



# ***Catalyzing a Domestic Commercial Market for High-Assay, Low-Enriched Uranium (HALEU)***

## **Report Executive Summary, April 2022**

Successful commercialization of advanced reactors will increase the likelihood and lower the costs of achieving the world’s climate goals. A commercially viable High Assay, Low-Enriched Uranium (HALEU) fuel cycle is critical to the successful deployment of many advanced reactor technologies.

Global supply of HALEU is currently dominated by a single company: the Russian state-owned enterprise TENEX. Reliance of future advanced reactor HALEU fuel cycles on a single, state-owned company creates significant economic and political risks. The February 2022 Russian invasion of Ukraine and the resulting geopolitical and commercial uncertainty is a stark warning against the overreliance on TENEX as a short-term or long-term fuel cycle partner for advanced reactor development projects. A diverse, reliable, and commercially viable HALEU fuel cycle is essential for the successful deployment of advanced reactors.

The main challenge of developing a mature commercial HALEU fuel cycle is that high assurance of long-term HALEU demand is needed to justify significant capital investments by fuel cycle companies, while high assurance of near- and mid-term HALEU availability is needed to support the business case for the deployment of advanced reactors. Federal policy and investment to jumpstart HALEU fuel cycle activities could help provide these initial market signals and catalyze development of a mature and sustainable commercial market. This federal investment would be small compared to the enormous climate benefits of successful advanced reactor commercialization.

A future HALEU fuel cycle will incorporate a variety of commercial operations including enrichment facilities, transportation infrastructure, and conversion and deconversion facilities. The absence of market signals to develop new HALEU supply (assurance of long-term commercial demand) and signals that enable long term HALEU demand (assurance of long-term commercial supply) has stalled HALEU fuel cycle infrastructure build-out despite significant government and private investments in advanced reactor technology.

Despite agreement among stakeholders that a commercial HALEU market and HALEU fuel cycle is needed to support advanced reactor commercialization in the United States, there has been limited discussion on the specific market characteristics or program design needed to provide adequate assurance of fuel availability. This paper presents the timing and supply and demand signal challenges associated with the development of a commercial HALEU market and fuel cycle, and outlines potential policy options to help catalyze a commercial HALEU market and HALEU fuel cycle in the United States.

A commercial HALEU market will need to evolve in tandem with the deployment of advanced reactors during the next two decades. The policy mechanisms best suited to support this evolving market will also need to change over time. Recommending different policies during three major time periods over the next fifteen years enables use of specific policy mechanisms to support changing market demands. The major policy insights and recommendations from this paper are:

- Near-term (2022 – 2027) expected demand for HALEU for advanced reactor projects cannot be fully met with new HALEU enrichment infrastructure in the United States due to the time required

to design, license, and construct new enrichment facilities and HALEU fuel cycle infrastructure. Alternative federal policies to ensure access to HALEU from domestic or international sources are needed to support near-term advanced reactor commercialization activities.

- Mid-term (2027 – 2034) demand for HALEU for advanced reactors projects could be met with new HALEU enrichment and fuel supply infrastructure in the United States. Market development programs should leverage federal cost-sharing and HALEU purchase agreements to provide demand assurance needed for initial capital investments. These can also leverage long-term federal funding and future government demand for HALEU to reduce federal taxpayer liabilities.
- Long-term (2034 and beyond) supply for HALEU for advanced reactor projects will largely occur after the phase-out of market development programs. Market maturation in the mid term should create sufficient supply and demand signals to develop a sufficient commercial market. Excessive federal government intervention in long-term HALEU markets risks market distortion and creation of artificial supply or demand signals that inhibit market maturation.
- Support for the complete front-end HALEU fuel cycle including enrichment facilities, transportation infrastructure, and conversion/deconversion facilities should be included in market development programs. Program-level identification of possible supply chain bottlenecks that will not be resolved by market supply and demand signals should be used to formulate federal market development programs and help catalyze a robust commercial HALEU fuel cycle.

A commercial HALEU fuel cycle development program can be designed to facilitate a domestic commercial market that supports deployment of advanced reactors. A commercial HALEU fuel cycle development program should be designed around the following activities:

- Evaluation of near-term and mid-term need for domestic HALEU fuel cycle activities depending on the deployment rate of advanced reactors and availability of HALEU from international markets. Both commercial demand and government demand for HALEU to support on-going and new nuclear energy projects should be included in market evaluations.
- Facilitation of near-term procurement of HALEU by providing programmatic support for HALEU procurement by end users.
- Support (financial and programmatic) of supplier investments in new HALEU fuel cycle production and fuel-cycle infrastructure through off-take procurement contracts and cost-share agreements to support mid-term market availability of HALEU. Such government support should be designed to develop market oriented and sustainable supply chains with at least two suppliers for both enrichment and deconversion activities.
- Facilitation of sale of HALEU production purchased by the federal government under off-take agreements to provide additional mid-term HALEU supply assurance.

These activities would help meet the overall goals of a commercial HALEU cycle development program for both HALEU suppliers and users. Market development programs can be designed to meet the needs of different HALEU fuel cycle companies while providing the supply and demand assurances needed to support the successful commercialization of advanced reactors as a climate solution.

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The full NIA HALEU report is available for download online at:

<https://nuclearinnovationalliance.org/catalyzing-domestic-commercial-market-haleu>