agreement for nuclear cooperation under Section 123 with a country that has not signed an Additional Protocol. As a matter of policy, the U.S. appears to consider an Additional Protocol as a de facto condition to nuclear cooperation agreements. Therefore, it does not seem like an additional statutory restriction would be necessary.

14. **Would requiring U.S. manufacturers of advanced nuclear reactors and associated fuel cycle facilities incorporate "safeguards-by-design" features, as defined by the IAEA, in the design and operations of their facilities make advanced nuclear technologies more proliferation-resistant and increase the competitiveness of U.S. manufacturers in the international nuclear market?**

The foreign nuclear export market is dominated by Russia, with China hoping to emerge close behind. Both these countries have weaker non-proliferation standards than the U.S. and are attractive because of their low costs. Any action that drives up U.S. costs makes the U.S. less

competitive abroad, eliminating any hypothetical benefits that could be realized by additional design requirements. Moreover, many reactor safety designs, especially advanced reactor designs, are proliferation-resistant, and therefore it is not apparent that mandating further design requirements would improve U.S. non-proliferation objectives.

15. **According to a 2018 GAO report, the NNSA has a sufficient supply of unobligated low-enriched uranium to produce tritium gas for our nuclear weapons program until at least 2041. The NNSA has also indicated that it has enough stockpiled HEU for naval reactors to last until 2060. For defense needs, how urgent and necessary is establishing a domestic uranium reserve?**

With respect to a domestic uranium reserve for defense purposes, this question should likely be answered by someone from the Department of Energy or Department of Defense.

16. **The United States currently has minimal uranium conversion capabilities, with the only domestic conversion plant sitting idle since 2017. Therefore, would DOE and U.S. commercial entities have to rely on foreign entities to convert uranium from the domestic reserve?**

I am not an expect in this area and would defer to the other panelists or specialists, including DOE to advise on its conversion capabilities. I would note that the only domestic conversion facility has been idled, but not decommissioned. It is my understanding that should there become a market need, the owner has indicated that it would restart this facility.

17. **What are the market implications of establishing a uranium reserve when there's an international supply glut of uranium in the international market and uranium prices remain low?**

I am not an expert in this area and would defer to the other panelists or specialists.

18. **At what price would DOE have to purchase uranium from U.S. mining companies to fill the uranium reserve for the domestic production of uranium to be cost-effective and economically viable?**

I am not an expert in this area and would defer to the other panelists or specialists.

Senator BARRASSO. Well, thank you so much for you testimony. It was very thoughtful, and we look forward to getting to questions in a few moments.

I would now like to welcome Mr. Paul Goranson this morning. In addition to serving as the president of the Uranium Producers of America, he is currently the Chief Operating Officer for Energy Fuels. It owns two uranium production facilities in Wyoming.

He has lived in Wyoming for many years. He is the past president of chemical resources based in Cheyenne, also lived in Casper, and I am delighted to have you here, my friend.

Please proceed.

STATEMENT OF WILLIAM PAUL GORANSON, PRESIDENT, URANIUM PRODUCERS OF AMERICA; CHIEF OPERATING OFFICER, ENERGY FUELS RESOURCES, INC.

Mr. GORANSON. Chairman Barrasso, Ranking Member Carper. Thank you for holding this hearing on the American Nuclear Infrastructure Act of 2020.

I am the President of the Uranium Producers of America, a trade association representing the domestic uranium mining and conversion industry. I am also the Chief Operating Officer for Energy Fuels Resources, and I have worked in the U.S. uranium industry for over 30 years.

The UPA strongly supports this bill, which will help reclaim America's leadership in global nuclear markets.

As I started my career, the U.S. led the world in uranium production, employing over 20,000 workers, supplying almost all our own nuclear fuel, and we were a net exporter of uranium.

Today, commercial reactors in the U.S. import more than 90 percent of annual demand, and less than 1 percent of the uranium they use is mined in the United States. This has left the domestic production on the brink of collapse.

Earlier this year, the multi-agency Nuclear Fuel Working Group recommended immediate government actions to address the predatory market tactics of the state owned uranium enterprises.

U.S. mine production in 2019 was the lowest since 1949. The U.S. mined only a fraction of uranium needed to fuel even one of our 95 commercial nuclear reactors.

Employment is at all time low, we are almost entirely dependent on imported uranium, and we rely heavily on strategic competitors to sell us uranium. Uranium imports from the former Soviet Union, Russia, Kazakhstan, and Uzbekistan represent almost half the fuel used by America's nuclear reactor fleet.

Let me be clear: We have a more than ample uranium supply in the U.S. We have over 40 million pounds annually of licensed and partially licensed capacity, almost enough to fuel America's entire commercial nuclear fleet.

When normal market forces are in play, U.S. mines are cost competitive globally. We have abundant high quality uranium resources for the future.

The challenge today for any free market uranium company, whether it is in the U.S., Canada, or Australia, is that we are not competing with other free market companies; we are competing

with governments that seek to use energy as political capital. State owned enterprises are not price sensitive.

When global prices plummeted a decade ago, free market companies were forced to reduce production and lay off workers, while Russia, Kazakhstan, and Uzbekistan increased their production, drove down prices, and took control of global supply chains.

The potential expiration of the Russian Suspension Agreement at the end of 2020 will only hasten the demise of the U.S. industry. The agreement already guarantees Russia 20 percent of the U.S. market, but Russia has already contracted to increase imports significantly, should the agreement expire.

The UPA strongly supports the Commerce Department's effort to extend RSA with protections for the domestic industry, as well as legislation to codify more restrictive limits on Russian uranium.

We appreciate the support of Chairman Barrasso in leading a bipartisan effort to rein in Russian uranium imports.

It is not just Russia; China is increasingly dumping underpriced uranium in the global markets. Data from the Departments of Energy and Commerce show that tens of millions of dollars' worth of Chinese uranium has entered the U.S. reactors in recent years. The U.S. must immediately take bold action to reserve a domestic supply chain for nuclear fuel in the United States.

The UPA strongly supports the draft American Nuclear Infrastructure Act. Section 402 would codify the Nuclear Fuel Working Group's proposal to establish a strategic uranium reserve. This reserve would ensure domestic uranium supply in the event of market disruption and reduce our reliance on state owned enterprises.

The Department of Energy's fiscal year 2021 budget requests $150 million for the uranium reserve, a modest investment, considering it will preserve the nuclear fuel cycle in the U.S., instead of ceding it to Russia, China, and their allies.

The UPA also supports the U.S. nuclear fleet, our Nation's largest source of carbon-free baseload power. Section 301 of the draft bill would provide financial incentives to prevent the premature shutdown of nuclear power facilities.

We appreciate the draft's recognition that such facilities should be buying American uranium. We look forward to working with the Committee to strengthen this requirement and ensure that nuclear power facilities receiving taxpayer funds procure U.S. mined and converted uranium.

Also, codifying the recent MOU signed by the EPA and NRC would further strengthen the legislation by providing certainty, robust, effective regulation of the in situ uranium recovery industry.

Thank you again, Chairman Barrasso, Ranking Member Carper, and members of the Committee. I look forward to your questions and working with the Committee to address these important issues.

[The prepared statement of Mr. Goranson follows:]

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STATEMENT OF WILLIAM PAUL GORANSON; PRESIDENT, URANIUM PRODUCERS OF AMERICA; CHIEF OPERATING OFFICER, ENERGY FUELS RESOURCES (USA) INC.

August 5, 2020

BEFORE THE

U.S. SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

FOR A FULL COMMITTEE HEARING TO EXAMINE A DISCUSSION DRAFT BILL, *AMERICAN NUCLEAR INFRASTRUCTURE ACT OF 2020*

I. INTRODUCTION

My name is William Paul Goranson, and I am the Chief Operating Officer of Energy Fuels Resources (USA) Inc., with offices in Casper, Wyoming. I am also the President of the Uranium Producers of America (UPA). On behalf of Energy Fuels Resources (USA) Inc. and the UPA, I am pleased to offer testimony in support of the draft of the *American Nuclear Infrastructure Act of 2020* released by Senate Environment and Public Works Committee Chairman John Barrasso (R-WY).

The UPA is the national trade association representing the domestic uranium mining and conversion industries. UPA's mission is to promote the viability of the nation's uranium industry, while being good stewards of the environments in which we work and live. UPA members conduct uranium exploration, development and mining operations in Arizona, Colorado, Nebraska, New Mexico, Texas, Utah and Wyoming. Our conversion member represents the lone remaining conversion facility in the United States in Illinois. The UPA strongly supports the draft legislation, which will help revitalize domestic uranium mining and conversion capabilities and reclaim United States' global leadership in nuclear energy.

II. STATE OF THE DOMESTIC URANIUM MINING AND CONVERSION INDUSTRY

The U.S. Department of the Interior defines uranium as a critical mineral "**essential to the economic and national security of the United States, the supply chain of which is vulnerable to disruption, and that serves an essential function in the manufacturing of a product, the absence of which would have significant consequences for the economy or national security**." Uranium is a critical component to ensuring a global nuclear deterrent, powering the ships and submarines of the world's largest nuclear navy, and providing the fuel for the world's largest

nuclear power program. Nuclear energy provides 20 percent of our electricity and 55 percent of our carbon-free power, bolstering clean air initiatives across the country.

The U.S. was once a global leader in uranium production, producing more than 40 million pounds annually in the early 1980s at a time when the domestic industry employed more than 21,000 Americans. Despite the existence of vast uranium resources in the United States, the lack of commercial purchasing of domestic uranium has driven production and employment to historic lows not seen since the dawn of the industry. U.S. uranium production in 2019 fell to 174,000 pounds, the lowest amount since the U.S. Energy Information Administration (EIA) began collecting this data in 1949. This is only a fraction of the material needed to power even one of the United States' 95 commercial nuclear reactors. In the first quarter of 2020, the EIA reports just over 8,000 pounds of uranium production, and all of that from four production facilities in Wyoming. In November 2017, the sole uranium conversion facility in the U.S. suspended its operations.

As the domestic industry has been forced to downsize its staffing, we have lost considerable talent and expertise that will become increasingly difficult to replace. Operating these facilities requires trained, experienced, and skilled engineers, geologists, scientists, technicians and operators. Several of these facilities are located in economically challenged regions. However, EIA reports that the total employment in the uranium mining and milling industry contracted by 29% in 2019 from 2018, and total employment fell by over 83% between 2008 and 2019.[1]

III. STATE-OWNED ENTITIES THREATEN U.S. NUCLEAR FUEL CYCLE CAPABILITIES

The uranium mining and conversion industry is on the verge of disappearing largely due to price-insensitive material from state-owned entities (SOEs). Left unchecked, we are placing

[1] 2019 Domestic Uranium Production Report, EIA May 2020, Table 6

our clean energy future in the hands of countries not aligned with the United States or our economic interests. Of immediate concern for the U.S. domestic industry is uranium imported from the countries of the Former Soviet Union (FSU) – Russia, Kazakhstan and Uzbekistan. In response to adverse market conditions, U.S. mine production of uranium dropped more than 95 percent between 2010 and 2019. This was not the case from SOEs; they ignored the market, increased their total supply, and further suppressed prices. In addition, the SOEs engage in predatory pricing designed to drive competition out of a market. SOEs take advantage of free market systems and are more concerned about increasing market share than profitability. U.S. companies are not competing with free market companies in the FSU; we are competing with their governments. Displacing U.S. supply, imports from SOEs in Russia, Kazakhstan and Uzbekistan have averaged over 40 percent of U.S. commercial reactor requirements since 2010. As of 2019, uranium imports from the FSU climbed to over 47 percent of U.S. reactor demand, the highest percentage over the last decade.[2]

Unfortunately, the expiration of the Russian Suspension Agreement (RSA) at the end of 2020 will exacerbate an already untenable situation. The RSA has imposed modest limits on Russian uranium imports since 1992, but its expiration altogether will open the floodgates for Russian uranium product. Russia has announced plans to significantly increase its U.S. market share after the agreement expires, hastening the demise of the domestic uranium industry. Depending on Russia for the uranium needed to power U.S. nuclear reactors is not a prudent strategy for U.S. security or energy interests given Russia's track record of using energy resources as an economic and political weapon. It is naïve to believe that Russia would not use its uranium supply and that of its allies to employ the same tactics against the U.S. The UPA supports the

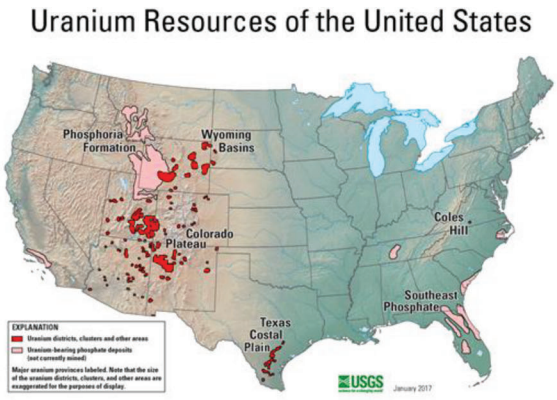
[2] EIA Uranium Marketing Annual Reports - Tables 3 and 18

Department of Commerce's efforts to renegotiate the RSA to reduce our reliance on Russian uranium products and provide additional protections for the domestic industry. The UPA also supports the bipartisan effort underway to enact a statutory backstop should Russia fail to agree to acceptable terms.

Chinese SOEs have also announced plans to expand their presence in the U.S. nuclear market. Chinese entities own large inventories and subsidize large uranium mines that are expanding production, despite having costs that are far above the current market price of uranium. China is also dramatically expanding its uranium enrichment capabilities, despite a glut in that market. Expanding enriched uranium imports, which contain natural uranium, would be a further displacement of the U.S. uranium supply.

The good news is that given a level global playing field, the domestic uranium industry has the capacity to produce significant quantities of uranium on a cost-competitive basis. According to the EIA, currently licensed/partially licensed operating and standby in situ recovery production capacity is about 22 million pounds of uranium concentrate production per year. Licensed conventional mill capacity equates to approximately 24 million pounds of uranium concentrate production per year. This annual capacity of 46 million pounds is almost the same amount of the average amount of uranium loaded into U.S. reactors from 2010-2019 (46.6 million pounds).[3] There are also significant uranium resources for the future. The U.S. Geological Survey reports that the U.S. holds approximately 1.2 billion pounds known, reasonably assured, and inferred resources, and that it has more than three times that amount in prognosticated undiscovered resources.[4]

[3] EIA Uranium Marketing Annual Reports – Table 18
[4] Critical Analysis of World Uranium Resources, U.S. Dept. of Interior, U.S. Geological Survey, Susan Hall and Margaret Coleman, 2012



IV. THE NEED FOR THE STRATEGIC URANIUM RESERVE: STRENGTHENING THE U.S. NUCLEAR FUEL SUPPLY CHAIN

In response to the Department of Commerce's finding that uranium imports from SOEs are a threat to national security, in July 2019 the White House established the Nuclear Fuel Working Group ("NFWG").[5] The NFWG determined that "America is on the brink of losing its ability to provide U.S.-origin nuclear fuel, threatening our national interest and national security."[6] The NFWG further stated that "[t]his reality threatens American energy security, narrows or eliminates foreign policy options and erodes American international influence to set strong non-proliferation, safety and security standards … Russia – a nation that has 'weaponized' its energy supply as an instrument of coercion – dominates nuclear markets."[7] As noted in a recent op-ed by U.S. Secretary of Energy Dan Brouillette:

> [a]fter decades of neglect, the commercial nuclear sector is at risk of insolvency. Meanwhile, other nations, notably Russia and China, are

[5] The White House Memorandum on the Effect of Uranium Imports on the National Security and Establishment of the United States Nuclear Fuel Work Group (July 12, 2019).
[6] Restoring America's Competitive Nuclear Energy Advantage: A strategy to assure U.S. National Security at 6 (Department of Energy, April 23, 2020).
[7] Ibid at 6.

> moving to advance their nuclear capabilities and export their technology to gain increased geopolitical influence. If we are able to regain our place as a world leader in nuclear technology, we must start at the beginning of the nuclear fuel cycle and start mining and converting uranium on a wide scale again.[8]

In order to counter the threat of uranium SOEs and provide immediate support to the domestic mining and conversion industries identified by the NFWG as at immediate risk, the NFWG proposes to establish a Uranium Reserve.[9] The UPA supports Section 402 of the *American Nuclear Infrastructure Act of 2020* ("ANIA"), which would codify the Uranium Reserve and ensure availability of uranium in the event of a market disruption and support strategic U.S. fuel cycle capabilities. Grounded in the Secretary of Energy's existing authority under sections 53, 63, and 161(g) of the Atomic Energy Act of 1954 to procure uranium product, Section 402 would require the Secretary of Energy to issue a Request for Information on the design of the program and account for its funding in the annual budgeting process. This is consistent with the NFWG's recommendations and the Department of Energy's existing authority and plans for formation of the Uranium Reserve.

V. PRESERVING NUCLEAR ENERGY GENERATION AND SUPPORTING A CLEAN ENERGY FUTURE

The UPA strongly supports the preservation of the U.S. commercial reactor fleet, a vital source of carbon-free, baseload power for the electrical grid. Section 301 of ANIA would provide incentives to prevent the premature shutdown of nuclear power facilities and associated increases in carbon emissions. We appreciate that Section 301 would require the Environmental Protection Agency to, in the course of certifying eligible facilities, prioritize those that use nuclear fuel mined, converted, enriched, and fabricated in the United States. Given the imminent risks facing the

[8] *See* Dan Brouillette, "A Safe, Prosperous Nation Requires Secure Supply Chains," The Hill, July 27, 2020.
[9] Restoring America's Competitive Nuclear Energy Advantage at 15-16.

domestic mining and conversion industries, we urge the committee to consider strengthening this requirement to ensure that facilities receiving taxpayer funds procure U.S.-mined and -converted material to the maximum extent practicable. This will ensure that Section 301 supports both the viability of the domestic fleet and a stable domestic supply chain for nuclear fuel that will be needed now and into the future.

We applaud the comprehensive framework laid out by ANIA to preserve today's nuclear infrastructure and supply chain, while also advancing a clean, reliable, and safe energy future for the U.S. in the form of advanced nuclear energy technologies. We look forward to working with Committee to improve and advance ANIA through the legislative process.

Senate Committee on Environment and Public Works
Hearing entitled, *"Hearing to Examine a Discussion Draft Bill, S.____, American Nuclear Infrastructure Act of 2020."*
August 5, 2020
Questions for the Record for Paul Goranson

Chairman Barrasso:

1. The Nuclear Regulatory Commission (NRC) and Environmental Protection Agency (EPA) recently signed a Memorandum of Understanding (MOU) to establish the respective roles and statutory responsibilities for the regulation of in-situ recovery (ISR) uranium production facilities.
    a. How will this MOU make the regulation of ISR facilities more predictable and affordable, while maintaining necessary environmental safeguard standards?

The implementation of the above referenced MOU is key to assuring regulatory certainty for UPA members. We agree with the Nuclear Regulatory Commission (NRC) staff's conclusion that the NRC's current regulations and those of Agreement States, as supplemented by site-specific license conditions, guidance documents, and the expertise of regulatory staff, "constitute a comprehensive and effective regulatory program" for uranium in situ recovery (ISR).[1] The NRC and Environmental Protection Agency' (EPA) MOU will help clarify the roles and responsibilities of each agency in regards to ISR. While the Uranium Mill Tailings Radiation Control Act (UMTRCA) gives the EPA authority to set generally applicable standards for uranium processing, the MOU helps clarify that the NRC is the primary regulator of ISR and is responsible for implementing and enforcing the standards, including setting the specific implementation requirements.

During the period between 2005 and 2016, some UPA members were in the process of licensing new uranium recovery facilities under NRC and Agreement States' regulatory program. During that licensing effort, the regulatory uncertainty that existed prior to the issuance of the MOU – primarily from EPA overreach in areas normally considered within NRC or Agreement State's jurisdiction – caused extremely costly delays and missed economic opportunities as markets changed. This MOU addresses that uncertainty by establishing clear roles and responsibilities. This clarification of roles and responsibilities under UMTRCA will create a more efficient licensing process that assures environmental and health standards are maintained in a predictable and effective manner.

    b. What can Congress do to further improve the regulation of NRC-licensed ISR facilities?

The MOU reinforces the UMTRCA's delineation of jurisdictional boundaries between the EPA and the NRC/Agreement States: EPA is authorized to set standards, while NRC and the Agreement States have implementation and enforcement authority. Despite this fact, the EPA in 2015 and again in 2017 proposed rules to exceed its authority under the UMTRCA. While this

[1] U.S. Nuclear Regulatory Commission staff's comments on the U.S. Environmental Protection Agency's proposed rulemaking for 40 CFR Part 192.

rulemaking effort was ultimately withdrawn, Congress should codify the MOU to prevent any future efforts by the EPA to exceed its statutory authority, whether through rulemaking or other means.

2. The statutory restriction that limits imports of Russian uranium, known as the Domenici Amendment, is set to expire at the end of 2020. What risk does Russia pose to America's uranium production and nuclear fuel supply chain if these limits are not extended?

The International Trade Commission (ITC) has conducted several sunset reviews of the Russian Suspension Agreement (RSA), and in every one of those sunset reviews the ITC has consistently presented its findings in a manner consistent to that stated in the most recent sunset review, "[…] we find that termination of the suspended investigation would likely lead to significant underselling of the domestic like product by subject imports, as well as likely significant price depression or suppression, within a reasonably foreseeable time."[2] This finding is further supported by the Commerce Department's Post Preliminary Analysis Memorandum in the 2017-2018 Administrative Review of the Agreement Suspending the Antidumping Investigation on Uranium from the Russian Federation, concluding, "[…] we preliminarily find, therefore, that absent a reversal of the pending termination of the Agreement and underlying investigation, the level of contracting during the life of the Agreement for post-2020 deliveries will contribute to the inability of the current Agreement to prevent the suppression and undercutting of domestic price levels."[3]

The following quote is found in the report prepared by the President's Nuclear Fuel Working Group (NFWG) titled *Restoring America's Competitive Nuclear Advantage*: "The ability of foreign state-owned enterprises to utilize the nuclear fuel cycle to establish dominant market positions and enduring bilateral relationships can pose significant geopolitical challenges for the United States."[4] Further, the Nuclear Fuel Working Group (NFWG) recommends that the Department of Commerce negotiate an extension of the RSA with the objective of limiting and further reducing quantities of Russian uranium.

However, as was the case in 2008 when the extension of the RSA was enacted upon a bilateral agreement between Russia and the U.S., the 2008 Domenici Amendment codified the limits on Russian imports to establish a statutory backstop to ensure enforceable limits on Russian exports and protections of the domestic uranium industry in the event of a lapse of the RSA. Whether the Commerce Department is successful or not, it is important that Congress establish limits on imports of Russian uranium beyond the current statutory termination date at the end of calendar year 2020. As the ITC and the NFWG have concluded, without limits on imports of Russian uranium, harm to the domestic uranium industry will continue. Further, unlimited access to the U.S. nuclear fuel market by Russia's state-owned enterprises risks increasing U.S. dependency

[2] Publication 4727, Uranium from Russia, Investigation No. 731-TA-539-C (Fourth Review), International Trade Commission, September 2017

[3] Post Preliminary Analysis Memorandum in the 2017 – 2018 Administrative Review of the Agreement Suspending the Antidumping Investigation on Uranium from the Russian Federation, Joseph A. Laroski Jr., U.S. Department of Commerce, June 17, 2020

[4] Restoring America's Competitive Nuclear Energy Advantage; A strategy to assure U.S. national security, U.S. Department of Energy, April 2020

on supply of a critical fuel necessary for generating carbon free energy from a strategic competitor that has worked against America's foreign policy objectives.

Allowing Russia the unlimited ability to import uranium into the U.S. will create nuclear fuel market conditions that will lead to U.S. nuclear utilities further increasing their reliance on imports from the Former Soviet Union, as Russian state-owned and influenced companies would continue dumping subsidized uranium on the global free market, suppressing prices in order to grab market share. This would be an existential threat to the domestic uranium mining, conversion, and enrichment segments of the domestic nuclear fuel cycle. The loss of this capacity would create a significant gap in the ability to replace the finite and diminishing stockpile of non-obligated U.S. origin uranium necessary for national security requirements before the need arises. It also would create U.S. reliance on Russian energy that Congress, and the Administration has urged other countries to avoid. For instance, Nordstream 2 is not the only example of Russia weaponizing its energy resources. The United States must not allow Russia to pair unfair energy trade practices with its foreign policy goals that are directly averse to American interests. Congress acting to codify the extension of limits on Russian uranium imports is necessary for the establishment of long-term protection of America's energy and national security and economic interests.

3. China is currently acquiring financial interests in uranium reserves around the world. What is the threat posed by China's long-term acquisitions of global uranium resources?

The United States is already experiencing an incursion of Chinese subsidized uranium into our domestic clean nuclear power generation. Data from the International Trade Commission (ITC) show that imports of enriched uranium from China have been occurring since 2015.[5] While it is a relatively small amount of material compared to what is imported from the Former Soviet Union, U.S. nuclear utilities spent more than $200 million on Chinese enriched uranium. That is more than the unfulfilled budget request from the Department of Energy (DOE) to begin purchasing uranium to establish the domestic uranium reserve. It seems the only thing that stemmed the tide of incoming uranium from China was the 301 tariffs imposed broadly on products from China.

However, those tariffs do not apply to mines outside of China where the communist party has taken a financial interest. The threat of the Chinese strategy of acquiring vast uranium reserves around the world is reminiscent of the other successful efforts to take control of critical supply chains, such as rare earth elements. China "Belt and Road" initiative has led it to acquire and control interests in large uranium mines in Africa and Greenland, thereby effectively removing these potential free-market sources of uranium from the market. The western nuclear fuel supply chain, including America's nuclear power plants, have and continue to rely on those mines as a source of supply. Using its state-owned enterprises, China not only controls significant portions of global uranium mines and resources, it is also able to leverage its growing nuclear energy and nuclear fuel programs to control markets in manner similar to the way Russia has weaponized its state-owned nuclear industry.

[5] Imports of Uranium Products from China (Customs Value), U.S. International Trade Commission, 2020

The result of China's initiative is the dumping of more state-owned and subsidized uranium on the global market at prices no market sensitive competitor, such as UPA's members, can sustain. As the NFWG concluded, the loss of nuclear leadership to Russia and China is a national security threat, and an imminent one at that.

Senator Sanders:

4. As you know, Section 402 of the American Nuclear Infrastructure Act discussion draft establishes a taxpayer-funded strategic uranium reserve that effectively creates a bailout for your company. In your testimony, you stated that you support this provision because the American uranium industry is "on the verge of disappearing."

   However, in June, you noted your company's strong balance sheet, stating that Energy Fuels currently has around $50 million in cash, working capital, and inventory. Additionally, according to the Energy Information Administration, only five companies produced uranium from seven domestic facilities in 2018. None are based in the United States. U.S. uranium producers do not pay federal reclamation fees or royalties on uranium mining activities, and in many cases have left taxpayers with the financial burdens of cleaning up the toxic byproducts of uranium mining.

   Given that, by your own estimation, American uranium producers like Energy Fuels are nowhere close to disappearing, and that the American taxpayers are already significantly subsidizing the uranium production industry by paying for the costs of cleanup, would you like to amend your statement of support for nuclear industry bailouts?

The uranium reserve results from a highly deliberative, interagency process investigating the state of the domestic nuclear fuel supply chain, not only for national security requirements, but also for energy security requirements to support the largest contributor of carbon-free electricity generation – the commercial nuclear fleet. In its conclusion, the NFWG found significant gaps in the domestic nuclear fuel supply chain that not only threaten America's clean energy generation, but also national security. The loss of a reliable and functional domestic nuclear supply chain has forced the U.S. to be almost 100% dependent on imported nuclear fuel, and more alarming, the NFWG determined that America's strategic competitors, including Russia and China and their state owned enterprises, benefitted the most from America's loss of its own nuclear fuel cycle. The NFWG identified, among several of other items, that creation of a uranium reserve would create an immediate demand for U.S. uranium and conversion services to restart a mere portion of the overall industry to prevent the imminent collapse of the domestic industry, loss of jobs, and the decision to decommission key domestic nuclear fuel facilities. To replace these facilities, once decommissioned, will take significant time and enormous finances. The uranium reserve will ensure the availability of these facilities in the event of disruptions in the global supply chain and ultimately, to fulfill the requirement for unobligated U.S. origin uranium for national security needs.

The characterization of the companies that own and operate the domestic facilities as non-U.S. is incorrect. For example, Energy Fuels is a domestic issuer under U.S. Securities and Exchange

laws and regulations, the majority of its ownership (approximately 70% at last count) is U.S. citizens and entities, 100% of its properties, assets, operations and workforce are located in the U.S., and its headquarters are located in Lakewood, Colorado with its executive management team composed entirely of U.S. citizens. Also, in southeast Utah, at its uranium mill, approximately half of the workforce is Native American.

The characterization of the domestic industry as subsidized by American taxpayers is also incorrect. In addition to paying annual claims maintenance fees that are intended to offset the cost to the taxpayer for the federal regulatory oversite, under current Bureau of Land Management (BLM) and U.S. Forest Service (USFS) regulations, there are stringent environmental and safety regulatory requirements that also require that 100% of the future and current reclamation costs are fully funded prior to mining. Given that the mining company must pay the claims maintenance fees and fully fund reclamation costs prior to mining, there is no place where the mining company receives a direct or in-kind subsidy from the American taxpayer.

The cleanup of former mines referenced in the question are not related to the uranium mining companies that exist today. These are the result of legacy of federal programs from the 1950's and 1960's, during the Cold War, when uranium mining was sponsored by the U.S. government. Today's uranium industry is subject to an array of modern federal and state laws and regulations that assure worker safety, public health, and environmental protection. The cleanup of legacy sites are currently being managed by DOE under its Defense Related Uranium Mine ("DRUM") program and by EPA under its existing authority that is fully funded by former mining companies through cleanup settlements authorized under CERCLA. The latter CERCLA action relates to the cleanup of abandoned uranium mines on the Navajo Nation. Therefore, at this time no taxpayer funds are used for the abandoned uranium mine cleanup other than those directly related to DRUM from the '50's and '60's. UPA members, including Energy Fuels, are seeking to become partners with the U.S. government and Navajo Nation on cleanup projects, and there is additional untapped capacity to work with our members in our mutual goals of protecting our citizens and providing reliable clean energy.

Senator Whitehouse:

5. It's a danger and a liability to have nuclear waste stored at our facilities. There is value to finding a way to solve that problem. As we embark on nuclear innovation, how can we make sure that the innovators see the value of pursuing advanced nuclear technologies that re-use spent nuclear fuel?

The UPA represents the uranium mining and conversion industries that represent the front-end of the nuclear fuel cycle. Our members are not involved in the handling of spent fuel. To the best of my knowledge, work is needed to improve the economic viability of reprocessing spent nuclear fuel. Congress might consider policies to encourage the innovation necessary to pursue advanced nuclear technologies that re-use spent nuclear fuel.

6. The 45Q tax credit provides a carbon payment for avoided emissions from carbon capture projects. A provision included in this draft bill would translate this idea for the existing nuclear fleet. Right now, our nuclear reactors are not compensated for their carbon free power and many are being prematurely retired and replaced with fossil fuels.

    - Do you support the inclusion of this existing nuclear credit program?

As I stated in my oral testimony and provided in UPA's written statement, we support Section 301 of ANIA wholeheartedly. A financially healthy nuclear fleet that is recognized for their carbon free power is necessary for the U.S. to meet its clean air energy objectives and to preserve a fleet that has demonstrated reliable and safe generation of carbon-free and emission-free electricity. This fleet would be difficult and expensive to replace.

- Do you have suggestions on how we could improve the provision?

We appreciate that Section 301 would require the Environmental Protection Agency to, while certifying eligible facilities, prioritize those that use nuclear fuel mined, converted, enriched, and fabricated in the United States. Given the imminent risks facing the domestic mining and conversion industries, we urge the committee to consider strengthening this requirement to ensure that facilities receiving taxpayer funds procure U.S.-mined and -converted material to the maximum extent practicable. This will ensure that Section 301 supports both the viability of the domestic fleet and a stable domestic supply chain for nuclear fuel that will be needed now and into the future.

7. This draft bill includes a new requirement that DOE report to Congress each year on the cumulative lifecycle costs to store, manage, and dispose of spent nuclear fuel. It also requires that DOE provide recommendations on how to better account for the lifecycle costs of the nation's nuclear waste stockpile.

    - What can Congress do to improve the financial accounting of nation's spent nuclear fuel?

As provided in my oral testimony, the UPA supports ANIA, including Section 502, *Annual report on the nuclear waste stockpile in the United States*.

Senator Van Hollen:

8. Given the proliferation risks of using HALEU fuel and plutonium-based fuel for advanced nuclear reactors, do you believe that it is necessary to require that foreign countries have in place an Additional Protocol with the International Atomic Energy (IAEA) as a precondition for the purchase of such technologies?

UPA's members that produce and convert natural uranium for use in nuclear reactors in the U.S. are subject to Additional Protocols with the IAEA as reported through the NRC. According to IAEA, as of October 2019, 136 countries, including Euratom, have signed onto the Additional Protocols, including some of the U.S.'s largest trading partners in nuclear fuel.

9. Would requiring U.S. manufacturers of advanced nuclear reactors and associated fuel cycle facilities incorporate "safeguards-by-design" features, as defined by the IAEA, in the design and operations of their facilities make advanced nuclear technologies more proliferation-resistant and increase the competitiveness of U.S. manufacturers in the international nuclear market?

UPA members are not involved in the design or manufacture of advanced reactors.

10. According to a 2018 GAO report, the NNSA has a sufficient supply of unobligated low-enriched uranium to produce tritium gas for our nuclear weapons program until at least 2041. The NNSA has also indicated that it has enough stockpiled HEU for naval reactors to last until 2060. For defense needs, how urgent and necessary is establishing a domestic uranium reserve?

On May 22, 2018, in testimony to the House Energy and Commerce Committee, Principal Deputy Assistant Secretary for the DOE's Office of Nuclear Energy Edward McGinnis described our nation's stockpile of HEU as "finite and diminishing." In its October 2015 Report to Congress titled "Tritium and Enriched Uranium Management Plan Through 2060,"[6] the DOE projected that without implementation of other options, the unobligated LEU fuel stockpile for tritium production will be consumed by 2027, and HEU inventories currently used to meet nondefense national priority missions will be exhausted as early as 2025. DOE announced on August 23, 2018 that a portion of the nation's HEU stockpile will now be down-blended in order to address the relatively near-term shortfall of LEU to produce tritium. According to an October 2018 article published by the Federation of American Scientists, the quantity of HEU transferred for down-blending for tritium use is estimated to be 160 MT.[7] That HEU would likely come from the stockpile set aside to assure naval reactor fuel through 2060 as stated in the 2015 report. While the exact defense needs and quantities for unobligated uranium is classified, it is likely that the 2060 date has been moved up substantially due to additional requirements. HEU is a costly, and currently irreplaceable, commodity that is vital to national security, and right now, the U.S. has no means for replacing that usage, now or in the foreseeable future.

In its report titled *Restoring America's Competitive Nuclear Energy Advantage* the NFWG recommends the following procurement strategy:

- *Mined and milled uranium estimated between 17 and 19 million pounds in the form of U3O8, beginning in 2020;*
- *Domestic conversion services resulting in about 6,000 to 7,500 tons of UF6, beginning no later than 2022; and*
- *Domestic enrichment services beginning possibly in the 2023 timeframe, of which 25% would be unobligated.*

[6] Tritium and Enriched Uranium Management Plan Through 2016; Report to Congress, U.S. Department of Energy, October 2015

[7] "DOE Declassifies Declassification of Downblending Move", Secrecy News, S. Aftergood, Federation of American Scientists, October 18, 2018

Currently, the U.S. has no means for producing unobligated enriched uranium necessary for defense needs to replace the stockpile. More urgently, with the front end of the nuclear fuel cycle on the verge of disappearing, the Nuclear Fuel Working Group identified that it was necessary to sustain, at least a portion of existing uranium mining and conversion capacity to produce U.S. origin natural uranium necessary to feed future unobligated enrichment capacity for defense needs. The Nuclear Fuel Working Group recommendations recognize that relying on a "finite" stockpile used for multiple priority defense and non-defense missions is not sustainable for future national security needs, and capacity, infrastructure, and trained workforces exist now and can be preserved for future defense needs.

11. The United States currently has minimal uranium conversion capabilities, with the only domestic conversion plant sitting idle since 2017. Therefore, would DOE and U.S. commercial entities have to rely on foreign entities to convert uranium from the domestic reserve?

According to the NFWG report, the uranium reserve would require up to 6,000 to 7,500 tons of UF6 in conversion services. The intent is for those conversion services to be produced domestically, and the purchased volume would represent the minimum necessary to create demand to allow the restart of the domestic conversion facility.

12. What are the market implications of establishing a uranium reserve when there's an international supply glut of uranium in the international market and uranium prices remain low?

The market impacts are expected to be minimal. The purchases of uranium for the uranium reserve will be placing a demand on production capacity that is currently idled. Additionally, the uranium purchased for the uranium reserve would be "off-market" transactions and would not influence current market conditions. These off-market transactions would not directly remove or supply uranium into the global market, because U.S. uranium production has essentially been idled.

13. At what price would DOE have to purchase uranium from U.S. mining companies to fill the uranium reserve for the domestic production of uranium to be cost-effective and economically viable?

As I stated in my oral testimony, where there is a market that is not overly influenced by the price suppressive practices caused by state-owned enterprises, it is UPA's belief that the cost of production in the U.S. is competitive with most other free market, western uranium production.

The U.S. was once a global uranium production leader and net exporter of uranium, producing more than 40 million pounds annually in the early 1980s at a time when the domestic industry employed more than 21,000 Americans. In 2019, the Energy Information Administration (EIA) estimates that we will mine less uranium in the U.S. than is enough to run even one of our country's 94 commercial nuclear reactors.[8] With current domestic uranium production and employment at historic lows, the United States is nearly completely dependent on other counties

[8] 2019 Domestic Uranium Production Report, U.S. Energy Information Administration, May 2020

to meet its nuclear power needs and we risk losing a key source of future supply for America's defense programs. Completely rebuilding the uranium industry would take decades.

EIA data still shows a tremendous amount of uranium production capacity from U.S. facilities. But the industry cannot survive and maintain this capacity under the current conditions, under which U.S. production may disappear altogether while Russia and China work to expand their influence in the global market.

DOE, through its predecessor agency U.S. Atomic Energy Commission, has a history of uranium purchases as recently as 1982. In fact, from 1961 to 1971, the DOE purchased over 250 million pounds of uranium at market prices from domestic miners.[9] On its website, DOE describes its expected strategy for purchasing uranium.

> *"Under the Uranium Reserve program, NE would buy uranium directly from domestic mines and contract for uranium conversion services. The new stockpile is expected to support the operation of at least two U.S. uranium mines, reestablish active conversion capabilities, and ensure a backup supply of uranium for nuclear power operators in the event of a market disruption.*
>
> *NE will initiate a competitive procurement process for establishing the Uranium Reserve program within the next year. Additional support will be considered over a 10-year period as market conditions evolve, including consideration of enrichment needs after first addressing the very near-term pressure on the uranium mining and conversion sub-sectors."*

https://www.energy.gov/ne/articles/building-uranium-reserve-first-step-preserving-us-nuclear-fuel-cycle

[9] Summary History of Domestic Uranium Procurement under U.S. Atomic Energy Commission Contracts – Final Report, Albrethsen and McGinley, U.S. Department of Energy, September 1982

Senator BARRASSO. Well, thank you so much for your testimony.

We will get to questions in a few moments, but first, we will go ahead to Boston, where Mr. Armond Cohen, Executive Director of the Clean Air Task Force, is joining us via Webex.

Mr. Cohen, welcome to the Committee, and please proceed.

STATEMENT OF ARMOND COHEN,
EXECUTIVE DIRECTOR, CLEAN AIR TASK FORCE

Mr. COHEN. Thank you very much, Mr. Chairman, and thank you for letting me participate remotely.

Mr. Chairman, Ranking Member Carper, members of the Committee, I appreciate the opportunity to engage this morning. I want to especially thank Senator Whitehouse for his acknowledgement of our past work together, forging an agreement among consumers, environmentalists, and industry around what was then a very novel approach to conservation in the utility sector.

I think that is an interesting model for what we can do on nuclear. The challenges are different than they were when Senator Whitehouse and I worked together years ago, but I think that the process could be the same. I think there is a huge center of gravity around moving this option forward.

So, as an environmentalist and a climate change fighter, why am I here? Because managing climate change is just a huge challenge. We have to achieve deep reductions in carbon emissions by mid-century.

It is not just electricity, which we usually focus on, but it is the rest of the system, which is 75 percent of total consumption, from transport, industry, and building heat.

All of the work that we have done and that many other groups have done has suggested that we need to maximize our options to achieve success. So we support rapid expansion of renewables, like wind and solar, development of other renewable resources like advanced geothermal as well as nuclear energy and carbon capture and storage, which can help complement the suite of zero-carbon resources.

Nuclear energy has some distinct contributions to make to this if we can get it right. First of all, it is where most of our current zero-carbon electricity comes from, as was noted by the Chairman at the outset.

Its major advantage, maybe its first major advantage, is that it is always on. Having an always on, always available, zero-carbon source to complement variable renewables that are weather dependent, most studies have shown, can substantially reduce the cost of a zero-carbon grid by reducing the need for redundant renewable capacity and expensive storage.

Second, it is very power dense, a lot of energy per square kilometer. Minimizing infrastructure footprints can be a key asset because infrastructure is not easy to build, and we need to increase our total amount of carbon-free energy at about 5 to 10 times the rate that we ever have historically.

Finally, because of its power density, it is also quickly scalable, at least when we are able to build standardized designs. For example, France substantially decarbonized its grid in 15 years, mainly with nuclear.

Nuclear also has some distinct advantages regarding its ability to produce zero-carbon hydrogen, which we may get to later, which will be necessary for the things we can't electrify.

But if we are going to replicate those past successes, we are going to need to make a lot of changes in the way we do nuclear, reducing costs, and improving delivery times. Some of this can be done with existing light water technology, but some of the advanced reactor designs will provide some distinct advantages in terms of lower costs, ability to standardize, faster to go from order to operation, lower material inputs, and so forth.

With that in mind, there is a lot to like in this draft bill that would advance those objectives. I will mention a few.

First of all, we very much like the notion of incentives for continued operation of the existing fleet. That will keep carbon out of the atmosphere during our transition and keep the infrastructure in place to build on.

Second, getting the NRC to think ahead on permitting for non-electric applications in places like the industrial sector and other novel applications. We like the provisions that allow for more international cooperation with trusted allies in the areas of harmonized licensing and joint investment and domestic plants, front running the regulatory issues related to use in advanced manufacturing, and so on. We provided staff with detailed comments to refine and enhance some of these provisions.

Before I close, though, I do want to echo Senator Carper in expressing our concern regarding the Section 201 and 203 permit and streamlining provisions. Our view is that the NRC currently has a very strong mandate from the Nuclear Energy and Innovation Modernization Act, as well as the environmental review provisions of the Fixing America's Surface Transportation Act of 2015, which streamlined environmental review. We think those provisions should be given a chance to work before we contemplate other major efforts in this area.

I agree with previous comments that nothing could be more damaging to a relaunch of this industry than a perception that environmental safeguards have been specially trimmed. Nuclear energy can be safe, but it also has to be perceived to be safe, and maintaining strong environmental permitting review would be important to public confidence.

There are several other provisions in this draft which I have noted in my testimony which I believe may be unnecessary or counterproductive, and we can get into that, but that was the major one.

That said, we applaud the efforts of the Chairman, Ranking Member, and other members of this effort to move forward with modernization of this important technology to make it relevant to the extremely daunting challenge of managing climate change.

Thank you very much.

[The prepared statement of Mr. Cohen follows:]

Before the United States Senate Environment and Public Works Committee

Hearing on the Discussion Draft of S___, the Advanced Nuclear Infrastructure Act of 2020

Testimony of Armond Cohen, Executive Director, Clean Air Task Force

August 5, 2020

SUMMARY OF TESTIMONY

Decarbonizing America's economy by midcentury is a stiff challenge. We not only need to remake the 80% of America's energy supply (and 60% of electricity) that is powered by uncontrolled fossil fuels; we may need to double total electricity supply by 2050 to help decarbonize industry, transport and buildings.

Fortunately, we have several options to achieve that goal, especially in the electricity sector. We have made strong progress on wind and solar energy, which now supplies 3.6% of America's total annual energy, and 9% of our electricity. We have emerging potential renewable sources such as super hot rock geothermal. We have demonstrated carbon capture and storage that removes carbon from fossil fuel use either before (to make hydrogen) or after combustion, and there many innovative technologies on the horizon that could make those technologies less expensive. And finally, we have America's largest zero carbon source of electricity, nuclear energy, providing 20% of total electricity generation, but only 8% of total energy consumed.

The evidence suggests that nuclear energy can play an important role in our future economy, but there are many challenges to address, just as there are with all other zero carbon energy sources.

The advantages of nuclear energy are, first, that it is firm or "dispatchable," and not dependent on weather, allowing us to avoid very expensive energy storage to ride through the weeks and months when wind and sun are at low ebb in most regions of the country. Second, nuclear energy plants are very compact, taking up a hundred to a thousand times less space per unit energy produced than an equivalent amount of wind and solar at very high penetrations, and significantly less transmission capacity; high power density may be a valuable attribute in a nation where siting any energy facility is controversial. And because nuclear units produce so much power, we can build them quickly when conditions are right; France eliminated 80% of its grid carbon emissions in only two decades through a scale up of nuclear energy. Third, nuclear energy can provide carbon-free heat to displace fossil fuels in industrial processes and buildings, and to efficiently create hydrogen, a zero carbon fuel that can be combusted for electric power without carbon emissions in natural gas turbines and which will be needed for decarbonizing the industrial and transport sectors. While in theory we could provide 100% of our electricity and other fuels with renewable energy, that is a risky bet; more options are likely to increase our chance of success.

At the same time, nuclear energy faces many challenges. Foremost among these are the high cost and delays associated with recent American and European projects. However, high cost and delay are not inevitable, as best construction and project management practices and the building of standardized multiple units have shown elsewhere in the world. In addition, advanced reactor designs using different coolants and other innovations could lower costs even further. We must also address another triad of issues: waste disposal, weapons

nonproliferation, and public perception of safety. Some, but not all, of these issues, can be addressed through advanced reactor designs.

The Advanced Nuclear Infrastructure Act of 2020 would begin to address some of these challenges. In particular, provisions that would provide incentives to support continued operation of the current nuclear fleet and examine permitting for advanced nuclear in non-electric applications such as heat demands by heavy industry such as cement and steel are important as the world transitions to zero-carbon energy production. Beyond what is currently in this bill, I would urge this committee to do more to create incentives for using nuclear power to produce zero-carbon fuels such as hydrogen.

The discussion draft before this committee today is a start. However, this bill proposes some alterations to environmental permitting that this Committee must reconsider. These provisions are not necessary, and could even be damaging, to the future of the advanced nuclear industry. Additional streamlining of environmental regulations such as the National Environmental Protection Act is not helpful for the nuclear industry or for our goals for decarbonization. This Committee has already provided the framework necessary to move forward with more efficient advanced nuclear licensing and permitting – through the recently passed Nuclear Energy Innovation and Modernization Act of 2019 and until 2022 through the Fixing America's Surface Transportation Act of 2015. Because of the work of this Committee, the Nuclear Regulatory Commission now has a good framework in place for environmental review of advanced nuclear technologies and development. I would urge this Committee not to include additional provisions to streamline environmental review of nuclear projects in any legislation, but instead to let the implementation of the Nuclear Energy Innovation and Modernization Act of 2019 proceed. Clean Air Task Force recommends removing Section 201 and Section 203 of this legislation.

Additionally, Clean Air Task Force has recommended changes to this draft legislation that include but are not limited to:

- Give NRC the authority to deny the imports of fuels by foreign adversaries, through establishment of an import license program, instead of denying domestic licenses to possess fuel that are held by utilities (Section 102);
- Establish three prizes, one each for a light water advanced small modular reactor, a non-light water advanced modular reactor, and a microreactor (Section 202);
- Include study of the use of advanced reactors for repowering of existing fossil fueled generation facilities in the report requested by Congress on unique licensing issues and requirements (Section 204)
- Put a cap on the value of the credit that can be awarded to existing nuclear generation, or consider a reverse auction for funds (Section 301)

We applaud the Chairman for proposing legislation that included the following provisions, and look forward to continuing to work with all Members of this committee to find a way to move these provisions forward that will support advanced and existing nuclear power:

- A report to Congress on the unique licensing considerations relating to the use of nuclear energy for non-electric purposes, specifically industrial applications and production of zero-carbon fuels (Section 204)
- Preserving at-risk nuclear facilities through an incentive program that is transparent and prioritizes safety, while protecting taxpayers and ratepayers against unnecessary compensation for utilities (Section 301)
- A report to Congress on advanced manufacturing and construction for nuclear energy applications (Section 403)
- An annual report on the spent nuclear fuel and high-level radioactive waste inventory in the United States (Section 502)

As this Committee considers this draft legislation, I urge you not to compromise on safety. The Nuclear Regulatory Commission is in the best position to focus on its role as regulator for this industry. Only with a truly independent and strong regulator can we build the trust that will be necessary for a low carbon future that includes nuclear energy in the United States.

Finally, I'd like to offer some important steps that will be necessary for making nuclear a scalable option for future decarbonization:

- Preserve the existing nuclear fleet to lower emissions during the transition and preserve our knowledge and sites
- Create market demand for advanced nuclear through government support, as we did for wind and solar, to achieve scale, and reduce costs through learning-by-doing
- Support research and development for advanced nuclear, particularly focusing on innovative business models, load following, and zero carbon fuel production
- Continue our progress in vigilant but fit-for-purpose regulation that enables advanced reactor innovation and safety, including through support for international harmonization of nuclear safety regulation
- Resolve key nuclear waste challenges
- Revive a federal research program on low dose radiation health impacts

Chairman, Ranking Member, and Distinguished Members of the Committee:

My name is Armond Cohen and I am Executive Director of Clean Air Task Force, an environmental organization dedicated to the protection of Earth's atmosphere, with a strong focus on strategies to commercialize carbon-free energy. I appreciate the opportunity to testify today.

My testimony will first lay out the scale of the climate challenge and the value of nuclear energy to decarbonization. Then, after summarizing the important challenges associated with nuclear power, I will discuss how advanced nuclear energy could provide a solution. Finally, I will specifically provide comments on how this draft legislation does and does not help achieve those solutions.

I. The scale of the climate challenge and the options

Earth's atmosphere has more carbon dioxide than at any time in human experience, most of it added in the last half century. To preserve a natural world anything like we have known, we will likely need to build a 100% carbon-free energy economy by 2050, and then progressively withdraw some of the carbon we've put into the skies already. Achieving climate stabilization targets, as Figure 1 below shows, will require essentially zeroing out energy-related greenhouse emissions from all sectors of the economy around 2050. That means not just the electric sector, but also transportation, industry, buildings and agriculture. And we must accomplish this feat as global demand for energy could as much as double in the coming decades, as developing economies get richer. So, U.S. comprehensive climate legislation with the goal of zero-carbon emissions by midcentury must cover all of these sectors.

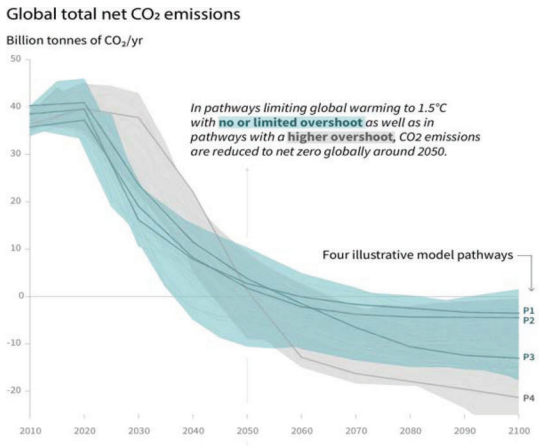


Figure 1: Pathways to limit global temperature to the Paris Agreement target of no more than 1.5 degree warming (Source: IPCC, Special Report: Global warming of 1.5^{0}C, 2018)

Although there are significant challenges, the pathway to a carbon-free economy is in concept straightforward: replacing existing greenhouse gas-emitting energy sources with zero-emitting resources and building additional zero-emitting resources to meet future growth. Eventually, we will also likely need to progressively withdraw some of the carbon we have put into the atmosphere already[1].

Decarbonizing America's economy by midcentury is a stiff challenge. We not only need to remake the 80% of America's energy supply (and 63% of electricity) that is powered by uncontrolled fossil fuels; we may need to double total electricity supply by 2050 to help decarbonize industry, transport and buildings.

I was honored in 2018 to be part of a group of authors who published an article in *Science* entitled "Net-zero emissions energy systems" which explored this challenge.[2] The key insight of that article is that it is best to think of a net-zero greenhouse gas emissions energy economy as a ***system*** of complementary and overlapping parts. These parts include zero-carbon electricity, fuels, storage, low-carbon industrial processes, and carbon capture and sequestration from

[1] This testimony addresses creating a carbon-free energy supply. It does not address energy efficiency improvements, carbon in agriculture, which represents roughly 25% of the greenhouse gas emissions problem, or carbon dioxide removal.

[2] Davis, Steven J., et al. "Net-zero emissions energy systems." *Science* 360.6396 (2018): eaas9793.

fossil fuel use. A greatly simplified schematic picture of such a system can be seen in Figure 2 below.

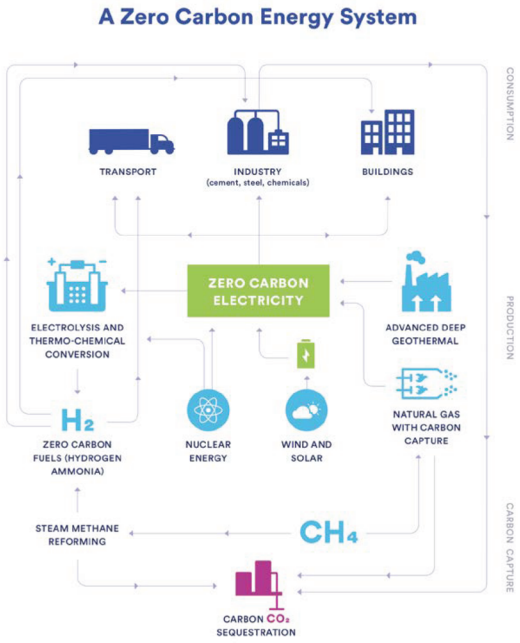


Figure 2: Schematic of a zero-carbon energy system (Source: Clean Air Task Force, 2019)

Building this zero carbon energy system is an enormous lift. Let's just take electricity. Figure 3 below shows the rate at which we will have to scale zero carbon electricity to decarbonize the grid by midcentury, assuming more electrification to decarbonize other sectors. To do so, we would need to build as much as 35 average Gigawatts per year every year from now until 2050. This is ***roughly five to ten times the rate*** at which we have ever deployed zero carbon technology.[3]

[3] And it is roughly three times the rate at which we deployed all generation technologies, predominantly gas, which are much faster and easier to site, in the 28 years from 1990 to 2018. See https://www.eia.gov/energyexplained/electricity/electricity-in-the-us-generation-capacity-and-sales.php

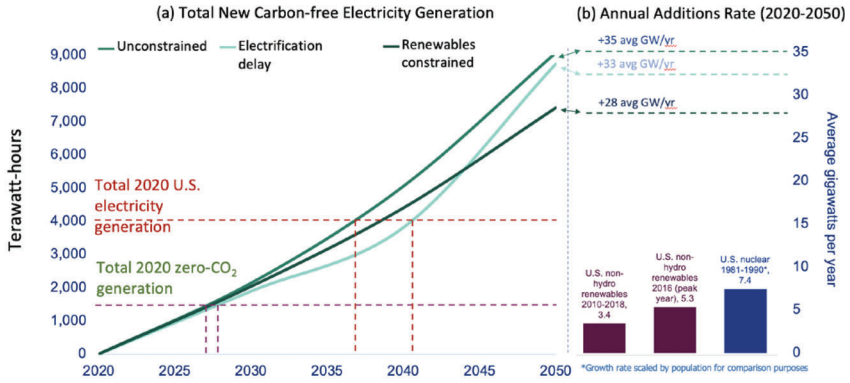


Figure 3: Scaling rates to decarbonize US electricity. Source: J. Jenkins, Princeton University , https://cpree.princeton.edu/sites/cpree2019/files/media/2020-02-010_-_wws_bradford_seminar_-_getting_to_zero.pdf

And that's just electricity, which represents about 40% of total American energy production and 33% of total US carbon dioxide emissions from fossil fuel burning. The other 60% of US energy is derived from oil, gas and coal for transportation, industrial process, and building heat. We need to decarbonize those sectors too. Some we can decarbonize with electricity, but many end uses will be difficult to electrify, especially heavy transport and high temperature heat in industry. For those, and perhaps for parts of the light duty transport and building sector, we'll need a zero carbon fuel, likely hydrogen-based. Today, we produce almost no zero carbon fuels for energy end uses.

Fortunately, we have several options to achieve the zero carbon goal, especially in the electricity sector. We have made strong progress on wind and solar energy, which now supplies 3.6% of America's total annual energy, and 9% of our electricity. We have emerging potential renewable energy sources such as super hot rock geothermal.[4] We have demonstrated carbon capture and storage that removes carbon from fossil fuel use either before (to make hydrogen) or after combustion, and there many innovative technologies on the horizon that will make those technologies less expensive.[5] And finally, we have America's largest zero carbon source of electricity, nuclear energy, providing roughly 20% of total US power consumption.

[4] See https://www.catf.us/resource/catf-eon-geothermal-workshop/

[5] See https://www.globalccsinstitute.com/resources/global-status-report/ and https://www.globalccsinstitute.com/wp-content/uploads/2019/08/Global-CCS-Institute_Response-to-the-National-Hydrogen-Strategy-Issues-Papers_July-2019-002.pdf

The question for this hearing is whether nuclear energy[6] can play a significant role in a future zero carbon economy. The evidence suggests it can, but there are many challenges to address, just as there are with all other zero carbon energy sources.

II. The value for multiple technological options to address climate change

A large literature has grown up in recent years on various paths to energy system decarbonization. There are some who contend that an energy system powered mostly if not exclusively by wind and solar energy is the most effective way forward, and that all other options such as nuclear and carbon capture are not worth pursuing. CATF has come to a different conclusion, based on our review of, and participation in, scores of studies of this issue addressing multiple pathways. This literature is concisely surveyed in a recent review of these studies.[7] The authors of that meta-study offer this assessment:

> Despite differing methods, scopes, and research questions, several consistent insights emerge from this literature... The literature outlines potentially feasible decarbonization solutions, but also clarifies several challenges that must be overcome along each path to a zero-carbon electricity system. In light of these challenges, and the considerable technological uncertainty facing us today, we conclude that a strategy that seeks to improve and expand the portfolio of available low-carbon resources, rather than restrict it, offers a greater likelihood of affordably achieving deep decarbonization.

Given the size of the climate problem and related energy system transformation task, and the consequences of failure to decarbonize in time, we face a very large risk management challenge. Every zero carbon energy technology has its challenges at large scale.[8] Nuclear energy, although it has scaled rapidly in the past, today faces challenges of cost and delivery time, as detailed later in this testimony. Carbon capture and storage is in its early commercial stages, and will be challenged by the task of siting the storage and pipeline network required. And wind and solar, while likely to be able to provide a majority of the power for future energy grids, at very large scale is likely to face both economic and siting challenges. All of these energy sources, at scale, in many geographies, face formidable opponents as well as supporters.

Portfolio theory and common sense suggests that reliance on any one pathway creates a higher risk of failure. This is illustrated through the simple generic example in Figure 4, where even an 80% chance of success in meeting each condition of deployment of a technology can result in a 50% probability of failure, which are very poor odds for climate mitigation. Creating more

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[6] In this testimony, I address only nuclear fission, and do not address fusion energy.

[7] See Jenkins, Jesse D., Max Luke, and Samuel Thernstrom. "Getting to Zero-carbon Emissions in the Electric Power Sector." *Joule* 2.12 (2018): 2498-2510.

[8] See Loftus, Peter J., et al. "A critical review of global decarbonization scenarios: what do they tell us about feasibility?" *Wiley Interdisciplinary Reviews: Climate Change* 6.1 (2015): 93-112.

options for zero carbon electricity, transport fuel, heat and industry will increase our chances of success.

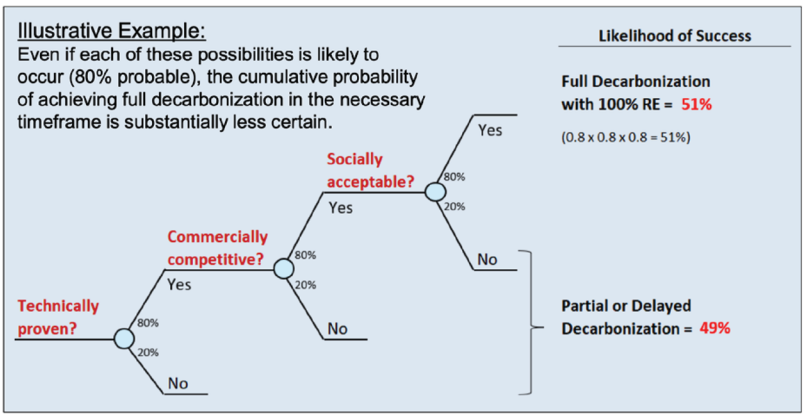

Figure 4: Risk of reliance on a single technology pathway to decarbonize. Illustration courtesy of Bruce Phillips, The Northbridge Group.

III. Some potential values of nuclear for decarbonization

The advantages of nuclear energy are, first, that it is firm or "dispatchable," and not dependent on weather, allowing us to avoid very expensive energy storage to ride through the weeks and months when wind and sun are at low ebb in most regions of the country; this value may be larger in less predictable future inevitably changed climate states. Second, nuclear energy plants are very compact, taking up a hundred to a thousand times less space per unit energy produced than other zero carbon energy forms, and significantly less transmission capacity; high power density may be a valuable attribute in a nation where siting any energy facility is controversial.

Scale and power density

Partly because of the enormous amount of energy that a nuclear power plant can provide per unit space, and the fact that nuclear energy plugs into existing grids quite easily without extensive modification, history has shown that nuclear energy can scale rapidly when policy is aligned to do so and there is a standard product available that can be built repeatedly. Figure 5 illustrates that nuclear energy has scaled quite rapidly in several countries.

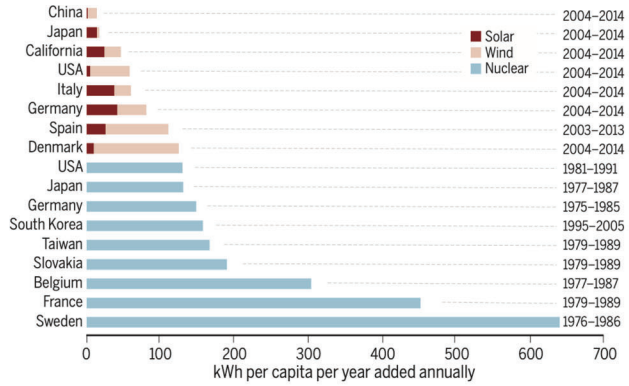

Figure 5: Average annual increase of carbon-free electricity per capita during decade of peak scale-up. Source: Cao, J., Cohen, A., Hansen, J., Lester, R., Peterson, P., & Xu, H. (2016). China-US cooperation to advance nuclear power. *Science*, *353*(6299), 547-548.

The most dramatic example of scaling is France, which nearly completely decarbonized its electric grid in 15 years through the deployment of nuclear energy, shown in Figure 6 below:

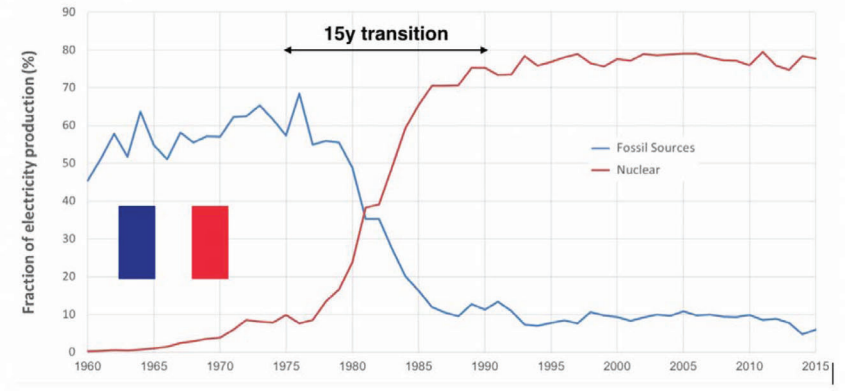

Figure 6: French electricity sources 1960-2015. Source: CATF based on World Bank Development Indicators

As discussed later, to achieve nuclear scaling rates like these again, we will need to improve nuclear business models and supporting policies. But it can be done.

Capability to produce zero carbon fuels

As noted at the outset, electricity represents only 40% of America's energy production and 33% of the US energy/CO2 problem (see Figure 7 below):

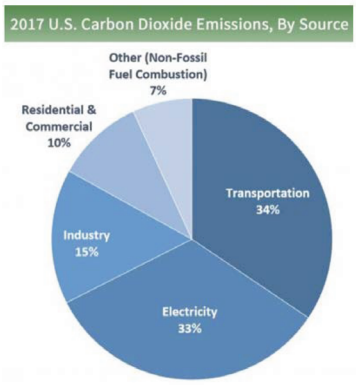

Figure 7: Sources of US carbon dioxide emissions. Source: US Energy Information Administration.

While we may be able to electrify substantial portions of the US economy and power them with a zero carbon electricity grid, there are likely to be substantial remaining demands for non-electric fuels for heavy transport, industrial processes like cement and steel, and building heat. Nuclear energy can provide carbon-free heat to displace fossil fuels in industrial processes and buildings, and to efficiently create hydrogen, a zero carbon fuel.

Additionally, existing nuclear power plants (and those future plants without sufficiently high temperatures) can utilize low-cost electricity to power electrolysis facilities and provide hydrogen for use in a zero carbon fuel system. High temperature reactors are currently on the horizon and poised to make a large impact on hydrogen production at greater efficiency. We don't need to wait for a complete hydrogen economy to start using this zero carbon fuel. Blending nuclear-produced hydrogen into existing natural gas pipelines can have a measurable impact on overall emissions without much infrastructure improvements. Currently, Hawaii blends 12% hydrogen into its natural gas pipelines in some areas[9], reducing overall emissions -- and additional pilot programs are underway in nations like the UK[10].

Nations like the United States, where some nuclear power plants are economically challenged, are looking at hydrogen production very seriously as a way to improve the economics of existing units. In September 2019, the U.S. DOE announced that it had partnered the Idaho

[9] https://www.hawaiigas.com/clean-energy/hydrogen/

[10] https://www.theguardian.com/environment/2020/jan/24/hydrogen-uk-gas-grid-keele-university

National Lab with three utilities (FirstEnergy, Xcel Energy, and Arizona Public Service) to pioneer nuclear electrolysis technology and future forms of hydrogen production.[11] Prior to that, Exelon and Nel Hydrogen began a DOE sponsored project to scale up existing proton exchange membrane electrolyzer technology for use with a nuclear power plant, and that effort is still ongoing.[12] Additionally, a 2013 IAEA report[13] discusses nuclear hydrogen production R&D (mostly theoretical and some government sponsored) in Canada, China, the EU, France, India, Japan, Russia, South Africa, South Korea, and the United States.

In short, nuclear-produced heat and hydrogen could be a very powerful tool in the decarbonization toolkit, even if nuclear power ultimately proves not to be needed to decarbonize electric grids.

III. *The challenges of nuclear power*

At the same time, nuclear energy faces many challenges. Foremost among these are the high cost and delays associated with recent American and European projects. The two are related, as delays result in additional interest costs during construction.

However, high cost and delay are not inevitable, as best construction and project management practices and the building of standardized multiple units have shown elsewhere. A recent study[14] for the UK-based Energy Technologies Institute analyzed the costs associated with more than two dozen large light water nuclear plants built over the last few decades. The first observation from the study is that nuclear costs have varied widely, by a factor of six, as shown in Figure 8 below:

[11] https://apnews.com/bd2475e2fc604c9c8b85b60360fd7f4c

[12] https://www.theengineer.co.uk/nuclear-norwegian-hydrogen/

[13] Hydrogen Production using Nuclear Energy, IAEA, 2013, https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1577_web.pdf

[14] Energy Technologies Institute, "The ETI Nuclear Cost Drivers Project," Energy Technologies Institute (2018), https://d2umxnkyjne36n.cloudfront.net/documents/D7.3-ETI-Nuclear-Cost-Drivers-Summary-Report_April-20.pdf

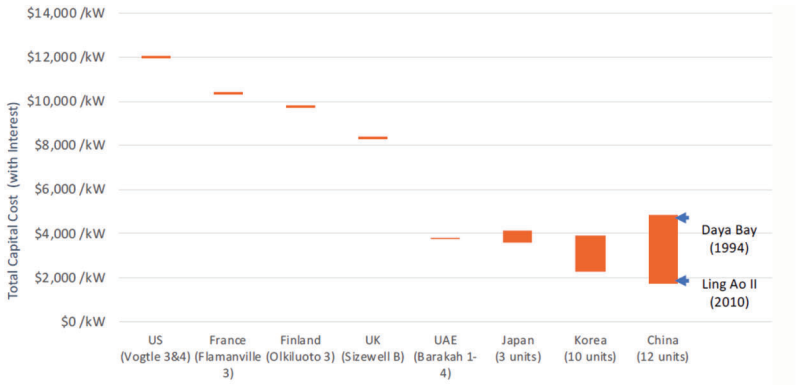

Figure 8: Variations in recent nuclear power plant costs. Source: see footnote 14.

The report, while showing Asian costs to be lower than OECD costs, decomposed cost drivers through a detailed scorecard method and found that ***the difference in unit costs was not primarily driven by differences in regulation or unit labor costs in Asia***, but rather by the efficiency of project management and other best practices. Specifically, top factors that led to higher costs included:

- The challenges of a delivery model that relies heavily on a bespoke "project" model that relies heavily on on-site construction of civil works (a substantial portion of which is necessary to contain water under high pressure) rather than upstream manufacturing and pre-assembly.
- Commencing construction with only a partially completed design.
- Doing "one off" projects rather than multiple builds, thus sacrificing learning by doing and economies of scale.

IV. Why new and advanced reactors?

Cost reductions may be achievable through more advanced designs many of which rely on coolants other than water. Small modular light water reactors as well as microreactors offer opportunities for entry into new markets for nuclear energy, and potentially new revenue streams. Examples of some advanced nuclear plants[15] being developed in North America and around the world include but are not limited to those in the table below:

[15]https://energy.mit.edu/wp-content/uploads/2018/09/The-Future-of-Nuclear-Energy-in-a-Carbon-Constrained-World.pdf?fbclid=IwAR09CR2mjhsZq6uh9cy2N0PDGSvbUUmy9zbaOp79mt_6OKfbcJMPeGRdYjU

Coolant	Thermal Neutron Spectrum	Fast Neutron Spectrum
Water	Small Modular Reactor (SMR)	
Helium	High Temperature Gas-Cooled Reactor (HTGR) and Very High Temperature Reactor (VHTR)	Gas-Cooled Fast Reactor (GFR)
Liquid Metal	—	Sodium Fast Reactor (SFR), Lead-Cooled Fast Reactor (LFR)
Molten Salt	Fluoride-Cooled High Temperature Reactor (FHR), Molten Salt Reactor–Fluoride (MSR–fluoride)	Molten Salt Reactor–Chloride (MSR–chloride)

Advanced nuclear plant types Source: see footnote 15.

Some advantages of these reactors:

- Fast reactors use more energetic neutrons to propel the reaction, potentially increasing fuel utilization and/or reducing back-end waste.
- Reactors operating with liquid metal coolant operate at high power density, therefore reducing overall radioactive material and size, due to the thermochemical properties of the coolant. Liquid metals also have higher boiling points (in the hundreds to thousands degrees Celsius) and can reduce the risk and/or severity of a "loss of coolant" event such as occurred in the three major nuclear accidents to date.
- Molten Salt has a high boiling point, similar to liquid metal, but allows for fuel to be mixed in solution with coolant, in some designs, reducing overall volume.
- Gas cooled reactors can leverage existing gas technology, and some utilize more robust fuel designs such as TRISO.
- Many reactors cooled by substances other than water can operate at reduced pressures compared to existing reactors offering potential benefits such as decreasing the need for expensive high pressure containment.

Across the board, these advanced reactor concepts utilize passive safety characteristics, such as reduced pressures, higher coolant boiling points, and/or meltable release plugs that eliminate auxiliary equipment and improve economics while reducing accident probability as well as the consequences of accidents.

The value proposition of these advanced reactors could be substantial:

- Significantly lower capital and/or operational costs than existing plants
- Reduced material inputs
- Manufacturability or rapid deployment capability
- Passive safety systems and inherent safety strategies
- Ease of operation and maintenance
- Reduced emergency planning zones
- Reduced offsite impact during an accident and increased flexibility/scalability of siting
- Increased proliferation resistance, decreased waste production and/or actinide management capacity, and more efficient use of fuel resources

- Hybrid generation adaptability (e.g. hydrogen production, desalination, etc.) and/or load following

All of these attributes could lead to substantially lower capital, licensing and operating costs. A recent detailed study[16] of cost inputs to eight different advanced reactor offerings concluded that the levelized cost of energy from these designs was likely to average $60/MWH, with some as low as $40/MWH. These costs are well within the range of other firm generating capacity options in North America such as combined cycle gas, and even competitive with other zero carbon energy sources such as wind and solar (sources with much lower firm capacity value) in many parts of the country. The estimated cost spread is shown in Figure 9 below.

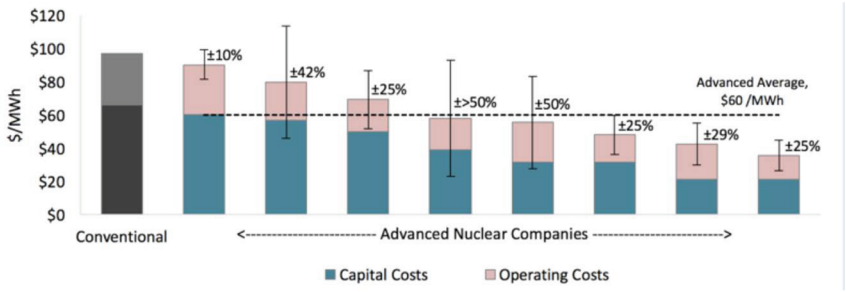

Figure 9: Advanced reactor cost estimates. Source: see footnote 16.

V. The Advanced Nuclear Infrastructure Act of 2020

Clean Air Task Force has provided extensive comments on the most recent draft of the legislation, which I will summarize here.

First, it is laudable that this Committee is dedicated to expanding our decarbonization options and creating a pathway for advanced nuclear technologies. The Clean Air Task Force applauds the leadership of the Chairman, Ranking Member, and others on this Committee who have sought to build legislative frameworks in which a more economically relevant nuclear industry can succeed.

However, there are provisions of this legislation that would not achieve this goal. In fact, the provisions that would additionally streamline environmental laws could have the unintended

[16] Energy Innovation Reform Project, "*What will advanced nuclear power plants cost?" (2016),* https://www.innovationreform.org/wp-content/uploads/2018/01/Advanced-Nuclear-Reactors-Cost-Study.pdf

effect of damaging the advanced nuclear effort. Without strong environmental standards, confidence in this industry would not increase to levels needed to see deployment of nuclear technologies at industrial sites, repowering generation facilities, and for other purposes in communities around this country. Clean Air Task Force recommends removing Section 201 and Section 203 of this legislation.

Other Clean Air Task Force recommended changes to this draft legislation include:

- Give the Nuclear Regulatory Commission the option of creating an International Advanced Nuclear Reactor Export and Innovation Division within the Office of New Reactors, instead of a new Branch to coordinate international activities including regulatory cooperation on advanced reactors (Section 101);
- Give NRC the authority to deny the imports of fuels by foreign adversaries, through establishment of an import license program, instead of denying domestic licenses to possess fuel that are held by utilities (Section 102);
- Establish three prizes, one each for a light water advanced small modular reactor, a non-light water advanced modular reactor, and a microreactor (Section 202);
- Include study of the use of advanced reactors for repowering of existing fossil fueled generation facilities in the report requested by Congress on unique licensing issues and requirements (Section 204)
- Put a cap on the value of the credit that can be awarded to existing nuclear generation, or consider a reverse auction for funds (Section 301)
- Do not require that lessons learned from the COVID-19 emergency on any processes or procedures be implemented at the Nuclear Regulatory Commission as a part of regular licensing and regulatory processes (Section 303)
- Use the OECD instead of NATO to designate investment by allies (Section 304)
- Do not require the Nuclear Regulatory Commission to enter into an additional MOU with the Department of Energy in order to exchange expertise on fuels (Section 401)
- Do not create a strategic uranium reserve (Section 402)

Finally, we applaud the Chairman for introducing legislation that included the following provisions, and look forward to continuing to work with all Members of this committee to find a way to move these provisions forward:

- A report to Congress on the unique licensing considerations relating to the use of nuclear energy for non-electric purposes, specifically industrial applications and production of zero-carbon fuels (Section 204)
- Preserving at-risk nuclear facilities through an incentive program that is transparent and prioritizes safety, while protecting taxpayers and ratepayers against unnecessary compensation for utilities (Section 301)
- A report to Congress on advanced manufacturing and construction for nuclear energy applications (Section 403)
- An annual report on the spent nuclear fuel and high-level radioactive waste inventory in the United States (Section 502)

Thank you for the opportunity to address this Committee, and I look forward to your questions.

Senate Committee on Environment and Public Works
Hearing entitled, *"Hearing to Examine a Discussion Draft Bill, S.____, American Nuclear Infrastructure Act of 2020."*
August 5, 2020
Responses to Questions for the Record for Armond Cohen

Chairman Barrasso:

1. Your written testimony states that "additional streamlining of environmental regulations such as the National Environmental [Policy] Act (NEPA) is not helpful for the nuclear industry or our goals for decarbonization." However, you also note that "high cost and delays" are of the foremost challenges facing the nuclear industry.

    a. Are there significant differences in safety and performance between today's operating reactors and advanced reactors currently are under development? Please explain why or why not.

Advanced reactors have very different safety and performance profiles than operating nuclear power plants. Many advanced reactors rely on coolants other than water, operate near or at ambient pressure, utilize accident resistant fuel forms, contain less radioactive materials, and/or incorporate passive systems relying on the forces of nature to improve operations and safety. Advanced reactors therefore potentially offer significantly reduced probabilities of release or exposure and performance improvements that should offer economic gains.

    b. Do you think all infrastructure projects should be subject to the same environmental review *process* (note this is not asking whether projects should be subject to the same environmental review *standards*) regardless of the size, operation, and/or safety features of the project?

It is not possible to answer this question in the abstract. There may be cases where inherent features of a project may make it appropriate to modify process, but this will depend on the facts of the case.

    c. What opportunities exist for the Nuclear Regulatory Commission (NRC) to reduce the costs and length of time to complete environmental reviews for nuclear projects, while still maintaining the same environmental standards? If so, please elaborate on how this may be accomplished.

We believe the largest opportunity for more efficient and protective review lies in the NRC's implementation of risk-informed performance based regulation, mandated under the Nuclear Energy Innovation and Modernization Act. In addition, as I noted in my testimony, provisions of the Fixing America's Surface Transportation Act also support accelerated review and, if implemented properly, could be consistent with public safety and environmental protection.

    d. Ms. Roma noted that NRC recently required a company that proposed to build a new nuclear reactor at a site with an operating power plant still assess a greenfield

site as part of previous its environmental review. The applicant is required to pay for the NRC staff's travel costs, adding costs and delays to a project. If an applicant proposes to co-locate a reactor at an existing site, would you support limiting an Environmental Impact Statement's "alternatives analysis" and not require analyzing a greenfield site?

Under appropriate circumstances, existing and brownfield plant proposals should be able to leverage existing, relevant, and non-obsolete regulatory bases when considering the deployment of a new nuclear reactor.

2. You recommend establishing three prizes for advanced reactors, "one each for a light water advanced small modular reactor, a non-light water advanced modular reactor, and a micro(-)reactor."

    a. Why do you recommend these three prize categories? Are there other options for providing multiple awards? If so, please elaborate.

We recommended multiple prize categories to ensure a diversity of technology approaches, and as replacement to the current draft text restricting the prizes to only those advanced reactor licenses not docketed by the commission as of the date of enactment. By recommending these three prize categories, no license seeker who may have submitted or be submitting a license application prior to the bill's enactment would be excluded. Another alternative to providing multiple awards would be to provide a restriction date that does not exclude any existing or future applicants, such as January 1, 2020, and to set forth different criteria that the license applications would need to meet (e.g., commercial readiness, markets, applications, etc.).

    b. The intent of the prize is to incentivize deployment of advanced reactors. By grouping awards as you suggest, the prize would instead reward technologies that are already committed to moving forward. Do you believe such an approach provides for an equitable competition for all entities, including companies that have applied for a Design Certification, a combined operating license, or an Early Site Permit?

Securing a license or already being committed to the licensing process does not ensure that an advanced reactor technology will be deployed. We believe these three categories are prime categories for deployment and ensure diversity of useful nuclear technology and the deployment of technology in any of the three categories is not currently guaranteed. We believe this approach is more equitable than the currently drafted approach, which would exclude potential early movers for applying for their license(s) prior to the enactment of this bill. Additionally, no license seeker should feel incentivized to delay their application in order to be eligible for the prize.

3. Ten former members of the Nuclear Regulatory Commission wrote a letter that supports removing investment restrictions on our nuclear energy sector. Those restrictions, known as "foreign ownership, control, or domination" (FOCD) are codified in sections 103 and 104 of the Atomic Energy Act. The draft legislation removes those restrictions from

countries that are members of the North Atlantic Treaty Organization (NATO), Japan, and the Republic of Korea.

a. How do the current FOCD restrictions hinder America's ability to preserve and expand the use of nuclear energy?

The FOCD restrictions inhibit investment in domestic nuclear energy projects – including from investors in allied nations - which are in need of significant financial participation. The restriction creates investment uncertainty and is more likely to push advanced reactor developers out of the country to demonstrate their technologies. This will harm U.S. nuclear technology leadership, U.S. nuclear export prospects, and overall nuclear security.[1]

b. Why does Clean Air Task Force propose to lift restrictions for OECD instead of the proposal in the draft legislation?

We believe that the OECD better represents allied trade cooperation. NATO is a Europe-centric organization, while the goal of lifting the restrictions with respect to FOCD is to allow investment from allied nations – not just those in European countries. OECD includes in its membership Japan, Korea and Australia, which represent sources of potential investment.

4. During the COVID-19 public health emergency, the Nuclear Regulatory Commission has implemented policies to make it easier for NRC licensees and the public to interact with the regulator. This includes the development of a standardized template to request routine regulatory exemptions and a website for the public to track those exemptions. Are there some processes and procedural improvements developed during the public health emergency that NRC could permanently implement to improve NRC's efficiency and transparency?

In general, we believe that processes and improvements made during the public health emergency should not be permanently implemented. One area that we feel has opportunity for permanent implementation is the increased use of virtual interaction and engagement methods both with the public and licensees.

5. Advanced nuclear reactors need new fuels, known as high-assay, low-enriched uranium (HALEU). HALEU is not currently commercially available and there is not a facility licensed by the NRC to enrich and fabricate this fuel. What must the NRC and the Department of Energy do to develop and license the commercial facilities necessary to provide for a durable HALEU fuel supply chain?

We believe that the provisions proposed in the Nuclear Energy Leadership Act (NELA), currently under consideration in the 116th Congress, related to HALEU would take many important steps in ensuring the creation of durable HALEU fuel supply chain. Specifically, the

[1] See https://www.energypolicy.columbia.edu/sites/default/files/file-uploads/NuclearAllies_CGEP-Report_072420.pdf

provisions in NELA that describe specific amounts to be made available within an aggressive timeline as well as research into HALEU transportation packages. The NRC's role in the research and development of transportation packages should be considered throughout the process and the NELA amounts could be increased along with additional support for staffing to further ensure a useable HALEU fuel supply chain.

Senator Sanders:

1. In your testimony, you said that The American Nuclear Infrastructure Act of 2020 should be improved by removing provisions that would weaken the National Environmental Policy Act (NEPA). Please explain in greater detail why you expect these streamlining provisions to be unnecessary and damaging.

These provisions are unnecessary because there are two new policies already underway that can work to accelerate environmental review.

First, the Nuclear Energy Innovation and Modernization Act requires the NRC to increase the use of risk informed, performance-based licensing techniques, an approach that CATF supported. The NRC is proceeding to implement this approach.[2] It should be given a chance to play out. If executed properly, it should simplify and potentially shorten review times.

Second, the recently enacted FAST Act[3] embodies several streamlining provisions:

- It requires agencies to coordinate their environmental reviews of projects to avoid duplication and accelerate the review process.
- It requires that a lead agency be assigned to each covered project. Within sixty days of a project being posted on the Dashboard, the lead agency is tasked with developing "a concise plan for coordinating public and agency participation in, and completion of, any required Federal environmental review and authorization of the Project." This plan must contain a permitting timetable, from which agencies may deviate only in limited circumstances.
- In addition, the Act expands agencies' ability to apply categorical exclusions to projects.
- But perhaps most significantly, Title XLI of the FAST Act establishes the Federal Permitting Improvement Steering Council, which is charged with streamlining the environmental review process for "covered projects"—activities involving investments of more than $200 million and the construction of infrastructure in one of the following sectors: renewable or conventional energy production, electricity transmission, surface transportation, aviation, ports and waterways, water resource projects, broadband, pipelines, manufacturing, or any other sector that the Council determines is subject to NEPA and meets certain conditions. Clearly nuclear projects would be covered under this provision.
- Notably, Title XLI restricts judicial review of the NEPA process for covered projects in two ways. First, it reduces to two years NEPA's otherwise applicable six-year statute of

[2] See https://www.catf.us/2020/07/modernzing-us-licensing-for-advanced-nuclear-energy/
[3] See https://www.govinfo.gov/content/pkg/PLAW-114publ94/pdf/PLAW-114publ94.pdf

limitations. Second, it makes it harder for project opponents to obtain a preliminary injunction by instructing courts to consider the potential negative impact on jobs that could result from such an order. Courts are further instructed to not presume that the potential effects of an injunction are irreparable.

These are significant streamlining policies. They should be given an opportunity to play out before we seriously entertain further changes.

We think further major modifications to the NEPA process are also potentially damaging because of the unique public concern around nuclear accident risk. If nuclear energy is to have an expanded role in the US energy system, public confidence in regulation will need to be high. Loosening NEPA review at this time could undermine that confidence and actually harm the industry's progress.

2. In your testimony, you said that The American Nuclear Infrastructure Act of 2020 should be improved by putting "a cap on the value of the credit that can be awarded to existing nuclear generation." How would you advise Congress ensure this bill is not a bailout for aging, economically struggling nuclear power plants?

First, we need to ensure that any taxpayer money spent on continued nuclear plant operation is truly needed to do so, and is not a windfall for plant owners. This will require very rigorous oversight and transparent examination of plant costs and available market revenues. At a minimum, we think this would require involvement of agencies with expertise in these matters such as FERC. It would also worth considering creating and designating an independent review function much like the Independent Market Monitor as exists in the various regional transmission organizations.

Second, the credit awarded should be limited to the environmental value provided by the plants. There are a few approaches that could be taken. Ideally a credit would be priced at the value of carbon avoided, but that would require detailed modeling of the power grid to determine what fossil energy resources are displaced through continued unit operation (and a credit assigned at, say $35-50/ton of carbon avoided, as is the case for the 45Q tax credit for carbon capture and sequestration). Instead, a "rule of thumb" approach might be more workable. For example, Congress could cap the credit at $25/MWh, which is the same as the 2019 wind energy production tax credit level, which is roughly equivalent to $100/ton of CO2, assuming the avoided fossil unit is a natural gas combined cycle unit.

Another way to ensure that we are not overpaying for the carbon benefits of a plant, and providing a windfall, is to cap the total funds available and implement a reverse auction approach that would force plants to compete for the limited pool of funding by "bidding" their lowest ask for a subsidy.

3. Do you see any ways public input at the Nuclear Regulatory Commission could be improved in The American Nuclear Infrastructure Act of 2020?

We would suggest two approaches to complement Washington-based input proceedings. First, there should be hearings near the location of proposed plants to allow for local community voices to be heard. Second, wherever possible, virtual participation in Washington-based proceedings should be allowed.

4. The U.S. House Select Committee on the Climate Crisis released an action plan at the end of June, which recommended in part that Congress direct the Nuclear Regulatory Commission to "increase inspections at aging plants and maintain a strong Reactor Oversight Process." Do you feel this bill could be improved in any way to better maintain strong safety standards at aging nuclear power plants?

Since this bill focuses on advanced nuclear, we would suggest that this issue be taken up in a separate venue.

Senator Whitehouse:

6. It's a danger and a liability to have nuclear waste stored at our facilities. There is value to finding a way to solve that problem. As we embark on nuclear innovation, how can we make sure that the innovators see the value of pursuing advanced nuclear technologies that re-use spent nuclear fuel?

Innovators already have a significant interest in pursuing advanced nuclear technologies that re-use spent nuclear fuel – a number of advanced reactor designs are seeking to use recycled fuel or are developing fast reactor technologies with a parallel recycling option. Providing federal support for commercial recycling solutions as well as making the nation's spent fuel stockpile available to companies pursuing advanced nuclear technologies would further incentivize these efforts and support their commercialization. The federal government could provide additional advanced nuclear demonstration funds for applicants that propose to re-use spent fuel; and, as part of a comprehensive nuclear waste reform initiative, allow nuclear plants that re-use spent fuel to be compensated from the existing nuclear waste fund for the value of diverting this waste from a permanent or interim repository.

7. The 45Q tax credit provides a carbon payment for avoided emissions from carbon capture projects. A provision included in this draft bill would translate this idea for the existing nuclear fleet. Right now, our nuclear reactors are not compensated for their carbon free power and many are being prematurely retired and replaced with fossil fuels.

    a. Do you support the inclusion of this existing nuclear credit program?

Yes.

    b. Do you have suggestions on how we could improve the provision?

First, we need to ensure that any taxpayer money spent on continued nuclear plant operation is truly needed to do so, and is not a windfall for plant owners. This will require very rigorous oversight and transparent examination of plant costs and available market revenues. At a

minimum, we think this would require involvement of agencies with expertise in these matters such as FERC. It would also worth considering creating and designating an independent review function much like the Independent Market Monitor as exists in the various regional transmission organizations.

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Another way to ensure that we are not overpaying for the carbon benefits of a plant, and providing a windfall, is to cap the total funds available and implement a reverse auction approach that would force plants to compete for the limited pool of funding by "bidding" their lowest ask for a subsidy.

8. This draft bill includes a new requirement that DOE report to Congress each year on the cumulative lifecycle costs to store, manage, and dispose of spent nuclear fuel. It also requires that DOE provide recommendations on how to better account for the lifecycle costs of the nation's nuclear waste stockpile.

    a. What can Congress do to improve the financial accounting of nation's spent nuclear fuel?

The accounting provisions in Section 502 of the current draft legislation provide an important and useful start, by requiring reporting of actual payments to contract holders and quantifying life cycle costs of spent fuel.

9. The bill includes several provisions that would potentially expedite or streamline the approval process for advanced reactors. You provided feedback that these provisions in the current draft are problematic.

    a. What specific recommendations do you have to improve these provisions?

I do not have recommendations for improvement of these provisions; I believe they should be deleted. These provisions are unnecessary because there are two new policies already underway that can work to accelerate environmental review.

First, the Nuclear Energy Innovation and Modernization Act requires the NRC to increase the use of risk informed, performance-based licensing techniques, an approach that CATF supported.

The NRC is proceeding to implement this approach.[4] It should be given a chance to play out. If executed properly, it should simplify and potentially shorten review times.

Second, the recently enacted Fixing America's Surface Transportation Act[5] embodies several streamlining provisions:

- It requires agencies to coordinate their environmental reviews of projects to avoid duplication and accelerate the review process.
- It requires a lead agency will be assigned to each covered project. Within sixty days of a project being posted on the Dashboard, the lead agency is tasked with developing "a concise plan for coordinating public and agency participation in, and completion of, any required Federal environmental review and authorization of the Project." This plan must contain a permitting timetable, from which agencies may deviate only in limited circumstances.
- In addition, the Act expands agencies' ability to apply categorical exclusions to projects;
- But perhaps most significantly, Title XLI of the FAST Act establishes the Federal Permitting Improvement Steering Council, which is charged with streamlining the environmental review process for "covered projects"—activities involving investments of more than $200 million and the construction of infrastructure in one of the following sectors: renewable or conventional energy production, electricity transmission, surface transportation, aviation, ports and waterways, water resource projects, broadband, pipelines, manufacturing, or any other sector that the Council determines is subject to NEPA and meets certain conditions. Clearly nuclear proejcts would be covered under this provision.
- Notably, Title XLI restricts judicial review of the NEPA process for covered projects in two ways. First, it reduces to two years NEPA's otherwise applicable six-year statute of limitations. Second, it makes it harder for project opponents to obtain a preliminary injunction by instructing courts to consider the potential negative impact on jobs that could result from such an order. Courts are further instructed to not presume that the potential effects of an injunction are irreparable.

These are significant streamlining policies. They should be given an opportunity to play out before we seriously entertain further changes.

We think further major modifications to the NEPA process are also potentially damaging because of the unique public concern around nuclear accident risk. If nuclear energy is to have an expanded role in the US energy system, public confidence in regulation will need to be high. Loosening NEPA review at this time could undermine that confidence and actually harm the industry's progress.

[4] See https://www.catf.us/2020/07/modernzing-us-licensing-for-advanced-nuclear-energy/
[5] See https://www.govinfo.gov/content/pkg/PLAW-114publ94/pdf/PLAW-114publ94.pdf

Senator Van Hollen:

10. Given the proliferation risks of using HALEU fuel and plutonium-based fuel for advanced nuclear reactors, do you believe that it is necessary to require that foreign countries have in place an Additional Protocol with the International Atomic Energy (IAEA) as a precondition for the purchase of such technologies?

The United States should encourage all countries seeking to import U.S. technology, reactor and materials to adopt the Additional Protocol. However, advanced reactor companies are considering different models for supplying reactors and fuel (including, for example, a buy-own-operate (BOO) model where the U.S. vendor owns and operates the reactor); further, there are different fuels types considered, and some of these are more proliferation resistant. For these reasons, we don't believe that there should be a firm requirement for the importer to join the AP. U.S. export licensing agencies should have the flexibility to consider a variety of national security factors, as provided in the Atomic Energy Act and implementing nuclear export control regulations, in granting licenses for the export of nuclear fuel.

11. Would requiring U.S. manufacturers of advanced nuclear reactors and associated fuel cycle facilities incorporate "safeguards-by-design" features, as defined by the IAEA, in the design and operations of their facilities make advanced nuclear technologies more proliferation-resistant and increase the competitiveness of U.S. manufacturers in the international nuclear market?

We believe that U.S. advanced reactors and manufacturers are well aware of the "safeguards-by-design" approach and are already considering safeguardability in developing design and manufacturing parameters. Further, the IAEA is still in the process of defining how safeguards will be applied to advanced reactor designs, and the advanced reactor community is part of this dialogue. This process is happening organically and we believe that no additional regulatory burden should be imposed on developers and manufacturers at this time.

12. According to a 2018 GAO report, the NNSA has a sufficient supply of unobligated low-enriched uranium to produce tritium gas for our nuclear weapons program until at least 2041. The NNSA has also indicated that it has enough stockpiled HEU for naval reactors to last until 2060. For defense needs, how urgent and necessary is establishing a domestic uranium reserve?

Given the size of the U.S. stockpile and the current (and projected) state of the uranium market (i.e., oversupply and low demand), we do not see an urgency in establishing a domestic uranium reserve.

13. The United States currently has minimal uranium conversion capabilities, with the only domestic conversion plant sitting idle since 2017. Therefore, would DOE and U.S.

commercial entities have to rely on foreign entities to convert uranium from the domestic reserve?

The operation of the Converdyn conversion plant was suspended in 2017 pending an improvement in business conditions, which currently reflect the oversupply of conversion capability. Primary foreign uranium conversion suppliers are longstanding allies of the United States, specifically Canada and France. The Converdyn plant could be returned to service fairly quickly upon improvement in business conditions; scaling up conversion capabilities is less complex than many other portions of the nuclear fuel cycle and should be achievable without creating a gap in the domestic conversion market.

14. What are the market implications of establishing a uranium reserve when there's an international supply glut of uranium in the international market and uranium prices remain low?

Because the reserve would not represent any significant share of the global uranium market, the reserve shouldn't have much, if any, impact on uranium prices. This would change, however, if the size of the reserve were to increase significantly.

15. At what price would DOE have to purchase uranium from U.S. mining companies to fill the uranium reserve for the domestic production of uranium to be cost-effective and economically viable?

Uranium prices have been hovering around $30 per pound this year. Natural uranium would likely need to be available to reactor operators at these prices. However, U.S. mining companies are unlikely to be able to offer such prices to the DOE due to the investments that they would need to make in standing up mining assets and the low scale of production in the U.S. compared to countries like Kazakhstan, Australia and Canada.

Senator BARRASSO. Well, thank you so much, Mr. Cohen, and as you stated, we are working together collaboratively. I appreciate your comments; they are very helpful.

As Senator Whitehouse talked about, we are a bipartisan Committee in our efforts here. We want to make sure we get the best results.

As Senator Carper said, we need to make sure that we bring our best game today and every day. So thank you for the comments to all three of you.

We will start with questions.

I would like to start with you, Mr. Goranson. We know American uranium production is right now at an all time low. This has had a devastating impact on production, certainly in our home State of Wyoming. To revitalize the nuclear fuel supply chain, the Department of Energy is proposing establishing a national uranium reserve. The discussion draft legislation follows through on that proposal.

Will you please describe how this strategic reserve will help preserve the Nation's nuclear fuel supply?

Mr. GORANSON. Thank you, Chairman Barrasso. The U.S. uranium industry is faced with a situation where, over the last several years of declining commercial purchases, it has led to an industry that is on the verge of collapse.

The uranium reserve would provide the U.S. Government with a backstop to support this industry in this vital piece of the industrial base, in order to preserve it and maintain a skilled work force, as well as maintaining the infrastructure necessary to produce uranium.

It would also provide for a domestic basis in case we have supply disruptions from our foreign imports, as well as a means for supporting any future national security and also energy security needs for the country.

Senator BARRASSO. On this Committee, we have members of the Foreign Relations Committee. We have the Chairman of the Armed Services Committee.

So I wanted to just ask you, Mr. Goranson, about Russia. Russia has weaponized its energy supplies; all of us are well aware, in terms of their efforts to advance their strategic interest. With regard to uranium, in Russia, they tend to manipulate the market by flooding America with cheap uranium to undercut out Nation's producers.

The Commerce Department right now is working to extend existing caps that limit the import into the United States of Russian uranium. If the caps are allowed to expire, Russia could have unlimited access to our uranium market. So I am leading efforts to make sure that doesn't happen.

Could you explain to the Committee why it is so important that we establish limits on how much Russian uranium comes into the country, and do it by law?

Mr. GORANSON. Chairman Barrasso, thank you. As you know, the Russian Suspension Agreement has been in effect since the early 1990s. It is in place, and it has gone through several sets of reviews where the Commerce Department has determined without that suspension agreement, the Russians will dump uranium on

the market. That is harmful for our domestic industry and for our national security.

As we go forward, looking forward to the Commerce Department's efforts to renegotiate the suspension agreement and extend it, we know one thing, that the Russian government we are dealing with today is not the same Russian government we were dealing with in 1992 or around that period.

It is important, in my perspective, to see legislation to codify those terms on the Russian Suspension Agreement to assure that it shows that the U.S. Government, the whole U.S. Government, supports this vital piece of protection of our domestic industry, but also to keep from becoming extremely reliant on a strategic competitor.

Senator BARRASSO. Ms. Roma, we talked earlier, and Senator Whitehouse did as well, on modernizing the regulatory approach. So tomorrow's advanced nuclear reactors, they are going to be smaller, safer than today's designs. They will also have a reduced environmental impact while they are generating clean energy.

The draft bill that we are working on requires the Nuclear Regulatory Commission to examine its environmental review process, and then identify opportunities to update outdated environmental requirements.

What aspects, Ms. Roma, of environmental reviews must we update to enable the safe deployment of these new technologies?

Ms. ROMA. Well, there is a whole handful that I can think of, but just a few off the top of my head.

The NRC can examine the use of generic environmental impact statements to address issues that are common across several different advanced reactor designs, such as the use of high SALAU fuel, or other common issues that would enable a subsequent site specific license to incorporate by reference that earlier analysis, and streamline the NRC's subsequent review of a site specific application.

Another area that the NRC could look to is reevaluating the presumption that advanced reactors necessarily require an environmental impact statement.

The one thing that I would note is that the NRC requires an environmental impact statement for power reactors, which have traditionally been large scale, light water nuclear reactors. But it doesn't require an environmental impact statement necessarily for smaller reactors, such as commercial non-power reactors, which tend to be 10 megawatts or less.

A lot of the designs that we are looking at in the advanced reactor designs are micro-reactors, so they would fall within that window. The only difference between the existing regulations for commercial non-power reactors and for power reactors is power requires EIS. So one thing that they could look at is that as well.

Another way that they could streamline is looking at co-located facilities and the alternative siting analysis that you need to do.

Oftentimes, new reactors are located at the same site as an existing reactor. Yet, under the NEPA methodology as implemented by the NRC, there is a very significant, in depth analysis of putting that reactor at another location that would be a greenfield site, for example, that needs to be analyzed, where the NRC staff flies out

and looks at all these other sites, when it is just going to come back to putting it at the exact same site as the existing nuclear power plant.

So there are a number of areas that the NRC could streamline and improve efficiencies. But the one thing that I would note is that, I actually thought, I understand and I hear the concerns that people are raising about doing a less in depth environmental review.

But I don't actually see that in the draft legislation. The draft legislation asks the NRC to look at ways that it can do the review more efficiently by looking at lessons learned and other areas that it can do a better review, not a less in depth review.

I just want to go back to the earlier comment that I made in my opening remarks. Longer doesn't mean better. The NRC, for the Fermi 3 environmental impact statement, the NRC wrote 2,200 pages. That is a lot of writing, not a lot of analysis.

So I think that the NRC can look at ways where it is not necessarily making very long environmental reviews, but doing better environmental reviews, that would be better for everybody.

Senator BARRASSO. Thank you, Ms. Roma.

Senator Carper.

Senator CARPER. Thanks, Mr. Chairman.

Again, our thanks to our witnesses, those who are really here, and those who wish they were here.

I want to start off with a question or two to Mr. Cohen if I could. Less than 2 years ago, Congress passed, as you know, the Nuclear Energy Innovation and Modernization Act, which made significant changes to the NRC's budget structure and to the NRC's regulatory framework for advanced nuclear reactors.

This law's significant changes include caps on NRC's budget, which phase down over time, and restrictions on the amount of money that the NRC can charge industry. The budget caps are expected to ratchet down starting, I believe, this coming fiscal year. But I am already hearing reports that the NRC's budget may be too low to meet its existing workload.

In February of this year, the NRC Inspector General surveyed 2,800 NRC staff to assess NRC's safety culture. The IG reported that 64 percent of the surveyed NRC employees said they were worried about the NRC's budget and what it might mean for the NRC's future.

My question for you, Mr. Cohen, have you heard similar concerns about the pending NRC budget cuts, and how important is it for the NRC to have the funding necessary to successfully fulfill its mission? Please proceed.

Mr. COHEN. Right, thank you. Yes, Senator Carper, we do share that concern. We have heard both from employees at the NRC as well as some of the advanced reactor developers, who are concerned about constraints. Obviously, the developers are interested in getting things moved through as quickly as possible.

We are concerned about the funding flows. Again, it goes back to the question of credibility and the ability of NRC to do its job, which is really critical to getting this industry back in business at scale. So we do share that concern.

In my testimony, I suggested that the caps that were put in place in the Nuclear Energy Innovation and Modernization Act be revisited and removed, or at least that the ratchet that starts at 30 percent, I believe, of the 2021–2022 request at least be frozen there and not be reduced further.

We are extremely concerned about understaffing at the agency. It can always be more efficient. I know that Chairman Svinicki is working very diligently to improve efficiency at the NRC. But we think overly restrictive funding is not going to help the cause.

Senator CARPER. OK, thank you. I have one more question for you, and then a question for Ms. Roma.

My second question for you, Mr. Cohen, deals with NEIMA and [indiscernible] and advanced nuclear framework. In your written testimony regarding the draft American Nuclear Infrastructure Act, you state that, "This bill proposes some alterations to environmental permitting that this committee must reconsider. These provisions are not necessary and could even be damaging to the future of the advanced nuclear industry."

My question is, Mr. Cohen, can you further discuss for us why you believe the streamlining provisions in the Chairman's draft legislation could be damaging to the advanced nuclear industry?

Mr. COHEN. Thank you. As I said in my opening remarks, Senator Carper, I think the major concern is that this industry needs not only to be safe, but to be perceived as safe. I think at least among the nuclear critics, there is already a view that the modernization that was undertaken in the Modernization Act that moves the agency to a more risk informed, performance based licensing approach is already a step, I guess from their standpoint, it is a step in the wrong direction; from our standpoint, it is a step in the right direction, to move from a prescriptive, burdensome, sort of widget based review to something that is more like looking at the whole safety case. We already have, I believe, a good framework in place to move things forward faster.

Then there is the FAST Act, or the Federal permitting, the Surface Transportation Act Amendments of 2015, that further provide environmental permitting streamlining. These are very significant provisions that apply to the NRC already.

There is a lead agency, there has to be a plan, all the agencies have to coordinate, there is a fixed schedule, you can't deviate from that schedule without extraordinary circumstances.

It expands the agency's ability to provide categorical exclusions, which the NRC could do. It establishes a Federal permitting improvement steering council, which can make further streamlining initiatives. And then it restricts judicial review of NEPA related reviews. It is a very substantial streamlining, again, not universally supported, but nonetheless, it is law.

My answer really is that with these two major efforts to clear the way and expedite environmental and safety review already in place, our view is that should be given a chance to work out. If we have problems down the road, then we will talk about those problems.

I just should say, I am a cofounder of the Nuclear Innovation Alliance, which is an alliance of environmental organizations, academic groups, and developers. I can tell you that this is not what

I am hearing that is priority No. 1 for the advanced reactor sector, or even priority No. 2.

I think that while there might be some perceived gain, I believe that the negative consequences of yet a third major reform on top of the previous two could undermine confidence in the integrity of the permitting process.

That is an issue of perception. I think we can argue the merits, but I think at least at a level of perception, this would be a bad move at this time when we are trying to get the industry back on its feet.

Senator CARPER. OK, thanks very much for those thoughtful comments.

Mr. Chairman, when we come back for a second round, I have one follow up with Ms. Roma and maybe Mr. Cohen on clean hydrogen production at reactor sites, which I think is quite promising.

Thank you.

Senator BARRASSO. Thank you, Senator Carper.

Right now, we have Senator Capito joining us remotely.

Senator Capito.

Senator CAPITO. Thank you, Mr. Chairman.

I want to thank our witness panel today.

Ms. Roma and Mr. Cohen, I have been working in a bipartisan fashion, particularly with Senator Whitehouse, on the Clean Industrial Technology Act, which is to promote the decarbonization of industries that inherently create greenhouse gas emissions, like steel production. Nuclear energy is primarily viewed by the public in terms of power generation.

So, your testimonies touched on nuclear technologies may be applied to industrial non-electric purposes, such as generating heat for use at a chemical facility, or hydrogen fractionization, or desalinization. Section 204 of the American Nuclear Infrastructure Act explicitly directs the NRC to review potential regulatory barriers to such deployments.

In your opinion, is the NRC currently equipped to review those applications for deployment of nuclear technologies outside of the spaces of power generation and medical research reactors, and what obstacles do you think they might face in that regulatory space?

Ms. Roma, I will go to you first.

Ms. ROMA. Thank you. That is a wonderful question.

The NRC is well equipped to probably handle a commercial, non-power reactor design that is similar to a research reactor that has already been deployed in the United States. So that would be a smaller version of a light water reactor design.

They have an existing guidance document that applies to that. They are looking at them now and applying them to the medical isotope community that is looking at getting licenses.

I think if you look at how the NRC regulations would apply to the non-power uses with advanced reactors, I think that that is an area that the NRC should further evaluate to do a gap analysis of where its regulations may fall short, or what guidance may need to be examined.

I am just going to give a quick example. I was working with a medical isotope client that was looking at preparing a commercial, non-power reactor application. So really, a first of a kind type application.

One of the things that we rolled up our sleeves and realized, is how many times the NRC makes a distinction between a power reactor and a non-power reactor that doesn't really have a regulatory necessity.

The NRC just implemented a regulation thinking that, Well, the only types of reactors that would do this are large scale, light water, nuclear power reactors. So they put the word power in there.

For example, a medical isotope production facility building a commercial non-power reactor can't apply for a combined operating license. It needs to submit a separate application for a construction permit, and then another application later for an operating license.

Just looking at the regulations and evaluating ways that there could be unintended consequences from the ways that the NRC worded their regulations at the time of the rulemaking I think would be helpful to ensuring when those applications come in, the NRC is prepared to evaluate them.

Senator CAPITO. I am going to skip Mr. Cohen. She gave a very good answer there, very complete answer there, because I want to get a chance to get a last question in.

There was an article in the Wall Street Journal yesterday, you can probably see the headline here, Saudi Arabia, With China's Help, Expands Its Nuclear Program. My question is, as you read through the article, you couldn't distinguish what the actual usage was going to be for the help that they are getting from China. Is it power, is it a weapons program? A lot of unanswered questions there.

I guess my question is, where do you see, since these reactors last for maybe a hundred years, this relationship of Saudi Arabia and China in the nuclear space, do you feel that is an issue? How are you all looking at that?

Mr. Cohen, I will go with you first. I am going to ask everybody that question.

Mr. COHEN. Senator Capito, we don't necessarily focus as much on the geopolitics of nuclear as some of the economic issues. But yes, I think it is a concern, and I would just flip that around and say, China is going to do what it is going to do. It has a mercantile model of export, often at below cost just for strategic reasons.

We are not going to do anything about that. I think we need a better mouse trap, and we need to be talking to our allies.

An example is what we did in the United Emirates in collaboration with the Korean institutions to build a western, or at least an OECD originated reactor, and under sort of western standards, with western non-proliferation agreements and so forth.

So I think our view is that the only way to win this one is to really come with a very robust, cost effective product, but also bring along the kinds of things that are in this bill in terms of international coordination of licensing. The Chinese will do what they do, and we may not win every commission. But we are not in the running right now.

Senator CAPITO. Right. Thank you.

Mr. Goranson, do you have a comment on that?

Mr. GORANSON. Senator Capito, yes, I do. As you have mentioned in your question, is that once a nuclear power plant is built into another country, that creates basically a hundred year relationship between those two entities.

This is another case for, as I mentioned in my testimony, as that where countries like China can use this to leverage foreign policy objectives. The Saudis have been a traditional ally of the United States for quite some time, but bringing the Chinese in and giving them this opportunity to be able to have such a critical part of their infrastructure under their control could create some challenges in our foreign policy as we move forward in the future with our foreign policy objectives.

As far as an answer as to how to resolve that, I am not an expert in foreign policy myself. But I will say that this is another example of why we need to be cognizant of these state owned enterprises where they can go in and use the leverage of their government to be able to compete.

The U.S. companies did try to compete for that nuclear technology in Saudi Arabia and also other nuclear fuel supply as well. As you can see, the state owned enterprises have an edge over the United States.

Senator CAPITO. Thank you.

Ms. Roma, do you have a comment on that?

Ms. ROMA. I do. Thank you, Senator. To answer your question directly, does this concern me? Yes, it does concern me that China is providing nuclear technology and services for Saudi Arabia.

I think it gets back to the crux of my testimony that underscores the importance of the U.S. asserting global leadership so that we can ensure that we have the highest level of safety and nuclear non-proliferation standards in place.

To echo the statements of the other panelists, particularly Mr. Cohen, what can we do about it? Well, right now, not much. We are not well positioned to compete against China, particularly in areas like Saudi Arabia, because we don't know if they want to build any of our plants.

That is why it is the importance of implementing the provisions of ANIA and ensuring that we can get out in front, particularly on these emerging technologies where the U.S. currently has the global lead in advanced reactors and in fusion facilities as well. We are going to lose the next generation of lead that we have because we are not going to be able to get our act together in time to compete against Russian and China.

Senator CAPITO. Right, and as we repeated, these are generational decisions that are being made, so thank you all very much.

Thank you, Mr. Chairman.

Senator BARRASSO. Thank you, Senator Capito.

Senator Cardin.

Senator CARDIN. Thank you, Mr. Chairman.

Let me thank all of our witnesses for their testimonies. This is a really important hearing.

In Maryland, nuclear power is very important, as it is around our country. We have two nuclear reactors located at Calvert Cliffs. They produce about 20 percent of our State's electricity needs, and 55 percent of our carbon-free electricity needs. It is an important source of energy in the State of Maryland, and of course, in our country.

I want to just underscore the point that Senator Carper made earlier with Mr. Cohen, and that is, I am proud of the work force of NRC located in the State of Maryland, headquartered in the State of Maryland. They are understaffed, and they are losing a lot of their expertise.

So I think the budget support here is an important part of what we do in regard to modernizing our nuclear energy fleet, as well as preserving our aging fleet.

Senator Barrasso, you are absolutely right. This is an issue that has brought our Committee together. We have worked in a bipartisan manner in order to advance nuclear energy in this country. I am proud to be part of that team.

I know your bill was introduced as a way to advance our mutual efforts. You hear that we have concerns in regard to the environmental aspects, and in regard to the traditional role of the NRC. So we look forward to working together to try to come to grips with the differences so that we can continue to advance this issue in the best tradition of our Committee.

Your bill deals with several aspects, including how we deal with advanced nuclear reactors, but also what do we do in regard to our existing nuclear fleet.

Senator Cramer and I have introduced a different approach dealing with our fleet, in that it provides an investment tax credit of 30 percent so that we can maintain our current nuclear fleet.

The challenge today is the cost of energy. As we know, it has fluctuated, declined, and it has made nuclear power much more challenging. The tax codes were developed at different times, giving certain incentives to other forms of energy that the nuclear industry does not enjoy.

My question to the panel is, how critical is it for us to deal with the economics of the pricing of energy as influenced by the policies of our own country in the tax code and elsewhere that could affect the ability to have economical nuclear modernization done for energy?

Mr. COHEN. Mr. Chairman, I would be happy to take a swing at that, if you would permit.

Senator Cardin, I agree with your statement of the problem. Basically, the bogey right now in the market is low cost natural gas, and we know that several, many units are not able to compete with that carbon emitting fuel.

The academic answer is that we need some sort of carbon policy that would level the playing field. That is happening in some States, but it is anyone's guess as to when that might happen federally, so we are really dealing with second best solutions.

CATF has been very active in States like New Jersey to enact provisions that would do much like what your bill did to recognize the value of the carbon-free energy from the nuclear units and enact a sort of a per unit or per kilowatt-hour payment.

That is the reason we support the section of this draft that would provide for a Federal version of that. It is, frankly, catch as catch can as you go around to the States.

As the opening anecdote suggested about Illinois and Ohio, there is often mischief that can occur when some of those deals are done. So I think a very transparent Federal support mechanism for existing nuclear units to run makes a lot of sense.

The questions of where the money comes from is, of course, important, but the design that we see in the draft is fundamentally sound. Our only comment there is that we would—the draft as written doesn't really put a cap on that payment. There should be some reasonable upper cap on the payment. You don't want to have something completely that is out of whack, with say, the value of the carbon avoided.

We recommended actually using as a possible benchmark the 2.5 cents per kilowatt-hour subsidy for wind that is currently in the production tax credit.

It has to be transparent; the public needs to understand that someone is reviewing these numbers, and we are not just giving out goodies without making sure that they are needed.

Finally we recommend that we defer caps on roll, because EPA is not really an economic regulator, and they may not be as competent to review the numbers.

Anyway, Senator Cardin, that is a long answer, but fundamentally, we support this kind of Federal intervention because we think doing this State by State is going to be a very long process, and we are probably going to lose a lot of carbon-free energy in that process.

Senator CARDIN. I would just comment that there are different ways to do it, different opportunities in Congress. Sometimes we have the opportunity through the tax codes, sometimes through appropriation and legislation.

So I think I have to recognize there is an imbalance right now of carbon. I support that, I think that makes sense, but we have to look at what it is feasible to level the playing field so that nuclear power can compete, and therefore investments will be made in its modernization.

Mr. Chairman, I don't have a clock in front of me, I don't know if I have used my time, but if either of the other two witnesses want to respond, I would appreciate their views on this.

Ms. ROMA. Thank you. I agree with the sentiments that Mr. Cohen just expressed.

I think that moving this to the Federal level from the State level would ensure some consistency. I think it provides much needed support that recognizes the carbon-free benefits that nuclear power provides that it is currently not compensated for. There are probably a number of different ways that that support could happen, whether it is a production tax credit or through this EPA measure that is set forth in ANIA.

Senator CARDIN. Thank you.

Mr. GORANSON. Senator Cardin, I will add that with respect to—from my perspective, if we go back and look at the President's Nuclear Fuel Working Group Report, in that report it also states, one of the important portions of part of that is to value what nuclear

power brings to its generating, that is, the clean air side of it, the baseload, the 24/7 power, is vital to maintaining a strong economy as well as vital to supporting our Nation's growth and place in the world.

So that is why the UPA has taken such a strong support for Section 301, which provides some of that support.

Senator CARDIN. Thank you, Mr. Chairman.

I thank the witnesses.

Senator BARRASSO. Thanks, Senator Cardin.

Senator Cramer.

Senator CRAMER. Thank you, Mr. Chairman.

Thanks to all of our panelists. I have been sitting here the entire time listening to every single word from my colleagues on both sides and all of the witnesses.

First of all, I am encouraged by it. Second of all, I continue to ask the question, how did we let this happen? How in the world did America ever allow its superiority in this realm slip away? Not just slip away, but we acquiesced it to our most dangerous adversaries. I think we need to get it back before it is too late.

One of the thoughts that has come to mind as I have been listening to some of this, Ms. Roma, when you were talking about the stockpiles or the reserves—whenever I bring up reserve to people, there are people that will say, Oh, but we have several years of reserves. We don't really need to worry about that.

Then I think about the state owned competitors that we have, who are run by emperors for life. Maybe you could just speak to the long game if you will, the importance of this, not just in the near future, but the consequence if we don't stop the bleeding soon.

Ms. ROMA. The question that you asked, how did this happen, is something that I have studied extensively for my entire 17 year career in this field.

I think that there are a lot of different factors that went into it. But one of the things that strikes me is that there seems to be a lot of complacency. There seems to be just an acceptance within the industry that we are the best, and of course, everybody wants the best, and we operate the best plants. So, by golly, we can build the best plants and design the best plants, and the rest of the world will want our plants.

That happened in the last generation of build. But then the U.S. stopped building, and other countries continued to build.

Countries like China are fairly newer to nuclear, and now they are doing lots of building, and so is Russia. They recognize, probably because of the integration of their state owned enterprises with their government, that if we can export this technology and embed ourselves in critical infrastructure in foreign countries, then we have the ability to exert our geopolitical influence.

I don't think that the United States was looking at it with that holistic a viewpoint. So I think that is where we are now, and we just need to accept that fact. One of the best advantages that we have is we continue to operate the most efficient fleet and the largest nuclear fleet in the world. We need to continue to do that in order for other countries to want our input and our advice on what are the safety standards, what are the nonproliferation standards,

what are the technology best practices, what are the operational best practices that we should implement.

If we don't operate as many nuclear power plants as we do, and we don't operate them as well as we do, they will stop asking us.

The second aspect is, right now, the United States, through our incredible universities and our national labs, we are at the forefront of advanced reactor development. We have numbers and numbers of advanced reactor initiatives. We have numbers of fusion companies that are looking at building demonstration facilities and commercially deploying their technologies. They are struggling to do that in the current climate that we have.

So anything that we can do to help the NRC do a more efficient review, to put accountability on them for how much money it costs to do a review for a reactor design, and making sure that the resources they spend are achieving the objectives that they intend for it to achieve, such as in its environmental reviews, those are all good things, and those all better position us to be able to help with developing programs around the world.

Senator CRAMER. This is so fascinating. I going to skip all my rate design stuff. I am a former regulator, nerd, but you just touched on something that I think is really, really critical. I think this is applicable to lots of things that we do in the United States.

I mean, China and Russia have taken our invention of hypersonic missiles, for example, and they are running with it while we are catching up. So often we do this.

I would rather export our excellence than import their mediocrity every time. But both of you have talked about—but all of you have talked about the supply chain. The supply chain that I worry the most about compromising is the intellectual supply chain. We are going to wake up one day, and nobody—to your point about the expertise, it is not going to be available because the opportunities weren't available.

Maybe in the remaining moments, you could speak to that, sir.

Mr. GORANSON. Senator Cramer, yes, I can. You are right. What we see here is our critical talent, what I consider one of the most key parts of our industry. I can speak from the uranium industry that, over the last few years, we have seen a lot of people come in through the domestic uranium industry, new hires, people right out of college.

Unfortunately because of our competition with these state owned enterprises, as recently as last April, I actually had to go tell talented, experienced people that their services were no longer needed because of market conditions created by our current situation.

Unfortunately, since 2013, I have learned that that story doesn't get easier by experience. I have had to do it several times. It has been a decline that has been very dramatic and very marked.

What is important, I see, is that we have to keep the talent, we have to keep the people. If we don't have—speaking from the uranium mining perspective, there is no school of uranium mining you can go to. It is a skill set and an industry that is unique amongst the different extractive industries simply because we deal with uranium.

So we have to have trained people. We want to do it safely; we want to be doing it in an environmentally protective manner. That

means we have to have smart people who understand our regulations and understand how we do things on a regular basis to not only produce uranium, but also do it safely and efficiently.

Senator CRAMER. Thank you, Mr. Chairman.

I am well over my time, but maybe in another round I will ask Mr. Cohen about some rate design things. I think reliability, for example, dispatchability has value that should be recognized in rates as well as the environmental pieces of it.

So with that, thank you.

Senator BARRASSO. Thank you.

Senator Whitehouse.

Senator WHITEHOUSE. Thanks, Chairman.

Just to nail down a few things that I think are well established in this hearing, there is value to the carbon-free nature of electric generation that does not create carbon emissions. Does anybody disagree with that proposition, or is that agreed?

Mr. GORANSON. Agreed.

Senator WHITEHOUSE. Agreed. And the nuclear industry is now ordinarily not compensated for that value. Does anybody disagree with that statement?

Agreed, OK.

And finally, the effect of that failure to compensate the industry for that value creates what an economist would call a market distortion. Does anybody disagree with that? So that is our situation. We have a market distortion that hurts the nuclear industry because it is not compensated for one of the assets of its power.

Correct? Yes, yes, yes? OK, good.

I think off of that platform, we have got a lot of opportunity to build here in bipartisan fashion. I would like to drill down now a little bit into the question of nuclear waste storage. That, I think everybody will agree, creates cost, creates hazard, creates danger. It is a liability in an economic sense to have nuclear waste stockpiled at our facilities. Correct?

So there is value to finding a way to solve that problem. The question that I have is, as we embark on nuclear innovation, how can we make sure that the innovators see the value of that?

Because if that is not on the table, then what you are going to see is a nuclear innovator who will say, I am going to put my money, my expertise, and my backing behind this power that costs 99 cents because it is cheaper than this other power that costs a dollar and one cent. They will save the two cent difference.

But if the dollar and one cent used the nuclear waste stockpile, that is a huge value to America and to society. And a little bit like our problem with the market distortion of not pricing carbon, not pricing the value of drawing down on nuclear waste stockpile and turning it into a positive use, I think risks create on a smaller scale the exact same economic distortion.

So let me ask Mr. Cohen first, since he is coming electronically, am I right that that is a problem? Is that something we should continue to work on to find an economic solution, so that the direction of innovation is not distorted away from the value of solving, at least to some degree, the nuclear waste stockpile problem?

Mr. COHEN. Yes, and Senator Whitehouse, I absolutely agree with your approach. I applaud the provision of this draft that

would actually require an annual report to Congress to quantify that liability and describe some of the opportunity. Yes, we do need to think about nuclear waste, spent fuel, as a potential asset.

The first thing we can do though, I think, is sort out the issue of the repository. It doesn't need to be first, but it should at least proceed in parallel. Regardless of reuse of spent fuel, there will be a residual amount, probably a significant amount, that will need to be dealt with and isolated for many, many years.

Senator WHITEHOUSE. Yes, that is a separate and larger issue. I am trying to focus on the innovation direction piece, here.

Ms. Roma.

Ms. ROMA. I agree that it is important to consider the spent fuel considerations for innovation.

Two points, just to add. One, a number of the advanced reactor technologies that are under development embed in their commercial case the spent fuel consideration. Having sat through investor meetings with private equity and venture capitalists looking at investing in them, one of the first questions they say is, well, what about the waste?

Senator WHITEHOUSE. Yes.

Ms. ROMA. And so a lot of them are looking at, can we use spent fuel, can we use natural uranium, so we don't have high level nuclear waste on the back end coming out? So, it is embedded in a number of these designs, but not all of them.

Senator WHITEHOUSE. Yes. If you are a utility buying, then you have this incentive. If you are not, then you don't, and so it is not a complete market response, it is only in those specific cases, correct?

Ms. ROMA. No. For any advanced reactor designer, who aren't necessarily looking at just selling to utilities, they actually consider it in their design because they have to go and sell this to customers, and customers are like, Well, what about the spent fuel?

Senator WHITEHOUSE. And some of them will be utilities?

Ms. ROMA. Yes. Some of the will be utilities. Some of them won't be.

Some of them are intended to be foreign countries that have no nuclear power programs right now and won't be able to handle the nuclear waste. So that is why they are trying to consider it as part of their commercial case. But some of this is pie in the sky technology advances that they are hoping to implement, and they haven't yet.

But to your second point about innovation, refer back to my earlier comments that we are at the forefront of advanced fission and fusion technology development.

America is a great innovator. When it has the support it needs, it can do leaps and bounds. So I would urge everybody to consider any financial support for innovation for spent fuel, ways to handle spent fuel.

Senator WHITEHOUSE. My time is up, so let me interject here, ask Mr. Goranson if he wants to add something, to add it as a question for the record, since my time is up.

But I do want to say, as somebody who has watched this for a while, there have been times when our leadership in this space has

left a lot to be desired. There have been times when our innovation has not been so great.

A lot of our existing reactor fleet is big, cludgy, complicated, nonstandardized, inefficient, not great design by anybody's standards.

I believe that is because they were built in a cost-plus environment, in which the utilities figured, spend everything you can get away with, because you are going to earn a return on equity on whatever you can legitimately put into this thing. That is not a path to innovation.

Now, I think we are on a much stronger path to innovation. But I think we have got to be candid and clear that America has not always been a great and successful innovator in this space. There has been a lot of cludgy stuff that got built, and there have been a lot of failures as a result.

So let's make sure innovation really works.

Thank you.

Senator BARRASSO. Thank you, Senator Whitehouse.

Senator Braun.

Senator BRAUN. Thank you, Mr. Chairman. I have been here a year and a half, and in the general context of what we are talking about, I have always been interested in the environment.

I think Sheldon's comments on finally starting to quantify these external costs makes a lot of sense.

We started the Climate Caucus here in the Senate less than a year ago, and I probably worked as hard on it, maybe not quite as much as trying to reform healthcare. The healthcare industry is fighting everything that we are trying to do. It does not want to reform itself.

My observation has been across the different parts of energy, from agriculture to power generation, transportation, and more broadly than that, technology, finance, they are interested in being part of the solution.

So I think my frustration is that we have got something that does not emit carbon dioxide. But it seems like we have got a large gulf between light water, the current fleet, which seems to be operating fairly safely across the world, at least, recently. How do we get from where we are to where we need to be by 2050?

The first question would be for Ms. Roma. What can we glean from what France has done, to where they are now, I think, close to 80 percent of their power generation? What have they done that we haven't, and is it just that they are taking the risk?

Please comment on that, and then I have a question for Mr. Cohen.

Ms. ROMA. France, I believe, gets about 80 percent of its power from nuclear power. It did that because it needed energy security and independence, and it figured if it builds all these nuclear power plants, then it controlled its own power, and didn't rely on other countries for its power. That is how they got to where they are.

We had a lot more alternatives, and we had a lot more natural resources in the United States, and so we have a more diverse energy portfolio.

Senator BRAUN. Is there anything we can learn from them specifically since they have put so many eggs in one basket? Will they

try to migrate from light water to advanced technology to kind of hedge their safety bets over time?

Ms. ROMA. I am not sure if they are going to migrate to advanced reactors. They are considering it, but they already get so much power from their operating fleet, which can operate for decades without having to develop a new technology.

One of the lessons that we could look to for France is how they handle spent fuel, how to reduce its volume and size and storage.

Senator BRAUN. Thank you.

Mr. Cohen, in a more general sense, how do you see that interplay between our existing fleet and advanced technology, nuclear technology? What is your vision of where that can go between now and 2050? Because to me, it looks like it is the one bird in the hand that we have.

I think we are already running into maybe bottlenecks as it relates to solar and wind, and it has got other disadvantages. Kind of give me your vision there of how you see that reliance on our current fleet, and advanced nuclear technology, and what percentage it would be of total energy generation by 2050.

Mr. COHEN. Well, if we don't get busy, it is going to be a very diminishing share, I am afraid.

Just going back to your previous question, Senator Braun, the secret to the French nuclear program was standardization, basically, settling on a design and building the same thing over and over again with the same people. We never did that in the United States. We actually had increasing costs rather than declining costs, as France was able to do.

So the key is getting back to that world where you are not building one off big units that have to be built mostly onsite.

I think my answer to you is basically for the near term, in the next 10 years, we should be doing more export of conventional reactors. That is the kind that are being built right now in United Emirates.

But innovation really offers us a number of opportunities to reduce material inputs to these units, making them much more manufacturable, much more standardizable, if that is a word. When we can get into that mass production mode, we are going to have a much better shot at scaling.

So that is where the innovation is really important, and that is a long discussion about what specifically needs to happen in the R&D space.

But fundamentally, my view is that we do need a different kind of business model and probably technology model to get to the scale that we need to do in the time that we have.

Senator BRAUN. Thank you. That makes sense, and I think that we can learn a lot from what we see works elsewhere if we want to hit the target by 2050.

Thank you.

Senator BARRASSO. Thank you.

Senator Booker.

Senator BOOKER. Thank you very much, Mr. Chairman, and to Ranking Member Carper, as well.

I just want to say some introductory comments at the top, that I share the bipartisan remarks that have been said at the begin-

ning. It is been an honor to work on this legislation. I have seen this as a space of urgency since I came to the Senate.

But we have, as Senator Whitehouse put it, terrible market distortions that undermine the value and the important part of our energy blend that nuclear is.

In fact, it not only has an important role, I think it has a critical role as we transition as a Nation to net-zero carbon emissions as quickly as possible. If we are going to avoid the worse impacts of possible climate change, nuclear has got to be a critical part of that.

It also has a national security issue as had already been said in this hearing of the challenges that we see from foreign adversaries that have taken our singular positioning in this kind of energy away from us as they have charged to embrace this while we have gotten entangled in a lot of things that undermine nuclear energy.

I believe there are two really critical sets of policies that the Federal Government should be focused on now if we are going to move forward. That is first, we need to enact policies to prevent the existing fleet that we have of reactors from shutting down permanently, and our existing fleet of reactors that do provide that majority of carbon-free electricity that is currently generated, losing these plants would be a massive step backward that we cannot afford to take in the fight against climate change.

Second, we need to enact policies that facilitate the development of next generation advanced reactors. This is a discussion at this hearing which I think is of such urgency. Advanced nuclear reactors have the potential to be even safer, more economical, generate less waste than existing reactors.

That is why I am so proud to be a part of the bipartisan work we have done in this Committee in recent years related to nuclear energy. I really believe that with the incorporation of some of the feedback that Senator Whitehouse and myself have, as well as from stakeholders, we can now really craft this important piece of legislation and move it forward out of Committee in a very bipartisan manner.

I just want to ask really briefly in the 2 and a half minutes I have left, for Armond Cohen.

Mr. Cohen, can you just explain why the Clean Air Task Force believes that it is important to have nuclear energy as a part of that mix as we try to de-carbonize our electricity generation as quickly as possible?

Mr. COHEN. Certainly. If we are going to get to zero by mid-century, you do the math, and you say, we have to basically build carbon-free energy at 5 to 10 times the rate that we ever have in the past. Those numbers are really daunting.

If we just rely on one source, as good as solar and wind are, and we support massive expansion of those resources, we are racing against time. We believe that nuclear could provide a lot of clean power very fast.

I gave the example of France earlier. If we could get to that kind of trajectory, we could provide a very significant chunk. So it is all about scale and time for us, nuclear being a very power dense resource. That is why we think it needs to be in the running, but we have a way to go to get there.

Senator BOOKER. We have talked a lot about electricity generation, and of course the important role it has. But can you also talk about sort of the non-electric purposes, industrial applications, productions of zero-carbon fuels, such as hydrogen? Can you explain why it is important from a climate change perspective to focus on these elements of application of [indiscernible] through our [indiscernible]?

Mr. COHEN. Right. It is important, Senator, to recognize that electricity is only 25 percent of total, final energy consumption in the United States and the world. The other 75 percent is basically molecules that get burned right now. It is oil and gas, fundamentally.

So, if we dealt with electricity, that would be great, but then we have industry and transport and building heat and all kinds of other applications. So we need a zero-carbon fuel to substitute for those molecules and for the things we can't electrify. We are going to lose 75 percent of the game if we don't have that.

Nuclear is uniquely suited, for reasons we go into in the testimony, for that hydrogen production in particular, because we can supplement the electrolysis with high temperature steam, and so forth. It is very power dense, can scale quickly. That is why we need to think about non-electric applications of nuclear.

Senator BOOKER. Ms. Roma, really quick, if I could just ask my question, could you explain real quickly, again, this international perspective is so urgent. Why is it important from a non-proliferation perspective for this legislation to facilitate the U.S. exercising more of a leadership role internationally related to advanced nuclear energy?

Ms. ROMA. One of the best tools that we have in our non-proliferation toolbox is exporting nuclear technology because with that can come the U.S. standards that go with that technology about how it can be used and where it can be used.

I will just give you an example. If you have a U.S. origin nuclear reactor, even if it goes to another country, and they further develop it, and then they try to export it to a third country, U.S. standards go with that technology all the way. Including what it can be used for and where it can go, making sure that the country that is the recipient of that technology has signed onto the highest level of nuclear non-proliferation agreements. If we don't have our hands in that technology, we don't really control where it goes or what somebody does with it.

To go back to Mr. Cohen's comment earlier about China and Saudi Arabia, does it concern us? Yes. Can we do anything about it? No, because what they are doing is perfectly legal, subject to the international agreements that they have committed to.

So we lose our ability to have that voice in the development of technologies and how those technologies are used and where they can go.

Senator BOOKER. Thank you very much.

Mr. Chairman and Mr. Ranking Member, again, I am just really grateful to be a part of this partnership with you all to try to advance what I consider utterly urgent for national security reasons, for the planetary challenges we have in climate change and more.

This is an exciting area, and I hope we can continue to make strides together in a bipartisan way.

Thank you.

Senator BARRASSO. Thank you so much, Senator Booker, for your leadership on this. I agree with you entirely.

You might not have heard my opening remarks, but I made reference specifically to your good work in helping in our efforts here, so thanks so much, Senator Booker.

Senator Van Hollen.

Senator VAN HOLLEN. Thank you, Mr. Chairman, Ranking Member Carper, and to the witnesses today.

I also share and believe much of the views that were expressed by my colleague, Senator Booker, during his questioning.

I do want to follow up with the last issue he raised with respect to nuclear non-proliferation. While I support the development of advanced nuclear reactors as part of our own energy mix and also would support exporting that technology, the export of that technology has to come with that important caveat that it is consistent with our nuclear non-proliferation goals. There are some aspects of advanced nuclear reactors that could increase the risks of proliferation with the development of the paleo, the more highly enriched uranium, and also as part of the reprocessing efforts, the plutonium.

So let me start with Mr. Cohen. Mr. Cohen, do you agree that we have to address those additional risks? What kinds of measures do you think we should put in place?

Mr. COHEN. Yes, I agree, Senator, we do have to be mindful of that issue. I think the specific opportunities here and challenges are first of all, as was mentioned, if we are in the game, we have a better control over what the product is and how it is deployed. If we are not in the game, we don't, and our adversaries will set the rules.

Second is that specifically, the bill contemplates international harmonization and coordination of licensing. I think that can be expanded to include international cooperation over non-proliferation.

Third point is that some of these designs actually may pose less proliferation risk than more. For example, many of them are much more efficient, so it means that the amount of fissile material involved is lower.

Finally, as we discussed earlier, there are a lot of opportunities for R&D on the back end of the fuel cycle. There is no such thing as a completely proliferation resistant reactor, let's just be honest, but there are many steps we could take as part of this innovation process to ensure that we have got as tight a rein on that problem as we possibly can.

Senator VAN HOLLEN. Well, I fully agree with you, that we should encourage and incentivize the companies that are developing these advanced reactors to build in, to the maximum extent feasible, those protections against non-proliferation.

Would you agree that we could address that issue with an amendment to this draft proposal that would say that countries that are receiving these advanced reactors should implement the additional protocol of the IAEA?

As you know, over 150 countries have signed that. It seems to be a basic protection that we could take to protect our non-proliferation efforts. Could you comment on that?

Mr. COHEN. Senator, I am not the staff non-proliferation expert. I would prefer to get back to you in writing, but that is the general direction of our program, is to try and socialize all of the newcomer countries into the existing international framework.

Senator VAN HOLLEN. Ms. Roma, can you comment on that? You mentioned in your remarks the importance of protecting against nuclear proliferation. Can you talk about writing in a requirement that recipient countries agree to the additional protocol with the IAEA?

Ms. ROMA. Senator, I am going to have to look into that and get back to you in writing. Namely, I would just want to evaluate more closely the existing framework that we have with our Section 123 agreements and our Part 810 process, and the restrictions and considerations that go with that to see what additional protections a write in like that would afford. I just need to look at it more closely.

Senator VAN HOLLEN. Sure. Well, the gold standard, which is what we have been applying in many of our recent agreements, would require recipient countries to sign the additional protocol with the IAEA to have that enhanced protection against nuclear proliferation.

Thank you for your comments. I look forward to your written responses.

Mr. Chairman, I look forward to working with you and the Ranking Member to address that aspect of this. Again, I am a proponent of nuclear energy as part of the mix, so long as we maximize the safety component, including the safeguarding against nuclear proliferation to the extent that we can. I think the IAEA additional protocol has been an important measure that we should ensure that people are complying with.

Senator BARRASSO. Thank you, Senator Van Hollen, for your continued leadership and interest in this important topic.

Senator Carper, I know you had a few additional questions.

Senator CARPER. Thanks, Mr. Chairman. It has been an important, and I think in many respects, a fascinating hearing. We are grateful to you, Mr. Chairman, for holding it, to our staffs for helping to put it together, and to our witnesses for being here with us today.

A long time ago, I was a naval flight officer living in California, and stationed at a base about halfway between San Francisco and San Jose right off of Route 101. It was called Moffett Field Naval Air Station. We shared half of that base with NASA, a big NASA installation on the other half of our base.

I was back visiting Moffett field, happened to be at Mountain View, visiting a technology company years later, and I revisited Moffett Field. It is no longer a naval air station, but NASA is still there.

I happened to visit a facility actually using one of the buildings on the Moffett Field side, where they were doing some NASA experiments. They were trying to figure out how to create electricity on Mars. It was a NASA funded operation, which led to the devel-

opment of a company now called Bloom Energy, which is headquartered not too far from Moffett Field in California.

A tropical storm roared up the East Coast yesterday, leaving a lot of wreckage and mayhem in its path. We almost never have tornadoes in Delaware. We did yesterday, and the weather forecasters tell us, the meteorologists tell us it is not going to be the last hurricane that is going to come visit us this summer. There will be plenty more, and we are going to lose power during those hurricanes, as we did yesterday in Delaware and other parts of our country.

There is a company now that is headquartered in California, but they actually have a considerable manufacturing facility in what used to be our Chrysler plant in the south side of the University of Delaware. It is called Bloom Energy, and they take hydrogen from natural gas, and they turn it into electricity. Yesterday, when the electricity went out in a number of places up and down the East Coast, they were able to restore the electricity right away by using these bloom boxes. Bloom boxes.

It would be great if somehow, the hydrogen that is used in conjunction with fuel cells in these bloom boxes, it would be great if the hydrogen could be clean hydrogen, and not just come from carbon sources, like natural gas. I understand, I think one of you actually mentioned in your testimony, actually mentioned something about clean hydrogen production at reactor sites.

I am sitting here thinking, is there a way to not only create through these bloom boxes, electricity for, could be a housing development, could be for a hospital, it could be a shopping center, is what they were using them for all over this country and around the world now.

But the bloom boxes could be an even more environmentally friendly source of electrical energy in this country if we could somehow come up with a clean hydrogen source, and nuclear power plants might somehow play a role in that.

Ms. Roma, would you just respond to that? Is that a pipe dream? Is that something that is realistic? I would welcome your thoughts, along with Mr. Cohen.

Ms. ROMA. No, I don't think it is a pipe dream, Senator, I think it is realistic. I think a lot of the non-power applications of advanced reactors are truly remarkable, from medical isotope reduction to water desalinization to heat processes, anything that you need to burn carbons for, hopefully can be replaced with advanced reactors. That is why I am in this field and excited about it.

Senator CARPER. Same question, Mr. Cohen, do you have any thoughts on clean hydrogen production from the nuclear power industry?

Mr. COHEN. Yes, Senator Carper, definitely not a pipe dream. In fact, the Department of Energy right now has four demonstrations with four separate U.S. power companies to do precisely that, to test out a use of nuclear for electrolysis.

As I mentioned earlier, the advanced reactors might even be better at doing that because they have higher heat, which will make the electrolysis process more efficient. So a lot of folks are chasing that right now. It should be part of the innovation process.

Our recommendation, although it is not—this Committee doesn't have jurisdiction over the DOE R&D budget, but we are separately

developing proposals to really put that whole effort of nuclear to hydrogen on fast forward.

Senator CARPER. That is great.

Mr. Goranson, I don't want to pass you by if you have something you would like to add on this, you are welcome, and thank you.

Mr. GORANSON. With respect to using nuclear power as a source of clean hydrogen generation, I think from my perspective I think it is an ideal way to do it. In fact, I was thinking here while you were raising it, it was raised by a science fiction writer 20 years ago, about doing that. To see some work being done right now to make it come to reality is, I think, it is an important thing to do.

Senator CARPER. Good. Thanks for that.

Mr. Chairman, I was handed a note by Lauren, who is sitting right behind me. The note says, France is reducing its dependency on nuclear power. Its goal is to reduce that dependency from 80 percent to maybe 50 percent by 2035, investing in renewables, and that is all well and good, and we commend them for going reliance on renewables.

We are seeing a growing reliance on renewable here, too, and we are seeing a dropping reliance on nuclear, which is concerning to a lot of us, Democrats, Republicans, and Independents, for a variety of reasons that we have discussed here today.

The nuclear industry, as I said earlier, has to bring their A game to work every day, and in several instances that I have described earlier, they haven't, and I have been very disappointed with that.

Having said that, there is still a lot of potential here, and it is important for us to seize the day. I look forward to working with you and our colleagues that are here and those that aren't to achieve that.

This won't surprise you, Mr. Chairman, but before this hearing ends, I want to ask for unanimous consent to submit for the record some statements from groups who have a real interest in these issues, too.

And with that, our thanks to the witnesses, great to see you all, and thanks to our staff for helping us to pull all this together. Thank you. We look forward to following up with you.

Senator BARRASSO. Well, thank you, Senator Carper. Without objection, those are submitted for the record.

[The referenced information follows:]

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August 12, 2020

VIA EMAIL

Senator John Barrasso
Chairman
Senate Environment and Public
Works Committee
410 Dirksen Senate Office Building
Washington, DC 20510

Senator Thomas Carper
Ranking Member
Senate Environment and Public
Works Committee
456 Dirksen Senate Office Building
Washington, DC 20510

Dear Chairman Barrasso and Ranking Member Carper:

As the world's largest publicly traded uranium company, Cameco is an essential part of US energy security. Cameco annually supplies approximately 25% of the uranium used to fuel US nuclear reactors, and the company has provided uranium to every reactor in the United States. With our operations in Wyoming and Nebraska, Cameco has historically been the largest US uranium developer, investing more than $1 billion into our US operations and producing 40 million pounds of uranium concentrates over the last several decades.

Cameco is uniquely situated in the uranium sector with investments across the front-end of the fuel cycle. Cameco and its partners have invested $500 million in Global Laser Enrichment (GLE) in an effort to help the US regain its leadership role in the development of uranium enrichment technology. Work continues at GLE's Wilmington, NC, facility to develop a next-generation enrichment technology that will be deployed to re-enrich the Department of Energy's depleted uranium tails in Paducah, Kentucky. Cameco also owns and operates the Port Hope Conversion Facility, currently the only open conversion plant in North America.

Given our investment and partnership in the US nuclear industry, Cameco endorses the American Nuclear Infrastructure Act (ANIA). It is timely and critically important legislation that takes a comprehensive approach to bolster US nuclear leadership. Cameco appreciates the ANIA's focus on challenges that uranium producers are facing from state-owned enterprises (SOEs), many of whom are from countries that are hostile to the US. In particular, Cameco wanted to highlight these key provisions in the ANIA:

- **Section 102**: this section provides the Nuclear Regulatory Commission (NRC) with the authority to deny a license if the Commission determines that possession or ownership of a covered fuel poses a threat to US national security or adversely impacts the physical and economic security of the US. Under this provision, the NRC could block licenses to SOEs from countries that are hostile to the US.

- **Section 301**: this section directs the Environmental Protection Agency (EPA) to establish a program to provide credit to struggling US reactors operating in competitive markets. Unfortunately, these competitive markets do not value the emissions-free attributes of nuclear reactors, but this provision would provide a credit to ensure that these struggling reactors remain on-line, a key part of ensuring a continued source of zero-carbon generation. We support provisions that require EPA to consider if a nuclear reactor uses US-mined uranium in assessing their eligibility for credit under this program.

- **Section 402**: This section would establish a National Strategic Uranium Reserve to provide assurance of the availability of uranium mined in the US in the event of a market disruption and to support strategic fuel cycle capabilities in the US. A key recommendation of the recent Nuclear Fuels Working Group report, this provision would bolster the prospects of a possible restart of Cameco's US uranium production.

We appreciate the Committee's continued leadership on nuclear issues, as exemplified by the recent passage of the Nuclear Energy Innovation and Modernization Act. We look forward to working with the Committee on the ANIA.

Please do not hesitate to reach out if you have any questions.

Thank you for your time and leadership.

Very best regards,

Tim S. Gitzel
President and Chief Executive Officer
Cameco Corporation

In Step to Strengthen the U.S. Uranium Mining Industry, EPA Administrator Wheeler Signs Important MOU with Nuclear Regulatory Commission

07/23/2020

Contact Information:
EPA Press Office (press@epa.gov)

Cheyenne, Wyo. (July 23, 2020) — At a press conference with Wyoming Governor Mark Gordon, U.S. Environmental Protection Agency (EPA) Administrator Andrew Wheeler signed a Memorandum of Understanding (MOU) with U.S. Nuclear Regulatory Commission (NRC) Chairman Kristine L. Svinicki to improve coordination and cooperation in the regulation of the ***in-situ*** recovery (ISR) process of uranium extraction.

"This MOU is an important step towards establishing a robust domestic uranium mining industry, which is increasingly important for the national security interests of the U.S.," **said EPA Administrator Andrew Wheeler.** "In situ uranium mining is a proven safe and cost-effective way to provide fuel for America's nuclear power plants, which supports thousands of jobs and is a large source of emissions-free energy. This MOU reflects a commonsense approach between agencies that has come to be expected under the Trump administration."

"The NRC welcomes opportunities, such as this, to clarify and enhance our partnerships with fellow regulators, at both the Federal and State levels, who share in the important work of safeguarding public health and protecting our environment," **said NRC Chairman Kristine L. Svinicki.** "I join Administrator Wheeler in giving many thanks to the EPA and NRC staff who collaborated in the development of this agreement."

"This agreement is a major win for uranium production in Wyoming," **said U.S. Senator John Barrasso**. "The Trump administration is limiting unnecessary regulations and making it easier for American companies to do business. Nuclear power is clean and reliable. It provides carbon free energy and creates good paying jobs. This agreement will help preserve Wyoming's uranium industry. Wyoming leads the United States in uranium production. I want to thank the leadership of the EPA and the NRC for answering my call to enter into this important agreement."

"This much-needed action returns to the original intent of Congress in stipulating the shared role that the Environmental Protection Agency and the Nuclear Regulatory Commission have in regulating uranium recovery operations. Under the prior administration, EPA ignored the congressional limitations on its authority, usurped NRC's responsibilities and attempted to impose new technically unfeasible standards – not based on science or risk – but merely to impede mining operations. By drawing clear lines between the roles of EPA and NRC, the agency with the most relevant experience is able to weigh in where issue-specific expertise is needed, to the benefit of both the environment and project review," **said National Mining Association President and CEO Rich Nolan.**

The MOU outlines how EPA and NRC will work to accomplish our respective responsibilities under Title II of the Uranium Mill Tailings Radiation Control Act of 1978 to protect public health, safety and the environment from radiological and non-radiological hazards.

To read the MOU, please visit: https://www.epa.gov/sites/production/files/2020-07/documents/epa-nrc-mou-2020.pdf.

Background

Both EPA and NRC have individual statutory responsibilities under the Atomic Energy Act of 1954 regarding uranium and thorium processing at ISR facilities. The EPA has standards under 40 CFR Part 192 that protect public health, safety and the environment from radiological and non-radiological hazards associated with uranium and thorium ore processing and its wastes. The NRC uses its authorities to develop regulations to implement these EPA standards and regulate ISR facilities.

On March 16, 1992, the NRC and the EPA signed an MOU to foster cooperation between the two agencies in protecting public health, safety and the environment on matters related to radiation. The 1992 MOU established a basic framework for the two agencies to resolve issues of concern that relate to the regulation of radiation in the environment. Today's MOU adds to the agencies' mutual agreements, including the 1992 MOU, and does not replace or supersede the 1992 MOU.

LAST UPDATED ON JULY 23, 2020

July 28, 2020

The Honorable John Barrasso
Chairman
Senate Environment and Public Works Committee
United States Senate
Washington, DC 20510

The Honorable Thomas R. Carper
Ranking Member
Senate Environment and Public Works Committee
United States Senate
Washington, DC 20510

The Honorable Frank Pallone
Chairman
House Energy and Commerce Committee
United States House of Representatives
Washington, DC 20515

The Honorable Greg Walden
Ranking Member
House Energy and Commerce Committee
United States House of Representatives
Washington, DC 20515

Dear Chairman Barrasso, Ranking Member Carper, Chairman Pallone, and Ranking Member Walden:

The undersigned support lifting the foreign ownership, control, or domination (FOCD) restriction in sections 103d and 104d of the Atomic Energy Act of 1954 (AEA), as amended, for utilization facilities. The U.S. Nuclear Regulatory Commission (NRC) proposed this amendment nearly 20 years ago, as the provisions had become, in the words of the NRC Chairman at the time, "increasingly problematic." Since then, the FOCD restrictions have been troublesome in additional instances, most notably with the licensing of the reactor expansions that had been proposed at the South Texas and Calvert Cliffs sites.

The international nuclear energy marketplace has changed dramatically since the FOCD provisions were substantially created in 1954. The United States now critically depends on working with foreign suppliers for major safety-related nuclear power plant components. In addition, international companies are involved in major elements of the U.S. nuclear energy enterprise. For example, Westinghouse both designs reactors and also operates a fuel fabrication facility in South Carolina. The company is now owned by a Canadian business, where it was

previously owned by a Japanese company and before that a British corporation. As another example, URENCO, a joint company of Germany, the United Kingdom, and the Netherlands, operates the only commercial enrichment facility in the United States which is located near Eunice, New Mexico.

The NRC already has the regulatory authority – i.e., the inimicality determination that it is required to make as part of utilization facility licensing – it needs to reject problematic foreign investment. The NRC legislative proposal to amend the FOCD provision from 20 years ago was reviewed by the U.S. Department of Defense, the U.S. Department of Justice, the U.S. Department of State and the National Security Council for their views – none objected. The Committee on Foreign Investment in the United States, which has the authority to review transactions involving foreign investment, is another difference between 1954 and today, and provides an additional layer of protection to U.S. interests.

Sufficient safeguards thus already exist to enable Congress to confidently remove the FOCD restriction for utilization facilities, which would then permit the NRC to more effectively manage modern corporate structures and a globalized supply chain. We view this amendment to the AEA as an appropriate modernization and one that would serve U.S. interests.

Sincerely,

George Apostolakis, former Commissioner, U.S. Nuclear Regulatory Commission

James K. Asselstine, former Commissioner, U.S. Nuclear Regulatory Commission

Stephen G. Burns, former Chairman, U.S. Nuclear Regulatory Commission

James R. Curtiss, former Commissioner, U.S. Nuclear Regulatory Commission

Nils J. Diaz, former Chairman, U.S. Nuclear Regulatory Commission

Dale E. Klein, former Chairman, U.S. Nuclear Regulatory Commission

Peter B. Lyons, former Commissioner, U.S. Nuclear Regulatory Commission

Jeffrey S. Merrifield, former Commissioner, U.S. Nuclear Regulatory Commission

Richard A. Meserve, former Chairman, U.S. Nuclear Regulatory Commission

William C. Ostendorff, former Commissioner, U.S. Nuclear Regulatory Commission

Natural Resources Defense Council Statement for the Record on
Senate Committee on Environment and Public Works
Hearing entitled, *"Legislative Hearing on a Discussion Draft Bill, S.___, American Nuclear Infrastructure Act of 2020"*
August 5, 2020

Thank you for this opportunity to provide this statement for the record from the Natural Resources Defense Council, Inc. (NRDC) on the draft of the American Nuclear Infrastructure Act of 2020 (the "draft Act"). Respectfully, the draft Act contains a host of highly objectionable provisions as well as other legislative proposals that need substantial development before enactment, and therefore the draft Act should be withdrawn.

Foremost, the draft Bill would degrade or remove applications of the National Environmental Policy Act 42 U.S.C. § 4321, *et seq*., (NEPA) to important matters of nuclear energy. Dismantling environmental regulations for new nuclear reactor designs will not facilitate commercial development of this technology; rather, this engineering and materials science work must stand up on its merits for safety, reliability and economic competitiveness. As with any new technology, robust environmental analysis as required by law must inform and guide decisions relating to major federal actions. NRDC's statement calls out deficiencies and harms in specific sections of the draft Act. We urge Congress not to compound existing environmental damage and risk to public health and safety through this draft Act.

Further, the draft Act proposes to throw more money at nuclear plants that cannot remain economically competitive, promotes unstable advanced nuclear fuels without sufficient safeguards, and sets up a superfluous domestic uranium reserve even though there is no danger of a uranium shortage. Rather than address these unwarranted nuclear energy topics, there is a host of overdue problems which the nuclear industry has left unsolved in its wake that Congress could tackle.

Sections 201 and 203 of the draft Act are wholly objectionable to NRDC, and, regardless of what form this legislation proceeds in, they should be withdrawn in their entirety. Both sections set forth changes to, or potential roadmaps to change, NEPA, which is the foundational environmental law currently under a frontal assault from the Trump administration.

This June, President Trump signed Executive Order 13927 encouraging agencies to exploit the economic crisis caused by the coronavirus pandemic and bypass NEPA's meaningful public input and environmental reviews meant to protect communities most impacted by government

decisions. And in July, the Council on Environmental Quality (CEQ) finalized its rollback of regulations implementing NEPA. These "updates" to CEQ's regulations turn embedded NEPA requirements on their head. Instead, CEQ regulations will now expedite projects with the bare minimum environmental review, public input, and analysis of long-term impacts on the environment, the climate, and our communities.

NEPA gives voice to all communities and provides what was crafted to be a just process for reviewing development projects. By ensuring everyone can participate in federal decision-making, NEPA ensures a seat at the table for the most powerful and the most vulnerable. Yet the Trump administration has taken major strides to put efficiency and streamlining ahead of democratic representation as well as public health, safety, and the environment. This draft Act proposes to take another bite out of NEPA.

Section 201 of the draft Act directs the Nuclear Regulatory Commission (NRC) to write a report that would address whether there are any circumstances in which "there is no need for an environmental impact statement under [NEPA] with respect to an advanced nuclear reactor; [and] ways in which the environmental review process for advanced nuclear reactors could be improved by reducing or eliminating duplicative requirements or requirements that are not applicable to advanced nuclear reactor designs." While the direction of a report would not usually be cause for deep concern, under the current Administrative assault on NEPA, such a report would become fuel on the fire.

Section 203 further attempts to write advanced reactors out of meaningful NEPA review via reliance on the early site permitting process. Such a provision does unquestioned damage as the NEPA process, however problematically enforced under NRC's current regulations, is the only way for the public to have any meaningful say in the controversial and impactful security, environmental and costly choices associated with the technology.

If this current attack on NEPA were to become law, combined with a Section 201 report that could recommend the further degrading of NEPA standards and requirements, the functional application of NEPA to the nuclear industry could be almost nil. Indeed, the current NEPA process as it is practiced by the NRC is demonstrably problematic and heavily weighted to exclude the public and meaningful environmental oversight. The NRC's rules routinely deny the right of judicial review to any state or member of the public who has not previously gained party status at the outset of the licensing in proceeding years, before NRC has even issued the first draft NEPA document. And to gain party status the state or public must file at least one admissible contention based on a "genuine dispute" with the applicant's environmental report on a "material issue of law or fact" in an expensive, hyper technical process that allows the agency to flyspeck and thereby reduce what Congress intended as a serious review to a rote, meaningless process. The NRC's "strict by design" NEPA process already successfully excludes local and state governments and community groups from raising serious concerns with potential health, safety, and environmental impacts of nuclear projects. Adoption of Section 203 would wholly negate the remaining public and environmental benefits of NEPA on these major federal actions concerning nuclear energy. Rather than continue down this path of degrading public participation, Congress should improve hearing and NEPA requirements at the NRC so that the

public and states can meaningfully participate in the execution of major federal actions as the law intends.

Section 301 of the draft Act creates financial assistance credits to keep economically at-risk nuclear reactors operational. The majority of the U.S. nuclear fleet is projected to end operations by the 2050s due to age and lack of economic competitiveness. But nuclear plants do not provide any unique resilience, reliability, or fuel diversity benefits; their sole beneficial attribute is the generation of low-carbon electricity. The problem is that when nuclear plants retire abruptly, the outcome can be increased generation and emissions from fossil fuel plants. Preventing closures of nuclear reactors therefore should focus primarily on providing the time needed to scale up clean energy alternatives, e.g., energy efficient and renewable energy. Specifically, a well-planned transition away from America's aging nuclear plants is critical.[1]

While Section 301 contains some limitations on supporting existing nuclear power plants such as a two-year limit on credits, it does not go far enough. The section is couched in terms of concern over carbon and other emissions, yet the requirements for credits fail to ensure this goal. Rather, the credits are to be awarded to reactors utilizing domestic uranium – a topic unrelated to emissions and, as we discuss below, a requirement devoid of public good. Additionally, the draft Act requires reactors receiving credits to provide an economic recovery plan. This ignores the reality of the aging U.S. nuclear fleet and instead continues to fund the impossible notion that nuclear reactors can operate forever. Nuclear reactors are already being pushed to operate twice their planned lifetime, to 80 years. The cost and risks of pushing reactors so far is unnecessary and a risk to the health and safety of communities and the environment. Rather than an economic recovery plan, a community and electricity source transition plan should be required in law as a component of any public funds supporting nuclear electricity generation.

Section 401 of the draft Act creates irresponsible proliferation and safety risks by promoting dangerous advanced nuclear fuels. Today all reactors in the Unites States delivering electricity to the grid use low-enriched uranium as fuel. This draft Act instead encourages uranium enriched in the isotope uranium-235 above these normal energy-use levels yet below typical enrichment levels in nuclear weapons (i.e., 5% - 20% uranium-235). At these higher levels of enrichment, the fuel becomes a nuclear proliferation risk, a terrorism risk, and the source of Japan's worst nuclear disaster before Fukushima, the 1999 Tokaimura Criticality Accident.

Advanced nuclear fuels should reduce or at least not increase proliferation risks compared with current technology; yet this is a standard this draft Act fails to meet. Nuclear power is unique in that there are substantial overlaps between civilian energy technology and military applications of this technology to nuclear weapons. The risk of nuclear weapons proliferation can be managed but not eliminated. Preventing the proliferation of nuclear weapons must remain a cornerstone of U.S. national security policy and a consideration of utmost importance for the future of nuclear power.

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[1] *See* NRDC, *Transitioning Away from Uneconomical Nuclear Power Plants: Protecting Consumers, Communities, Workers, and the Environment* (November 2018), https://www.nrdc.org/sites/default/files/transition-away-uneconomical-nuclear-plants-ib.pdf.

Section 402 of the draft Act directs the Secretary of Energy to establish a uranium reserve of U.S. mined uranium. A U.S. uranium reserve is a wasteful solution in search of a problem because the ostensible purpose of the proposal – to assure against domestic uranium supply disruptions – is a concern without merit. The United States already has a reserve of Department of Energy (DOE) held excess uranium inventory, and it has been the source of years of discussion and occasional controversy on how to manage and dispense with it.[2] The Uranium Producers of America has complained repeatedly of DOE's entry into the market. Press reports in the last few years describe the domestic producers calling for DOE to "cease transfers of excess uranium from federal inventory until the uranium market recovers from its current oversupplied state," and further complaining that "DOE's inventory sales had a negative impact on the uranium market and the domestic uranium industry."[3] The best way to assure a U.S. reserve exists into the future is to leave natural uranium, unmined, in its place in nature; the existing in situ reserves cost nothing to maintain until such time as needed.

Moreover, much of America's uranium supply comes from countries that are strong allies with whom we have stable trade relationships, including almost half from Canada and Australia alone. And the International Atomic Energy Agency opened a global "uranium bank" a few years ago to assure a stable supply of low-enriched uranium; a domestic uranium reserve would truly be a waste of taxpayer dollars to subsidize a polluting industry.

While giving a windfall to undeserving, polluting mining companies is wasteful in and of itself, the prospect of promoting the opening of new uranium mines or expanding open mines compounds existing harm and pollution when (1) the existing regulatory structure is an inadequate and dreadful mess that allows permanent damage to scarce groundwater resources and public lands across the American West; and (2) there are huge environmental justice impacts to uranium mining and a terrible, toxic legacy that remains to be cleaned up. Presently, the EPA has a database of over 15,000 abandoned uranium mines still waiting to be cleaned up, mostly in the western US, and disproportionately impacting tribal lands and Native American communities.[4] The proposed uranium reserve would do nothing to serve America, and in the process would further degrade precious groundwater resources and negatively impact tribal lands and lives. There are less costly, wiser, more vital federal actions that should be undertaken with respect to uranium recovery, including: finalizing the Environmental Protection Agency (EPA)'s protective set of uranium recovery regulations; researching how to address the groundwater impacts of uranium recovery; and finally addressing the massive cleanup and environmental injustices associated with the domestic uranium industry's legacy.

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[2] *See* Congressional Research Service, *The Front End of the Nuclear Fuel Cycle: Current Issues*, at 5-8 (updated July 29, 2019), https://fas.org/sgp/crs/nuke/R45753.pdf (hereinafter "CRS 2019 Report"), and Government Accountability Office, *Excess Uranium Inventories: Clarifying DOE's Disposition Options Could Help Avoid Further Legal Violations* (Sept. 26, 2011), https://www.gao.gov/assets/590/585407.html.

[3] *See* World Nuclear News, *US agencies look at excess uranium inventory* (Mar. 10, 2017), https://www.world-nuclear-news.org/Articles/US-agencies-look-at-excess-uranium-inventory, and indeed, the domestic producers have already been shielded from the reality of an overabundance of uranium. As CRS stated in its 2019 Report (at 8), "[e]xplanatory language in the conference report accompanying the Energy and Water, Legislative Branch, and Military Construction and Veterans Affairs Appropriations Act, 2019 (P.L. 115-244, H.Rept. 115-929) directs DOE to end the uranium transfers and explains that $60 million above the budget request is appropriated in lieu of anticipated profits from those transfers."

[4] EPA, *Uranium Mines and Mills Location Database*, https://www.epa.gov/radiation/uranium-mines-and-mills-location-database-0.

Other sections of the draft Act merit specific objection, such as Sections 205 and 302, respectively, as they both essentially remove the NRC's ability to recover regulatory costs, further placing in harm's way the agency's ability to meet its safety objectives over the long term. Indeed, more discussion and analysis should be done both by the agency and Congress to ensure the NRC has the financial and technical resources to fully meet any safety challenge that could be presented by an aging domestic reactor fleet.

In contrast to the harm and waste evident in the American Nuclear Infrastructure Act of 2020, Congress should:

- Prioritize solving the nuclear waste problem over the demonstration of new nuclear technology;
- Wait for completion and operational experience from the AP1000 and a prototype Small Modular Reactor projects now underway, and assess lessons learned from their safety, reliability and potential economic competitiveness before entertaining federal cost sharing investments to license and construct non-Light Water Reactor (LWR) advanced nuclear reactor demonstration plants;
- Consistently apply a nuclear weapons proliferation test to advanced nuclear designs;
- Consider severe accident consequences and the full impacts of the nuclear fuel cycle associated with advanced nuclear reactors; and
- Require greater clarity on likely economic competitiveness for advanced nuclear designs earlier in the research and development cycle.

Sincerely,

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U.S. Nuclear Innovation in a Global Economy

Updating an Outdated National Security Framework

NUCLEAR INNOVATION ALLIANCE

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I. Executive Summary

The U.S. Advanced Reactor Industry Has Promise But Needs Global Support. Advanced reactors have the potential to raise the global standard of living by providing clean, affordable, and reliable energy to the masses. And in a world suffering from the effects of climate change, with severe droughts, wildfires, and rising sea levels, developing this nascent industry—with its potential to provide immense amounts of carbon free power—becomes even more important.

For now, the U.S. leads in advanced reactor design, with dozens of domestic ventures in next-generation nuclear technologies. But this growing industry is running smack into a Cold War statutory framework that assumes any foreign participation in the U.S. nuclear industry is a national security risk, regardless of the partner. This framework has not changed since it was initially enacted in the early 1950s during the height of the Cold War, despite the fact that we live in a very different world today, nearly 70 years later.

Cold War-Era FOCD Restrictions Hinder U.S. Innovation & Jobs. Specifically, we are talking about the Atomic Energy Act's ("AEA") restriction on foreign, ownership, control, or domination (so-called "FOCD") of nuclear reactors, set forth in Sections 103(d) and 104(d) of the AEA (42 U.S.C. §§ 2133(d), 2134(d)). Under this restriction (the "FOCD Provision"), the U.S. Nuclear Regulatory Commission ("NRC"), the U.S. regulator for nuclear power, cannot license a reactor if the applicant is subject to FOCD, nor can it transfer an existing reactor license to a person or company subject to FOCD. Critically, the FOCD Provision applies the same regardless of the foreign participant's country of origin, whether Canada or North Korea. This is because the FOCD Provision is a product of the early Cold War, when nuclear technology was primarily limited to the United States and Soviet Union, globalization had not yet occurred, and the regulatory framework focused on preventing the sharing of nuclear technology, including technology designed for peaceful uses.

When the FOCD Provision was established, only a few countries were nuclear powers, and thus foreign involvement in nuclear power was viewed with great skepticism. This restriction was not a problem in the early years of U.S. nuclear power, as reactors were built and owned by local utilities, with little if any direct foreign involvement. However, today international partners play a key role in the U.S. nuclear industry and have large stakes in U.S.-based reactor designers and fuel cycle companies (such as uranium enrichment companies and fuel fabricators). Foreign investment from our allies, far from being viewed with skepticism, is instead critical for the U.S. civilian nuclear industry to succeed.

In this era of global partnership, the FOCD Provision – as applied by the NRC – has led to absurd outcomes. Ultimately, because of this law, *projects were cancelled, costing billions of dollars for the struggling commercial U.S. nuclear power industry*. Examples include:

- 2012 NRC denial of an effort by the French nuclear giant Électricité de France, S.A. ("EDF"), ongoing since 2007, to build a new nuclear reactor in Maryland which would have provided thousands of jobs, hundreds of millions of dollars in revenue, and millions of megawatt-hours of carbon-free power.

- 2011 NRC staff denial of a joint U.S.-Japanese effort to build a new nuclear reactor in Texas, also ongoing since 2007, which would have again provided thousands of U.S. jobs and millions

of MWh of clean energy. Here, the U.S. partner left the project but Toshiba, a mere 10% owner of the project, used its own capital to drive it forward. The NRC staff denial of the project was only overturned years later in 2015—after a successful legal challenge of the NRC staff's decision—but also after significant damage was done to the project's economics and it was later cancelled.

- Application of very onerous corporate governance provisions to multiple nuclear plant projects—including restrictions on company management and establishment of a Special Nuclear Committee of the Board of Directors—an even to a mere 1.7% investment in a nuclear plant by a Canadian company.

- Even commercially insignificant projects have experienced the illogic of the U.S. laws, when NRC required a four-levels removed subsidiary of a Swedish company to sell its small research reactor to a U.S. entity because the licensee's ultimate parent was headquartered abroad.

Without Congressional action, the FOCD Provision will inhibit investment in U.S. advanced reactor innovation, which needs significant financial participation to move from the drawing board to the field. As applied by the NRC, this outdated provision of the AEA creates significant investment uncertainty. At best, it places onerous and expensive corporate governance restrictions and oversight requirements on many types of foreign investments in reactor license applicants—or their parent companies—even if the investments are from long-time U.S. partner such as Canada and Japan. At worst, it can result in a license being denied and a project terminated—like UniStar's Calvert Cliffs Unit 3 project—because of the foreign investment.

Our allies are interested in supporting U.S. advanced reactor vendors, and often have higher tolerance for these investments than their U.S. counterparties. However, instead of safeguarding American interests, maintaining this outdated law is more likely to push advanced reactor developers out of the country to demonstrate their technologies and will stifle investment in those that remain, harming U.S. nuclear technology leadership, U.S. nuclear export prospects (as there will be fewer U.S.-designed and built plants to thereafter export abroad), and overall nuclear security.

The FOCD Provision Offers No National Security Benefit. A law that cannot distinguish the national security risk between a Canadian versus a North Korean investment is not a useful tool for safeguarding national interest. That is why the U.S. government has developed many other tools to monitor and protect against impermissible investments in the U.S. nuclear industry. At the forefront is the Committee on Foreign Investment in the United States ("CFIUS"), which polices all significant foreign investments into the nuclear industry and was recently strengthened by Congressional action. This interagency review process is better suited to evaluate investment and national security implications compared to the NRC, a safety regulator composed largely of scientists and engineers.

Additionally, the U.S. Department of Energy ("DOE") and other export control regimes already police the transfer of nuclear technology without prior notice or approval from the U.S. government. Lastly, the NRC itself implements a parallel but more flexible "inimicality" review of foreign investments into U.S. reactor licensees, apart from its own FOCD review, and applies the "inimicality" standard to non-reactor licensees. This inimicality review, required under the same section of the AEA that houses the FOCD Provision (42 U.S.C. §§ 2133(d), 2134(d)), separately allows the NRC to deny a reactor license (and other non-reactor licenses) that are contrary to U.S. national security interests.

Recommendations to Improve U.S. Nuclear Innovation.

- *Recommendation 1: Congress should strike the FOCD Provision from Section 103(d) and 104(d) of the AEA.*

- *Recommendation 2: In the alternative, Congress should amend the FOCD Provision in the AEA to permit the NRC to exempt certain low-risk countries from FOCD review. Congress should then require the NRC to develop and present to Congress a list of countries to be exempted from FOCD review within 180 days (including countries with established non-proliferation records), and complete a rulemaking codifying the exemption within two years.*

The FOCD Provision will significantly restrict safe and helpful investment into U.S. advanced reactors by our allies. As nuclear innovation in nuclear power is increasingly occurring outside of the United States, the U.S. government—Congress included—must encourage instead of bar foreign direct investment from our allies and neighbors to grow this industry and international trade.

The proposed amendments to the AEA, which can be easily inserted into pending nuclear legislation, recognize the importance of foreign investment into the U.S. nuclear industry, while acknowledging the important role current national security and foreign investment protections already offer. The changes would also significantly expand opportunities for our allies to financially support advanced reactor projects in the United States, helping our country regain its global leadership role in nuclear power.

II. Today's Interconnected Nuclear World Collides with a 1950s National Security Framework

A. Innovation in Advanced Reactors is Truly Global

Developing and building advanced reactor technology is a thoroughly global venture. The United States, while a leading contributor, is a partner in a global nuclear industry.

Nothing demonstrates this better than looking at the current U.S. nuclear industry itself. Outside of nuclear reactors themselves, the U.S. industry is characterized by joint ventures and close collaborations with our strongest national allies. For example, Westinghouse, which developed the first commercial nuclear reactor and is considered to be one of the most well-known U.S. nuclear companies,[1] is indirectly owned by a consortium of Canadian private equity firms, with majority ownership acquired by Brookfield Business Partners LP in August 2018. Before that, Westinghouse was previously owned by Toshiba, a Japanese company, and before that by British Nuclear Fuels.[2] Leading nuclear vendor GE-Hitachi, which commercialized the Boiling Water Reactor, is a joint venture 60% owned by GE, and 40% by Hitachi.[3] The only commercial nuclear fuel enrichment facility in the United States, the URENCO USA facility in New Mexico, is owned by a European consortium.[4] And the list goes on.

All of these joint ventures and foreign investments into the nuclear supplier community were subject to U.S. national security reviews at the time, from CFIUS and nuclear export control regulators. Despite the fact that these joint ventures handle enriched nuclear fuel and own fuel fabrication facilities, the FOCD restriction does not apply to them because they do not specifically own *nuclear reactors*. And these ventures have largely worked well—enabling U.S. businesses to benefit from the financial strength and significant technical and business capabilities of foreign companies.

Likewise, innovation in advanced reactor development is largely global. For now, the U.S. leads in advanced reactor design. There are dozens of domestic ventures in next-generation nuclear technologies.[5] However, while many innovators in the nuclear industry are based in the United States,[6] a number of leading innovators are from abroad. For example, Terrestrial Energy, a Canadian company, was granted a large DOE award to help develop an Integrated Small Modular Reactor in the United States.[7] NuScale recently formed a partnership with Doosan, a South Korean company, to work together on fabrication of reactor components.[8] Lightbridge, a leading U.S. nuclear fuel innovator, formed an alliance with France's Framatome to develop a new safer, more efficient nuclear

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[1] *Shippingport Nuclear Power Station: First US Commercial Central Electric-Generating Station to Use Nuclear Energy*, The American Society of Mechanical Engineers, https://www.asme.org/about-asme/engineering-history/landmarks/47-shippingport-nuclear-power-station.

[2] *2018 Annual Report*, Brookfield Business Partners L.P., at 41, https://bbu.brookfield.com/~/media/Files/B/Brookfield-BBU-IR-V2/Annual%20Reports/bbp-q4-annual-report-2018.pdf.

[3] Soichi Inai, *GE Hitachi Nuclear Developing New SMR with US Company*, Nikkei Asian Review (Mar. 14, 2017), https://asia.nikkei.com/Business/GE-Hitachi-Nuclear-developing-new-SMR-with-US-company.

[4] *See Global Operations*, URENCO (last accessed Oct. 31, 2019), https://urenco.com/global-operations.

[5] *Keeping Up with the Advanced Nuclear Industry*, Third Way (Jan. 2018), https://www.thirdway.org/graphic/keeping-up-with-the-advanced-nuclear-industry (showing a marked increase from the previous year)

[6] *See 2019 Advanced Nuclear Map*, Third Way (last accessed Oct. 30, 2019) https://www.thirdway.org/graphic/2019-advanced-nuclear-map.

[7] *U.S. Advanced Nuclear Technology Projects to Receive $18 Million from the U.S. Department of Energy*, Office of Nuclear Energy, U.S. Department of Energy (Nov. 13, 2018), https://www.energy.gov/ne/articles/us-advanced-nuclear-technology-projects-receive-18-million-us-department-energy.

[8] *Doosan, NuScale Sign Agreements for SMR Cooperation*, World Nuclear News (Jul. 24, 2019), https://www.world-nuclear-news.org/Articles/Doosan,-NuScale-sign-agreements-for-SMR-cooperatio.

fuel.[9] Of the winners of Britain's Advanced Modular Reactor competition, six are based outside the United States and all eight are global companies.[10] Indeed, of the existing fast-neutron reactors in the world, two are in India, two are in Japan, and three are in Russia.[11]

In this global nuclear economy, our allies are working hard to foster innovation in their countries and with the United States. Canada is leading an effort to establish their nuclear laboratory at Chalk River as a leading global innovation, including for U.S. entrepreneurs.[12] U.S. companies are increasingly looking to Canada,[13] the United Kingdom,[14] and other destinations to license their first prototype reactors. At the same time, leading foreign innovators like Terrestrial[15] and URENCO are looking to the U.S. as a potential second home.

Now is a pivotal moment in U.S. nuclear innovation. Russia and China are investing billions into their domestic advanced reactor programs, and have successfully demonstrated advanced reactor technologies, such as the BN-800 sodium-cooled fast breeder reactor. China has started building its first small modular reactor (SMR), the ACP100 integrated pressurized water reactor (PWR), which was the first SMR to pass the IAEA's safety review back in 2016.[16] For the U.S. to compete, it cannot go it alone, and the developing advanced reactor industry should benefit from the experience and investment from outside the United States. The U.S. government must embrace global investment into its nuclear industry, and form stronger relationships with its neighbors and key allies, to help offset a global nuclear framework increasingly led by other world powers with dissimilar interests.

B. An Outdated Atomic Energy Act Framework Restricts Nuclear Investment, Even From Our Closest Allies

The AEA FOCD Provision: There is an important headwind, however, to building out a future where the U.S. leads nuclear innovation in a global economy. Created during the height of the Cold War and in early stages of the nuclear industry, when only the United States and Soviet Union had nuclear power, a specific provision of the AEA, found in Sections 103(d) and 104(d) (42 USC §§ 2133(d), 2134(d), respectively) bars foreign ownership, control, or domination of a U.S. nuclear reactor licensee (again, these provisions are referred to collectively as the "FOCD Provision"). The NRC incorporates this restriction into its regulations at 10 CFR 50.38. This rule applies to all types of nuclear reactors, including large commercial reactors and even demonstration reactors and medical isotope production facilities—but it does not apply to nuclear fuel vendors or reactor suppliers.

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[9] *Lightbridge and Framatome Launch Enfission to Commercialize Innovative Nuclear Fuel*, Lightbridge (Jan. 25, 2018), http://ir.ltbridge.com/news-releases/news-release-details/lightbridge-and-framatome-launch-enfission-commercialize.

[10] *See Rolls-Royce Group Wins Funding as UK SMR Race Gathers Pace*, Nuclear Energy Insider (Sep. 11, 2019), https://analysis.nuclearenergyinsider.com/rolls-royce-group-wins-funding-uk-smr-race-gathers-pace.

[11] *Advanced Nuclear Reactors: Technology Overview and Current Issues*, Congressional Research Service, Table A-1, at 42, (Apr. 18, 2019), https://crsreports.congress.gov/product/pdf/R/R45706.

[12] *See CNL Releases Exciting Vision for the Chalk River Laboratories*, Canadian Nuclear Laboratories (Apr. 25, 2017), https://www.cnl.ca/en/home/news-and-publications/stories/2017/20170425.aspx.

[13] *See, e.g., New Brunswick Power: Partner Announced in Nuclear Research Cluster*, Advanced Reactor Concepts Newsroom (Jul. 9, 2018), https://www.arcnuclear.com/arcnews/new-brunswick-power-partner-announced-in-nuclear-research-cluster.

[14] *See, e.g., Advanced Modular Reactor (AMR) Feasibility and Development Project*, Government of the United Kingdom (Sep. 5, 2018) https://www.gov.uk/government/publications/advanced-modular-reactor-amr-feasibility-and-development-project.

[15] *Terrestrial Energy USA Signs MOU with Energy Northwest for Idaho National Laboratory Project*, Terrestrial Energy (Mar. 28, 2018), https://www.terrestrialenergy.com/2018/03/terrestrial-energy-usa-signs-mou-with-energy-northwest-for-idaho-national-laboratory-project/.

[16] *See China's ACP100 passes IAEA safety review*, Nuclear Engineering International (May 4, 2016), https://www.neimagazine.com/news/newschinas-acp100-passes-iaea-safety-review-4883437.

Specifically, the AEA's FOCD Provision states:

> No license may be issued to an alien or any corporation or other entity if the Commission knows or has reason to believe it is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government.

The Historical Context of the FOCD Provision: The FOCD requirement was added in the 1954 revision to AEA, which opened up nuclear energy to civilian development. At the time, the world was a very different place than it is today. Atomic energy was still being valued primarily for its *military* contribution—the Cold War was well underway, the Soviet Union and United Kingdom had started testing nuclear warheads, and in early 1954 the world's first nuclear-powered submarine, the USS *Nautilus,* was launched. The use of the atom for civilian purposes was only starting to be explored:

- In December 1953, President Eisenhower gave his famous "Atoms for Peace" speech, where he pledged that the U.S. would share peaceful nuclear technology with the world, if the receiving nation committed to not use the technology to develop nuclear weapons.[17]

- In early 1954, construction began in Pennsylvania on the Shippingport reactor, the first civilian nuclear power project to supply electricity to the grid (which it did three years later in 1957).

Because the civilian nuclear power industry was born out of U.S. defense work, the U.S. government believed in 1954 that it needed to be very careful with the spread of this new technology. After all, both the Shippingport reactor design and the *Nautilus* reactor design came out of the U.S. national laboratories based on similar designs, both were constructed by Westinghouse, and both were developed under the leadership U.S. government—specifically, then-Captain Hyman Rickover, the father of the then-emerging U.S. nuclear Navy.[18]

Thus, when the FOCD provision was enacted, it was the product of a different era—an era well before the development of post-World War II's globalized world, and the modern, global nuclear industry. There was an inherent distrust of foreign involvement in nuclear power, and the FOCD Provision seemed to make sense given the uncertainty of where atomic energy would lead humanity.[19] Concerns existed, for example, that foreign ownership could raise the risk of diversion of nuclear fuel or spent nuclear fuel generated at these power plants—ownership of enriched uranium and plutonium was limited to just a few countries at the time, much different than today. In fact, private ownership of enriched uranium and plutonium was prohibited until the 1964 amendments to the Atomic Energy Act.

However, the world that has developed today is incredibly different than that of 1954, and probably could not have been imagined by the drafters of the 1954 AEA. The civilian nuclear industry has blossomed, and nearly all of our allies operate nuclear power plants and fuel cycles of their own. France derives over 70% of its energy from nuclear power,[20] and Westinghouse—the creator of the

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[17] Address by Mr. Dwight D. Eisenhower, President of the United States of America, to the 470th Plenary Meeting of the United Nations General Assembly (Dec. 8, 1953), https://www.iaea.org/about/history/atoms-for-peace-speech.

[18] More about the historical background about the development of nuclear power can be found in the article: Michael Wallace, Amy Roma, and Sachin Desai, Center for Strategic and International Studies, *Back from the Brink: A Threatened Nuclear Energy Industry Compromises National Security* (Jul. 2018), https://www.csis.org/analysis/back-brink-threatened-nuclear-energy-industry-compromises-national-security.

[19] More about the legislative history of the FOCD Provision can be found in Part II of the academic article: Sachin Desai & Kathy Oprea, *U.S. Nuclear Foreign Ownership Policy Ready for a Refreshed Interpretation*, 37 Energy L.J. 85 (2016), https://www.eba-net.org/assets/1/6/21-85-134-Desai_FINAL.pdf.

[20] International Atomic Energy Agency, *Country Nuclear Power Profiles, France* (updated in 2019), https://cnpp.iaea.org/countryprofiles/France/France.htm.

Shippingport reactor mentioned above, was for a long time owned by Japan's Toshiba, before now being owned by a consortium led by a Canadian firm.[21]

This leaves the FOCD Provision a product of a bygone era—and even in 1954 members of the government and public recognized that the limited monopoly on civilian nuclear technology was to be short-lived, and curtailing foreign involvement in nuclear power was not in the best long-term interests of the country—with one group noting: "Discrimination against noncitizens and foreign corporations may deter the full development and utilization of atomic energy in this country, since it will discourage foreigners from putting their peaceful discoveries to work in our own country."[22] That warning from the 1950s rings particularly true today.

The AEA FOCD Provision in Practice Today: Nonetheless, without direction from Congress, the NRC and its agency staff have been left to apply an incongruous Cold-War era concept in the modern day. Because of the direct language of the FOCD Provision, the NRC has interpreted the language of the FOCD Provision as creating a clear prohibition on 100% indirect foreign ownership of an operating reactor by a licensee.[23] Moreover, the NRC has never approved more than about 50% indirect ownership of a licensee by a foreign interest, or *any* foreign direct ownership of a power plant by a foreign interest.[24] Moreover, because the FOCD Provision is country-neutral, an investment from Canada is treated the exact same as one from North Korea. Indeed, the NRC has used this provision, for example, to deny a license to a Canadian company in the past,[25] and more recently to a French company that sought to build a reactor in the United States of its own design.[26]

Even when not denying licenses under the FOCD Provision, the agency throws up significant roadblocks with even lesser levels of investment or control—as little as 1.7%. In those limited cases where the NRC has permitted foreign ownership, it has imposed significant restrictions on the entities involved. The NRC permits the use of Negation Action Plans to theoretically "mitigate" foreign control, by assuring that "the foreign interest can be effectively denied control or domination."[27] These requirements are very strict, however, greatly complicating corporate governance and disincentivizing foreign investment into an already complex industry.[28] More fundamentally, the purpose of Negation Action Plans is to eliminate foreign involvement in a nuclear reactor, which is simply incongruous with global collaboration on nuclear innovation and advanced reactor development. In the future, nuclear innovators, no matter if they hail from the U.S. – or Canada, Japan, or Europe – need to be involved in the operation of reactors they designed and built because they know the technology best. This created a significant barrier today to foreign investment in U.S. nuclear power.

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[21] World Nuclear News, Toshiba Sells Westinghouse-Related Assets in USA (Apr. 6, 2018), http://www.world-nuclear-news.org/Articles/Toshiba-sells-Westinghouse-related-assets-in-USA.

[22] Desai & Oprea, *supra* note 19, at 97.

[23] *Fresh Assessment of Foreign Ownership, Control, or Domination of Utilization Facilities*, NRC Staff, SECY-14-0089, at 6 (Aug. 20, 2014), https://www.nrc.gov/docs/ML1330/ML13301A684.pdf ("SECY-14-0089").

[24] *Id.*

[25] *Id.* at 23-24.

[26] *See* infra § III.A (discussing Calvert Cliffs reactor expansion example)

[27] SECY-14-0089, Enclosure 2: Commission Case Law, Agency Case Histories, and FOCD Negation Action Plans, at 22 https://www.nirs.org/wp-content/uploads/2016/07/secy-14-0089encl.-2.pdf.

[28] Negation Action Plans often require that: (1) the majority of the licensee's directors and principal officers must be U.S. citizens; (2) the company establish a special committee to ensure all AEA-licensed materials are used "consistent with the common defense and security and public health and safety," comprised of U.S. citizens independent of the board of directors and the foreign investor. *Id.*

III. The FOCD Provision Continues to Harm U.S. Nuclear Innovation

A. FOCD Rules Impeded Crucial Foreign Investment in New U.S. Nuclear Projects and Led to Project Demises

It is unusual that one sentence of the AEA could cost billions of dollars of lost investment into a U.S. industry – but that is the case with the FOCD Provision. While there is a wealth of capital waiting to be invested into domestic nuclear innovation and jobs, it has been scared away by the very negative precedent set by the NRC's interpretation and application of the FOCD Provision in the early 2000s.[29]

Example 1: FOCD Provision Barred a French Effort to Construct a New Nuclear Plant in Maryland

Probably the most striking example of the FOCD Provision inhibiting constructive foreign investment concerns a French effort to build a new reactor (of its own French design) in Maryland, costing the nuclear industry hundreds of millions of dollars.

In 2007, Électricité de France, S.A. ("EDF"), a French nuclear vendor and utility, and Constellation Energy Group, Inc. ("Constellation"), a U.S. nuclear utility, formed a joint venture called UniStar and submitted an application to the NRC to build a new unit at the existing Calvert Cliffs nuclear power plant.[30] Critically, the reactor was to be of the French Evolutionary Power Reactor ("EPR") design, so the flow of capital and technology was inward bound. The foreign country, France, is a long-standing ally that generates nearly three quarters of its electricity from nuclear power[31]—hardly the type of country the U.S. should be policing investment from.

The application was submitted to the NRC in mid-2007.[32] After five years and hundreds of millions of dollars invested, Constellation had to back out of the project, but EDF decided to move forward with licensing and construction and acquired Constellation's 50% share of UniStar.[33] The result was that the French would entirely fund construction of a new nuclear reactor on U.S. soil, bringing thousands of U.S. jobs and new nuclear technology.

However, the FOCD Provision compromised the project. The NRC staff concluded that the new arrangement resulted in 100% indirect foreign ownership of an NRC license, and that no mitigation measure could address this problem.[34] Eventually, an NRC administrative licensing board determined that the project ran afoul of the NRC's FOCD provision, and denied the license to UniStar in 2012.[35]

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[29] Energy deregulation occurred in the late 1990s/early 2000s, leading to an increase in foreign investment in U.S. utilities and thus driving development of the NRC's FOCD precedent.

[30] *Calvert Cliffs 3 Nuclear Project, LLC* (Calvert Cliffs Nuclear Power Plant, Unit 3), LBP-12-19, 76 NRC 184, 187 (2012), *aff'd*, CLI-13-4, 77 NRC 101 (2013).

[31] *Nuclear Power in France*, World Nuclear Association (last updated Oct. 2019), https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/france.aspx.

[32] Application Review Schedule for the Combined License Application for Calvert Cliffs, Unit 3, NRC (last updated Mar. 28, 2017), https://www.nrc.gov/reactors/new-reactors/col/calvert-cliffs/review-schedule.html.

[33] Letter Re: Calvert Cliffs 3 Nuclear Project, LLC, and UniStar Nuclear Operating Services, LLC (Calvert Cliffs Nuclear Power Plant, Unit 3), Docket No. 52-016-COL (Nov. 3, 2010), https://adamswebsearch2.nrc.gov/webSearch2/main.jsp?AccessionNumber=ML103070520.

[34] LBP-12-19, 76 NRC at 188-89.

[35] *Id.*

The result was that after seven years of effort and hundreds of millions of dollars, the FOCD Provision completely halted the French project on grounds that had nothing to do with safety or security.

Example 2: FOCD Provision Greatly Impeded a Japanese Effort to Build a New Nuclear Plant in Texas

Just a few years later, the FOCD Provision nearly terminated a promising effort to build two new nuclear reactors in Texas, again costing the industry billions of dollars in stranded investments and lost revenue.

In this case, Nuclear Innovation North America ("NINA"), a partnership between U.S.-owned NRG Energy (the major, 90% project owner) and Japan's Toshiba (the reactor vendor and 10% project owner), applied to the NRC in 2007 to build two new reactors in Texas.[36] After Fukushima in 2011, the U.S. partner again hesitated to move forward, but the foreign party was still willing to take the project across the finish line as the NRC license review was nearly complete. Here, Toshiba took it upon itself to continue to fund the NRC licensing of the project in full, even though it would still possess just 10% of the project's overall value and would gain no additional benefits as to corporate control.

Despite being only a 10% owner, Toshiba preemptively instituted a Negation Action Plan to offset its already limited control of the project. This plan eliminated foreign control of all matters pertaining to nuclear safety, security, and reliability, put key decisionmaking authority in the hands of U.S. citizens, required many key personnel be U.S. citizens, and instituted a board-level security committee and separate advisory committee to monitor foreign control.[37] In practice, such Negation Action Plans are expensive to maintain, and create significant additional burdens on plant owners and operators—all just to prevent a steadfast US ally and robust nuclear power, Japan, from having 'too much' control of a power plant that a Japanese company itself designed.

Nonetheless, after Toshiba took on this risk to support U.S. nuclear innovation at great cost to itself, the NRC staff looking to the FOCD Provision decided in 2011 (and reaffirmed in 2013) that NRG's "diminishing financial position" put Toshiba "in a position to control and dominate NINA," and thus made the applicant, NINA, ineligible for an NRC reactor license.[38] The NRC staff even used as a reason for the decision the risk of diversion of the uranium fuel and spent nuclear fuel from the to-be-built reactors, despite Japan having dozens of its own power plants. It thereafter took approximately five years of failed negotiations with the NRC staff, and eventual litigation with the agency before an administrative licensing board, before the agency over 2014 and 2015 reversed course and found that Toshiba's mere funding of the application did not interfere with NINA's "exclusive control" of decisions involving nuclear safety, security, and reliability.[39]

The licensing board took a reasonable view of the FOCD provision, but this was perhaps too little too late. The huge five-year delay to the project's licensing—attributable almost entirely to the FOCD provision—led to enormous cost increases and was a key factor in its eventual termination.

Other Examples: FOCD Negation Action Plans Discourage Even Small Investments into Nuclear Power

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[36] *Nuclear Innovation N. Am. LLC* (South Texas Project Units 3 & 4), LBP-14-3, 79 NRC 267, 286 (2014), *aff'd*, CLI-15-7, 81 NRC 481 (2015).

[37] *Combined License Application for South Texas Project Units 3 & 4 Expansion, Negation Action Plan* (2015) https://www.nrc.gov/docs/ML1512/ML15124A111.pdf.

[38] *Nuclear Innovation N. Am. LLC*, LBP-14-3, 79 NRC at 276.

[39] *Id*. at 291-312.

Even for those investments that did not find themselves barred by the FOCD Provision, strict Negation Action Plan provisions applied to low-risk investments, setting difficult precedent for the industry.

- **Strict Negation Action Plan Requirements for Miniscule Investments**: When a Canadian company, Gaz Metro, tried to make a mere 1.7% investment into the NRC licensees for the Millstone Nuclear Power Station, the NRC staff imposed a strict Negation Action Plan to prevent Gaz Metro from having any control over the plant operation (which it did not have anyway).[40] In particular, the licensee had to stand up a Special Nuclear Committee of U.S. citizens, a majority of whom are not officers, directors, or employees of any of the parties. The cost of maintaining these committees can easily exceed $1 million a year.

- **Implicit 50% Ownership Cap:** The NRC has traditionally capped foreign investment at 50% under the FOCD rules. This precedent developed in the 1990s when British Energy tried to take a 50% or greater investment in the Clinton nuclear power plant in Illinois, in a joint venture with PECO Energy (a precursor to Exelon),[41] and has extended to the current day. Even with a 50% investment by a strong U.S. ally, the NRC staff imposed a burdensome Negation Action Plan, including the requirement for a board committee to monitor FOCD issues and provide frequent reports, at the cost of millions a year to maintain. These costly Negation Action Plans have worked their way into multiple new reactor projects, including with the South Texas Project discussed above, and in another effort to construct two nuclear power reactors in Texas around the same time period.[42]

- **Indirect Ownership of a Test Reactor.** The NRC determined that Aerotest, a holder of an operating license for a radiography and research reactor, was in violation of the FOCD rules when all the stock of its indirect U.S. parent was purchased by a U.S. company owned by a Delaware corporation traded on the New York Stock Exchange but headquartered in Sweden. Although Aerotest adopted a "negation plan" to assure that all safety related decisions relating to the operation of the research reactor were made by U.S. citizens, the NRC insisted that Aerotest was out of compliance with Section 104d of the AEA, which resulted in a forced sale of the reactor to a U.S. company.

B. FOCD Rules Can Present Even Greater Problems for Advanced Reactors

As discussed above, advanced reactor innovation is being led by global collaboration, from the GE-Hitachi joint venture to NuScale's collaboration with Doosan. Several companies with 100 percent foreign upstream ownership, such as Terrestrial and URENCO, are also promising leaders in nuclear innovation in the United States. Moreover, as demonstrated by the above Maryland and Texas reactor projects, foreign investors have generally shown a much larger appetite and risk tolerance to new nuclear projects in the United States—staying involved even when U.S. domestic partners would not. That is one reason why foreign private equity companies are eager to invest in U.S.-based nuclear innovators, whether Canada's investment in Westinghouse or South Korea's interest in partnering with NuScale.

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[40] *See* NRC Safety Evaluation by the Office of Nuclear Reactor Regulation, Application for the Indirect Ownership Interest in the License for Millstone Power Station, Unit 3, Docket No. 50-423 (Jun. 15, 2012), https://www.nrc.gov/docs/ML1213/ML121300496.pdf.

[41] Safety Evaluation for the Proposed Transfer of Clinton Power Station Operating License from Illinois Power Company to AmerGen Energy Company, LLC, Docket No. 50 461, § 5.0 (Nov. 24, 1999).

[42] *Combined License Application for Comanche Peak Nuclear Power Plant Units 3 and 4 Expansion, Negation Action Plan* (2010), https://www.nrc.gov/docs/ML1334/ML13345A334.pdf.

This complex network of advanced reactor partnerships risks hitting a brick wall with the FOCD Provision, just as EDF and Toshiba did during the "Nuclear Renaissance." New nuclear reactor ventures will require significant foreign investment that will be difficult to untangle. Foreign investors will not be keen to invest in reactor development when they are prohibited from owning revenue-generating assets. Further, foreign technology from our long-standing allies will likely be behind key parts of many new reactor designs, making it hard—if not simply impossible—to separate the foreign partner when it comes to key decisions about advanced reactor safety and security. Given the already numerous undertakings that exist with licensing an advanced reactor, the added significant cost and uncertainty of addressing U.S. FOCD rules will tip the scales for foreign participants against further investment into nuclear power in the United States, just when it is needed most to offset gains in nuclear leadership by others.

IV. Other Foreign Investment Regimes Already Protect U.S. National Security

Apart from the FOCD Provision, three robust programs are already in place to protect U.S. national security interests from improper foreign control of a U.S. nuclear business.

The first is the Committee on Foreign Investment in the United States ("CFIUS" or "Committee"). CFIUS is an interagency committee that reviews certain foreign transactions to evaluate the potential foreign investment's implications on U.S. national security. The Treasury Secretary is the chairperson of CFIUS, and DOE is represented on the Committee. Nearly all material investments in nuclear power fall under the Committee's jurisdiction. CFIUS members holistically evaluate a transaction's implications on national security and can request additional information from the parties. It has a broad remit to impose conditions on the parties to mitigate national security risks, with the ability to even suspend transactions altogether.

Moreover, CFIUS's powers have been greatly strengthened by passage of the 2018 Foreign Investment Risk Review and Modernization Act ("FIRRMA"), which also created a mandatory filing program for many types of material investments into nuclear technology companies.[43] Although this mandatory filing is relatively short (five pages or less), it could often lead to much more extensive filings. The result is that if a foreign investor wishes to finance a U.S. nuclear innovator, it would have to likely file a lengthy disclosure document with CFIUS, which would evaluate the transaction with input from up to sixteen federal agencies or departments.

Second, there are multiple regimes that police the export of sensitive technology—nuclear technology included—to foreign companies. Most important in this regard is the DOE's export controls regulations specific to nuclear technology, found in 10 CFR Part 810 (and often called the "Part 810 Regulations"). The Part 810 Regulations require notification to DOE for ***any*** export of technology or assistance related to development or use of nuclear fuel or nuclear reactors—even if that export is to a foreign person located in the United States (a so-called "deemed export"). In many cases, such as exports of sensitive technologies like uranium enrichment, or for exports to sensitive destinations such as Russia or China (or citizens of Russia and China in the United States), prior agency approval is needed which can often take a year or more to obtain. Following a 2018 announcement by DOE,[44] the Part 810 regulations practically bar all exports of advanced reactor technology to China. As any significant investment into a nuclear company implicates an exchange of nuclear technology, this

[43] *Review of Foreign Investment and Export Controls,* Title XVII of the FY 2019 National Defense Authorization Act (NDAA), Public Law 115-232, 132 Stat. 2173 (Aug. 13, 2018), https://home.treasury.gov/sites/default/files/2018-08/The-Foreign-Investment-Risk-Review-Modernization-Act-of-2018-FIRRMA_0.pdf.

[44] *U.S. Policy Framework on Civil Nuclear Cooperation with China*, DOE National Nuclear Safety Administration (Oct. 2018), https://www.energy.gov/sites/prod/files/2018/10/f56/US_Policy_Framework_on_Civil_Nuclear_Cooperation_with_China.pdf.

prohibition serves to bar most Chinese investments into the U.S. nuclear industry, completely unrelated to the FOCD Provision.[45]

Third, the NRC itself performs an "inimicality" review in addition to and separate from its generic FOCD review. The same section of the AEA that established the FOCD Provision (42 U.S.C. §§ 2133(d), 2134(d)), also states that "no license may be issued to any person within the United States if, in the opinion of the Commission, the issuance of a license to such person would be inimical to the common defense and security or to the health and safety of the public." This statutory provision requires the NRC to essentially conduct another review process of "foreign interests involved in the licensing of" nuclear reactors.[46] However, the NRC's inimicality review benefits from being tailored to the country at issue, so that an investment into a nuclear reactor operator by Canada is not treated the same as an investment from North Korea, which provides critical and reasonable flexibility that the current FOCD Provision does not.

The NRC's inimicality review has been used without issue for the NRC to evaluate the national security concerns associated with foreign investment and control of important nuclear facilities other than nuclear power plants (for which the NRC's FOCD Provision does not apply). For example, in the licensing of the United States' sole uranium enrichment facility—the National Enrichment Facility in New Mexico, a facility with arguably greater national security implications than a nuclear power plant—the NRC reviewed the applicant's foreign parent involvement in detail as part of its non-inimicality review, including complex creditor arrangements and control of nuclear material, and also worked with DOE to establish processes to safeguard against impermissible foreign involvement in critical aspects of the enrichment process.[47]

V. Recommendations for Needed Legislative Reform

A. The FOCD Provision Cannot Be Effectively Reformed Without Congressional Action

The FOCD Provision is a statutory relic unique to the Cold War era, and its continued existence in a global nuclear economy creates an unnecessary chilling effect on foreign investment into U.S. nuclear projects. No investor can reasonably risk investing billions into a nuclear project, only to find out years later that the NRC could pull the plug on licensing because of the investment itself—just as France's EDF and Japan's Toshiba found out the hard way. At the same time, the FOCD Provision provides no significant national security benefit, considering that at least three separate regimes police the same issue and also conduct substantive reviews of foreign involvement in the US nuclear industry.

To its credit, the NRC has recognized this disconnect. Although the NRC Commission found itself bound to uphold the denial of the UniStar license on FOCD grounds back in 2012, it nonetheless directed the NRC staff at that time to do a "Fresh Assessment" of the NRC's foreign ownership

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[45] The U.S. Department of Commerce's ("DOC") dual-use export control regime also regulates exports of technology and assistance concerning non-reactor systems, equipment, and tools in use at a nuclear power plant, as well as certain technology related to spent fuel storage. *See* 15 C.F.R. § 730 et seq. Even beyond DOE and DOC, the NRC separately regulates exports of physical reactor components. *See* 10 C.F.R. Part 110. Between these three regulators, the vast majority of valuable, proprietary technology at a nuclear power plant is controlled for export by at least one federal agency.

[46] *Recommendations for a Process to Conduct Inimicality Reviews for the Licensing of Utilization Facilities*, NRC Staff, SECY-16-0056 (Apr. 27, 2016), https://www.nrc.gov/docs/ML1532/ML15320A283.pdf.

[47] *Notice of Receipt of Application for License; Notice of Availability of Applicant's Environmental Report; Notice of Consideration of Issuance of License; and Notice of Hearing and Commission Order*, 69 Fed. Reg. 5873 (Feb. 6, 2004); *NUREG-1827, Safety Evaluation Report for the National Enrichment Facility in Lea County, New Mexico*, at 1-5 (2005), https://www.nrc.gov/docs/ML0517/ML051780290.pdf. The National Enrichment Facility is indirectly owned by the European company URENCO.

requirements.[48] In 2014, the NRC staff came back with a lengthy review of all past examples of foreign ownership in nuclear power plants, and with recommendations to lessen certain FOCD-related burdens.[49] Eventually, the NRC staff issued a draft guidance document—while it did little more than memorialize the NRC staff's FOCD precedent into guidance, although the staff did attempt to establish a possible path forward to foreign investments greater than 50%.[50]

However, the draft was strongly criticized as still incorporating onerous requirements for mitigation of foreign control.[51] Moreover, progress later stalled and the draft guidance was never finalized, for unclear reasons. It is important to also recognize that even if the guidance was finalized, it remains uncertain how it would be interpreted by courts given the broad language of the statute itself. The result is that more has to be done to update a decades-old law that ignores the global nature of the nuclear industry.

B. Recommendations

As a result of the significant problems posed by the FOCD Provision, and the inability for the provision to be appropriately reigned in at the agency level, NIA proposes two recommendations to amend the AEA:

- ***Recommendation 1: Congress should strike the FOCD Provision from the Atomic Energy Act.***

  The best solution is also the most straightforward—the FOCD Provision should simply be struck from the AEA. As discussed above, the provision itself presents a significant burden, without providing any compensating national security benefit. Given that the FOCD Provision comprises one sentence in Section 103(d) of the AEA, the legislative amendment would be very straightforward, and could be worked into several nuclear bills currently working through Congress, such as the Nuclear Energy Leadership Act (S. 903).[52]

- ***Recommendation 2: Congress should amend the AEA to permit the NRC to exempt certain low-risk countries from FOCD review, and require that the NRC implement this exemption within two years.***

  In the alternative to a complete striking of the FOCD Provision, Congress can also revise the AEA to permit the NRC to exempt certain countries from FOCD review. This can be easily done by inserting a phrase such as "except as permitted by the Commission" to the end of the FOCD Provision in 42 U.S.C. §§ 2133(d) and 2134(d). This clause would permit the NRC, by rule or order of the NRC Commission, to exempt certain countries (and by extension the

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[48] SRM-SECY-12-0168, Staff Requirements In Re: Calvert Cliffs 3 Nuclear Project, LLC & Unistar Nuclear Operating Services, LLC (Calvert Cliffs Nuclear Power Plant, Unit 3) (Mar. 11, 2013) (asking the NRC Staff to "provide a fresh assessment on issues relating to foreign ownership"), https://www.nrc.gov/docs/ML1307/ML13070A150.pdf.

[49] *See generally* SECY-14-0089.

[50] Draft Standard Review Plan on Foreign Ownership, Control, or Domination, Office of Nuclear Reactor Regulation, NRC-2016-0088 (2016), https://www.regulations.gov/document?D=NRC-2016-0088-0002.

[51] *See, e.g.*, Comments of the Nuclear Energy Institute on the NRC "Draft Standard Review Plan on Foreign Ownership, Control, or Domination, Revision 1," and the NRC "Draft Regulatory Guide on Foreign Ownership, Control, or Domination of Nuclear Power, and Non-Power Production or Utilization Facility," Docket No. NRC-2016-0088 (2016), https://www.regulations.gov/document?D=NRC-2016-0088-0012.

[52] *Murkowski, Booker, and 13 Colleagues Reintroduce the Nuclear Energy Leadership Act*, U.S. Senate Committee on Energy & Natural Resources (Mar. 27, 2019), https://www.energy.senate.gov/public/index.cfm/2019/3/murkowski-booker-and-13-colleagues-reintroduce.

citizens and corporate entities of those countries) from the requirements of the FOCD Provision.

To ensure prompt implementation of this amendment, Congress should require that the NRC develop a list of countries to exempt from FOCD review, and present that list to Congress within 180 days after passage of the relevant legislation. Such a list could be based on given counties' historical commitments to non-proliferation and status as good actors in the nuclear community. This list could also take into account a country's adherence to U.S. and global nuclear safety and security standards, and other factors relevant to NRC and U.S. national security interests. Congress should require that the list of exempted countries then be codified by rulemaking within two years in total after passage of the relevant legislation.

Developing such a list is not difficult for the NRC or the U.S. government. It has already drafted such a list as part of its general license for the export of certain reactor equipment under 10 CFR Part 110.[53] Similarly, DOE as part of its Part 810 regulations has also established a similar list of destinations for which exports of nuclear reactor technology do not need prior U.S. government approval.[54] Lastly, recent revisions to CFIUS have established a concept of "excepted foreign states"—comprised of U.S. allies such as the United Kingdom and Canada—that can avoid some of the more stringent aspects of CFIUS reviews.[55]

If the United States is unwilling to permit the inward flow of technology and investment from our allies and partners to make the U.S. a hub for innovation, then it will fall further behind in the pursuit of advanced reactor technology to competitors such as China and Russia. These countries are expending huge sums to promote their domestic and foreign programs and doing everything they can to source technology and dollars into their domestic champion companies. These efforts are seeing results, as they are securing project after project both in their own markets and abroad, often at the expense of U.S. companies. Only by working with its partners and allies can the United States reverse this trend and reestablish its leading role in the global nuclear and energy economy.

VI. Conclusion

The FOCD Provision was a product of world that doesn't exist today. Today, the U.S. industry is part of a global network and needs investment from abroad to grow and thrive. U.S. leadership in advanced reactors will only come from working with our allies and partners, many of whom are willing to invest heavily in this area. A Cold-War era restriction on foreign investment not only hampers U.S. innovation and foreign direct investment, as seen in the concrete examples discussed above, it is superfluous given the robust CFIUS and export control regimes and already in place. Reform of the FOCD Provision thus represents a simple way to grow foreign investment into U.S. advanced reactor deployment, in the process promoting domestic economic growth, jobs, and U.S. competitiveness in this critical technology.

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[53] Under this regulation, the NRC permits exports of many nuclear reactor components without prior agency approval to a set of about three dozen countries it has pre-determined to be good actors—including Japan, France, and traditional U.S. allies *See* 10 C.F.R. § 110.26(b).

[54] *See* 10 C.F.R. Part 810, Appendix A.

[55] Hogan Lovells, *Client Alert – U.S. Treasury Department Issues Final CFIUS Regulations* (Jan. 17, 2020), https://www.hoganlovells.com/~/media/hogan-lovells/pdf/2020-pdfs/2020_01_17_us_treasury_department_issues_final_cfius_regulations.pdf.

Nuclear Innovation and NEPA

Streamlining NRC NEPA Reviews for Advanced Reactor Demonstration Projects While Safeguarding Environmental Protection

NUCLEAR INNOVATION ALLIANCE

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Disclaimer

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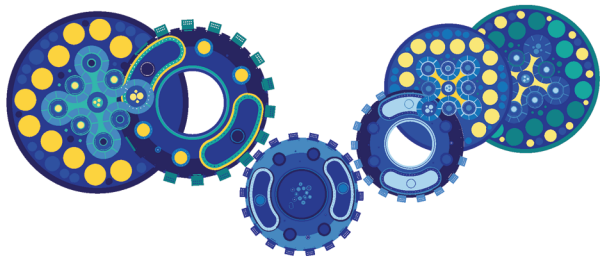

Nuclear Innovation and NEPA

Streamlining NRC NEPA Reviews for Advanced Reactor Demonstration Projects While Safeguarding Environmental Protection

I. Executive Summary

The nation stands at the cusp of an energy revolution. Around the country, dozens of companies are developing next-generation nuclear reactors ("advanced reactors"),[1] which have the potential to provide clean, reliable, and affordable energy in abundant quantities. They promise to provide zero-carbon power, return the United States to a position of nuclear energy leadership, and bring thousands of skilled, well-paying jobs to towns and cities across the country. Advanced nuclear has the potential to be a critical contributor in addressing climate change.[2]

Ironically however, one challenge to addressing this environmental crisis resides in an environmental statute—the National Environmental Policy Act ("NEPA")[3]—and its practical application by the agency responsible for licensing advanced reactors—the U.S. Nuclear Regulatory Commission ("NRC"). The NRC should act to streamline NEPA reviews to ensure they are pragmatically proportionate to advanced nuclear development, and do not result in time, money, and resources wasted on regulatory reviews that do not achieve the objectives of the statute.

What is NEPA? The purpose of NEPA is to "prevent or eliminate damage to the environment," by having federal agencies take a "hard look" at the environmental impacts of their actions before they take them.[4] Critically, NEPA does not set substantive standards—the statute instead provides a process to help agencies *consider and disclose* the consequences of their actions.[5] NEPA reviews should be "concise, clear, and to the point."[6] Since its inception, NEPA has generated immense benefits.[7] However, there are times when its execution raises roadblocks contrary to its underlying purpose.

NEPA reviews are implemented at the agency level. It is in execution here that the "concise" and clear nature of NEPA reviews sometimes get lost. Critic after critic—from both sides of the aisle—have discussed the well-known "ratcheting up" of NEPA reviews. As early as 1997, the White House Council of Environmental Quality (CEQ) noted that agencies were trying to generate "litigation-proof" NEPA reviews, increasing costs and

[1] The term "advanced reactor" is used broadly in this article, to refer to passively safe, small modular and non-light water reactors.
[2] Jenkins, Luke & Thernstrom (2018), "Getting to zero: insights from recent literature on the electricity decarbonization challenge," *Joule* 2, 2487-2510, December 19, 2018.
[3] 42 U.S.C. 4321 *et seq.*
[4] 42 U.S.C § 4321.
[5] *See Dep't of Transp. v. Pub. Citizen*, 541 U.S. 752, 756 (2004); *Baltimore Gas & Elec. Co. v. Nat. Res. Def. Council, Inc.*, 462 U.S. 87, 98 (1983).
[6] 40 CFR § 1502.1.
[7] NEPA, *Success Stories and NEPA Benefits*, https://ceq.doe.gov/docs/get-involved/ Success_Stories.html.

time but not necessarily quality.[8] In practice, NEPA reviews have increased in size over the years even though the statute's requirements have remained the same. For example, in the early 1980s, the NEPA review documentation for construction and operation of the Palo Verde Nuclear Power Plant—a greenfield 3-unit power plant, the *largest in the U.S.* —numbered roughly 700 pages including appendices and responses to comments.[9] By comparison, the NRC's NEPA documentation for the recently licensed Vogtle nuclear power plant, a smaller 2-unit expansion on an already existing nuclear plant site, numbered over 1500 pages.[10]

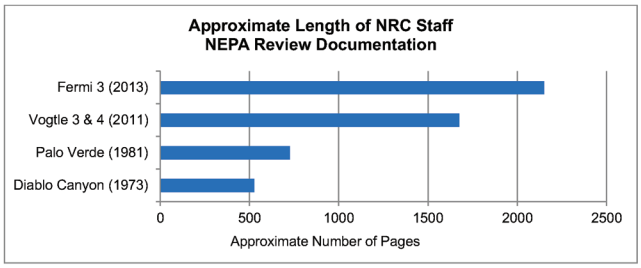

Chart developed by NIA using data derived from U.S. NRC documents

How does NEPA factor into the NRC's advanced reactor licensing review? The NRC licensing review consists of two parts: (1) a robust technical review of safety, (2) and an equally—if not more robust—environmental review to comply with the procedural requirements of NEPA. NEPA reviews can require about a third or more of agency staff effort. It is common that the agency's NEPA documentation, memorialized in an Environmental Impact Statement (EIS), *is the same length or longer than* the NRC's substantive technical evaluation, documented in a Safety Evaluation Report (SER). This wastes significant resources on arguably duplicative efforts that do not have a proven nexus to public safety and delays beneficial projects that would improve environmental quality overall.

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[8] CEQ, ENVIRONMENTAL QUALITY -- 25TH ANNIVERSARY REPORT OF THE COUNCIL OF ENVIRONMENTAL QUALITY (1995) https://ceq.doe.gov/docs/ceq-publications/nepa25fn.pdf; Bradley C. Karkkainien, *Toward a Smarter NEPA: Monitoring and Managing Government's Environmental Performance*, 102 Colum. L. Rev. 903, 917-18 (2002).

[9] NRC, *Draft Environmental Statement Related to the Operation of Palo Verde Nuclear Generating Station, Units 1, 2, and 3*, a https://books.google.com/books?id=Quc3AQAAMAAJ&lpg=PR14&ots=QqoeXGdVcs&dq=%22final%20environmental%20statement%22%20Palo%20Verde%20operating%20license&pg=PR14#v=onepage&q=%22final%20environmental%20statement%22%20Palo%20Verde%20operating%20license&f=false (providing the final EIS for the for construction permit for Palo Verde, and the draft EIS for Palo Verde's operating permit)

[10] NRC, *NUREG 1872, Final Environmental Impact Statement for an Early Site Permit (ESP) at the Vogtle ESP Electric Generating Plant Site* (Aug. 2008), https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1872/; NRC, *NUREG-1947, Final Environmental Impact Statement for Combined License (COLS) for the Vogtle Electric Generating Plant Unit 3 and 4* (Mar. 2011), https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1947/.

The last round of new reactor applicants was better equipped to shoulder the long costs and timelines of NRC reviews: they were large-scale utilities, building large-scale nuclear power plants, and secured by healthy balance sheets of large corporation or ratepayer funding. Moreover, the designs reviewed were comparable to the same traditional light water reactors (LWRs) that comprise the current fleet (although improved to be simpler and safer)—keeping the scope of NEPA reviews in check. Now the NRC is faced with licensing first-of-a-kind advanced reactor designs. Many of these are designed by innovative companies seeking to commercialize technologies coming out of US universities and national laboratories. In today's highly competitive electric power market, neither developers nor ratepayers can afford to waste resources on an inefficient or unpredictable licensing process. Many nuclear entrepreneurs also need a proof-of-concept prototype or demonstration reactor ("demonstration project")[11] to access additional capital from investors and arrange customers. Some innovators are moving abroad to build their demonstration reactors. As a result, the U.S. risks losing out on the immense zero-emissions benefits these technologies can bring to the U.S. energy mix.

In response, the NRC has spent significant energy *right-sizing* the licensing path for its safety-focused *technical* review of advanced reactors, but has paid little attention to applying a right-sized, practical approach to *environmental* reviews. This will be a major roadblock, if left unaddressed. Past experience indicates that NEPA reviews may be a dominant schedule driver for first-of-a-kind NRC licensing actions. In particular, two parts of the NEPA process could prove especially unpredictable for advanced reactors—the requirements to analyze alternatives and connected actions. Without proper attention from the agency and support from Congress, these two requirements could turn what is intended to be a straightforward license application for a small demonstration project into a lengthy and impractical environmental treatise.

The NRC and Congress can take the following steps to help pave the way for advanced nuclear innovation while preserving the important environmental analyses offered by NEPA. There are indications that the NRC is looking to improve the NEPA review process, and this paper provides suggestions in support of that effort.

RECOMMENDATIONS

- **<u>Recommendation 1:</u> Reevaluate the Presumption that Advanced Nuclear Demonstration Projects Require EISs:** Currently, NRC regulations presume that an EIS must be drafted for any power reactor or testing facility license application, which is likely to include most demonstration projects. Yet there are shorter analyses the agency can conduct under NEPA, including Environmental Assessments (EAs) – EISs' smaller cousins – and categorical exclusions.

[11] The scope of what constitutes a "Demonstration Project" can be determined in the future. However, the authors note that the term "Demonstration Project" is defined in the Nuclear Energy Leadership Act (S.3422, 115th Congress), for example, as "an advanced nuclear reactor operated (A) as part of the power generation facilities of an electric utility system; or (B) in any other manner for the purpose of demonstrating the suitability for commercial application of the advanced nuclear reactor."

What the NRC Can Do: The NRC's current policy does not take into account the inherent design benefits of advanced reactors, which can reduce or eliminate offsite environmental impacts and reduce generation of spent nuclear fuel. They can be constructed modularly, sited at brownfield locations, and use less material and space than traditional nuclear plants. Moreover, demonstration projects can be tailored to further reduce impact. It is not necessary to presume that such reactors require an EIS, and the NRC should modify its regulations accordingly. The NRC should further explore CEQ guidance in encouraging agencies to consider how steps to mitigate environmental impacts in the project design can reduce the impact of a proposed action beyond "significant" (called a "Mitigated Finding of No Significant Impact" or "Mitigated FONSI").

What Congress Can Do: Congress can also provide for rebuttal presumptions that certain or all demonstration project reviews fall within NEPA's categorical exclusion from environmental reviews, as has already been done for oil and gas projects under Section 390 of the Energy Policy Act of 2005.

- **Recommendation 2: Tailor the Scope of NEPA Reviews for Demonstration Projects:** NEPA review complexity calibrates to the number of the selected alternatives. Even in licensing traditional LWRs, the agency alternatives analysis proved to be a costly exploration of often unreasonable or unnecessary alternatives, such as siting a natural gas facility at the site of an already operating nuclear plant. Additionally, NEPA's requirement to evaluate "connected actions" or those actions closely related to a project, risks being over-extended here. With an overly broad scope, the environmental review for the licensing of a proof-of-concept or first-of-a-kind demonstration project could become a broad evaluation of the advanced reactor ecosystem, prematurely including industry-wide fuel cycle or spent fuel issues.

  What the NRC Can Do: The NRC can take initiative to streamline its reviews and recognize the benefits of co-location at national laboratories and federal facilities. It can also clarify that broad fuel cycle issues are not to be considered for demonstration project activities.

  What Congress Can Do: To facilitate an initiative by NRC, without risking costly and time-consuming litigation, Congress can provide for tailored exemptions of design alternatives and some connected actions analyses, such as for demonstration projects that are sited at a national laboratory or other federal facilities.

- **Recommendation 3: Increase Use of Generic Environmental Impact Statements (GEIS) to Address Common Advanced Reactor NEPA Questions:** GEISs are broad EISs that handle an issue common to a number of licensees at once—making the plant-specific NRC application shorter and

simpler. The NRC has effectively used GEISs to prevent repetitive NEPA processing. For example, the NRC handles most issues regarding spent nuclear fuel (SNF) storage and disposal through a GEIS, meaning that plant specific NEPA reviews do not have to repeatedly evaluate this topic.

What the NRC Can Do: There are a number of topics common to most, if not all, advanced reactor license applicants—from the use of new fuel types and high-assay low-enriched uranium (HALEU) fuel, to issues with modular construction. The NRC should move to address these in a generic manner to avoid impeding individual projects.

What Congress Can Do: Congress can ensure sufficient funding support is provided for the NRC to take these early steps. It can also encourage the NRC to look at the issue by requesting a report on advanced reactor NEPA issues that can be handled generically.

- **Recommendation 4**: **Allow Applicants to Draft EAs and EISs**: Presently the NRC essentially *duplicates* the cost of a NEPA review. An NRC reactor license applicant submits an Environmental Report (ER) to the agency with their application, which covers all the same areas as an EIS and is prepared with the same level of rigor, at great cost to the applicant. The NRC then duplicates that analysis in preparation of the EIS, and the NRC's costs in preparing the EIS are *charged back to the applicant*. This massive duplication of time and money is ineffective and contrary to the public interest.

  What the NRC Can Do: CEQ already permits applicants to draft EAs, and both the Federal Energy Regulatory Commission (FERC) and the Bureau of Land Management (BLM) also allow applicants to draft EAs. The NRC should adopt this process. Although CEQ regulations only permit applicants to draft EAs, the NRC should explore further how to validate applicant submitted EAs, rather than duplicating work in the drafting of the EIS.

  What Congress Can Do: Congress should instruct the NRC to permit reactor license applicants to draft EAs. In addition, with CEQ support, Congress should implement a process for NRC and other license applicants to draft EISs for demonstration projects.

Statement for the Record on the Discussion Draft Bill,
"S._____, American Nuclear Infrastructure Act of 2020"

Edwin S. Lyman, PhD
Director of Nuclear Power Safety, Climate and Energy Program
Union of Concerned Scientists
Washington, DC
August 5, 2020

Chairman Barrasso, Ranking Member Carper, and distinguished members of the Senate Committee on Environment and Public Works:

The Union of Concerned Scientists (UCS) greatly appreciates the opportunity to provide comments on the discussion draft of the "American Nuclear Infrastructure Act of 2020." UCS believes that nuclear power can play a role in helping to mitigate climate change, but only if it meets very high standards of safety and security, and if it is part of a comprehensive and equitable energy strategy that achieves deep cuts in emissions; drives investments in renewable energy, energy efficiency, and other zero- and low-carbon technologies; improves public health; and addresses environmental justice and labor priorities.

A strong and independent Nuclear Regulatory Commission (NRC) is critical for ensuring nuclear power safety and security and thus the viability of the technology going forward. However, we are concerned that the NRC's effectiveness is diminishing as it reduces the rigor of its oversight, endangering public health and safety. The recent NRC Office of the Inspector General Safety Culture and Climate Survey (https://www.nrc.gov/docs/ML2020/ML20209A307.pdf) paints a dismal picture of a technical staff that is losing confidence in its leadership to carry out the agency's mission. For example, the survey found that there was significant concern among the NRC staff that the agency's so-called risk-informed initiatives are reducing its focus on safety.

We fear that the Nuclear Energy Innovation and Modernization Act (NEIMA) has contributed to the agency's problems, given its mandate that the NRC develop guidance and rules designed to "risk-inform" licensing of advanced reactors. However, risk-informing regulations simply does

not make sense when the risks are not sufficiently well understood—as is the case with novel and untested reactor designs.

Inflexible budget constraints are only aggravating the agency's problems. NEIMA's cap on the NRC's corporate support costs has presumably forced the agency to make budget cuts, some of which are likely having a negative impact on NRC's activities. Corporate support is used not only for critical security functions such as personnel background investigations and drug testing, but also activities that are crucial during this pandemic, such as human resources management and custodial services. UCS urges Congress to conduct a review of the impacts of the cap on the agency's ability to operate safely, securely, and effectively.

UCS would welcome comprehensive legislation to address these and other issues. For instance, Congress should require that the NRC fully account for the current and projected impacts of climate change—such as extreme flooding—on the safe operation of current reactors and in the siting and licensing of new ones. However, the discussion draft does not include provisions such as this that we think are necessary to help ensure the safe and secure use of nuclear power.

We will now address our specific concerns with the discussion draft:

Section 102: We oppose this provision. UCS is not aware of any analysis to support the assertion that there are national security concerns associated with the import of Russian or Chinese-fabricated fuel. And if there were, the NRC already has the authority to deny such imports with interagency input. More salient questions about the quality and safety of Russian and Chinese fuel could also be addressed through the NRC's current processes. If U.S. fuel fabricators are worried about competition from Russia and China they should focus on ensuring they can make a better product.

Oddly, the provision appears to keep the door open to imports of high-assay low-enriched uranium (HALEU) from Russia and China (or other foreign sources) for domestic fuel fabrication for non-light water reactors. This may be unavoidable given the low likelihood that a sufficient domestic supply of HALEU will be established soon enough to support the current

timelines for the Department of Energy (DOE) advanced reactor demonstration reactor program and the Department of Defense (DOD) micro-reactor program, not to mention commercial projects. However, allowing Russia and China to meet this demand could disincentivize investment to establish domestic HALEU production. Although we are not persuaded this is a security issue either, it does present a greater vulnerability for the U.S. nuclear supply chain than import of fabricated light-water reactor fuel from Russia and China.

Sections 201 and 203: UCS opposes any proposal to curtail National Environmental Policy Act (NEPA) evaluations for advanced reactor licensing (or any other Federal action subject to NEPA, for that matter), especially at a time when NEPA is under unprecedented attack. And there is no technical justification for the notion that thorough environmental reviews would not be necessary for "advanced reactors" as a group—even very small ones. Such proposals are especially problematic given that NEPA currently provides the only mechanism through which the NRC is required to consider environmental justice issues, including input from community stakeholders. By truncating NEPA reviews, such issues may end up receiving even less scrutiny than they already do. This would be out of step with the long-standing need for greater attention to matters of racial and economic equity, now supported by a growing national consensus.

UCS is particularly concerned about Section 201(c)(2), which would require the NRC to consider circumstances under which it would not have to prepare an environmental impact statement at all when licensing an advanced reactor—meaning that the agency could make a "finding of no significant impact." UCS does not believe there are any conceivable circumstances under which the NRC could reasonably make such a finding for construction and operation of a new nuclear reactor.

Section 202: UCS opposes this section. Congress should not authorize prizes that create incentives for applicants to pressure the NRC to accelerate its approval process, which could compromise safety and security. Instead, such prizes should be awarded for genuine and significant nuclear technology advances, as judged by an independent panel. Also, the reference to 10 CFR Part 70 in this provision would appear to be in error, as Part 70 contains the NRC's requirements for licensing of fuel cycle facilities, not licensing of fuel for use in reactors.

Section 301: UCS supports a suite of just and equitable state and federal policies that will help get the U.S. on a pathway to achieve net zero emissions by mid-century and limit the worst impacts of climate change. These include policies such as a well-designed economy-wide cap or price on carbon or a low-carbon electricity standard that would help address a key market failure, promote growth of renewable energy and other zero-carbon electricity, and require nuclear power to compete on a level playing field with other zero- and low-carbon technologies for a growing share of U.S. electricity. We do not support a piecemeal approach that would only provide credits to at-risk nuclear plants. As a stand-alone provision in a nuclear infrastructure bill, it could give nuclear an unfair advantage over energy efficiency, renewables, and other zero- and low-carbon technologies and does not serve the public interest.

UCS recognizes and appreciates that this section contains economic, consumer protection, and nuclear safety conditions similar to those we have put forward for evaluating whether such credits are appropriate on the state level. However, our conditions also included support for stronger renewable energy and energy efficiency standards and development of transition plans to aid affected workers and communities when nuclear plants do close—elements absent from the discussion draft bill.

Also, because of recent changes to the NRC's Reactor Oversight Process that weaken evaluation standards, UCS no longer believes the NRC Action Matrix rankings are sufficient indicators of nuclear safety performance. The Institute of Nuclear Power Operations (INPO) ratings system might be a better standard to use. In addition, the safety advantages of so-called accident-tolerant fuels now appear to be far smaller than initially believed. At this point, their use should not be one of the safety criteria for providing financial support.

Section 302: We strongly oppose this provision. Rulemaking is a fundamental activity of the NRC to carry out its statutory safety and security responsibilities, and the agency's judgment should not be subject to the vagaries of the appropriations process to determine which rulemakings can proceed.

Section 303: An NRC review of COVID-19 lessons learned could be useful. Such a report should analyze the implications of the many safety and security exemptions that the NRC has granted on an expedited basis in response to impacts of the pandemic on nuclear facilities. The report should also review the effectiveness of the limited-scope security drills that the NRC is proposing to temporarily substitute for the force-on-force inspections mandated by the Atomic Energy Act (and which do not meet the letter of the law). The report should not be used to justify normalizing the diminished levels of regulatory oversight, exemptions from work-hour limits, exemptions from security officer training and qualification requirements, and reduced equipment surveillance and maintenance that the NRC has permitted on an emergency basis due to the public health emergency.

Section 304. The current prohibition on Foreign Ownership, Control, and Domination (FOCD) of U.S. utilization facilities (such as nuclear power reactors) is valuable, reasonable, and can be flexibly applied by the NRC. We see no justification for eliminating it. Removing the prohibition only for NATO countries, Japan, and South Korea does not alleviate the concern. For example, there are a number of countries in NATO with undemocratic or corrupt governments – Turkey, Hungary and Romania come to mind. Ownership or control of nuclear plants in the U.S. by such countries would raise security and safety concerns. We urge the Committee to solicit the views of the intelligence agencies on this provision.

Section 402: We are deeply skeptical of the need for a uranium reserve and do not believe there is a genuine national security justification for it. The fact that the provision would allow the reserve to purchase uranium from U.S. mines that are owned or controlled by foreign entities other than Russia or China also calls into question the "national security" rationale.

However, if the program goes forward, it should acquire uranium at the lowest cost available from the international market, and not subsidize high-cost domestic production. In addition, Congress should ensure that any program resulting in expanded domestic uranium mining should be carried out in accordance with the highest environmental, public health, and occupational safety standards, and should not result in disproportionate impacts on BIPOC (Black, Indigenous, and People of Color) communities.

Section 501: The subprogram established here is not appropriate for the NRC. If housed at the NRC, this subprogram should be restricted to development of a workforce to meet the agency's own personnel needs and not the workforce of the industry it regulates.

Section 502: This could be a useful report if it specifically requires the NRC to consider in more depth additional costs related to long-term spent fuel storage that may occur due to contingencies such as cask or fuel degradation and the eventual need for repackaging. It should also require an analysis of the security issues associated with long-term surface storage, both in pools and in dry casks, and the potential need for a new rulemaking to strengthen security requirements for nuclear waste storage and require expedited transfer of spent fuel from pools to dry casks.

Finally, we would like to offer a suggestion on terminology. Congress should consider changing the definition of HALEU referenced in legislation to align with URENCO's working definition of HALEU as 10 to < 20% enriched uranium so there is no overlap with "LEU+." This distinction aligns with Category II and III security rankings. (See https://gain.inl.gov/HALEU_Webinar_Presentations/11-Fletcher,URENCO-28Apr2020.pdf). Redefining HALEU would also help to avoid awkward phrasing such as " high-assay, low-enriched uranium that is not low-enriched uranium plus" in Section 401.

Senator BARRASSO. I also have some unanimous consent requests for items for the record. One is my August 3rd, 2020, op-ed entitled "The Future of Nuclear Energy Is American"; a July 17th article from the Energy Information Administration entitled "U.S. Uranium Production Fell to an All-Time Annual Low in 2019"; a July 2020 report from the Columbia Center of Global Energy Policy entitled "Strengthening Nuclear Energy Cooperation Between the United States and Its Allies"; and a letter from the Nuclear Energy Institute supporting the draft American Nuclear Infrastructure Act of 2020.

[The referenced information follows:]

From: Durdaller, Sarah (EPW)
To: Durdaller, Sarah (EPW)
Subject: ICYMI: Barrasso Op-Ed: The Future of Nuclear Energy is American
Date: Monday, August 3, 2020 11:00:50 AM

For Immediate Release:
August 3, 2020

Contact: Sarah Durdaller ~202.224.6176
Sarah_Durdaller@EPW.Senate.gov

In Case You Missed It…

Barrasso Op-Ed: The Future of Nuclear Energy is American

"As Chairman of the Senate Environment and Public Works Committee, I have legislation to help revive, strengthen and protect our use of nuclear power."

By: U.S. Senator John Barrasso
August 3, 2020
Casper Star Tribune

Wyoming's uranium production needs a jump-start. Our state is the number one producer of nuclear fuel in the nation. For generations, Wyoming's uranium fueled America's nuclear energy successes. Now, new challenges have slowed production. Foreign adversaries in Russia and China have undercut Wyoming's uranium producers. The industry stands at a crossroads.

From the Manhattan Project through the beginning of the 21st century, the United States was the globe's undisputed leader of nuclear energy. For generations, America led the world in nuclear engineering, reactor design, nuclear services and technical expertise.

Nuclear energy powers our businesses, homes and military. America's 95 operating nuclear reactors generate approximately 20 percent of our nation's electricity and provide over half of our carbon-free energy. They also create good-paying jobs at power plants and uranium mines. Wyoming produced 87 percent of America's domestic uranium supply in 2018.

Today, nuclear energy faces serious hurdles. Regulatory costs and subsidies for renewable energy technologies are forcing America's nuclear power plants to close at an alarming rate.

Since 2013, 10 plants have stopped operating. One more will shut down before the

end of this year. As plants have closed, Wyoming's uranium production has also struggled. The impacts of the COVID-19 public health crisis have made matters worse. Currently, there is no significant uranium production in the United States. We are headed in the wrong direction.

Russia and China are subsidizing their government-owned nuclear companies to assert their energy influence around the world. China is searching the globe for uranium reserves and investing heavily in the countries where it's found. They want to secure more nuclear fuel for themselves and increase their control of the global supply.

Meanwhile, American nuclear power plants have come to rely on cheap Russian imports of uranium to meet their nuclear fuel needs. Right now, roughly 40 percent of the uranium coming into the United States originates in Russia or its satellite states of Kazakhstan and Uzbekistan. Russian-backed companies are developing fuel that can be placed directly in American reactors.

I am leading efforts to limit imports of Russian uranium. America cannot be dependent on Vladimir Putin and communist China for our nuclear fuel. Wyoming, and other states in the West, stand ready to produce much more uranium but we are being undercut. Putin is unfairly flooding the U.S. market with cheap uranium — making us more reliant on Russia and putting Wyoming uranium miners out of work. This must stop.

In April, the Trump administration issued a report that detailed just how dire the situation in our nuclear industry has become. The report concluded we must take steps now to help America's nuclear sector. It's critical for our energy and our national security. We have to reclaim our place as the world's leader of nuclear energy.

As Chairman of the Senate Environment and Public Works Committee, I have legislation to help revive, strengthen and protect our use of nuclear power. The bill takes recommendations from the Trump administration's report and makes them into law. Reinvigorating America's nuclear energy infrastructure will create jobs, make America more secure and grow our economy.

The legislation would establish a national uranium reserve to protect our national interests and bolster Wyoming's production. Building a national uranium reserve will ensure America's nuclear plants always have the ability to operate on American nuclear fuel. In an emergency, America should not need to look beyond our borders for uranium to operate our reactors. Having a secure stockpile of American nuclear fuel is essential for our energy and defense needs.

We also must preserve and expand America's use of nuclear energy. Governor Gordon recently signed into law a bill passed by the Wyoming State Legislature to pave the way to deploy advanced nuclear technologies in Wyoming. Our legislation will help make that vision a reality.

Our bill would cut red tape that has slowed advancements in nuclear development. It simplifies the permitting process so federal approvals are much more predictable

for nuclear plant operators.

Nuclear material is already used for medical radiation therapy and to power our Navy's aircraft carriers and submarines. Our legislation will assist entrepreneurs looking for brand-new applications of nuclear technologies.

To take advantage of these technologies, we must have the advanced nuclear fuels available to power first-of-its-kind designs. The legislation will help innovators develop those new nuclear fuels – so Wyoming can once again produce the uranium that powers America.

It's crucial for Wyoming and for the entire country that we modernize our nuclear industry. America can once again be on the cutting edge of nuclear development. It's time to bring our nuclear fleet into the 21st century. Our bill helps get that done. The future of nuclear energy is American.

Sen. John Barrasso, a Republican from Wyoming, is chairman of the Senate Environment and Public Works Committee.

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U.S. Energy Information Administration

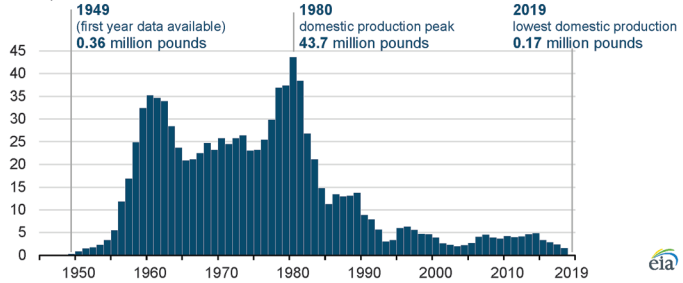
Skip to sub-navigation

Today in Energy

July 17, 2020

U.S. uranium production fell to an all-time annual low in 2019

U.S. uranium concentrate (U3O8) production (1949–2019)
million pounds U3O8



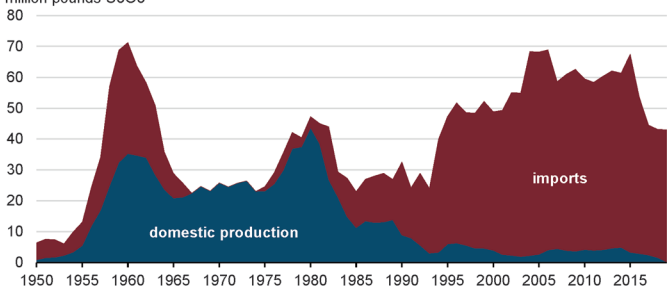
Source: U.S. Energy Information Administration, *Monthly Energy Review* and *Domestic Uranium Production Report*

The United States produced 174,000 pounds of uranium concentrate (U3O8) in 2019, 89% less than in 2018 and the lowest amount produced since the U.S. Energy Information Administration's (EIA) data series began in 1949. Domestic U3O8 production has declined since its peak of 43.7 million pounds in 1980.

Producing uranium concentrate, U3O8, is the first step in nuclear fuel production. After the uranium ore is mined, it goes through a milling process that extracts uranium from the ore, producing uranium concentrate (U3O8). Although the original ore contains as little as 0.1% uranium, U3O8 is usually more than 80% uranium. U3O8 is then processed at conversion and enrichment facilities, where it's made into reactor fuel pellets. Fuel fabrication plants assemble the fuel pellets into fuel rods for use in commercial nuclear reactors.

In the late 1940s and early 1950s, the United States introduced incentives and trade policies encouraging the growth of domestic uranium production. After these policies ended in the 1980s, domestic production began to decline. Other countries, such as Canada and Australia, have more accessible, high-quality uranium deposits, allowing them to produce U3O8 at a lower cost than the United States. Since 1990, purchased imports of U3O8 have exceeded domestic U3O8 production each year.

U.S. annual domestic production and foreign imports of uranium (1950–2019)
million pounds U3O8



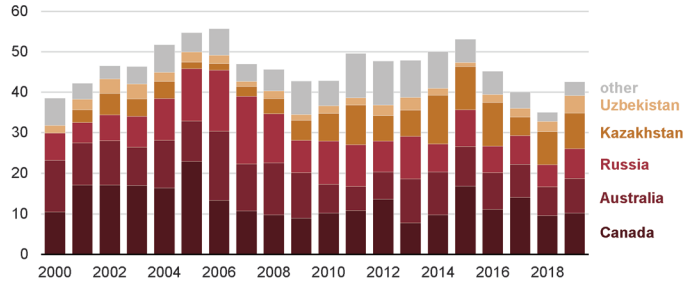
Source: U.S. Energy Information Administration, *Monthly Energy Review*

Owners and operators of commercial nuclear power reactors buy uranium in the form of U3O8, uranium hexafluoride, or enriched uranium, or a combination of these forms. When the uranium is purchased earlier in the fuel cycle, such as in the form of U3O8, owners and operators pay for conversion, enrichment, and fabrication into fuel rods. In 2019, the fuel assemblies, or structured groups of fuel rods, loaded into U.S. commercial reactors contained 43.2 million pounds of U3O8. About 9% of this amount was U.S.-origin, and 91% was foreign-origin.

In 2019, U.S. commercial nuclear power reactor operators purchased a total of 48.3 million pounds of U3O8. Foreign imports of U3O8 supply the majority of fuel to U.S. commercial nuclear reactors, and 42.6 million pounds, or 88% of the total U3O8 purchased, were imported in 2019.

Canada, which has large, high-quality uranium reserves, has historically been the largest source of U.S. uranium imports. In 2019, Canada remained the largest source of imports of uranium supplied to U.S. civilian nuclear power plants, followed by Kazakhstan, Australia, and Russia. Subsidies for uranium producers in Kazakhstan have led to increases in the country's uranium exports, including those to the United States.

Origin country of foreign uranium purchased by U.S. commercial nuclear operators
million pounds U308 equivalent



Source: U.S. Energy Information Administration, *Uranium Marketing Annual Report*

Domestic production and imports of uranium have declined in recent years as a result of decreased demand for U3O8 as more U.S. commercial nuclear reactors retire from service. The United States currently has 95 operating commercial nuclear reactors at 57 nuclear power plants. Most recently, Indian Point Unit 2, near New York City, retired in April 2020. Iowa's Duane Arnold Energy Center is scheduled to retire later in 2020, and Indian Point Unit 3 is scheduled to retire in 2021. By 2025, three additional reactors at two plants are expected to retire, according to data reported to EIA.

You can find more information about uranium in EIA's *Domestic Uranium Production Report* and *Uranium Marketing Annual Report*.

Principal contributor: Slade Johnson

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Center on Global Energy Policy

STRENGTHENING NUCLEAR ENERGY COOPERATION BETWEEN THE UNITED STATES AND ITS ALLIES

BY MATT BOWEN
JULY 2020

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This policy paper represents the research and views of the author. It does not necessarily represent the views of the Center on Global Energy Policy. The paper may be subject to further revision.

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ABOUT THE AUTHOR

Dr. Matt Bowen is a research scholar at the Center on Global Energy Policy (CGEP), focused on nuclear energy, waste, and nonproliferation. Before joining CGEP, he held positions at Clean Air Task Force and the Nuclear Innovation Alliance. Bowen spent over four years at the US Department of Energy (DOE) as a senior advisor in the Office of Nonproliferation and Arms Control from 2011 to 2015. He left DOE in January 2017 as an associate deputy assistant secretary in the Office of Nuclear Energy. Bowen has a PhD in theoretical particle physics from the University of Washington, Seattle and a BS in physics from Brown University.

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EXECUTIVE SUMMARY

Nuclear energy cooperation between the United States and its allies has been important for over a half century. Bilateral cooperation agreements with key countries date back to the 1950s, and the United States played a principal role in the development of several allied nuclear energy programs. Today, the international nuclear energy marketplace has changed, and the supply chain is globalized—the US program, for example, depends on working with allies for major safety-related components. However, limitations imposed by legacy US statutes and other obstacles are hampering greater collaboration in areas that would enhance the country's nuclear program today. Developing advanced reactors to produce dispatchable zero-carbon electricity and heat as part of global efforts to address climate change would be aided by greater cooperation and utilization of resources and financing across countries.

Deeper cooperation with like-minded allies would also allow the United States to better compete against other supplier countries that have different commercial and geopolitical objectives. If the challenges facing the US nuclear program are not overcome, the country risks further ceding its role as a leading nuclear technology exporter to China and Russia. Already China and Russia are growing their domestic nuclear energy programs and offering attractive financing to prospective customers of this technology around the world. These nuclear competitors may place differing priorities on areas such as nonproliferation, and therefore maintaining a US role in the nuclear supplier regime is connected with national security considerations.

This paper, part of the Center on Global Energy Policy at Columbia University's nuclear power program, examines part of what may be required for the United States to regain momentum in the nuclear power industry after an erosion of domestic capabilities stemming from a long hiatus in new reactor orders. The paper discusses the historical importance of nuclear cooperation between the United States and allies, some of the challenges that the US and some allied nuclear energy programs are facing, and how cooperation could be reinvigorated to the benefit of the United States and its allies.

In short, the paper finds:

- Advanced reactor development and demonstration are both expensive endeavors: each can cost over a billion dollars. Greater cooperation between the United States and allies such as Canada, France, Japan, the Republic of Korea, and the United Kingdom would enable more sources of investment and help keep development costs low by utilizing existing facilities and capabilities.
- Laws dating back to 1954, however, have created barriers to foreign investment in domestic nuclear reactors—even among the country's closest allies. These laws inhibit efforts for nuclear energy cooperation in areas that are becoming critical in the modern economy, particularly investment in new US reactor projects and preserving existing reactors. The international nuclear energy marketplace has changed

dramatically since these provisions were created, making these legacy restrictions increasingly problematic.

- In 1999, the US Nuclear Regulatory Commission (NRC) proposed amending parts of the Atomic Energy Act of 1954 to enable the NRC to more effectively manage modern corporate structures and a globalized supply chain. This proposal, not since enacted, would help to facilitate greater cooperation on advanced reactor demonstration between the United States and its allies.
- Also, current international programs in the US Department of Energy's Office of Nuclear Energy are not structured to facilitate greater cooperation between the United States and its allies on advanced reactor demonstration. Either reorienting existing programs or establishing new ones with this aim would increase the likelihood of successful demonstration of advanced reactors.

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NUCLEAR ENERGY INSTITUTE

August 3, 2020

The Honorable John Barrasso
Chairman
Committee on Environment and Public Works
U.S. Senate
410 Dirksen Office Building
Washington, D.C. 20510

Dear Chairman Barrasso,

On behalf of the commercial nuclear energy industry, the Nuclear Energy Institute (NEI)[1] expresses its support for the draft "American Nuclear Infrastructure Act of 2020." We strongly support this effort to reestablish U.S. global leadership in nuclear energy through preserving the existing fleet, revitalizing the domestic nuclear energy supply chain infrastructure, and supporting the development, licensing, and international competitiveness of American advanced nuclear technologies.

Commercial nuclear energy is the source of nearly 20 percent of our nation's electricity and more than half of our carbon-free electricity. Nuclear energy facilities demonstrate unmatched reliability by operating with an average capacity factor of more than 90 percent — higher than all other electricity sources. And, nuclear energy facilities are not only more efficient and cleaner; they also employ more workers, an average of 400-700 permanent jobs per unit, at 36 percent higher wages than similar jobs in the local area.

Nuclear energy in this country is at a crossroads. The existing fleet of 95 operating nuclear reactors is the backbone of carbon free electricity in the U.S. However, ten reactors have closed prematurely over the past seven years, and many more face severe economic challenges and have either announced plans to close or are at risk of ceasing operations before the end of their operating licenses.

[1] The Nuclear Energy Institute (NEI) is responsible for establishing unified policy on behalf of its members relating to matters affecting the nuclear energy industry, including the regulatory aspects of generic operational and technical issues. NEI's members include entities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect and engineering firms, fuel cycle facilities, nuclear materials licensees, and other organizations involved in the nuclear energy industry.

At the same time, energy policymakers in the U.S. and around the world are increasingly recognizing the value of nuclear energy in a clean energy system. In response, dozens of U.S. companies are working to develop and deploy advanced nuclear technologies to meet the expected global demand. Our innovators are in a race with other countries to develop, commercialize and deploy these technologies. The American nuclear industry is competing globally with state-owned enterprises and businesses that are often heavily subsidized by their governments. This legislation will strengthen the domestic nuclear industry and send a strong message that the U.S. is committed to remain a leader in nuclear energy technology.

Supporting the existing fleet, the development of advanced nuclear technologies, and the domestic fuel cycle infrastructure are all crucial steps in maintaining U.S. nuclear technological leadership. Your draft will support the existing fleet by recognizing the value of its zero-carbon electricity and establishing a credit program for reactors that are at risk of premature closing.

The draft also recognizes that the Nuclear Regulatory Commission's (NRC's) regulatory process must be transformed and streamlined to support both the existing fleet and the deployment of advanced reactors. The draft enhances the NRC's environmental review process for advanced reactors and focuses attention on unique licensing issues or requirements related to the flexible operation of nuclear reactors and their use for non-electric applications. The NRC is encouraged to identify and incorporate lessons learned from the COVID-19 public health emergency. Last, the draft continues the fee-reform efforts from the Nuclear Energy Innovation and Modernization Act by taking the costs associated with generic rulemaking activities not attributable to a specific NRC license off the fee-base.

In addition to addressing regulatory transformation, the draft spurs innovation in the private sector through the establishment of prizes for advanced reactor and advanced fuel development. In order to thrive, the existing fleet and future advanced reactors must have a robust domestic nuclear supply chain infrastructure. The draft focuses on the revitalization of this infrastructure, including the establishment of a uranium reserve. The efforts of Congress focusing on the existing fleet and the future of the nuclear industry are important, timely and extremely valuable.

We thank you for your initiative and hope the legislation will be given serious consideration in the closing months of 116th Congress.

Yours very sincerely,

Maria Korsnick

Maria Korsnick

Senator BARRASSO. I want to thank all of you, Ms. Roma, Mr. Goranson, Mr. Cohen, thank you so much for being here today.

Other members of the Committee, and you saw a number of members came and left, some of them may submit additional questions for you to answer in writing, and we ask that you please respond as quickly with thorough answers as you could.

As a result, the hearing record will remain open for 2 weeks.

We are so very grateful you would take the time to be with us and to share your knowledge and your expertise.

With that, I want to just thank you once again for your time and your testimony, and the hearing is adjourned.

[Whereupon, at 11:52 a.m., the hearing was adjourned.]

[Additional material submitted for the record follows:]

116TH CONGRESS
2D SESSION

S. _____

To reestablish United States global leadership in nuclear energy, revitalize domestic nuclear energy supply chain infrastructure, support the licensing of advanced nuclear technologies, and improve the regulation of nuclear energy, and for other purposes.

IN THE SENATE OF THE UNITED STATES

_____ introduced the following bill; which was read twice and referred to the Committee on _____

A BILL

To reestablish United States global leadership in nuclear energy, revitalize domestic nuclear energy supply chain infrastructure, support the licensing of advanced nuclear technologies, and improve the regulation of nuclear energy, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

(a) SHORT TITLE.—This Act may be cited as the "American Nuclear Infrastructure Act of 2020".

(b) TABLE OF CONTENTS.—The table of contents for this Act is as follows:

SEC. 2. DEFINITIONS.

In this Act:

(1) ACCIDENT TOLERANT FUEL.—The term "accident tolerant fuel" has the meaning given the term in section 107(a) of the Nuclear Energy Inno-

vation and Modernization Act (Public Law 115–439; 132 Stat. 5577).

(2) ADVANCED NUCLEAR FUEL.—The term "advanced nuclear fuel" means—

(A) advanced nuclear reactor fuel (as defined in section 3 of the Nuclear Energy Innovation and Modernization Act (42 U.S.C. 2215 note; Public Law 115–439)); and

(B) accident tolerant fuel.

(3) ADVANCED NUCLEAR REACTOR.—The term "advanced nuclear reactor" has the meaning given the term in section 3 of the Nuclear Energy Innovation and Modernization Act (42 U.S.C. 2215 note; Public Law 115–439).

(4) APPROPRIATE COMMITTEES OF CONGRESS.—The term "appropriate committees of Congress" means—

(A) the Committee on Environment and Public Works of the Senate; and

(B) the Committee on Energy and Commerce of the House of Representatives.

(5) CHAIRMAN.—The term "Chairman" means the Chairman of the Nuclear Regulatory Commission.

(6) COMMISSION.—The term "Commission" means the Nuclear Regulatory Commission.

(7) DEPARTMENT.—The term "Department" means the Department of Energy.

(8) HIGH-ASSAY, LOW-ENRICHED URANIUM.—The term "high-assay, low-enriched uranium" means uranium with an assay greater than 5 weight percent, but less than 20 weight percent, of the uranium-235 isotope.

(9) INSTITUTION OF HIGHER EDUCATION.—The term "institution of higher education" has the meaning given the term in section 101(a) of the Higher Education Act of 1965 (20 U.S.C. 1001(a)).

(10) LOW-ENRICHED URANIUM PLUS.—The term "low-enriched uranium plus" means high-assay, low-enriched uranium with an assay greater than 5 weight percent, but less than 10 weight percent, of the uranium-235 isotope.

(11) NATIONAL LABORATORY.—The term "National Laboratory" has the meaning given the term in section 2 of the Energy Policy Act of 2005 (42 U.S.C. 15801).

(12) SECRETARY.—The term "Secretary" means the Secretary of Energy.

TITLE I—REESTABLISHING AMERICAN INTERNATIONAL COMPETITIVENESS AND GLOBAL LEADERSHIP

SEC. 101. INTERNATIONAL NUCLEAR REACTOR EXPORT AND INNOVATION ACTIVITIES.

(a) COORDINATION.—

(1) IN GENERAL.—The Commission shall—

(A) coordinate all work of the Commission relating to—

(i) nuclear reactor import and export licensing; and

(ii) international regulatory cooperation and assistance relating to nuclear reactors; and

(B) support interagency and international coordination with respect to—

(i) the consideration of international technical standards to assist the design, licensing, and construction of advanced nuclear systems;

(ii) efforts to help build competent nuclear regulatory organizations and legal frameworks in countries seeking to develop nuclear power; and

(iii) exchange programs and training provided to other countries relating to nuclear regulation and oversight to improve nuclear technology licensing, in accordance with paragraph (2).

(2) EXCHANGE PROGRAMS AND TRAINING.—With respect to the exchange programs and training described in paragraph (1)(B)(iii), the Commission shall coordinate, as applicable, with—

(A) the Secretary;

(B) National Laboratories;

(C) the private sector; and

(D) institutions of higher education.

(b) AUTHORITY TO ESTABLISH BRANCH.—The Commission may establish within the Office of International Programs a branch, to be known as the "International Nuclear Reactor Export and Innovation Branch", to carry out such international nuclear reactor export and innovation activities as the Commission determines to be appropriate.

(c) EXCLUSION OF INTERNATIONAL ACTIVITIES FROM THE FEE BASE.—Section 102 of the Nuclear Energy Innovation and Modernization Act (42 U.S.C. 2215) is amended—

(1) in subsection (a), by adding at the end the following:

"(4) INTERNATIONAL NUCLEAR REACTOR EXPORT AND INNOVATION ACTIVITIES.—The Commission shall identify in the annual budget justification international nuclear reactor export and innovation activities described in section 101(a) of the American Nuclear Infrastructure Act of 2020."; and

(2) in subsection (b)(1)(B), by adding at the end the following:

"(iv) Costs for international nuclear reactor export and innovation activities described in section 101(a) of the American Nuclear Infrastructure Act of 2020.".

(d) SAVINGS CLAUSE.—Nothing in this section alters the authority of the Commission to license and regulate the civilian use of radioactive materials.

SEC. 102. DENIAL OF CERTAIN DOMESTIC LICENSES FOR NATIONAL SECURITY PURPOSES.

(a) DEFINITION OF COVERED FUEL.—In this section, the term "covered fuel" means enriched uranium that is fabricated into fuel assemblies for nuclear reactors by an entity that—

(1) is owned or controlled by the Government of the Russian Federation or the Government of the People's Republic of China; or

(2) is organized under the laws of, or otherwise subject to the jurisdiction of, the Russian Federation or the People's Republic of China.

(b) PROHIBITION ON UNLICENSED POSSESSION OR OWNERSHIP OF COVERED FUEL.—Unless specifically authorized by the Commission in a license issued under section 53 of the Atomic Energy Act of 1954 (42 U.S.C. 2073) and part 70 of title 10, Code of Federal Regulations (or successor regulations), no person subject to the jurisdiction of the Commission may possess or own covered fuel.

(c) LICENSE TO POSSESS OR OWN COVERED FUEL.—

(1) CONSULTATION REQUIRED PRIOR TO ISSUANCE.—The Commission shall not issue a license to possess or own covered fuel under section 53 of the Atomic Energy Act of 1954 (42 U.S.C. 2073) and part 70 of title 10, Code of Federal Regulations (or successor regulations), unless the Commission has first consulted with the Secretary and the Secretary of State before issuing the license.

(2) PROHIBITION ON ISSUANCE OF LICENSE.—

(A) IN GENERAL.—A license to possess or own covered fuel shall not be issued if the Secretary and the Secretary of State make the determination described in subparagraph (B).

(B) DETERMINATION.—

(i) IN GENERAL.—The determination referred to in subparagraph (A) is a determination that possession or ownership, as applicable, of covered fuel poses a threat to the national security of the United States that adversely impacts the physical and economic security of the United States.

(ii) JOINT DETERMINATION.—A determination described in clause (i) shall be jointly made by the Secretary and the Secretary of State.

(iii) COMMISSION NOTIFICATION.—On making the determination described in clause (i), the Secretary and the Secretary of State shall immediately notify the Commission.

(iv) CONGRESSIONAL NOTIFICATION.—Not later than 30 days after the date on which the Secretary and the Secretary of State notify the Commission

under clause (iii), the Commission shall notify the appropriate committees of Congress of the determination.

(v) PUBLIC NOTICE.—Not later than 15 days after the date on which the Commission notifies Congress under clause (iv) of a determination made under clause (i), the Commission shall make that determination publicly available.

(d) SAVINGS CLAUSE.—Nothing in this section alters any treaty or international agreement in effect on the date of enactment of this Act.

TITLE II—EXPANDING NUCLEAR ENERGY THROUGH ADVANCED NUCLEAR TECHNOLOGIES

SEC. 201. ADVANCED NUCLEAR REACTOR PROJECT ENVIRONMENTAL REVIEWS.

(a) DEFINITION OF ENVIRONMENTAL REVIEW PROCESS.—In this section, the term "environmental review process" means the environmental review activities carried out by the Commission pursuant to part 51 of title 10, Code of Federal Regulations (or successor regulations).

(b) ENVIRONMENTAL REVIEW PROCESS FOR ADVANCED NUCLEAR REACTORS.—Not later than 120 days

after the date of enactment of this Act, the Commission, in consultation with the Secretary and the Chair of the Council on Environmental Quality, shall—

(1) identify and review—

(A) the existing environmental regulations applicable to advanced nuclear reactors, including regulations promulgated under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.);

(B) any lessons learned from the environmental review process carried out under those regulations for any nuclear reactor for which an operating license is in effect as of the date of enactment of this Act, including research and test reactors (as defined in section 3 of the Nuclear Energy Innovation and Modernization Act (42 U.S.C. 2215 note; Public Law 115–439)); and

(C) any existing guidance on integrating other environmental laws and regulations into the environmental review process for advanced nuclear reactors;

(2) identify how title XLI of the FAST Act (42 U.S.C. 4370m et seq.) and Executive Order 13807 (42 U.S.C. 4370m note; relating to establishing dis-

cipline and accountability in the environmental review and permitting process for infrastructure projects) are applicable to the environmental review process for advanced nuclear reactors;

(3) identify and, if applicable, integrate into the environmental review process under paragraph (5) any environmental impacts of advanced nuclear reactor designs;

(4) identify project schedules and milestones for the environmental review process to support the licensing of advanced nuclear reactors; and

(5) if the Commission determines that it would be beneficial to improve the environmental review process for advanced nuclear reactors, revise the regulations identified under paragraph (1)(A) or promulgate new regulations to establish a technology-inclusive, risk-informed environmental review process for advanced nuclear reactors that accounts for—

(A) the changes made to the licensing process for advanced nuclear reactors under section 103(a) of the Nuclear Energy Innovation and Modernization Act (42 U.S.C. 2133 note; Public Law 115–439); and

(B) the matters identified under paragraphs (1) through (4).

(c) REPORT.—Not later than 1 year after the date on which the Commission issues the third operating or combined license for an advanced nuclear reactor, the Commission shall submit to the appropriate committees of Congress a report that describes—

(1) any differences between the environmental review process for nuclear reactors licensed and in operation as of the date of enactment of this Act and the environmental review process for advanced nuclear reactors;

(2) any circumstances in which it is appropriate to determine, based on an environmental assessment under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.), that there is no need for an environmental impact statement under that Act with respect to an advanced nuclear reactor;

(3) ways in which the environmental review process for advanced nuclear reactors could be improved by reducing or eliminating duplicative requirements or requirements that are not applicable to advanced nuclear reactor designs; and

(4) ways in which environmental regulations other than those promulgated under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.) could be integrated into the environmental

review process for advanced nuclear reactors to reduce the environmental impacts of advanced nuclear reactors.

SEC. 202. ADVANCED NUCLEAR REACTOR AND FUEL PRIZES.

Section 103 of the Nuclear Energy Innovation and Modernization Act (Public Law 115–439; 132 Stat. 5571) is amended by adding at the end the following:

"(f) PRIZES FOR ADVANCED NUCLEAR REACTOR AND ADVANCED NUCLEAR FUEL LICENSING.—

"(1) PRIZE FOR ADVANCED NUCLEAR REACTOR LICENSING.—

"(A) IN GENERAL.—Subject to the availability of appropriations under paragraph (4), the Secretary is authorized to make an award in an amount described in subparagraph (B) to the first non-Federal entity to which the Commission—

"(i) issues an operating license for an advanced nuclear reactor under part 50 of title 10, Code of Federal Regulations (or successor regulations), for which an application has not been docketed by the Commission as of the date of enactment of this subsection; or

"(ii) issues a combined license for an advanced nuclear reactor under subpart C of part 52 of title 10, Code of Federal Regulations (or successor regulations), for which an application has not been docketed by the Commission as of the date of enactment of this subsection.

"(B) AMOUNT OF AWARD.—An award under subparagraph (A) shall be in an amount equal to the total amount assessed by the Commission and collected under section 102(b)(2) from the entity receiving the award for costs relating to the issuance of the license described in that subparagraph.

"(2) PRIZE FOR ADVANCED NUCLEAR FUEL APPROVAL.—

"(A) IN GENERAL.—Subject to the availability of appropriations under paragraph (4), the Secretary is authorized to make an award in an amount described in subparagraph (B) to the first non-Federal entity for which the Commission approves under part 70 of title 10, Code of Federal Regulations (or successor regulations), an advanced nuclear fuel that—

"(i) uses a higher percentage of the nuclear fuel than is used by nuclear fuels approved by the Commission as of the date of enactment of this subsection; or

"(ii) uses isotopes derived from spent nuclear fuel (as defined in section 2 of the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101)) or depleted uranium as fuel that can be used in an advanced nuclear reactor.

"(B) AMOUNT OF AWARD.—An award under subparagraph (A) shall be in an amount equal to the total amount assessed by the Commission and collected under section 102(b)(2) from the entity receiving the award for costs relating to the approval described in that subparagraph.

"(3) FEDERAL FUNDING LIMITATION.—An award under this subsection shall not exceed the total amount expended (excluding any expenditures made with Federal funds received for the applicable project) by the entity receiving the award for costs relating to the project for which the award is made.

"(4) AUTHORIZATION OF APPROPRIATIONS.—There is authorized to be appropriated to the Sec-

retary to carry out this subsection $[*to be supplied*].".

SEC. 203. NEW NUCLEAR ENERGY PROJECT APPLICATION REVIEWS.

Section 185 of the Atomic Energy Act of 1954 (42 U.S.C. 2235) is amended—

(1) in the section heading, by striking "and Operating Licenses" and inserting "**AND OPERATING LICENSES**";

(2) in subsection a., by striking the subsection designation and all that follows through "All applicants" in the first sentence and inserting the following:

"a. IN GENERAL.—All applicants";

(3) in subsection b., by striking the subsection designation and all that follows through "After" in the first sentence and inserting the following:

"b. COMBINED LICENSES.—After"; and

(4) by adding at the end the following:

"c. APPLICATION REVIEW FOR NUCLEAR ENERGY PROJECTS.—

"(1) DEFINITIONS.—In this subsection:

"(A) COOPERATING AGENCY.—The term 'cooperating agency' means any agency with—

"(i) jurisdiction under Federal law; or

"(ii) special expertise as described in section 1501.6 of title 40, Code of Federal Regulations (as in effect on December 4, 2015).

"(B) EARLY SITE PERMIT.—The term 'early site permit' has the meaning given the term in section 52.1 of title 10, Code of Federal Regulations (or a successor regulation).

"(C) ENVIRONMENTAL IMPACT STATEMENT.—The term 'environmental impact statement' means the detailed written statement required under section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)(C)).

"(2) EARLY SITE PERMITS.—

"(A) SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT.—In a proceeding for a construction permit or a combined construction permit and operating license for a site for which an early site permit has been issued, any environmental impact statement prepared by the Commission with a cooperating agency shall be prepared as a supplement to the environmental impact statement prepared for the early site permit.

"(B) INCORPORATION BY REFERENCE.—A supplemental environmental impact statement under subparagraph (A) shall incorporate by reference the analysis, findings, and conclusions from the environmental impact statement prepared for the early site permit.

"(3) PRODUCTION, UTILIZATION, OR FUEL FACILITY LOCATED AT AN EXISTING SITE.—In reviewing an application for an early site permit, construction permit, operating license, or combined construction permit and operating license for a production, utilization, or fuel facility located at the site of a licensed production, utilization, or fuel facility, the Commission, to the maximum extent practicable, shall use information that was part of the licensing basis of the licensed production, utilization, or fuel facility.

"(4) RELATIONSHIP TO OTHER LAW.—Nothing in this subsection exempts the Commission from any requirement for full compliance with section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)(C)).".

SEC. 204. REPORT ON UNIQUE LICENSING CONSIDERATIONS RELATING TO THE USE OF NUCLEAR ENERGY FOR NONELECTRIC APPLICATIONS.

(a) IN GENERAL.—Not later than 1 year after the date of enactment of this Act, the Commission shall submit to the appropriate committees of Congress a report (referred to in this section as the "report") addressing any unique licensing issues or requirements relating to—

(1) the flexible operation of nuclear reactors, such as ramping power output and the use of nuclear energy for electric and nonelectric applications;

(2) the use of advanced nuclear reactors exclusively for nonelectric applications; and

(3) the colocation of nuclear reactors with industrial plants or other facilities.

(b) STAKEHOLDER INPUT.—In developing the report, the Commission shall seek input from—

(1) the Secretary;

(2) the nuclear energy industry;

(3) technology developers;

(4) the industrial, chemical, and medical sectors;

(5) nongovernmental organizations; and

(6) other public stakeholders.

(c) CONTENTS.—

(1) IN GENERAL.—The report shall describe—

(A) any unique licensing issues or requirements relating to the matters described in paragraphs (1) through (3) of subsection (a);

(B) options for addressing those issues or requirements—

(i) within the existing regulatory framework;

(ii) as part of the technology-inclusive regulatory framework required under subsection (a)(4) of section 103 of the Nuclear Energy Innovation and Modernization Act (42 U.S.C. 2133 note; Public Law 115–439) or described in the report required under subsection (e) of that section (Public Law 115–439; 132 Stat. 5575); or

(iii) through a new rulemaking; and

(C) the extent to which Commission action is needed to implement any matter described in the report.

(2) COST ESTIMATES, BUDGETS, AND TIMEFRAMES.—The report shall include cost estimates, proposed budgets, and proposed timeframes for implementing risk-informed and performance-based regulatory guidance in the licensing of nuclear reactors for nonelectric applications.

SEC. 205. ENABLING PREPARATIONS FOR THE DEMONSTRATION OF ADVANCED NUCLEAR REACTORS ON DEPARTMENT SITES.

(a) DEFINITION OF EARLY SITE PERMIT.—In this section, the term "early site permit" has the meaning given the term in section 52.1 of title 10, Code of Federal Regulations (or a successor regulation).

(b) AUTHORITY.—With respect to preparations for the demonstration of an advanced nuclear reactor on a Department site, the Commission, subject to the availability of appropriations, may fund any costs associated with—

(1) any pre-application proceedings relating to an early site permit;

(2) any review of early site permit applications; and

(3) any applicable review or analysis required under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.).

(c) EXCLUSION OF CERTAIN ACTIVITIES FROM THE FEE BASE.—Section 102(b)(1)(B) of the Nuclear Energy Innovation and Modernization Act (42 U.S.C. 2215(b)(1)(B)) (as amended by section 101(c)) is amended by adding at the end the following:

"(v) Costs for activities to review an application for an early site permit (as de-

fined in section 52.1 of title 10, Code of Federal Regulations (or a successor regulation)) to demonstrate an advanced nuclear reactor on a Department of Energy site.".

TITLE III—PRESERVING EXISTING NUCLEAR ENERGY GENERATION

SEC. 301. AT-RISK NUCLEAR REACTOR INCENTIVES.

(a) FINDINGS.—Congress finds that—

(1) as of December 31, 2019, 96 nuclear reactors provided approximately 20 percent of the electricity used in the United States and more than 55 percent of the carbon-free, clean energy used in the United States;

(2) from 2013 through June 2020, 10 nuclear reactors ceased operation prior to the end of the operating licenses of those reactors;

(3) as of June 2020, by 2025, an additional 5 nuclear reactors are scheduled to cease operations prior to the end of the operating license of those reactors;

(4) 25 percent, or more, of the current nuclear fleet, primarily in the competitive electricity market, is at risk of ceasing operations prior to the end of the operating licenses of those reactors;

(5) carbon emissions and emissions of other pollutants typically increase when a nuclear reactor ceases operations; and

(6) a program to incentivize nuclear energy generation to avoid carbon dioxide emissions offers substantial environmental benefits to the United States.

(b) DEFINITIONS.—In this section:

(1) ADMINISTRATOR.—The term "Administrator" means the Administrator of the Environmental Protection Agency.

(2) CERTIFIED NUCLEAR POWER FACILITY.—The term "certified nuclear power facility" means a nuclear power facility that—

(A) operates in a competitive electricity market; and

(B) is certified under subsection (d)(1)(B)(iii).

(3) CREDIT.—The term "credit" means a credit awarded to a certified nuclear power facility under subsection (c)(2).

(c) ESTABLISHMENT OF PROGRAM.—The Administrator, in coordination with the Secretary, shall establish a carbon emissions avoidance program—

(1) to evaluate nuclear power facilities that are determined to be at risk of premature shutdown due to economic factors; and

(2) to award credits to certified nuclear power facilities in accordance with subsection (d).

(d) FINANCIAL ASSISTANCE.—

(1) CERTIFICATION.—

(A) APPLICATION.—In order to be certified under subparagraph (B)(iii), the owner or operator of a nuclear power facility that is at risk of premature shutdown due to economic factors shall submit to the Administrator an application at such time, in such manner, and containing such information as the Administrator determines to be appropriate, including information on—

(i) the operating costs necessary to make the examination described in subparagraph (B)(i), including—

(I) the average annual operating loss per megawatt-hour expected to be incurred by the nuclear power facility over the 2-year period for which credits are to be awarded;

(II) any private or publicly available data with respect to current or projected bulk power market prices;

(III) out-of-market revenue streams;

(IV) operations and maintenance costs; and

(V) capital costs, including fuel;

(ii) the source of mined uranium and the location where the uranium is converted, enriched, and fabricated into fuel assemblies for the nuclear power facility for the 2-year period for which credits are to be awarded; and

(iii) the use of accident tolerant fuel, if commercially available.

(B) DETERMINATION TO CERTIFY.—The Administrator, in consultation with the Secretary, shall, for each application received under subparagraph (A)—

(i) examine the operating costs of the nuclear power facility submitted under clause (i) of that subparagraph;

(ii) estimate the potential incremental carbon emissions that would result if the

nuclear power facility were to shut down and be replaced with other types of power generation; and

(iii) based on the results of the examination under clause (i) and the estimation under clause (ii), determine whether to certify the nuclear power facility to receive credits.

(C) PRIORITY.—In determining whether to certify a nuclear power facility under clause (iii) of subparagraph (B), the Administrator, in consultation with the Secretary, shall give priority to a nuclear power facility that, as determined under the examination under clause (i) of that subparagraph—

(i) needs fewer dollars per megawatt-hour to break even on operating costs;

(ii) uses nuclear fuel that is mined, converted, enriched, and fabricated into fuel assemblies in the United States;

(iii) has a good safety record, as determined by the NRC Action Matrix or the Performance Indicators of the Reactor Oversight Process, such that the plant falls under the "licensee response" column indi-

cating no current significant safety issues; and

(iv) maximizes the use of accident tolerant fuels, if commercially available.

(2) DETERMINATION OF CREDITS.—Credits shall—

(A) be awarded on a dollar per megawatt-hour basis, to be based on the current operating economics of the certified nuclear power facility over a 2-year period, including annual operating losses; and

(B) include in the determination of the amount of the credit, for purposes of quantifying under subparagraph (A) the average expected annual operating loss per megawatt-hour incurred by the certified nuclear power facility over a 2-year period, any private or publicly available data with respect to current or projected—

(i) bulk power market prices;

(ii) out-of-market revenue streams;

(iii) operations and maintenance costs; and

(iv) capital costs, including fuel.

(3) TERM.—

(A) IN GENERAL.—The Administrator shall provide each certified nuclear power facility credits for a 2-year period.

(B) RENEWAL.—The owner or operator of a certified nuclear power facility that receives credits under this section may seek to recertify the nuclear power facility in accordance with paragraph (1).

(4) AUDIT.—During the 2-year period beginning on the date on which a certified nuclear power facility first receives a credit, the Administrator, in coordination with the Secretary, shall periodically audit the certified nuclear power facility.

(5) RECAPTURE.—The Administrator shall, by regulation, provide for the recapture of the benefit of any credit to a certified nuclear power facility that, during the period described in paragraph (2)—

(A) terminates operations; or

(B) does not operate at an annual loss in the absence of a credit.

(6) ECONOMIC RECOVERY PLAN.—An owner or operator of a nuclear power facility seeking to receive credits under this section shall submit to the Administrator, as part of an application submitted under paragraph (1)(A), a detailed plan to sustain

operations at the conclusion of the applicable 2-year credit period—

(A) without receiving additional credits; or

(B) with the receipt of additional credits of a lower amount than the credits awarded during that 2-year credit period.

(e) REPORT.—Not later than January 1, 2024, the Comptroller General of the United States shall submit to Congress a report with respect to the credits awarded to certified nuclear power facilities, which shall include—

(1) an evaluation of the effectiveness of the credits in avoiding carbon emissions while ensuring grid reliability;

(2) a quantification of the ratepayer savings achieved under this section; and

(3) any recommendations to renew or expand the credits.

(f) AUTHORIZATION OF APPROPRIATIONS.—There is authorized to be appropriated to carry out this section $[*to be supplied*] for each of fiscal years 2021 through 2029.

SEC. 302. REGULATORY FEE REVISIONS.

Section 102 of the Nuclear Energy Innovation and Modernization Act (42 U.S.C. 2215) (as amended by sections 101(c) and 205(c)) is amended—

(1) in subsection (a), by adding at the end the following:

"(5) SPECIFIC RULEMAKING ACTIVITIES.—The Commission shall identify in the annual budget justification rulemaking activities that are not attributable to an existing licensee."; and

(2) in subsection (b)(1)(B), by adding at the end the following:

"(vi) Costs for activities that—

"(I) are related to any rulemaking that is not attributable to an existing licensee; and

"(II) are identified by the Commission under subsection (a)(5).".

SEC. 303. REPORT ON LESSONS LEARNED DURING THE COVID–19 PUBLIC HEALTH EMERGENCY.

(a) IN GENERAL.—Not later than 60 days after the date of enactment of this Act, the Commission shall submit to the appropriate committees of Congress and make publicly available a report on actions taken by the Commission during the public health emergency declared by the Secretary of Health and Human Services under section 319 of the Public Health Service Act (42 U.S.C. 247d) on January 31, 2020, with respect to COVID–19.

(b) CONTENTS.—The report under subsection (a) shall include—

(1) an identification of the processes, procedures, and other regulatory policies that were revised or temporarily suspended during the public health emergency described in subsection (a);

(2) a description of any process efficiencies that resulted from the matters identified under paragraph (1);

(3) a discussion of lessons learned from the matters identified under paragraph (1);

(4) a list of actions that the Commission will take to incorporate the lessons described in paragraph (3) into the licensing activities and regulations of the Commission; and

(5) a description of when the actions described in paragraph (4) will be implemented.

SEC. 304. INVESTMENT BY ALLIES.

(a) IN GENERAL.—The prohibitions against issuing certain licenses for utilization facilities to certain corporations and other entities described in the second sentence of section 103 d. of the Atomic Energy Act of 1954 (42 U.S.C. 2133(d)) and the second sentence of section 104 d. of that Act (42 U.S.C. 2134(d)) shall not apply to an entity described in subsection (b) if the Commission deter-

mines that issuance of the applicable license to that entity is not inimical to—

(1) the common defense and security; or

(2) the health and safety of the public.

(b) ENTITIES DESCRIBED.—An entity referred to in subsection (a) is a corporation or other entity that is owned, controlled, or dominated by—

(1) the government of—

(A) a country that is a member of the North Atlantic Treaty Organization;

(B) Japan; or

(C) the Republic of Korea;

(2) an entity that is owned, controlled, or dominated by a government described in paragraph (1);

(3) a corporation that is incorporated in a country described in any of subparagraphs (A) through (C) of paragraph (1); or

(4) an alien who is a national of a country described in any of subparagraphs (A) through (C) of paragraph (1).

(c) TECHNICAL AMENDMENT.—Section 103 d. of the Atomic Energy Act of 1954 (42 U.S.C. 2133(d)) is amended, in the second sentence, by striking "any any" and inserting "any".

TITLE IV—REVITALIZING AMERICA'S NUCLEAR SUPPLY CHAIN INFRASTRUCTURE

SEC. 401. ADVANCED NUCLEAR FUEL APPROVAL.

(a) AGENCY COORDINATION.—

(1) IN GENERAL.—Not later than 1 year after the date of enactment of this Act, the Chairman and the Secretary shall enter into a memorandum of understanding relating to the approval of advanced nuclear fuels.

(2) MEMORANDUM OF UNDERSTANDING CONTENTS.—The memorandum of understanding entered into under paragraph (1) shall require the Department and the Commission to coordinate, as appropriate—

(A) to ensure that the Department has sufficient technical expertise to support the timely research, development, demonstration, and commercial application by the civilian nuclear industry of innovative advanced nuclear fuels, including by facilitating the development and sharing of criticality benchmark data to support—

(i) the licensing of fuel enrichment, deconversion, and fabrication facilities for advanced nuclear fuels containing—

(I) low-enriched uranium plus; or

(II) high-assay, low-enriched uranium that is not low-enriched uranium plus; and

(ii) the certification of transportation packages for advanced nuclear fuels containing—

(I) low-enriched uranium plus; or

(II) high-assay, low-enriched uranium that is not low-enriched uranium plus;

(B) to ensure that the Commission has sufficient technical expertise to support the evaluation for advanced nuclear fuels;

(C) to identify methods to improve the use of computers and software codes to calculate the behavior and performance of advanced nuclear fuels based on mathematical models of the physical behavior of advanced nuclear fuels;

(D) to ensure that the Department maintains and develops the facilities necessary to enable the timely research, development, dem-

onstration, and commercial application by the civilian nuclear industry of innovative advanced nuclear fuels; and

(E) to ensure that the Commission has access to the facilities described in subparagraph (D), as needed.

(b) REPORTING REQUIREMENTS.—Not later than 180 days after the date of enactment of this Act, the Commission shall submit to the appropriate committees of Congress a report that—

(1) identifies criticality benchmark data needed to support—

(A) the licensing of fuel enrichment, deconversion, and fabrication facilities for advanced nuclear fuels containing—

(i) low-enriched uranium plus; or

(ii) high-assay, low-enriched uranium that is not low-enriched uranium plus; and

(B) the certification of transportation packages for advanced nuclear fuels containing—

(i) low-enriched uranium plus; or

(ii) high-assay, low-enriched uranium that is not low-enriched uranium plus;

(2) identifies and describes any updates to regulations, certifications, and other regulatory policies that the Commission determines are necessary for licensing and oversight relating to high-assay, low-enriched uranium, including—

(A) certifications relating to transportation packaging for—

(i) low-enriched uranium plus; and

(ii) high-assay, low-enriched uranium that is not low-enriched uranium plus; and

(B) licensing of fuel enrichment, deconversion, and fabrication facilities for high-assay, low-enriched uranium, and associated physical security plans for those facilities; and

(3) includes a timeline for completing the updates described in paragraph (2) within the existing regulatory framework.

SEC. 402. NATIONAL STRATEGIC URANIUM RESERVE.

(a) DEFINITIONS.—In this section:

(1) PROGRAM.—The term "program" means the program established under subsection (b)(1).

(2) URANIUM RESERVE.—The term "Uranium Reserve" means the uranium reserve operated pursuant to the program.

(b) ESTABLISHMENT.—

(1) IN GENERAL.—Not later than 60 days after the date of enactment of this Act, the Secretary, subject to the availability of appropriations, shall establish a program to operate a uranium reserve in accordance with this section.

(2) AUTHORITY.—In establishing the program and operating the Uranium Reserve, the Secretary shall use the authority granted to the Secretary by sections 53, 63, and 161 g. of the Atomic Energy Act of 1954 (42 U.S.C. 2073, 2093, 2201(g)).

(c) PURPOSES.—The purposes of the Uranium Reserve are—

(1) to provide assurance of the availability of uranium mined in the United States in the event of a market disruption; and

(2) to support strategic fuel cycle capabilities in the United States.

(d) EXCLUSION.— The Secretary shall exclude from the Uranium Reserve uranium that is mined in the United States by an entity that—

(1) is owned or controlled by the Government of the Russian Federation or the Government of the People's Republic of China; or

(2) is organized under the laws of, or otherwise subject to the jurisdiction of, the Russian Federation or the People's Republic of China.

(e) REQUEST FOR INFORMATION.—Not later than 90 days after the date of enactment of this Act, the Secretary shall publish a request for information to help the Secretary evaluate—

(1) options for the operation and management of the Uranium Reserve;

(2) contractual mechanisms pursuant to which the Secretary could acquire uranium; and

(3) the quantities, form, transportation, and storage of uranium in the Uranium Reserve.

(f) BUDGET REQUEST.—For each fiscal year beginning after the date of enactment of this Act, the Secretary shall include in the budget justification submitted to Congress pursuant to section 1105 of title 31, United States Code—

(1) a request for amounts for the acquisition, transportation, and storage of uranium in the Uranium Reserve; or

(2) an explanation of why amounts are not requested for the acquisition, transportation, or storage of uranium in the Uranium Reserve.

SEC. 403. REPORT ON ADVANCED METHODS OF MANUFACTURING AND CONSTRUCTION FOR NUCLEAR ENERGY APPLICATIONS.

(a) IN GENERAL.—Not later than 180 days after the date of enactment of this Act, the Commission shall submit to the appropriate committees of Congress a report (referred to in this subsection as the "report") on manufacturing and construction for nuclear energy applications.

(b) STAKEHOLDER INPUT.—In developing the report, the Commission shall seek input from—

(1) the Secretary;

(2) the nuclear energy industry;

(3) nuclear and manufacturing technology developers;

(4) the manufacturing and construction industries;

(5) standards development organizations;

(6) nongovernmental organizations; and

(7) other public stakeholders.

(c) CONTENTS.—

(1) IN GENERAL.—The report shall—

(A) examine any unique licensing issues or requirements relating to the use of innovative—

(i) advanced manufacturing processes; and

(ii) advanced construction techniques;

(B) examine—

(i) the requirements for nuclear-grade components in manufacturing and construction for nuclear energy applications;

(ii) opportunities to use standard materials, parts, or components in manufacturing and construction for nuclear energy applications; and

(iii) opportunities to use standard materials that are in compliance with existing codes to provide acceptable approaches to support or encapsulate new materials that do not yet have applicable codes;

(C) identify any safety aspects of innovative advanced manufacturing processes and advanced construction techniques that are not addressed by existing codes and standards, so that generic guidance may be updated or created, as necessary;

(D) identify options for addressing the issues, requirements, and opportunities examined under subparagraphs (A) and (B)—

(i) within the existing regulatory framework; or

(ii) through a new rulemaking; and

(E) describe the extent to which Commission action is needed to implement any matter described in the report.

(2) COST ESTIMATES, BUDGETS, AND TIMEFRAMES.—The report shall include cost estimates, proposed budgets, and proposed timeframes for implementing risk-informed and performance-based regulatory guidance for manufacturing and construction for nuclear energy applications.

TITLE V—MISCELLANEOUS

SEC. 501. NUCLEAR ENERGY WORKFORCE DEVELOPMENT.

Section 313 of division C of the Omnibus Appropriations Act, 2009 (42 U.S.C. 16274a) is amended—

(1) in subsection (b), in the matter preceding paragraph (1), by striking "in each of fiscal years 2009 to 2019" and inserting "for each of fiscal years 2021 through 2030,"; and

(2) by adding at the end the following:

"(d) NUCLEAR ENERGY TRAINEESHIP SUBPROGRAM.—

"(1) DEFINITIONS.—In this subsection:

"(A) COMMISSION.—The term 'Commission' means the Nuclear Regulatory Commission.

"(B) INSTITUTION OF HIGHER EDUCATION.—The term 'institution of higher education' has the meaning given the term in section 101(a) of the Higher Education Act of 1965 (20 U.S.C. 1001(a)).

"(C) NATIONAL LABORATORY.—The term 'National Laboratory' has the meaning given the term in section 2 of the Energy Policy Act of 2005 (42 U.S.C 15801).

"(2) ESTABLISHMENT.—The Commission shall establish, as a subprogram of the Integrated University Program established under this section, a workforce development subprogram under which the Commission, in coordination with institutions of higher education and trade schools, shall competitively award traineeships that provide focused training to meet critical mission needs of the Commission and nuclear workforce needs, including needs relating to—

"(A) nuclear criticality safety; and

"(B) the nuclear tradecraft workforce.

"(3) REQUIREMENTS.—In carrying out the workforce development program described in paragraph (2), the Commission shall—

"(A) coordinate with the Secretary to prioritize the funding of traineeships that focus on—

"(i) nuclear workforce needs; and

"(ii) critical mission needs of the Commission;

"(B) encourage appropriate partnerships among—

"(i) National Laboratories;

"(ii) institutions of higher education;

"(iii) trade schools; and

"(iv) the nuclear energy industry; and

"(C) on an annual basis, evaluate nuclear workforce needs for the purpose of implementing traineeships in focused topical areas that—

"(i) address the workforce needs of that community; and

"(ii) support critical mission needs of the Commission.".

SEC. 502. ANNUAL REPORT ON THE SPENT NUCLEAR FUEL AND HIGH-LEVEL RADIOACTIVE WASTE INVENTORY IN THE UNITED STATES.

(a) DEFINITIONS.—In this section:

(1) HIGH-LEVEL RADIOACTIVE WASTE.—The term "high-level radioactive waste" has the meaning given the term in section 2 of the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101).

(2) SPENT NUCLEAR FUEL.—The term "spent nuclear fuel" has the meaning given the term in section 2 of the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101).

(3) STANDARD CONTRACT.—The term "standard contract" has the meaning given the term "contract" in section 961.3 of title 10, Code of Federal Regulations (or a successor regulation).

(b) REPORT.—Not later than January 1, 2022, and annually thereafter, the Secretary shall submit to Congress a report that describes—

(1) the annual and cumulative amount of payments made by the United States to the holder of a standard contract due to a partial breach of contract under the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101 et seq.) resulting in financial damages to the holder;

(2) the amount spent by the Department to reduce future payments projected to be made by the United States to any holder of a standard contract due to a partial breach of contract under the Nu-

clear Waste Policy Act of 1982 (42 U.S.C. 10101 et seq.);

(3) the cumulative amount spent by the Department to store, manage, and dispose of spent nuclear fuel and high-level radioactive waste in the United States as of the date of the report;

(4) the projected lifecycle costs to store, manage, and dispose of the projected inventory of spent nuclear fuel and high-level radioactive waste in the United States, including spent nuclear fuel and high-level radioactive waste expected to be generated from existing reactors through 2050;

(5) any mechanisms for better accounting of liabilities for the lifecycle costs of the spent nuclear fuel and high-level radioactive waste inventory in the United States; and

(6) any recommendations for improving the methods used by the Department for the accounting of spent nuclear fuel and high-level radioactive waste costs and liabilities.

SEC. 503. TECHNICAL CORRECTION.

Section 104 c. of the Atomic Energy Act of 1954 (42 U.S.C. 2134(c)) is amended—

(1) by striking the third sentence and inserting the following:

"(3) LIMITATION ON UTILIZATION FACILITIES.—The Commission may issue a license under this section for a utilization facility useful in the conduct of research and development activities of the types specified in section 31 if—

"(A) not more than 75 percent of the annual costs to the licensee of owning and operating the facility are devoted to the sale, other than for research and development or education and training, of—

"(i) nonenergy services;

"(ii) energy; or

"(iii) a combination of nonenergy services and energy; and

"(B) not more than 50 percent of the annual costs to the licensee of owning and operating the facility are devoted to the sale of energy.";

(2) in the second sentence, by striking "The Commission" and inserting the following:

"(2) REGULATION.—The Commission"; and

(3) by striking "c. The Commission" and inserting the following:

"c. RESEARCH AND DEVELOPMENT ACTIVITIES.—

"(1) IN GENERAL.—Subject to paragraphs (2) and (3), the Commission".

Discussion Draft Titled *"American Nuclear Infrastructure Act of 2020"*
Section-by-Section

SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

Sec. 1. Short title; table of contents.
This section cites this Act as the "American Nuclear Infrastructure Act of 2020" and provides the table of contents.

Sec. 2. Definitions.
This section defines terms used in this Act. The terms include accident tolerant fuel; advanced nuclear fuel; advanced nuclear reactor; appropriate Committees of Congress; Chairman; Commission; Department; high-assay, low-enriched uranium; institutions of higher education; low-enriched uranium plus; national laboratory; and Secretary.

TITLE I—REESTABLISHING AMERICAN INTERNATIONAL COMPETITIVENESS AND GLOBAL LEADERSHIP

Sec. 101. International Nuclear Reactor Export and Innovation Activities.
This section requires the Nuclear Regulatory Commission (Commission) to coordinate all work of the Commission relating to nuclear reactor import and export licensing and international regulatory cooperation and assistance relating to nuclear reactors. The Commission must also coordinate international activities with respect to the establishment of certain technical standards, efforts to build nuclear regulatory organizations and legal frameworks, and exchange programs and training to other countries. The Commission's exchange programs and training must be coordinated with the Secretary of Energy (Secretary), national laboratories, the private sector, and institutions of higher education. The Commission is authorized to establish the International Nuclear Reactor Export and Innovation Branch within the Commission's Office of International Programs. The costs for activities described in this section are not subject to the Commission's fee-recovery requirements.

Sec. 102. Denials of certain domestic licenses for national security purposes.
This section defines covered fuel as enriched uranium that is fabricated into fuel assemblies by an entity that is owned or controlled by Russia or China, or is organized under the laws of Russia or China. The section prohibits the possession or ownership of covered fuel, unless the Commission specifically authorizes such possession or ownership. A license shall not be issued if the Secretary and Secretary of State jointly determine that possession or ownership of covered fuel poses a threat to the national security of the United States. If such a determination is made, the Secretary and Secretary of State must immediately notify the Commission. The Commission must notify Congress not later than 30 days of the determination. The determination shall be made publicly available 15 days after Congressional notification. Nothing in this section alters any treaty or international agreement in effect on the date of enactment of this Act.

TITLE II—EXPANDING NUCLEAR ENERGY THROUGH ADVANCED NUCLEAR TECHNOLOGIES

Sec. 201. Advanced nuclear reactor project environmental reviews.
This section requires the Commission to consult with the Secretary and the Chair of the Council on Environmental Quality to identify existing environmental regulations applicable to advanced nuclear reactors, lessons learned from environmental reviews of operating reactors, and existing guidance to integrate other environmental laws and regulations for advanced nuclear reactors' environmental reviews. The report must identify how the Fixing America's Surface Transportation Act (P.L. 114-94), and Executive Order 13807 affect the environmental review process for advanced nuclear reactors. It directs the Commission to consider and, if deemed beneficial to improving the environmental review process for advanced reactors, revise existing regulations or promulgate new regulations to establish a technology-inclusive, risk-informed environmental review process for advanced nuclear reactors.

Not later than one year after the Commission issues the third license for an advanced nuclear reactor, the Commission must submit a report to Congress that describes differences between the environmental review process for nuclear reactors that are operating when the Act is enacted and advanced nuclear reactors. The report must also describe circumstances in which an environmental assessment could be used for an advanced nuclear reactor instead of an environmental impact statement, identify opportunities to improve and update environmental reviews for advanced reactors, and integrate environmental regulations to reduce the environmental impacts of advanced nuclear reactors.

Sec. 202. Advanced nuclear reactor and fuel prizes.
This section authorizes the Secretary to award a prize, subject to the availability of appropriations, equal to the amount of regulatory fees assessed by the Commission for the first operating permit or combined permit for an advanced nuclear reactor issued to a non-Federal entity by the Commission. An application that is docketed for review by the Commission as of the date of enactment of this Act does not qualify for the award.

This section also authorizes the Secretary to award a prize, subject to the availability of appropriations, equal to the amount of regulatory fees assessed by the Commission for the first approval of an advanced nuclear fuel to a non-Federal entity. The approved fuel must use a higher percentage of the nuclear fuel than currently approved fuel or must use isotopes derived from spent nuclear fuel or depleted uranium.

The non-Federal entity shall not receive total Federal funding, including the amount of the award authorized by this section, which exceeds costs relating to the project for which the award is made.

Sec. 203. New nuclear energy project application reviews.
This section directs the Commission to prepare a supplemental environmental impact statement for a construction permit or a combined permit in which an environmental impact statement was previously prepared for an early site permit. The Commission shall incorporate by reference the

analysis, findings, and conclusions from the prior environmental impact statement into the supplemental environmental impact statement.

The section also requires the Commission to use information that was part of the licensing basis of a currently licensed nuclear facility for the review of a proposed nuclear facility at the same site, to the maximum extent practicable.

Nothing in this section exempts the Commission from the requirements of section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S.C. 4332(2)(C)).

Sec. 204. Report on unique licensing considerations relating to the use of nuclear energy for nonelectric applications.
This section directs the Commission to submit a report to Congress, not later than one year after the date of enactment, identifying unique licensing issues or requirements related to the flexible operation of nuclear reactors, use of nuclear reactors for nonelectric applications, and colocation of nuclear reactors with industrial plants or other facilities. The Commission shall seek input from the Secretary; the nuclear energy industry; technology developers; the industrial, chemical and medical sectors; nongovernmental organizations; and other public stakeholders.

The report must also describe options for addressing such issues or requirements as part of the existing regulatory framework, the technology-inclusive regulatory framework required by the Nuclear Energy Innovation and Modernization Act (Public Law 115–439) (NEIMA), or through a new rulemaking, and the extent to which Commission action is needed to implement matters in the report. The Commission's report shall include cost estimates, budgets and timeframes for implementing the section.

Sec. 205. Enabling preparations for the demonstration of advanced nuclear reactors on Department sites.
This section excludes funding to support pre-application proceedings or the review of an early site permit and the environmental review associated with advanced nuclear reactor demonstrations that will be located on Department of Energy (Department) sites from the Commission's fee recovery requirements.

TITLE III—PRESERVING EXISTING NUCLEAR ENERGY GENERATION

Sec. 301. At-risk nuclear reactor incentives.
This section directs the Administrator of the Environmental Protection Agency to establish a carbon emissions avoidance program to evaluate nuclear power facilities determined to be at risk of premature shutdown due to economic factors and award credits to certified facilities. To qualify for the credits, the owner or operator of a nuclear power facility shall submit an application to the Administrator. The application must include information on operating costs; the source of mined uranium and location where the uranium is converted, enriched, and fabricated into fuel assemblies; and if the facility will use accident tolerant fuel.

The Administrator determines to certify facilities for which an application is received. To certify, the Administrator must examine the operating costs of the facility and estimate potential

incremental carbon emissions avoided if the facility receives a credit. The Administrator shall prioritize facilities that need fewer dollars per megawatt-hour to break even; uses nuclear fuel mined, converted, enriched, and fabricated in the United States; has a good safety record as determined by the Commission's Reactor Oversight Process; and maximizes the use of accident tolerant fuels, if commercially available.

The Administrator awards credits on a dollar per megawatt-hour basis over a two-year period. The amount of the credit is based on a certified facility's operating loss. A certified facility may apply to be recertified for a subsequent two-year period in accordance with the application requirements.

The Administrator shall periodically audit certified facilities. The Administrator shall recapture credits if a certified nuclear power facility ceases operation or would not operate at a loss in the absence of the credit during that two-year period. Applicants shall submit an economic recovery plan to sustain operations at the conclusion of the credit period without receiving additional credits or with a reduced credit amount in subsequent two-year credit periods.

This section also directs the Comptroller General of the United States to submit a report to Congress evaluating the effectiveness of the program with respect to avoiding carbon emissions while maintaining the reliability of the electric grid, the amount of ratepayer savings, and recommendations to renew or expand the credits.

The section authorizes the appropriation of $[to be supplied] from fiscal year 2021 through 2029 to carry out this program.

Sec. 302. Regulatory fee revisions.
This section directs the Commission to identify and request funding in the annual budget justification for rulemaking activities not attributable to a specific Commission licensee. Funding for rulemaking activities not attributable to a specific licensee and identified by the Commission in the annual budget justification is excluded from the Commission's fee recovery requirements.

Sec. 303. Report on lessons learned during the COVID–19 public health emergency.
This section directs the Commission to submit a report to Congress, not later than 60 days after the date of enactment of this Act, that identifies processes, procedures, and other regulatory policies that were revised or suspended during the public health emergency; a description of efficiencies that resulted from those activities; a list of actions that Commission will take to incorporate such lessons into future licensing activities and regulations; and when the actions will be implemented.

Sec. 304. Investment by allies.
This section allows certain foreign entities to receive a license described in section 103(d) or 104(d) of the Atomic Energy Act of 1954 (Public Law 83-703) for a nuclear utilization facility if the Commission determines that issuing such license is not inimical to the common defense and security or the health and safety of the public. This section applies to an entity that is owned, controlled, or dominated by the government of a country that is a member of the North Atlantic

Treaty Organization (NATO), Japan, or the Republic of Korea; a corporation that is incorporated in those countries; or an alien who is a national of those countries.

TITLE IV—REVITALIZING AMERICA'S NUCLEAR SUPPLY CHAIN INFRASTRUCTURE

Sec. 401. Advanced nuclear fuel approval.
This section directs the Commission to enter into a memorandum of understanding (MOU) with the Department to support the development and approval of advanced nuclear fuels referred to as high-assay, low-enriched uranium (HALEU). The MOU requires the Department and Commission to ensure the Department has sufficient technical expertise to support the development of innovative advanced nuclear fuels and to ensure the Commission has sufficient technical expertise to support the evaluation of advanced nuclear fuels. The MOU must also identify methods to improve the use of computers and software codes to model the behavior of advanced nuclear fuels. The MOU directs the Department to maintain facilities to enable deployment of innovative advanced nuclear fuels; and to ensure the Commission has access to such facilities.

This section also directs the Commission to submit a report to Congress, not later than 180 days after the date of enactment of this Act, identifying data needs to support the licensing of fuel facilities that can produce HALEU and associated HALEU transportation packages. The report must also identify necessary regulatory updates to support the licensing and certification of such facilities.

Sec. 402. National strategic uranium reserve.
This section directs the Secretary to establish, subject to the availability of appropriations, a program to operate a uranium reserve. The uranium reserve is established and operated using the authority granted to the Secretary by sections 53, 63, and 161g of the Atomic Energy Act of 1954.

The purpose of the uranium reserve is to provide assurance of the availability of uranium mined in the United States in the event of a market disruption and support strategic fuel cycle capabilities in the United States. The Secretary shall exclude uranium that is mined in the United States by an entity that is owned, controlled or organized under the laws of Russia or China, from the uranium reserve.

The Secretary must issue a Request for Information not later than 90 days after enactment of this Act to evaluate options for the operation and management of the reserve; contractual mechanisms to acquire the uranium; and the quantities, form, transportation, and storage of the reserve. The Secretary shall include a request for amounts for the uranium reserve in the Department's budget justification or an explanation why amounts are not requested.

Sec. 403. Report on advanced methods of manufacturing and construction for nuclear energy applications.
This section directs the Commission to submit a report to Congress, not later than 180 days after the date of enactment of this Act, on manufacturing and construction for nuclear energy

applications. In developing the report, the Commission shall seek input from the Secretary; the nuclear energy industry; nuclear and manufacturing technology developers; the manufacturing and construction industries; standards development organizations; nongovernmental organizations; and other public stakeholders.

The report shall examine unique licensing issues or requirements related to the use of innovative advanced manufacturing processes and advanced construction techniques for nuclear energy applications. The report must examine requirements for the use of nuclear-grade components for nuclear energy applications; opportunities to use standard materials in manufacturing and construction for nuclear energy applications; and opportunities to use standard materials that are in compliance with existing codes. The report must identify safety aspects of innovative advanced manufacturing and advanced construction techniques that are not addressed by existing codes and standards and identify options for addressing identified needs within the existing regulatory framework or through a new rulemaking. Cost estimates, proposed budgets, and proposed timeframes for implementing guidance for advanced manufacturing and advanced construction techniques are required.

TITLE V—MISCELLANEOUS

Sec. 501. Nuclear energy workforce development.

This section reauthorizes the Integrated University Program through 2030. It also establishes a new traineeship subprogram to provide focused training to meet critical mission needs of the Commission and nuclear workforce needs relating to nuclear criticality safety and the nuclear tradecraft workforce. To carry out the traineeship program, the Commission shall coordinate with the Secretary; encourage appropriate partnerships among national laboratories, institutions of higher education, trade schools, and the nuclear energy industry; and annually evaluate nuclear workforce needs.

Sec. 502. Annual report on the spent nuclear fuel and high-level radioactive waste inventory in the United States.

This section directs the Secretary to annually submit a report to Congress that describes the annual and cumulative payments made by the United States to the holder of a standard contract due to a partial breach of the contract under the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101 et seq.) resulting in financial damages to the holder and the amount spent to reduce projected legal payments. The report must identify the cumulative amount spent and projected lifecycle costs to store, manage, and dispose of spent nuclear fuel and high-level radioactive waste; mechanisms for better accounting for the lifecycle costs of the nation's spent nuclear fuel and high-level radioactive waste inventory. The Secretary must make recommendations for improving the methods used to account for spent nuclear fuel and high-level radioactive waste costs and liabilities.

Sec. 503. Technical correction.

This section makes a technical correction to the Atomic Energy Act of 1954, as amended by NEIMA, to permit the Commission to issue a license for a research and test reactor if not more than 75 percent of the annual costs to the licensee of owning and operating the facility are devoted to the sale of nonenergy services, energy services, or a combination thereof, other than for research and development or education and training.

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