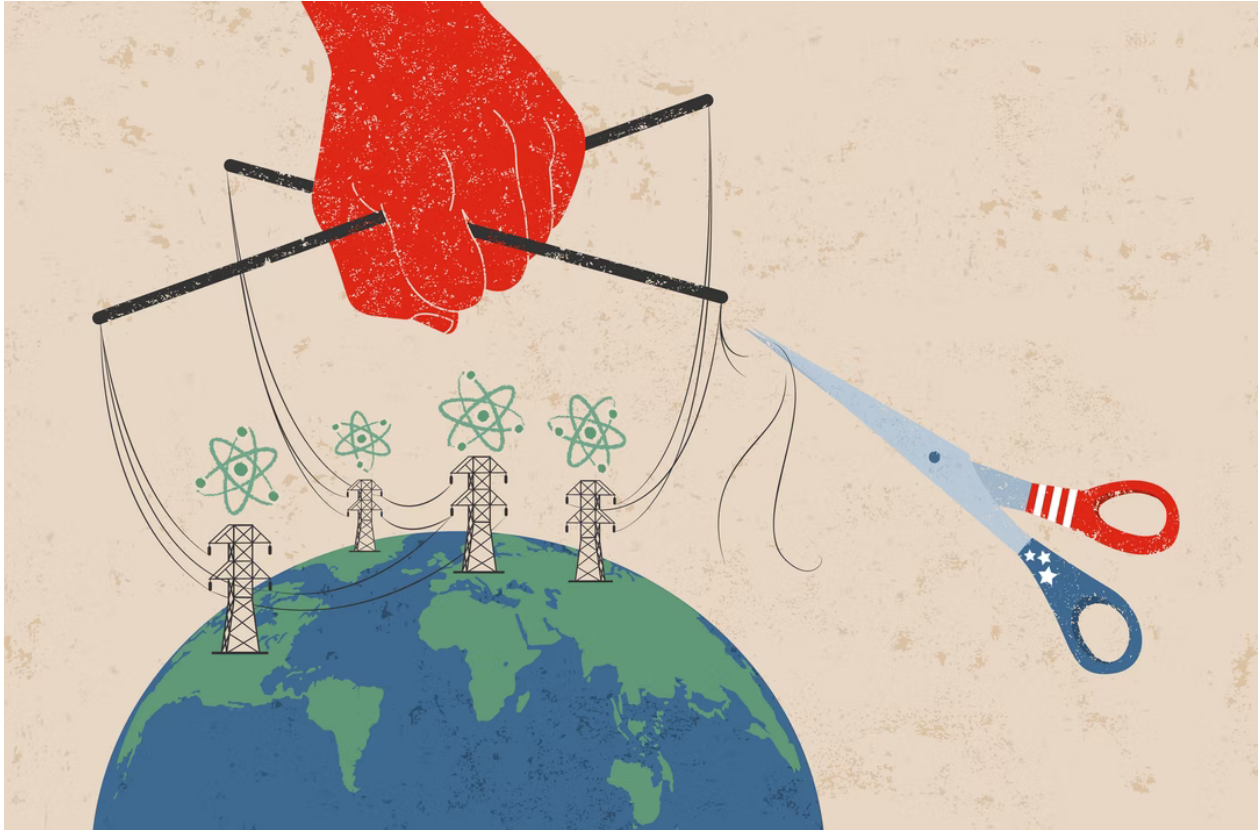


Developing Domestic HALEU Supply Spells Freedom from Russian Dependency



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Key Takeaways

Russia is currently the world's only viable commercial supplier of high-assay low-enriched uranium (HALEU), the necessary fuel for many advanced nuclear power reactors rapidly emerging in the United States and the rest of the world. Russia's global monopoly on HALEU has been a serious concern for years, but the Russian invasion of Ukraine has highlighted the acute political risks and moral objections of relying on Russian HALEU supply.

Developing a domestic capacity to produce HALEU fuel would provide the US independence from Russian HALEU supply and enable the domestic fuel sector to compete globally in a fast-emerging area of the energy economy as a more reliable alternative to Russia. It would also help re-establish American global leadership in nuclear energy, helping us meet our climate, clean energy, national security, and economic goals.

The Energy Act of 2020 established the Advanced Nuclear Fuel Availability Program in the US Department of Energy (DOE). This program is intended to stimulate the domestic development of a commercial HALEU supply chain, particularly uranium enrichment capacity. Recent events in Ukraine have only reinforced the imperative of robustly funding and swiftly moving forward with the DOE HALEU program.

The Growing Case for Domestic HALEU Alternatives

The following considerations underscore the importance of developing and investing in alternative sources of HALEU fuel quickly:

Climate Change

Nuclear energy already provides the majority of our emissions-free power, and advanced reactors—with their enhanced passive safety profiles, reduced upfront capital costs, and greater flexibility in applications and end uses—hold tremendous promise as a source of clean, firm energy that can be rapidly scaled and deployed to meet the ever-increasing challenge of combating global climate change. But, a technology that continues to depend upon Russia as the sole source of needed fuel would be immeasurably less desirable for wide-scale deployment as a climate solution.

Energy Security

Our first advanced reactors are expected to come online within the next several years, and there is growing interest in these technologies at the state-level given their significant benefits and potential. However, any advanced reactor fleet solely reliant on fuel supply from Russia would be untenably vulnerable to the whims of an aggressive, authoritarian regime. Fostering the buildout of HALEU production infrastructure would provide a reliable, domestic fuel source for our advanced reactors and create a fuel supply lifeline to allies that would operate such plants overseas. Moreover, it would strengthen the US nuclear fuel sector overall, thereby fortifying low-enriched uranium (LEU) supply for our presently operating light-water nuclear power plants. Approximately 20% of the fuel now used by our existing fleet was enriched in Russia.

Economic and Jobs Impact

According to some estimates, the development of a commercial HALEU enrichment facility could create hundreds, perhaps thousands, of direct construction and manufacturing jobs and many more indirect jobs. For example, a federally-sponsored HALEU demonstration project supported more

than 200 US jobs and a commercial-scale plant would presumably create even more, including lasting, well-paying positions for the local community in facility operations and maintenance.

The more far-reaching economic and employment impacts from a domestic HALEU industry would come from the growth of the U.S. advanced nuclear sector, which would be seriously constrained without dependable HALEU supply. For instance, advanced reactors are drawing increasing attention as a potential economic lifeline for retiring coal plant communities—not only are they a carbon-free alternative to coal generation, but they could also create greater numbers of better-paying jobs while being able to leverage much of the existing workforce.

Enhancing Europe’s Energy Sovereignty

Europe is heavily dependent upon Russian fossil fuels, particularly natural gas, for its energy needs. Following the Ukrainian invasion, European capitals have been openly reevaluating their long-term energy strategies and focusing greater attention to non-fossil energy alternatives. As argued in this recent op-ed on America’s “Arsenal of Clean Energy,” the US is well-situated to address both the short-term and long-term energy challenges of its European allies.

American advanced nuclear, made possible by decades of innovation and R&D at US national laboratories, has garnered increasing international interest and is a key part of the broader energy solutions that the US can provide. However, ensuring reliable fuel supply for US advanced reactor technologies is essential to supporting the energy security interests of our international partners.

European countries are already reaching out to the US for alternatives to Russian light-water reactor fuel. Several European states are completely dependent upon Russian nuclear fuel imports, prompting some to approach US fuel companies for substitute supply arrangements. Infrastructure developed under the HALEU program could enable the US to offer a wider and more competitive array of nuclear fuel services to international markets.

Export Competitiveness

Demand for advanced nuclear is projected to grow, not just in Europe, but throughout the world, and the energy implications of the Ukraine conflict will likely reverberate beyond the immediate region. The ability to provide reliable fuel supplies for exported advanced reactors would strengthen US competitiveness in this burgeoning global market, especially vis-à-vis Russia and China, which both possess comprehensive nuclear fuel supply chains and can bundle guaranteed fuel with their nuclear plant exports.

National Security

The capacity to assure reliable fuel supply not only makes US industry more commercially competitive, but it would also advance US national security and nonproliferation objectives by disincentivizing other countries from developing sensitive fuel cycle technologies. Taking steps to establish the U.S. as a major commercial supplier of HALEU would position the US to lead in setting

international norms on the production, transportation, and use of HALEU, as opposed to ceding this responsibility to other countries (such as Russia).

Implementation of the HALEU Program

DOE released a Request for Information (RFI) on the HALEU Availability Program in December 2021, seeking stakeholder feedback on issues and questions related to the implementation of the program. In its response to the RFI, Third Way urged DOE to expeditiously distill public input, establish a strategy for program execution, and proceed promptly with issuing funding opportunities and proposal requests for the program.

Third Way also recommended DOE to strongly consider implementing a “savings account”-style HALEU bank, through which DOE would commit to procuring a large enough quantity of HALEU to incentivize enrichers to invest in the buildout of HALEU production capacity. The HALEU accumulated in the bank would enable DOE to fulfill supply needs in the event of disruptions, creating confidence in long-term supply and availability. The bank would also accelerate the development of a commercial market by encouraging direct contracts between enrichers and advanced reactor operators, as well as minimizing market distortions by releasing HALEU only under strict conditions. Third Way highlighted the advantages of this HALEU bank approach, although it did not rule out other possible options, such as a federal cost share for HALEU infrastructure.

At this stage, it is critical that the HALEU program receive the highest funding levels possible for the following reasons:

- **Program Options:** While a HALEU bank approach presents compelling benefits, available funds will ultimately constrain DOE in what options it can practically pursue. Therefore, absent certainty in a strong funding figure, it is challenging for DOE to establish and articulate a detailed strategic plan and course of action on the HALEU program.
- **Multiple Suppliers:** It is crucial for there to be sufficient funding to support the development of multiple HALEU suppliers in order to avoid creating a single point of failure, as is currently the challenge with Russia. Multiple suppliers would also encourage market competition, thereby lowering costs and generating other economic benefits.
- **Program Advancement:** The FY22 Omnibus provided \$45 million for the HALEU program. While this is an uptick from the figure originally authorized under the Energy Act of 2020, this amount does not afford DOE sufficient means to move forward with further funding opportunities and other HALEU program activities.

Addressing Immediate Needs

The Russia-Ukraine conflict also brings to light near-term HALEU supply challenges that will need to be addressed. Even if the development of a domestic HALEU supply chain were to proceed in earnest, the Russian invasion suddenly created barriers to procuring the 20 metric tons of HALEU needed for the first cores of the Advanced Reactor Demonstration Program (ARDP) Pathway 1 demonstrations.

Although Russia was once considered an option to supply these initial fuel loads (an exemption granted under the Russian Suspension Agreement in the Energy Act of 2020), that door has now essentially closed. Both ARDP demonstrations are targeting start dates in the 2027-2028 timeframe, meaning that project developers X-energy and TerraPower will require their first HALEU deliveries by 2024 and 2025, respectively. It is unlikely that enrichment capacity could be brought online quickly enough to meet those timelines. Robust investments in the fuel cycle supply chain could still produce a solution, and would in any case be required to support the long-term commercialization of advanced reactors.

In order to ensure the timely completion of the first ARDP projects, public and private stakeholders are assessing unconventional HALEU supply pathways such as downblending, which involves mixing federal stocks of highly enriched uranium (HEU) with natural uranium or LEU, to quickly produce the necessary HALEU loads in the interim. Once the feasibility of downblending options is determined, additional funding should be provided to enable their execution. However, **viable downblending schemes must not divert resources from the principal effort of building out domestic enrichment capacity and other HALEU infrastructure.**

Congress Must Take Action

The development of a domestic commercial HALEU market has been an urgent priority for years, and Russia's recent actions have only intensified this urgency. At current funding levels, it would take several decades to accrue the federal funds needed to achieve the ultimate objectives of the HALEU program. We simply don't have that long.

Congress must take bold steps now to provide early, upfront funding so the program can meet accelerated timelines. Third Way recommends that Congress appropriate no less than \$300 million in FY23 for the HALEU program. This vital down payment would help the US get on track with the development of domestic HALEU infrastructure and support downblending activities that will produce the initial fuel needed by the first ARDP demonstrations in a timely fashion. Significant additional investment will still be needed in subsequent fiscal years, but the larger the amount of funding provided in FY23 appropriations and through any other appropriations packages this year, the more swiftly the program can build momentum and set the direction necessary to meet the requisite milestones on schedule.

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