RESTORING AMERICA'S COMPETITIVE NUCLEAR ENERGY ADVANTAGE

A strategy to assure U.S. national security

U.S. DEPARTMENT OF ENERGY

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RESTORING AMERICA'S COMPETITIVE NUCLEAR ENERGY ADVANTAGE

A strategy to assure U.S. National Security

Executive Summary

Nuclear power is intrinsically tied to National Security.

- America has lost its competitive global position as the world leader in nuclear energy to state-owned enterprises, notably Russia and China, with other competitor nations also aggressively moving to surpass the United States (U.S.).
- The Strategy to Restore American Nuclear Energy Leadership is designed to restore America's competitive nuclear advantages.

It is in the U.S. national security interest to preserve and grow the assets and investments of the entire U.S. nuclear enterprise. We can do so by addressing domestic and international security interests, expanding nuclear generation, minimizing commercial fleet fiscal vulnerabilities, assuring defense needs for uranium, and leveling the playing field against state-owned enterprises.

First, the U.S. Government will take bold action to revive and strengthen the uranium mining industry, support uranium conversion services, end reliance on foreign uranium enrichment capabilities, and sustain the current fleet, removing strategic vulnerabilities across the nuclear fuel cycle and restoring a world-class workforce to provide benefits to the U.S. and to compete in the international market.

Next, the U.S. Government will leverage American technological innovation and advanced nuclear Research, Development, and Demonstration (RD&D) investments to accelerate technical advances and regain American nuclear energy leadership.

Finally, the U.S. Government will move into markets currently dominated by Russian and Chinese State Owned Enterprises (SOE) and recover our position as the world leader in exporting best-in-class nuclear energy technology, and with it, strong non-proliferation standards. We will restore American nuclear credibility and demonstrate American commitment to competing in contested markets and repositioning America as the responsible nuclear energy partner of choice.

The Nuclear Fuel Working Group recognizes the importance of taking focused, deliberate action to prevent the near-term collapse of the domestic uranium mining, milling, and conversion industries and the need to support US strategic fuel cycle capabilities. This strategy includes concrete actions that the Administration has already taken through its Fiscal Year 2021 Budget that demonstrate its commitment to these principles as well as recommendations for additional action that can be used by the Administration to inform future policy decisions. Any recommendations in this strategy beyond those already reflected

in the President's Budget will be subject to relevant budgetary, regulatory, and policy development processes before adoption or execution. Given the dynamic nature of the challenges facing the front-end of the nuclear fuel cycle, the Administration will continue to monitor market conditions and track progress. The NFWG supports implementation of focused, carefully executed policy measures that achieve the Administrations goals and ensure deployment of the most effective and efficient solutions.

Congress has provided broad bipartisan and bicameral support for U.S. nuclear energy.

It is within our power to pull America's nuclear industrial base back from the brink of collapse and restore our place as the global leader in nuclear technology – ensuring a strong national security position and buttressing our economic strength for generations.

The Current Landscape

America has lost its competitive global position as the world leader in nuclear energy. The U.S. has ceded its leadership position to countries with state-owned-enterprises, including Russia and China, and additional nations from the developing world are accelerating to fill the void. After decades of neglect, the entire U.S. commercial nuclear sector, from mining through power generation, is at high-risk of insolvency. America is on the brink of losing its ability to produce US-origin nuclear fuel, threatening our national interest and national security.

This 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. America's broad strategy of energy dominance has a gaping vulnerability. Russia – a nation that has "weaponized" its energy supply as an instrument of coercion – dominates nuclear markets. Russia is advancing its economic and foreign policy influence around the world with $133 billion in foreign orders for reactors, with plans to underwrite the construction of more than 50 reactors in 19 countries. China, a strategic competitor that uses predatory economics as a tool of statecraft, is currently constructing four reactors abroad, with prospects for 16 more reactors across multiple countries, in addition to the 45 reactors built in China over the past 33 years, and the 12 reactors currently under construction in China.

Meanwhile, the United States is entirely absent from global new build nuclear reactor market with no foreign orders. The United States is missing out on a nuclear reactor market that the U.S. Department of Commerce (DOC) estimates is valued at $500-740 billion over the next 10 years. U.S. industry faces competition from other nation states by state-owned enterprises that are directed by their respective national strategic economic and foreign policy goals. We should not pretend the U.S. nuclear reactor industry operates in a truly free global market – left exclusively to its own efforts to survive. American companies do not only face competition from other international companies – they face competition from State actors.

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[1] "Nuclear Power in China," World Nuclear Association (Feb. 2020), https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/china-nuclear-power.aspx, (last accessed March 3, 2020).

Strategic Approach

The Strategy to Restore American Nuclear Leadership is designed to right the ship and restore America's comparative nuclear advantages. It will de-risk the fuel cycle, assure national security, and restore America's international leadership in technology and nonproliferation standards, revitalizing the U.S. nuclear industry to compete effectively in the global nuclear market.

It will most importantly restore America's sovereign ability to control its use of the most powerful naturally occurring element on the planet -– uranium -– for peaceful uses and defense purposes.

First, the U.S. Government will take immediate and bold action to revive and strengthen the uranium mining industry, support uranium conversion services, and sustain the current fleet, removing strategic vulnerabilities across the nuclear fuel cycle and restoring a world-class workforce to provide benefits to the U.S. and enable the United States to compete in the international market.

Next, the U.S. Government will leverage American technological innovation and advanced nuclear RD&D investments to accelerate advances and regain American nuclear energy leadership.

Finally, the U.S. Government will move into markets currently dominated by Russian and Chinese State Owned Enterprises (SOE) and recover our position as the world leader in exporting best-in-class nuclear energy technology, and with it, strong non-proliferation expectations. We will restore American nuclear credibility and demonstrate the American commitment to compete in contested markets, repositioning America as the responsible nuclear energy partner of choice.

National Security Interests

On July 12, 2019, President Donald J. Trump determined that "the United States uranium industry faces significant challenges in producing uranium domestically and that this is an issue of national security."

Eight national security considerations underpin the President's finding and justify the need for a comprehensive strategy.

Uranium is an important and unique critical mineral: Uranium is the most powerful elements found in nature. Uranium is inextricably linked to the entire nuclear industry – for peaceful uses and defense purposes. President Trump established the importance of critical minerals, including uranium, to the economic and national security through Executive Order 13817. Uranium is a critical mineral. We must reduce vulnerabilities and build supply chain resilience to reclaim U.S. nuclear leadership and reassert America's ability to govern the use of uranium, before it is too late.

Critical infrastructure resilience enabled through nuclear energy: U.S. energy infrastructure fuels the U.S. economy of the 21st century. Without a stable energy supply, health and welfare are threatened and the U.S. economy cannot function. As a result, U.S. national security interests begin with preserving the critical infrastructure provided by baseload, carbon-free, reliable commercial nuclear power. Nuclear power provides approximately 20 percent of the nation's electricity with capacity factors above 90 percent, meaning that the average U.S. nuclear power plant is typically generating power near 100 percent of its licensed capacity more than 90 percent of the time. Of the 16 designated critical infrastructure sectors (Presidential Policy Decision 21), electric power provides an "enabling function" across all critical infrastructure sectors, and nuclear power is a critical part of the electricity sector.

Mission Assurance: The Department of Defense (DoD) depends primarily on the grid to power its installations. Yet, these installations require the reliable and resilient power for mission assurance so that the nation can defend itself in times of peace and active conflict. While the current commercial fleet is a critical part of the national grid on which the majority of domestically located military bases and installations rely, current reactors do not provide dedicated service specifically to military assets. Furthermore, military services operate remote installations within U.S. borders and around the world, with forward operating installations being the most vulnerable to disruption. DoD is pursuing development of an advanced deployable micro-nuclear reactor, which holds the promise of being able to provide reliable and resilient power to the military in the field, while also assessing how commercial micro-nuclear reactors could power military installations at home. In a future of increasingly electrified warfare, power delivery becomes increasingly critical to mission success.

Strong Nonproliferation and Safety Standards: U.S. national security also depends on the success of global nuclear non-proliferation agreements. The credibility of the U.S. within the global non-proliferation regime depends on the viability and health of a robust civilian nuclear industry and technology leadership position of U.S. innovators in the global market. U.S. regulatory structures remain the international gold standard for safe operation of nuclear power facilities and adoption of stringent international safeguard and security measures. If U.S. industry is not poised to compete in the international market, America's ability to influence global non-proliferation, security, and safety standards is not credible. The strength of our non-proliferation and nuclear safety efforts must rest on a foundation of domestic nuclear industry credibility and government commitment.

100-year foreign policy relationships: When a nation chooses to pursue nuclear power, its choice of partner matters greatly. Establishment of nuclear infrastructure incorporates large scale cross-cutting economic, security, and geopolitical relationships between the purchasing nation and the technology providing nation for the ensuing 100 years. Abdicating American leadership in the international competition for nuclear influence through neglect of this industry has empowered Russia and China to establish long-term relationships with nations, inimical to U.S. national interests. This includes a NATO ally and multiple nations that hold high strategic geopolitical importance. Today, there are a number of Eastern European and African nations that appear to be moving toward cooperation with Russia and China. We must not cede these long-term relationships and hinder our ability to build positive foreign policy engagements.

Defense Needs: The U.S. has well-defined defense needs that also depend on a healthy nuclear fuel cycle in the long-term. There are currently two defense needs for uranium: low-enriched uranium is needed to produce tritium required for nuclear weapons, and highly- enriched uranium is used to fuel Navy nuclear reactors. Agreements with foreign suppliers prohibit the use of uranium for military purposes. DOE's National Nuclear Security Administration is responsible for both these missions, and has sufficient stockpiles of unobligated uranium fuel to support tritium production until 2041 and Navy propulsion until the 2050's. Ensuring a viable industry mitigates risk to future supply chains.

Uranium availability assurance: Strategic policies of state-owned foreign competitors have successfully skewed markets already stressed by a post-Fukushima demand collapse. All sectors of the U.S. nuclear fuel cycle are fragile, with mining and conversion the most vulnerable facing imminent collapse. U.S. industry has made it clear that it has little reserve to compete and low prospects for additional capital investments in those two sectors. We must restore and grow those capabilities in the immediate term as an investment in our energy and national security.

Workforce and Supplier Base: Accompanying the specific requirements for military capabilities and a robust nuclear defense industrial base are the additional interrelated factors of workforce viability and vendor base sustainability. The civilian workforce that supports the civilian nuclear fleet, the growing advanced nuclear industry, and the nuclear defense industrial base all hail from the same highly skilled sources – U.S. universities, National Laboratories, highly skilled labor training programs, and service in the Navy through its Naval Reactors educational programs. Meanwhile, sole source acquisition realities have driven up prices for defense programs as the vendor base has dwindled across the domestic nuclear enterprise. The scale of these challenges indicate that a defense-only perspective fails to provide economies of scale to stimulate sufficient demand to protect U.S. national security interests.

Strategy Development

In his July 12, 2019 Presidential Memorandum on the Effect of Uranium Imports on the National Security and Establishment of the United States Nuclear Fuel Working Group, the President established a Working Group to undertake "a fuller analysis of national security considerations with respect to the entire nuclear fuel supply chain," and report back to the President. At the President's direction, the Assistant to the President for National Security Affairs and the Assistant to the President for Economic Policy co-led the Working Group policy coordination process to develop recommendations for reviving and expanding nuclear fuel production.

The Working Group's efforts built upon ongoing work by the National Economic Council, the National Security Council, the Office of Science and Technology Policy, and other federal agencies to complete a full review of U.S. nuclear energy policy that the President directed in June 2017, to "revive and expand the nuclear energy sector." This strategy from the Working Group includes results from both of these efforts.

The clear outcome of the Working Group's efforts is confirmation that it is in the nation's national security interests to preserve the assets and investments of the entire U.S. nuclear enterprise and to revitalize the sector to regain U.S. global nuclear leadership. We can accomplish this by addressing domestic and international security interests, expanding nuclear generation, minimizing commercial fleet fiscal vulnerabilities, assuring defense needs for uranium, and leveling the playing field against state-owned enterprises.

The clear outcome of the Working Group's efforts is confirmation that it is in the nation's national security interests to preserve the assets and investments of the entire U.S. nuclear enterprise and to revitalize the sector to regain U.S. global nuclear leadership.

The Working Group strategy has considered policy options to create new commercial demand while recognizing that the U.S. national security interest is truly integrated with the health of the entire front-end of the nuclear fuel cycle – the United States needs a strong civil nuclear industry to enable national defense.

[1] The March 11, 2011, earthquake and tsunami that caused widespread devastation and significant loss of life in north-central Japan also triggered a serious accident at the Fukushima Daiichi nuclear power plant. Subsequent policy decisions around the world regarding nuclear power plants led to a steep decline in demand for uranium.

Strategy Methodology

The Working Group recognized that, to achieve the President's vision of a vibrant and self- sustaining U.S. nuclear energy industry for both defense and commercial needs, policy actions undertaken by the U.S. government to catalyze the sector and restore U.S. leadership must consider all segments of the front-end of the nuclear fuel cycle. Policy recommendations included in this report recognize the national security imperative of maintaining a strong nuclear energy industry that supports both U.S. commercial and defense needs. They also recognize the interdependent nature of each phase of the nuclear fuel cycle – which means that the success of domestic uranium mines are intrinsically tied to the downstream success of U.S. commercial exports.

Accordingly, the policies outlined in this strategy are complementary. The Administration has included several of these measures in its Fiscal Year 2021 Budget, demonstrating its strong commitment to addressing the critical challenges facing the nuclear industry. Additional actions, especially in in future fiscal years will be subject to the Executive Branch budgetary process and Congressional appropriations. Near-term actions taken by the Administration will help revitalize U.S. uranium mining, bolster the waning nuclear fuel subsectors, revive dormant U.S. capabilities, restore and maintain U.S. technology supremacy, and drive U.S. exports, while assuring consistency with U.S. nonproliferation objectives and supporting national security.

Further, the Working Group understands that the revitalization of the nuclear industry is a truly national goal with broad bipartisan support. Over the past five years, both the U.S. Senate and House of Representatives have brought a keen focus to maintaining the current nuclear fleet, expanding research and development activities, reestablishing U.S. nuclear technology leadership, and supporting U.S. nuclear exports. Congress has focused on fact-finding about the state of the U.S. nuclear industry, the effectiveness of Department of Energy (DOE) nuclear programs, and oversight of the Nuclear Regulatory Commission (NRC). Reasons for Congressional support have ranged from national security, to economic, and environmental. Congress has adopted two foundational bills focused on advanced reactor development and licensing – both by huge margins in the House and without a single "no" vote in the Senate. The Nuclear Energy Innovation Capabilities Act of 2017 (Pub. L. 115-248) and the Nuclear Energy Innovation and Modernization Act (NEIMA) (Pub. L. 115-439) were signed by the President in September of 2018 and January of 2019, respectively. Further relevant bills are currently under consideration in both chambers and the Administration looks forward to working with Congress on their development.

Meanwhile, the NRC has made important strides in recent years. The first small modular reactor license application has cleared Phase 4 of the NRC Design Certification Application review and the NRC is following the direction of NEIMA to develop an appropriate licensing framework for next-generation advanced reactors.

To prevent the near-term collapse of the U.S. uranium mining, milling, and conversion industries, the policies recommended by the Working Group will support the front-end of the nuclear fuel cycle today and improve the long-term prospects for the nuclear sector from uranium mining through reactor operations. The policy measures considered in this

strategy can help enable the continued and expanded use of clean, reliable, resilient baseload nuclear power in an evolving energy landscape, broaden support for the revitalization of industry, assure economic and national security interests are met, and may have significant ancillary benefits. The United States government is demonstrating a clear commitment to a healthy commercial civil nuclear sector to attract private investment. Focused, carefully executed actions will revive and expand the nuclear sector while maintaining capabilities that are critical to broad U.S. national security interests.

Focused, carefully executed actions will revive and expand the nuclear sector while maintaining capabilities that are critical to broad U.S. national security interests.

Simply put, it is within our power to pull America's nuclear industrial base back from the brink of collapse and restore our place as the global leader in nuclear technology – ensuring a strong national security position and buttressing our economic strength for generations to come.

Strategic Objectives

Uranium, the foundational element of the U.S. nuclear industry, transcends treatment as a pure commodity. Strategic and market-distorting policies of foreign competitors are successfully skewing uranium markets already stressed by a post-Fukushima demand collapse.1 Risk management coordination of the domestic nuclear fuel cycle, which is primarily borne by industry with little U.S. government support at present, should be improved across industry and relevant federal government departments and agencies. Domestic uranium mines are the part of the fuel cycle closest to shutting down, but other elements of the domestic fuel cycle face similarly fragile economic realities due to the predatory practices of foreign state-owned conglomerates. Elements of the entire U.S. nuclear industry, from the mines to the operating power plants and even the reactor vendors, have made it clear that they have little ability to compete and low prospects for additional capital investments.

The Strategy to Restore American Nuclear Energy Leadership recognizes that United States national security interests are truly integrated with the health of the nuclear fuel cycle. Policies focused on executive, regulatory, and legislative actions that enhance the positive attributes of nuclear power – clean, reliable, resilient, safe, sustainable, and firm baseload power in an evolving energy landscape – will have significant ancillary benefits for industry and national security.

Together, the policy objectives endorsed by the President's Nuclear Fuel Working Group together will:

- Triage the Damage: Provide immediate action to support domestic uranium miners and restore the viability of the entire front-end of the nuclear fuel cycle;
- Revitalize and strengthen the front- end of the nuclear fuel cycle and domestic nuclear industry: Smartly decrease undue permitting and regulatory burdens on industry to level the domestic playing field and value attributes provided by U.S. commercial nuclear power;
- Lead the world in technology and standards: Reestablish U.S. leadership in next-generation nuclear technology; and
- Empower U.S. Export Competitiveness: Level the playing field versus foreign competitors, expand the arena of competition space, and challenge our rivals.

There are short-term actions we can take and other actions that will be considered going forward, depending on conditions, needs, and progress. Implementing carefully considered policies will, address domestic and international security interests, minimize commercial fleet fiscal vulnerabilities, expand nuclear generation at home and abroad, and assure defense needs for uranium.

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[1] The March 11, 2011, earthquake and tsunami that caused widespread devastation and significant loss of life in north-central Japan also triggered a serious accident at the Fukushima Daiichi nuclear power plant. Subsequent policy decisions around the world regarding nuclear power plants led to a steep decline in demand for uranium.

PROVIDE IMMEDIATE ACTION TO SUPPORT U.S. URANIUM MINING AND RESTORE THE VIABILITY OF THE ENTIRE FRONT-END OF THE NUCLEAR FUEL CYCLE

How: Directly purchase uranium by establishing a Uranium Reserve

The DOC report to the President ("Commerce report") outlined details of its investigation into the effect of imports of uranium on the national security of the United States, pursuant to Section 232 of the Trade Expansion Act of 1962. The Commerce report recognized the near-term threat of losing all U.S. uranium mining[2] and milling capabilities and the potential permanent closure of the only U.S. uranium conversion facility, which is currently in cold standby, but cannot be maintained indefinitely in that state for technical and market reasons. The Working Group agreed with the need to mitigate these near-term risks while considering action that would support the entire front-end of the nuclear fuel cycle.

The Department of Energy recognizes that addressing the challenges facing the front end of the nuclear fuel cycle is a multi-year effort. The Department is working on solutions that support reestablishing critical capabilities and enabling the United States to provide direct support for the most vulnerable sectors of the front-end of the nuclear fuel cycle beginning in calendar year 2020. Subsequent support will be considered as deemed necessary across a 10-year period as the government and private sector work to reestablish US technology and market share.

The Administration supports actions associated with the timeline that will provide funding for a competitive procurement for U.S. uranium mining, conversion services, in the very near term, as reflected in the Fiscal Year (FY) 2021 President's Budget, and will also consider enrichment needs after first addressing the existing pressure on the uranium mining sector. The Department of Energy believes that a 10-year timeline reflects a responsible approach to addressing the challenges facing the front-end of the fuel cycle.

The new Uranium Reserve will provide assurance of availability of uranium in the event of a market disruption and support strategic U.S. fuel cycle capabilities, and is not designed to replace or disrupt market mechanisms. As included in the President's Fiscal Year 2021 Budget Request, during the first year, it is expected that the reserve would directly support the operation of at least two U.S. uranium mines and the reestablishment of active domestic conversion capabilities. Establishing this reserve is a critical step needed to address the overreliance on imported uranium product that has undermined U.S. energy security and impacted U.S. fuel supply capabilities. This action addresses near-term challenges to the production and conversion of domestic uranium, where the risks are most immediate.

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[2] In this report, the term "mined and milled uranium" will generally be used to include mining and milling or in situ uranium recovery. The Working Group recognizes that there are generally two types of uranium recovery. The first is traditional hard-rock mining, which must be paired with uranium milling for achieving a uranium product in the form of U3O8, which is ready for conversion. The second is in situ recovery, which involves using a liquid chemical extraction technique which results in U3O8 production, obviating the need for milling. There are active licenses for both methods of uranium production in the United States. Most policies, unless specifically identified within the report apply to either method and will be broadly referred to as "mined and milled uranium" or "mining and milling".

The Administration will evaluate the impacts of the reserve and other policy measures to inform next steps within the proposed 10-year timeline. Factors that will be considered include status and conditions in other sectors of the front-end of the fuel supply, such as enrichment, as well as implications for other parts of the nuclear industry. For example, expansion of the existing American Assured Fuel Supply (AAFS), and merging it with the new Uranium Reserve to establish a unified reserve could be considered. The AAFS currently contains enough uranium for six reactor core reloads and a modified version could increase the number of reactor fuel reloads of enriched uranium substantially and could require those loads to contain a percentage of unobligated uranium, meaning uranium that is free of peaceful use restrictions established through international agreements. Further consideration to the evolving market needs, based on next-generation fuel and advanced reactor deployment would be also considered in any such action.

A decision to expand the currently proposed uranium reserve will be made based on a variety of factors, including cost, impact, need, and on-the-ground conditions. The ultimate goal of the Administration's actions is to create an appropriate safeguard for the United States and our allies against unfair market intervention by foreign states or other disruption and provide a source of unobligated uranium for strategic purposes in a manner that is in the best interest of the taxpayer.

Any potential expansion of the currently proposed uranium reserve to include enriched uranium or an expansion of the AAFS could require the procurement of the equivalent of about 24 additional large light-water reactor reloads of enriched uranium, with the following estimated scale of services to be procured and commencement dates:

- Mined and milled uranium estimated between 17 and 19 million pounds in the form of U_3O_8, beginning in 2020;
- Domestic conversion services resulting in about 6,000 to 7,500 tons of UF_6, beginning no later than 2022; and
- Domestic enrichment services beginning possibly in the 2023 timeframe, of which 25% would be unobligated.

However, no commitment has been made to take action beyond the Uranium Reserve proposed in the FY21 Budget, which addresses the sectors most imminently at risk.

REVITALIZE AND STRENGTHEN THE FRONT - END OF THE NUCLEAR-FUEL CYCLE AND DOMESTIC NUCLEAR INDUSTRY:

How: Smartly decrease undue permitting and regulatory burdens to industry to level the domestic playing field and value attributes provided by U.S. commercial nuclear power.

- End DOE's bartering of uranium and reevaluate DOE's Excess Uranium Inventory Management Policy
- Create a level playing field for all energy sources in power markets and encourage FERC action to improve competition in the wholesale energy markets
- Streamline regulatory reform and land access for uranium extraction
- Support Department of Commerce efforts to extend the Russian Suspension Agreement to protect against future uranium dumping in the U.S. market
- Enable NRC to deny imports of nuclear fuel fabricated in Russia or China for national security purposes

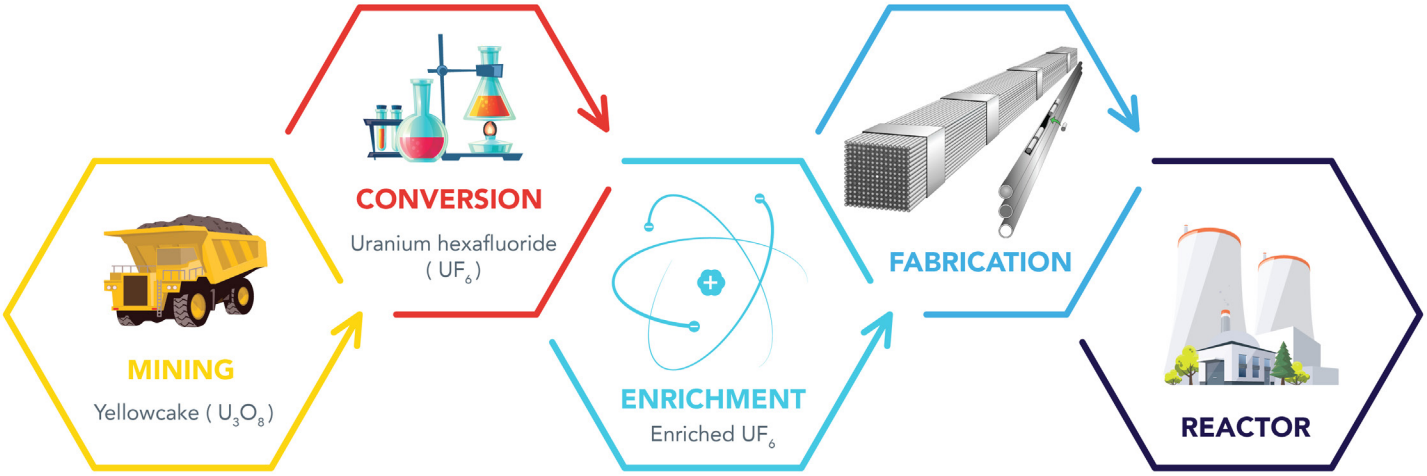
In addition to development of the uranium reserve, the United States must find long-term solutions to increase the competitiveness of the entire front-end of the nuclear fuel cycle. Actions that increase market certainty and remove undue regulatory burdens will help the U.S. mining, conversion, enrichment, and fuel fabrication subsectors decrease costs to ensure long-term viability in a global market dominated by foreign state-owned enterprises.

End DOE's Bartering of Uranium and reevaluate DOE's Excess Uranium Inventory Management Policy: DOE will cease bartering uranium and reevaluate the 2008 Policy Statement on Management of DOE Excess Uranium Inventory, which will immediately address an industry concern. For nearly a decade, DOE has bartered excess uranium inventory in return for services at DOE Environmental Management (EM) cleanup sites. In FY 2020, DOE received appropriations necessary to complete the annual work at DOE's EM sites and did not conduct barter. The President's FY21 Budget Request does not request, nor support, a continuation of the Uranium Barter Program. Additionally, DOE will revisit the 2008 Policy Statement to provide increased certainty to the domestic mining industry.

Create a level playing field for all energy sources in power markets and encourage FERC action to improve competition in the wholesale energy markets: The health of the front-end of the U.S. nuclear fuel sector is inextricably linked to the health of the operating fleet of nuclear reactors in the United States and those exported from the United States. For several years the U.S. nuclear fleet and competitive energy markets have faced fundamental challenges brought on by a combination of state subsidies to select generators, the Shale Gas Revolution, increased renewables penetration, and stagnant load growth. Since 2013, eight nuclear power plants (nine units) have prematurely retired and seven more (10 units) have announced intention to close by 2025. This trend was most recently highlighted by the permanent closure of Three Mile Island on September 20, 2019. Moreover, a large body of analyses suggests that at a minimum, an additional 25 units are at risk of premature retirement.

The majority of nuclear power plants under economic stress are in the deregulated electricity markets whose rules are overseen by the Federal Energy Regulatory Commission (FERC). The Working Group recognizes FERC's open docket (Docket No. AD18-7-000) and supports FERC action to expedite efforts with states, Regional Transmission Organizations (RSO)/ Independent System Operators (ISO), and other stakeholders to improve energy price formation, increase competition, and protect consumers in centrally-organized wholesale electricity markets. The Working Group also recognizes FERC's efforts to accurately price state-publicized capacity resources in its recently announced Minimum Offer Price Rule. (Docket Nos. EL16-49-000 and EL18-178-000 (Consolidated).

How uranium fuel is made:



Streamline regulatory reform and land access for uranium extraction: Federal lands possess a bounty of high-quality uranium deposits, particularly in the Western United States. Uranium producers that hope to develop new facilities must navigate complicated licensing and permitting procedures that often require interaction with multiple federal agencies and/ or regulatory entities.

When the sub-surface mineral estate is owned by the federal government, traditional hard rock uranium mining is permitted by the U.S. Department of the Interior's (DOI) Bureau of Land Management (BLM), along with the surface owning agency. Milling operations are regulated by the NRC. When licensed on federal land, permitting and mineral leasing is required for any method of uranium production.

Throughout the regulatory process, National Environmental Policy Act (NEPA) analysis is required, in addition to other environmental or land preservation analyses. These procedures and processes can take years to successfully navigate, which equates to higher project risk and higher permitting and licensing costs. Efforts to streamline governmental and regulatory processes have the potential to increase the competitiveness of all new uranium production facilities.

The Working Group supports the adoption of many regulatory reform and land use policies previously advanced by the BLM, including those advanced under Executive Order 13817, "A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals." In particular, policies shall be followed to clarify the roles and responsibilities of relevant federal agencies and regulatory bodies in permitting and licensing procedures; establish or improve intra-governmental coordination processes; streamline NEPA and National Historic Preservation Act reviews; develop an online tracking system for uranium production applications; align goals and targets for permitting and licensing timelines across the federal government; require annual uranium training for relevant DOI employees; expand access to uranium deposits on federal lands, including support for necessary legislation; and better assess minerals on federal lands and consider categorical exclusions for uranium mineral exploration and development activities.

Support Department of Commerce (DOC) efforts to extend the Russian Suspension Agreement (RSA) to protect against future uranium dumping in the U.S. market:
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. Some countries, such as Russia, leverage their position to coerce nations that have become exclusively dependent upon their uranium and fuel services. Russia's strategy, however, is not reserved to former satellite states. By undercutting U.S. and other foreign alternatives, Russia has become a major enrichment supplier to domestic U.S. nuclear reactor operators. Following a deliberate strategy, Russian suppliers have aggressively targeted the U.S. market for several decades:

- In 1991, the U.S. International Trade Commission determined that there was a reasonable indication that the front-end of the nuclear fuel cycle subsectors were materially injured by imports of uranium from the U.S.S.R. that allegedly were being sold at less than fair market value;
- In 1992, following the dissolution of the U.S.S.R., the United States entered into suspension agreements with Soviet successor countries, including Russia;
- Since 1992 several amendments to the RSA have been signed by DOC and the Government of Russia, most recently in 2008 when the governments agreed to institute new quotas through 2020 sold directly or indirectly to U.S. utilities;
- In 2008, Congress also enacted legislation to codify many provisions of the amended RSA and instituted statutory import limits aligned with the 2008 amended RSA; and
- Subsequent reviews led to notices of continuation of the RSA by DOC that found that termination of the RSA would likely lead to the continuation or recurrence of uranium dumping and harm to American industry.

Since 1992 DOC has upheld the need for a Suspension Agreement that establishes a maximum cap for imports of Russian uranium to 20 percent of the U.S. market to reduce the impact of Russia's unfair trade practices. The RSA that remains in place today is arguably the United States' sole buffer preventing Russia from forcing all enrichment services out of

the United States, further decimating the front-end of the nuclear fuel cycle. DOC is again reviewing the RSA for possible extension upon the expiration of the current agreement in 2020. The Working Group supports the extension of the RSA beyond 2020 and the consideration of further lowering the cap on Russian imports under future RSA terms.

Enable NRC to deny imports of nuclear fuel fabricated in Russia or China for national security purposes: The Working Group recognizes the importance of protecting the fuel fabrication subsector from erosion due to the strategic action of Russian or Chinese state-owned enterprises. The NRC currently provides general licenses for imports of nuclear material, including from Russia and China. The Russian state-owned enterprise, TVEL, began a project in 2008 to develop replacement fuel for U.S.-origin reactors operating in the United States. While this path is not currently being pursued, TVEL could develop such replacement fuel in the near future. If this occurs, the Working Group supports swift action, via Executive Order to limit or ban the import of nuclear fuel fabricated in Russia or China, on national security grounds, in so far as fuel imports adversely impact the physical and economic security of the United States.

LEAD THE WORLD IN TECHNOLOGY AND STANDARDS

How: Reestablish U.S. leadership in next-generation nuclear technology

- Fund R&D for Accident Tolerant Fuels, fund R&D for High-Assay Low-Enriched Uranium (HALEU), complete HALEU enrichment demonstration program, and fund advanced water treatment technology for uranium mining and in-situ recovery
- Support the National Reactor Innovation Center and Versatile Test Reactor
- Fund R&D and demonstration of U.S. advanced nuclear reactor technology
- Demonstrate the use of Small Modular Reactors (SMRs) and micro-reactors to power federal facilities

In addition to the stress on the current U.S. commercial fleet, U.S. global technology leadership has deteriorated substantially since the era of U.S. dominance in nuclear technology development and global sales from 1950 to 1990. The United States still has the brightest minds and greatest nuclear science capabilities, and an industry-led resurgence is occurring. However, civil nuclear reactor vendors from the United States have competed poorly in recent decades in the global new build market. According to UxC, a nuclear industry market research and analysis company, of the 107 new nuclear reactors that will be completed around the world by 2030, 43 will be supplied by Chinese vendors, 29 by Russia, 10 by India, nine by South Korea, and four by France. Meanwhile, the performance of the United States is alarming – U.S.-based reactor vendors are expected to see only three units built by 2030, according to the same report. This includes two reactors at the Vogtle Plant in Georgia (the only new build reactors to begin construction and reach completion in the United States in over thirty years). U.S. commercial vendors have been outcompeted in the export market by state-owned enterprises backed by the full support of governments using nuclear exports as geostrategic national security tools to establish bilateral relationships that will last nearly a century from design to decommissioning.

The large light-water reactors common in today's market will, in the future, be joined by new advanced reactors, including light-water advanced small modular reactors (SMRs), advanced non-light water reactors, and a subset of SMRs known as micro-reactors. Some of these advanced reactors will provide electricity to remote locations while others will provide high-temperature process heat for nonelectrical services such as desalination. Other technologies under development could also provide options for the management of waste from nuclear power.

As nations implement strategies to deploy cleaner energy technologies, many increasingly favor nuclear reactors. In fact, DOC estimates the global civil nuclear market to be valued at $500-$740 billion over the next 10 years. While U.S. private sector innovators have a massive opportunity to compete in these markets, the competition is a step ahead of the U.S. in demonstrating next-generation technologies. China, for instance, is currently operating a small-scale fast reactor and is starting a demonstration project. They are also operating

a small-scale high temperature gas reactor. Russia meanwhile operates two commercial fast reactors and has a new fast test reactor under construction.

DOC estimates the global civil nuclear market to be valued at $500-$740 billion over the next 10 years.

Fund R&D for Accident Tolerant Fuels, fund R&D for High-Assay Low-Enriched Uranium (HALEU), complete HALEU enrichment demonstration program, and fund advanced water treatment technology for uranium mining and in-situ recovery: Regaining technology leadership in uranium extraction, enrichment, and fuel fabrication are strongly supported by the Working group through the following actions.

DOE will continue and successfully complete the Office of Nuclear Energy's Accident Tolerant Fuel (ATF) program to help the United States reposition itself as the global technology leader in nuclear energy by ensuring that the United States is at the forefront of providing next-generation fuels to the market in a manner that supports current and future nuclear fleets. These fuels will increase the safety and economic position of today's reactors.

Some ATF designs and advanced reactors under development will require fuels with higher enrichment levels. DOE is currently conducting a three-year $115 million demonstration of HALEU production using U.S.-origin enrichment technology, which can be adopted by the private sector for commercialization and deployment after the three-year period, should the demonstration be successful and demand materialize. DOE will continue and successfully complete its HALEU demonstration program by 2022 to ensure that a technology is proven. DOE will also support HALEU infrastructure research and development to ensure that HALEU facilities and equipment are quickly licensed.

One of the high-cost drivers for uranium mining, especially in situ uranium extraction, is the treatment and disposition of waste water. DOE will commence a new sub-program to research advanced water treatment to lower the cost of meeting environmental standards for waste-water disposition, benefiting the entire front-end of the U.S. nuclear fuel cycle.

Support the National Reactor Innovation Center and Versatile Test Reactor: Recognizing that the United States is already behind leading competitor nations like Russia and China in developing the research infrastructure necessary to support the long-term success of advanced nuclear reactor technologies, the President signed into law on September 28, 2018 the Nuclear Energy Innovation Capabilities Act, which authorized the establishment of the National Reactor Innovation Center (NRIC) and the Versatile Test Reactor (VTR). Last summer, DOE designated Idaho National Laboratory as the lead for the NRIC, which will assist with the development of advanced nuclear energy technologies by harnessing the capabilities of the DOE National Laboratories. Earlier in 2019, DOE established the mission need for the VTR through Critical Decision-Zero and the FY 2021 Budget proposes $295 million to support the design and construction of the facility. The Working Group recommends continued support for NRIC and the VTR.

Fund R&D and support demonstration of U.S. advanced nuclear reactor technology: In order to move the United States back into a technology leadership position and to set up U.S. nuclear innovators for success in competition against state-owned enterprises, the Working Group supports continued funding of advanced nuclear reactor research and development and enabling the demonstration of advanced nuclear reactors in partnership with the private sector.

Demonstrate the Use of Small Modular Reactors (SMRs) and micro-reactors to power federal facilities: The Working Group recommends using the purchasing power of the federal government to spur demand. The federal government is a major purchaser of domestic power generation. The purchasing power of U.S. departments and agencies, in particular the Department of Defense, is an important component for sustaining a baseline of U.S. nuclear power generation, while strengthening the durability of many U.S. critical national security facilities. Next-generation nuclear reactors, in particular due to their scale and safety features, could be ideal for providing resilient and reliable off-grid power directly to military installations and other national security infrastructure. For this reason, the Working Group recommends the adoption of policies by Executive Order that demonstrate SMRs' potential to enhance energy flexibility and energy security at domestic military bases in remote locations. If the demonstration is successful, the Department of Defense should identify opportunities at domestic military installations where SMRs could enhance or supplement the fulfillment of installation energy requirements. Doing so would serve as a mechanism for adoption of early deployments of these technologies.

EMPOWER U.S. EXPORT COMPETITIVENESS

How: Level the playing field versus foreign competitors, expand the sphere of competition and challenge our rivals.

- Designate a senior Administration position dedicated to leading nuclear export coordination and implementation.
- Establish a Nuclear Industrial Base structure analogous to the Defense Industrial Base.
- Fund the R&D for domestic origin commercial fuel replacements for international sale for use in foreign-origin reactors, including Accident Tolerant Fuel.
- Increase efficiencies in the export processes and the adoption of 123 Agreements to open new markets for exports of U.S. civil nuclear technologies, equipment, and fuel.
- Add civil nuclear to the annual Select-USA Investment Summit.
- Expand civil nuclear international cooperation programs, including regulatory technical exchanges and assisting in the development of foreign nuclear regulatory frameworks to accelerate foreign licensing of U.S. nuclear technologies with existing NRC licenses (i.e., SMRs).
- Ensure U.S. financing institutions support civil nuclear industry to compete against foreign state financing.
- Promote the reentry of U.S. vendors into the research reactor supply market

Reestablishing technology leadership is paramount for the long-term export position of the nation, which is vital to supporting domestic nuclear capabilities. At times, however, even when U.S. technology can competitively vie for market share, other nations are able to pull together technology, services, financing, training, and used-fuel takeback to create more attractive bid packages. To counter this whole-of government approach from our competitors, the Working Group supports the rapid adoption of policies that increase the short-term competitiveness of nuclear exports.

The competitiveness of the U.S. nuclear industry in the global market is critical for more than the health of the industry and the economic opportunities it presents. It also underpins U.S. non-proliferation goals and the national security. In non-proliferation endeavors, U.S. credibility underpins negotiations. When another nation desires access to U.S. technology, strong non-proliferation standards and regulatory rigor can be ensured. Credibility, however, is linked to the quality of the technology available and the preponderance of alternative technology in the global export market. Unfortunately, some foreign exporting nations, like Russia and China, do not hold their trading partners to the same high standards and may even use lower standards as a selling point. The dominant market position of Russian and, in the future, Chinese state-owned enterprises is enabling foreign countries to import nuclear

technologies without the same non-proliferation safeguards required by the United States and its allies, further disadvantaging U.S. civil nuclear exports, as well as reducing global efforts for a robust international nuclear safeguards and security regime.

Designate a senior Administration position dedicated to leading nuclear export coordination and implementation: The Working Group recognizes the need for a centralized and elevated nuclear export leader within the federal government. It recommends the designation of a senior level official within the Executive Branch who will be tasked with leading nuclear exports in partnership with the private sector and all relevant federal agencies.

The competitiveness of the U.S. nuclear industry in the global market is critical for more than the health of the industry and the economic opportunities it presents. It also underpins U.S. non-proliferation goals and the national security.

Establish a Nuclear Industrial Base structure analogous to the Defense Industrial Base: The Working Group supports the establishment of a Nuclear Industrial Base advisory committee charged with making recommendations on the confluence of public and private investment and nuclear supplier base challenges pertaining to the national security considerations provided in this strategy. Successful nuclear nations have the strong integrated support of their federal governments.

Fund the R&D for domestic origin commercial fuel replacements for international sale for use in foreign-origin reactors, including Accident Tolerant Fuel (ATF): In the global export market, U.S. nuclear companies have largely been precluded from selling products or services to reactors of foreign origin. To change this paradigm, the Working Group supports the establishment of a program to provide domestic-origin replacement fuel for foreign- origin reactors in international markets, especially in markets where U.S. allies and partner nations are solely reliant on adversarial state-owned nuclear corporations for supply. By establishing a new foreign fuel replacement program, which will be informed by the outcomes of the ATF program, the United States will be well-positioned to provide world-leading ATF replacement fuels for foreign-origin reactors in the future.

Increase efficiencies in the export processes and the adoption of 123 Agreements to open new markets for exports of U.S. civil nuclear technologies, equipment, and fuel: U.S. nuclear material and equipment exports generally require government-to-government interaction, cooperation, and entry into force of an international agreement. These formal agreements ensure the peaceful use of U.S.-origin nuclear material and equipment. Section 123 of the U.S. Atomic Energy Act of 1954, as amended, provides the framework for major nuclear cooperation between the United States and foreign nations, and it represents the nation's statutory requirements for major civil nuclear cooperation between the United States and foreign nations involving exports of material or equipment. Supplementing Section 123, Part 110 and 810 of Chapter 10 of the Code of Federal Regulations outline the

main process for transfers of U.S. nuclear material, equipment, and technology to foreign nations for peaceful use. The United States' participation and membership in multilateral non-proliferation and export control regimes, such as the Treaty on the Non-Proliferation of Nuclear Weapons and the Nuclear Suppliers Group further ensure the peaceful use of nuclear energy and hinder nuclear proliferation.

The Working Group recognizes the importance of nuclear export approvals and 123 Agreements to U.S. national security. Consistent with the process improvement achieved in 2019 for Part 810 applications, the U.S. Government will ensure that high standards, consistent with U.S. law are maintained while investigating methods to further increase efficiency in the processes for each.

Add civil nuclear to the annual Select USA Investment Summit: DOC shall include the civil nuclear industry in the DOC's annual Select-USA Investment Summit as a simple and low-cost, yet important step to demonstrate the U.S. Government commitment to revitalizing the civil nuclear industry.

Expand civil nuclear international cooperation programs, including regulatory technical exchanges and assisting in the development of foreign nuclear regulatory frameworks to accelerate foreign licensing of U.S. nuclear technologies with existing NRC licenses: U.S. excellence in regulating domestic or U.S. nuclear technologies is an edge on which the Working Group believes the United States must further capitalize. NRC's efforts to facilitate best practices by foreign regulators to ensure international safety standards may also enable the expedient licensing of U.S. nuclear reactor technologies in those markets. The U.S. NRC is currently working to develop its own new advanced reactor-licensing framework. As advanced reactors come to market and challenge licensing frameworks and regulations within host countries, U.S. engagement, through expansion of current NRC international partnership programs, will be essential to ensuring U.S. primacy in international deployment of next-generation reactors.

Ensure U.S. financing institutions support civil nuclear industry to compete against foreign state financing: Nowhere are the predatory tactics of State-owned enterprises more evident than in the realm of export financing. Export financing is a key project selection factor for governments and potential investors when selecting nuclear technologies in the global market. The new SOE model includes bringing equity investment to the negotiating table under a government-to-government arrangement. In some cases, SOE's have built turnkey projects in which client countries enter into long-term power purchase agreements to eliminate customer financial liabilities.

In order to integrate emerging U.S. private sector nuclear technologies with government-backed financing, the Working Group believes the Export-Import Bank (Ex-Im) is essential for competing against SOEs. Ex-Im does have challenges, including lacking a mechanism for equity investment, internal policies governing domestic content, and strict adherence to rules, such as those of the Organization for Economic Cooperation and Development (OECD). Neither Russian nor China adhere to these restrictions, which can put U.S. nuclear project financing and export packages at a competitive disadvantage.

To level the playing field, the new U.S. International Development Finance Corporation (DFC), which recently replaced the Overseas Private Investment Corporation pursuant to the BUILD Act, should fix legacy policies that disallow support for nuclear projects. Strengthening the internal capacity of Ex-IM and DFC, and utilizing expertise within other Federal Agencies will be critical to enable competitive financing models for nations seeking U.S. industry as the responsible nuclear partner of choice.

Promote the reentry of U.S. vendors into the research reactor supply market: The Working Group supports exploring new creative concepts for nuclear projects including building workforce and technical capacity in nascent nuclear nations through foreign sales of U.S.-origin research reactors and partnerships with U.S. educational programs.

SUMMARY OF MEASURES

- Directly purchase uranium by establishing a Uranium Reserve
- End DOE's bartering of uranium and reevaluate DOE's Excess Uranium Inventory Management Policy
- Create a level playing field for all energy sources in power markets and encourage FERC action to improve competition in the wholesale energy markets
- Streamline regulatory reform and land access for uranium extraction
- Support Department of Commerce efforts to extend the Russian Suspension Agreement to protect against future uranium dumping in the U.S. market
- Enable NRC to deny imports of nuclear fuel fabricated in Russia or China for national security purposes
- Fund R&D for Accident Tolerant Fuels, fund R&D for High-Assay Low-Enriched Uranium (HALEU), complete HALEU enrichment demonstration program, and fund advanced water treatment technology for uranium mining and in-situ recovery
- Support the National Reactor Innovation Center and Versatile Test Reactor
- Fund R&D and support demonstration of U.S. advanced nuclear reactor technology
- Demonstrate the Use of Small Modular Reactors (SMRs) and micro-reactors to power federal facilities
- Designate a senior Administration position dedicated to leading nuclear export coordination and implementation
- Establish a Nuclear Industrial Base structure analogous to the Defense Industrial Base
- Fund the R&D for domestic origin commercial fuel replacements for international sale for use in foreign-origin reactors, including Accident Tolerant Fuel
- Increase efficiencies in the export processes and the adoption of 123 Agreements to open new markets for exports of U.S. civil nuclear technologies, materials, and fuel
- Add civil nuclear to the annual Select-USA Investment Summit
- Expand civil nuclear international cooperation programs, including regulatory technical exchanges and assisting in the development of foreign nuclear regulatory frameworks to accelerate foreign licensing of U.S. nuclear technologies with existing NRC licenses

- Ensure U.S. financing institutions support civil nuclear industry to compete against foreign state financing
- Promote the reentry of U.S. vendors into the research reactor supply market

TABLE OF SUGGESTED READINGS

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2020

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