Reducing Reliance: Prospects for the U.S. Decoupling from Russian Uranium by 2028

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Executive Summary

The Prohibiting Russian Uranium Imports Act, passed in August 2024, details that the United States must stop importing natural uranium and unirradiated low-enriched uranium (LEU) from Russia starting in 2028.[1] This paper explores the viability of the United States decoupling from Russian nuclear-related imports by 2028 and outlines the challenges to reviving the U.S. front-end nuclear fuel cycle. After analyzing Harmonized System Data from the U.S. International Trade Commission for each nuclear fuel cycle stage, this paper finds that the United States is mainly dependent on Russia for enriched uranium. The United States is largely not dependent on Russian imports for earlier steps in the fuel cycle, including mining and milling, and conversion. Therefore, the main challenge to meeting the 2028 deadline is displacing imports of Russian enriched uranium, which accounts for 20% to 25% of the amount of enriched uranium used in U.S. civilian reactors.[2]

This paper then calculates the amount of low enriched uranium U.S. civil reactor owners and operators will require in 2028,[3] and the amount of Russian enriched uranium that will need to be displaced.[4] This paper concludes that absent additional action it is unlikely that the United States will be able to domestically produce enriched uranium at sufficient scale to fully replace Russian supplies by 2030, let alone by 2028. Even accounting for the expansion of the National Enrichment Facility managed by Louisiana Energy Services in New Mexico, by 2028 total domestic production is estimated to be 600-695 metric tons of uranium (MTU), roughly 30% to 35% of the total U.S. requirement.[5] The five other facilities selected by the U.S. government for potential contracting for LEU will likely not be operational by 2028. In turn, decoupling from Russia leaves a gap of roughly 486 MTU, or 25%. Thus, the United States will likely have to increase imports of enriched uranium from allied and friendly countries to displace imports of Russia nuclear fuel by 2028. UK's Urenco and France's Orano are expanding capacity in the next few years and could help to offset some

[1] United States Nuclear Regulatory Commission, *Backgrounder on Uranium Import Ban,* (October 31, 2024). https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/uranium-import-ban.html. Accessed August 20, 2025.

[2] The percentage of enriched uranium that the United States imports from Russia is dependent on the parameters used to calculate enriched uranium product generated from separative work unit (SWU), namely % tails assay and % product assay. This paper calculates that roughly 25% of enriched uranium used in U.S. civilian nuclear reactors are sourced from Russia, using data from up to 2023, a tails assay of 0.22% and a product assay of 4.5%. According to a report created by the United States House of Representatives to supplement the data in the Prohibiting Russian Uranium Imports Act, the U.S. imports over 20% of total enriched uranium from Russia. United States House of Representatives, *PROHIBITING RUSSIAN URANIUM IMPORTS ACT,* H. Rept. 118-296 (December 1, 2023), pp. 5. https://www.congress.gov/committee-report/118th-congress/house-report/296/1. Accessed August 20, 2025;
The Nuclear Energy Institute writes that in 2022, around 20% of enriched uranium came from Russia. John Kotek, "Nuclear Energy Industry Committed to Secure Fuel Supply," Nuclear Energy Institute, (June 16, 2022). https://www.nei.org/news/2022/nuclear-energy-industry-committed-to-fuel-supply. Accessed August 20, 2025.

[3] Calculated requirements do not account for any potential stockpiling by reactor owners and operators.

[4] Using U.S. Energy Information Administration provided data from up to 2023.

[5] Louisiana Energy Services is a subsidiary of British-Dutch-German company Urenco. United States Nuclear Regulatory Commission, "Louisiana Energy Services (LES)," (January 15, 2025). https://www.nrc.gov/info-finder/fc/urenco-enrichment-fac-nm-lc.html. Accessed August 20, 2025.

gaps left by Russia.[6] Other potential opportunities to offset a gap of Russian enriched uranium involve the additional production of LEU through the American Centrifuge Plant and implementing further action through the Sapporo 5 partnership.

Introduction

In May of 2024, the United States passed the Prohibiting Russian Uranium Imports Act, banning U.S. companies from importing natural uranium and unirradiated low-enriched uranium (LEU) from Russia starting in 2028.[7] The ban is set to fully take effect in 2028, but until then certain domestic companies can receive waivers from the U.S. government to import nuclear fuel from Russia. After analyzing Harmonized System Data from the U.S. International Trade Commission for each nuclear fuel cycle stage, this paper finds that the United States is mostly dependent on Russia for enriched uranium. Russia currently supplies the equivalent of roughly 20% to 25% of the enriched uranium used in U.S. civilian nuclear reactors.[8] The United States appears not to be largely dependent on Russian imports for earlier steps in the fuel cycle, including mining, milling, and conversion. Thus, this paper focuses more so on U.S. efforts to displace imports of Russian enriched uranium.

Following the Prohibiting Russian Uranium Imports Act, the U.S. government plans to contract domestic companies to supply enriched uranium, as an alternative to Russian supply. In December 2024, the U.S. Department of Energy (DOE) selected six companies to compete to win contracts to supply U.S. LEU demand.[9]

In May 2025, President Trump signed four Executive Orders to further decouple from Russian and Chinese nuclear fuel dependencies and to revive the domestic U.S. nuclear fuel cycle.[10] Despite these actions, officials from Russia's state-owned nuclear enterprise Rosatom argue that the U.S. uranium ban is ineffective, and that U.S. companies will return to importing uranium from Russia due to a lack of viable alternatives.[11] Others have argued that beyond these six companies being

[6] Dmitry Gorchakov, "How will the US ban on Russian enriched uranium impact both countries?" The Bellona Foundation (May 30, 2024). https://etc.bellona.org/2024/05/30/usa_russian_uranium_ban/. Accessed August 20, 2025.
[7] United States Nuclear Regulatory Commission, *Backgrounder on Uranium Import Ban*.
[8] The percentage of enriched uranium that the United States imports from Russia is dependent on the parameters used to calculate enriched uranium product generated from SWU, namely % tails assay and % product assay. This paper calculates that roughly 25% of enriched uranium used in U.S. civilian nuclear reactors are sourced from Russia, using data from up to 2023, a tails assay of 0.22% and a product assay of 4.5%. According to a report created by the United States House of Representatives to supplement the data in the Prohibiting Russian Uranium Imports Act, the U.S. imports over 20% of total enriched uranium from Russia. United States House of Representatives, *PROHIBITING RUSSIAN URANIUM IMPORTS ACT*.
[9] Office of Nuclear Energy, United States Department of Energy, "Biden-Harris Administration Announces Contracts to Buy U.S.-Sourced Low Enriched Uranium" (December 10, 2024). https://www.energy.gov/ne/articles/biden-harris-administration-announces-contracts-buy-us-sourced-low-enriched-uranium. Accessed August 20, 2025.
[10] Office of Nuclear Energy, United States Department of Energy, "9 Key Takeaways from President Trump's Executive Orders on Nuclear Energy" (June 10, 2025). https://www.energy.gov/ne/articles/9-key-takeaways-president-trumps-executive-orders-nuclear-energy. Accessed August 20, 2025.
[11] World Nuclear News, "Russia 'ready to keep supplying enriched uranium to USA'" (May 23, 2025). https://www.world-nuclear-news.org/articles/russia-happy-to-keep-supplying-enriched-uranium-to-usa, (accessed August 20, 2025); ROSATOM State Atomic Energy Corporation, *Coming Up Short Without Rosatom*, 275 (May 2024). https://rosatomnewsletter.com/2024/03/22/coming-up-short-without-rosatom/ (accessed August 20, 2025).
In November 2024, Russia enacted a retaliatory ban on exporting enriched uranium to the US, meant to last until 2026. Similar to the United States, Russian entities can continue to export enriched uranium if they receive a waiver from the Russian government. Government of Russia, *Правительство ввело временные ограничения на экспорт обогащённого урана в США*, No.1544 (November 15, 2024). http://government.ru/news/53343/. Accessed August 20, 2025.

considered to supply LEU, more needs to be done to enhance domestic front-end nuclear fuel cycle capabilities in order to successfully decouple from Russia by 2028.[12]

Enriched uranium is essential to create the fuel used in all U.S. civil nuclear reactors currently operating, which supply almost 20% of U.S. electricity generation.[13] The United States also requires a substantial amount of enriched uranium to meet President Trump's ambitions for advanced reactors, meant to power future data centers and fulfill the U.S. government's need for big data compute capacity.[14] This demand has been coupled with a push over the past and current presidential administration to revive the U.S. nuclear fuel cycle.

If the United States does not decouple from Russia, Moscow could potentially exert leverage over Washington in a crisis or conflict scenario. Russia has demonstrated its willingness to use its position as a dominant energy exporter as leverage multiple times, such as through its restriction of gas through the Nord Stream 1 pipeline to Europe in 2022, following the Russian invasion of Ukraine.[15] In a future conflict, Russia could refuse to export enriched uranium to the United States to compel the United States to fulfill its demands.

Additionally, U.S. imports of enriched uranium from Russian state-owned enterprises provides significant financial benefit to the Russian government, and by extension, the Russian military. The Bellona Foundation reports that Russia earns roughly $1 billion annually from exporting enriched uranium to the United States, around half of their total enriched uranium exports.[16]

This paper assesses the viability of decoupling from imports of Russian nuclear fuel by the 2028 deadline. It evaluates the United States' ability to domestically enrich uranium and assesses if any of the five planned domestic enrichment facilities could offset the Russian displacement. Lastly, it evaluates other possible sources to contribute to domestic enriched uranium requirements.

[12] Gracelin Baskaran and Meredith Schwartz, "Fueling the Future: Recommendations for Strengthening U.S. Uranium Security," Center for Strategic and International Studies (February 5, 2025). https://www.csis.org/analysis/fueling-future-recommendations-strengthening-us-uranium-security (accessed August 20, 2025); Filip Rudnik, "Russia continues to export uranium to the United States," The Centre for Eastern Studies (June 18, 2025). https://www.osw.waw.pl/en/publikacje/analyses/2025-06-18/russia-continues-to-export-uranium-to-united-states (accessed August 20, 2025).

[13] World Nuclear Association, "Nuclear Power in the USA" (August 6, 2025). https://world-nuclear.org/information-library/country-profiles/countries-t-z/usa-nuclear-power. Accessed August 20, 2025.

[14] This paper solely considers U.S. requirements for low-enriched uranium; calculated U.S. requirements for advanced reactors that require high-assay low-enriched uranium (HALEU) are not included.

[15] BBC News, "Nord Stream 1: How Russia is cutting gas supplies to Europe," (September 29, 2022). https://www.bbc.com/news/world-europe-60131520. Accessed August 20, 2025.

[16] Dmitry Gorchakov, "How will the US ban on Russian enriched uranium impact both countries?," The Bellona Foundation (May 30, 2024). https://etc.bellona.org/2024/05/30/usa_russian_uranium_ban/. Accessed August 20, 2025.

Brief Overview of Front-End Nuclear Fuel Cycle

According to openly available information, there are four main stages of the front-end nuclear fuel cycle—mining/milling, conversion, enrichment, and fuel fabrication. First, uranium ore is **mined** and next the uranium ore concentrate (also referred to as yellowcake, or U3O8) is extracted through **milling**. Second, the uranium concentrate is shipped to a **conversion** facility where impurities are removed and the uranium concentrate is combined with fluoride to create uranium hexafluoride (UF6).[17] Third, the uranium hexafluoride is transported to an **enrichment** facility, where it undergoes isotopic separation to increase concentration of fissile uranium-235 relative to uranium-238, generally to about 3% to 5% for civil nuclear reactors. Lastly, enriched uranium is turned into fuel assemblies at **fuel fabrication** facilities. The United States relies on foreign suppliers to meet its demand for mining/milling, conversion, and enrichment, but it is largely self-sufficient when it comes to fuel fabrication. [18]

Figure 1. Nuclear Fuel Cycle – Imports and Exports[19]

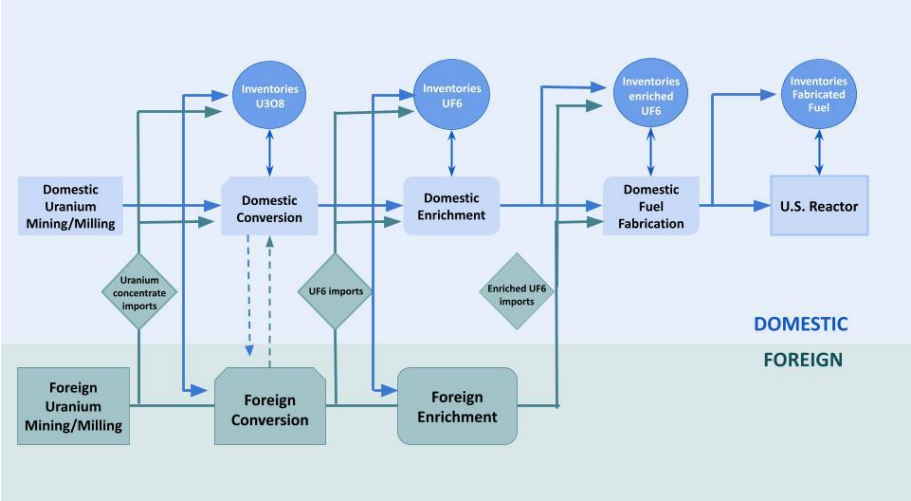

Image redrawn by author, taken from The Front End of the Nuclear Fuel Cycle: Current Issues, *Congressional Research Service*[20]

The front end of the nuclear fuel comprises many different "producers, suppliers, and utilities" that "buy, sell, store, and transfer uranium materials" in various parts of the world. [21]

To ensure adequate supply, nuclear reactor owners and operators in the United States diversify their purchases of "uranium products and services" among domestic and foreign suppliers, and

[17] Nuclear Threat Initiative, "Module 2: Uranium Enrichment: How is Uranium Enriched?" (2025). https://tutorials.nti.org/nuclear-101/uranium-enrichment/. Accessed August 20, 2025.
[18] World Nuclear Association, "US Nuclear Fuel Cycle," (November 20, 2024). https://world-nuclear.org/information-library/country-profiles/countries-t-z/usa-nuclear-fuel-cycle#uranium-fuel-fabrication. Accessed August 20, 2025.
[19] ""Domestic" and "foreign" are used here consistent with DOE's interpretations of the terms. Domestic refers to physical facilities operating within the United States, regardless of a foreign corporation ownership. In some instances, domestic uranium producers, suppliers, enrichers, and utilities operating in the United States have foreign ownership or are subsidiaries of foreign corporations. The term foreign is used to describe any non-U.S. based facility or material origin. Foreign inventories may exist in other countries, but are not shown here". Lance Larson, *The Front End of the Nuclear Fuel Cycle: Current Issues,* Congressional Research Service, R45753 (July 29, 2019). *https://sgp.fas.org/crs/nuke/R45753.pdf. Accessed August 20, 2025.*
[20] Lance Larson, *The Front End of the Nuclear Fuel Cycle: Current Issues*, pp. 11.
[21] Ibid., pp. 9.

through primary and secondary sources.[22] Many buyers, sellers, enrichers, converters, and reactor owners and operators also stockpile uranium at various stages of the front-end nuclear fuel cycle in order to hedge in the event of a supply disruption. [23]

U.S. Imports from Russia across the Nuclear Fuel Supply Chain

Mining/Milling and Conversion

The United States does not appear to be dependent on Russia for mining and milling.[24] However, the United States has very little domestic production and relies heavily on other countries.[25] Specific contracts between individual U.S. reactor owners/operators and mining companies are often confidential, making it challenging to ascertain which international companies U.S. reactor owners and operators are reliant on for mining and milling services.

However, in comparing the data collected from USA Trade Online, it is likely that in 2023 and 2024 the United States was reliant on companies such as Kazakhstan's Kazatomprom, France's Orano, Canada's Cameco, and companies operating in Australia (including Australia's BHP and Quasar from the United States). [26] It is worth noting that although Kazatomprom is controlled by the government of Kazakhstan, it has strong ties to Rosatom, Russia's nuclear state-owned enterprise.[27]

Additionally, a large amount of uranium ore also came from Namibia in 2024 and 2025, but not 2023. This indicates that US purchasers likely bought mining and milling services from China's China General Nuclear Power Group and China National Nuclear Corporation, as these companies operate the vast majority of uranium mining in Namibia.

[22] Lance Larson, *The Front End of the Nuclear Fuel Cycle: Current Issues*, pp. 9.
[23] This can complicate drawing accurate conclusions about foreign dependencies using purchase data published by the U.S. Energy Information Administration (EIA). See footnote 51 for further information.
[24] As Rosatom's Uranium One company mines in Kazakhstan and the United States import uranium ore from Kazakhstan, it is possible that U.S. reactor owners and operators import uranium ore from Russia's non-domestic mining company, Uranium One. However, a number of other mining companies mine in Kazakhstan, including Kazatomprom, Cameco, Orano, and CGN. Uranium One is listed as a company that sold uranium to U.S. reactor owners and operators in Table 24 of the EIA's 2023 UMAR, but it unknown to what degree or amount. World Nuclear Association, "Uranium and Nuclear Power in Kazakhstan," (June 19, 2025). https://world-nuclear.org/information-library/country-profiles/countries-g-n/kazakhstan#uranium-mining. Accessed August 20, 2025.
[25] Until the 1970s, the United Stated possessed significantly greater uranium mining capacity. The discovery of higher-grade uranium ore abroad, along with changes in U.S. public sentiment and national energy laws and regulations, reduced domestic mining capacity. Opposition of uranium mining grew over past decades out of environmental concerns and the damaging impact of U.S. mining and milling on tribal communities. All of this contributed to under-investments in U.S. mining and exploration. The aftermath of the Fukushima nuclear disaster also caused larger decreases in domestic mining capacity in the 2010s. Many mines struggled to compete against larger foreign competitors such as Cameco and Kazatomprom. MIT Climate, "Utah has the last conventional uranium mill in the country. What does it do?" Massachusetts Institute of Technology (October 8, 2024). https://climate.mit.edu/posts/utah-has-last-conventional-uranium-mill-country-what-does-it-do (accessed August 20, 2025); Jacob Lorinc and Maria Clara Cobo, "Uranium Firms Revive Forgotten Mines as Price of Nuclear Fuel Soars," Bloomberg (March 3, 2024). https://www.bloomberg.com/news/articles/2024-03-03/uranium-firms-revive-forgotten-mines-as-price-of-nuclear-fuel-soars (accessed August 20, 2025).
[26] According to World Integrated Trade Solution data, imports in 2022 and 2023 for this value primarily came from Canada, Australia, Namibia, and Estonia. Similarly, the UN Comtrade database reports that in 2024, uranium ore and concentrate imported to the United States primarily came from Canada and Namibia, along with the United Kingdom and South Africa. World Integrated Trade Solution, "United States Uranium ores and concentrates imports by country in 2022," World Bank. https://wits.worldbank.org/trade/comtrade/en/country/USA/year/2022/tradeflow/Imports/partner/ALL/product/261210, (accessed August 20, 2025); UN Comtrade Database, "HS 261210 Trade Data" United Nations. https://comtradeplus.un.org/TradeFlow?Frequency=A&Flows=M&CommodityCodes=261210&Partners=842&Reporters=all&period=2024&AggregateBy=none&BreakdownMode=plus, (accessed August 20, 2025).
[27] Marco Siddi and Kristiina Silvan, *Russia and Kazakhstan in the global nuclear sector: From uranium mining to energy diplomacy*, Finnish Institute of International Affairs, 371 (October 2023). https://fiia.fi/en/publication/russia-and-kazakhstan-in-the-global-nuclear-sector. Accessed August 20, 2025.

Table 1. Annual U.S. Imports of Mined and Milled Uranium (kg)[28]

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025 Jan-May
Australia	3,410,857	3,474,430	2,252,723	1,053,113	642,403	298,666	556,967	1,024,454	1,916,403	3,304,423	1,368,358
Namibia	440,128	576,254	739,158	166,058	232,632			521,423		495,804	514,667
Canada	18,282			4			21	18,549	644,254	72,354	
Japan						8,925				2,380	
Estonia								100,591			
Kazakhstan	995,997	1,593,131	136,434								
United Kingdom						2					

Table 2. Annual U.S. Imports of Uranium Oxide (including Milled Uranium) (kg)[29]

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025 Jan-May
Canada	4,277,297	5,359,733	6,395,213	4,228,409	643,880	152,076	258,127	769,568	2,636,099	6,424,078	1,348,013
Kazakhstan			832,317	320,020	1,238,304		250,783	81,367	166,967	1,977,548	565,169
South Africa	38,877	257,786	292,024	153,565					26,633	150,690	
Japan				1,860						16,383	
Germany									2	3	
France								2			
Sweden			2,130								
Uzbekistan		230,000									

Source: Tables above display Harmonized System District-Level Data of Imports to the United States for the commodities detailed above. Data was collected from USA Trade Online, a tool from the U.S. Census Bureau, which displays export and import data of commodities from and to the United States.[30]

The United States is not largely dependent on Russia for conversion services either.[31] However, there is only one domestic conversion facility inside the United States, so civilian reactor owners and operators are largely reliant on foreign sources.[32] While the U.S. is heavily dependent on

[28] U.S. Census Bureau, "USA Trade Online," https://usatrade.census.gov. Accessed August 20, 2025.
This table represents imports to the United States of "Uranium Ores and Concentrates (kg) HTS Code 2612100000". The HS Trade code 261210, "Uranium ores and concentrates" does not distinguish between uranium ore and uranium ore concentrate, and so likely reflects the products of both uranium milling and mining. As U3O8, the product of uranium milling, is a form of uranium oxide the data in the second table also represents the product of uranium milling, as well as other possible exports of other forms of uranium oxide.
It "is uncertain how "uranium ores and concentrates" are defined by the U.S. ITC, as "concentrate" is the physical and chemical product from "ore" processing" (or uranium milling). "Natural uranium oxide" is also used to describe uranium concentrate." Lance Larson, *The Front End of the Nuclear Fuel Cycle: Current Issues,* Congressional Research Service.
[29]U.S. Census Bureau, "USA Trade Online," https://usatrade.census.gov. Accessed August 20, 2025.
This table represents imports to the United States of "Uranium Oxide (kg) HTS Code 2844102010." See footnote above.
[30] "ITC data does not estimate the amount of uranium materials purchased by utilities for a given year. ITC data does not infer the quantities of uranium materials used, stored, or processed by a nuclear utility and reactor operator. ITC data differs from the EIA data reporting, which may combine purchases by country for uranium concentrate, uranium hexafluoride, and enriched uranium as equivalents of U3O8."" Lance Larson, *The Front End of the Nuclear Fuel Cycle: Current Issues,* Congressional Research Service.
[31] Although not reflected in USA Trade Online Data, some sources posit that there may be some amount of purchased conversion services not reflected in import data (possibly circumvented though a third country). One source estimates purchased Russian conversion services to reflect an additional $30-60 million annually; this inconsistency in publicly available data merits further investigation. Rowen Price, Ryan Norman and Alan Ahn, "Western Reliance on Russian Fuel: A Dangerous Game," Third Way (September 20, 2023). https://www.thirdway.org/memo/western-reliance-on-russian-fuel-a-dangerous-game. Accessed August 20, 2025.
[32] As of August 2025, the Honeywell International plant is only conversion facility in the United States, located in Illinois and operated by Converdyn. The Honeywell plant had been on standby from 2017 to 2023 "due to market conditions" but has since resumed operations and received $14 million from the DOE in 2023 to create a domestic uranium reserve. As of 2024, the facility has reduced its capacity to 7,000 MTU per year due to market demand. There does not appear to be any plans for the construction of new conversion facilities in the

imports for mining, milling, and conversion, import sources are mostly companies from U.S. allied and friendly countries. The import data collected from USA Trade Online displays that in 2023, imports of natural uranium hexafluoride came from Canada, most likely indicating imports from Canadian Cameco. In 2024, imports of natural uranium hexafluoride came from Canada, the UK, the Netherlands, and Germany, most likely indicating imports from Cameco and British-Dutch-German Urenco. [33]

Table 3. Annual U.S. Imports of Converted Uranium (kg)[34]

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025 Jan- May
Canada		522,070	119	217	4,796,227	39,686	3,341,281	2,082,521	2,326,272	2,644,717	1,604,439
France		2,996									897,038
United Kingdom											67
Netherlands											24
Germany					35,942						

Source: Table above displays Harmonized System District-Level Data of Imports to the United States for the commodities detailed above. Data was collected from USA Trade Online, a tool from the U.S. Census Bureau which displays export and import data of commodities from and to the United States.

Enrichment

The United States imports more enriched uranium than any other country.[35] From the calculations in this paper, over the past five years roughly 25% of the enriched uranium used in nuclear fuel for U.S. civilian reactors came from Russia. [36]

The United States only has one enrichment facility, the National Enrichment Facility, a gas centrifuge facility located in Eunice, New Mexico.[37] According to DOE documents, the existing capacity of the National Enrichment Facility is around 4.9M SWU per year, which is around one

United States at the time of this report. Julie Kozeracki, Chris Vlahoplus, Katheryn Scott, Melissa Bates, Billy Valderrama, Erica Bickford, Tim Stuhldreher, Andrew Foss, Tom Fanning, *Pathways to Commercial Liftoff: Advanced Nuclear,* United States Department of Energy (March 2023), pp. 32. https://www.energy.gov/sites/default/files/2025-07/LIFTOFF_DOE_Advanced-Nuclear.pdf. Accessed August 20, 2025.

[33] When reviewing World Integrated Trade Solution data from 2023, main imports for this value primarily came from Canada and Kazakhstan, as well as South Africa and Germany. The UN Comtrade database reports that in 2024, natural uranium and its compounds primarily imported to the United States came from Canada and Kazakhstan. World Integrated Trade Solution, "United States Natural uranium and its compounds, etc imports by country in 2022," World Bank. https://wits.worldbank.org/trade/comtrade/en/country/USA/year/2022/tradeflow/Imports/partner/ALL/product/284410 (accessed August 20, 2025); UN Comtrade Database, "HS 284410 Trade Data" United Nations. https://comtradeplus.un.org/TradeFlow?Frequency=A&Flows=M&CommodityCodes=284410&Partners=0&Reporters=842&period=2024&AggregateBy=none&BreakdownMode=plus (accessed August 20, 2025).

[34] U.S. Census Bureau, "USA Trade Online," https://usatrade.census.gov. Accessed August 20, 2025. This table represents imports to the United States of Natural Uranium Hexafluoride (kg), HTS Code 2844102025.

[35] Gracelin Baskaran and Meredith Schwartz, "Fueling the Future: Recommendations for Strengthening U.S. Uranium Security."

[36] 2023 Imports from Russia were greater than average as buyers, sellers, and traders all stockpiled Russian enriched uranium before the Prohibiting Russian Uranium Imports Act came into effect in August of 2024. Filip Rudnik, "Russia continues to export uranium to the United States."

[37] Urenco USA, "About Urenco USA," https://urencousa.com/about/. Accessed August 20, 2025.

third of current U.S. demand (around 15M SWU).[38] The facility is currently expanding to increase capacity by about 15%. All new cascades are planned to be operating by early 2027. [39]

Aside from Rosatom, the United States reportedly imports from UK-based Urenco, which has enrichment facilities located in the Netherlands, Germany, the UK, and the United States, and from Orano, which operates in France.[40]

As seen in the table below, the United States also appears to have restarted importing enriched uranium from China, where nuclear state-owned enterprise CNNC owns multiple enrichment facilities (primarily intended for domestic use).[41] It was announced in October 2024 that a National Security Council (NSC) investigation was underway as to whether China had been assisting Russia with circumventing the ban by importing uranium from Rosatom and then re-selling it to American buyers, as customs data shows Russia has begun to export large amounts of enriched uranium to China.[42] DOE was also reportedly investigating this claim.[43]

Table 4. Annual U.S. Imports of Enriched Uranium[44]

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025 Jan- May
Russia	460,357	570,783	507,804	547,768	486,386	452,947	550,388	588,429	701,834	334,856	241,451
Netherlands	292,852	522,875	429,030	785,046	876,324	544,825	660,456	571,838	410,941	366,346	214,465
France	36,191	95,866	93,694		121,160	113,490	121,679	212,237	327,758	332,638	151,724
United Kingdom	387,011	260,837	455,502	461,187	309,091	205,374	402,098	402,021	366,336	446,784	107,201
Germany	223,379	428,821	441,698	591,108	412,729	518,024	482,330	535,926	428,801	274,042	89,371
China	26,659	63,033	15,351	75,605	7,410				267,877	123,894	72,522
Romania						49,507					
Czech Republic					90						
Australia	50										

Source: Table above displays Harmonized System District-Level Data of Imports to the United States for the commodities detailed above. Data was collected from USA Trade Online, a tool from the U.S. Census Bureau which displays export and import data of commodities from and to the United States.

[38] Julie Kozeracki, Chris Vlahoplus, Katheryn Scott, Melissa Bates, Billy Valderrama, Erica Bickford, Tim Stuhldreher, Andrew Foss, Tom Fanning, *Pathways to Commercial Liftoff: Advanced Nuclear,* United States Department of Energy (March 2023), pp. 32, https://www.energy.gov/sites/default/files/2025-07/LIFTOFF_DOE_Advanced-Nuclear.pdf. Accessed August 20, 2025.
[39] Urenco USA, "Urenco USA Starts Up First Phase of New U.S. Enrichment Capacity" (May 19, 2025). https://www.urenco.com/news/uusa/2025/urenco-usa-starts-up-first-phase-of-new-u.s-enrichment-capacity. Accessed August 20, 2025.
[40] David Kramer, "Russian strikes on Ukrainian nuclear plants stir talk but little action in Western nations" *Physics Today* 1; 76 (5): 20 (May 2023). https://doi.org/10.1063/PT.3.5232 (accessed August 20, 2025); Urenco, "Global Operations," (2025). https://www.urenco.com/global-operations (accessed August 20, 2025).
[41] See "Possible Sources to Counter Displacement" section.
[42] William Freebairn, "US government looking into Chinese enriched uranium imports, officials say," S&P Global (October 29, 2024). https://www.spglobal.com/commodity-insights/en/news-research/latest-news/electric-power/102924-us-government-looking-into-chinese-enriched-uranium-imports-officials-say. Accessed August 20, 2025.
[43] Timothy Gardner, "US probes uranium imports from China to prevent circumventing Russian ban," Reuters (September 17, 2024). https://www.reuters.com/markets/commodities/us-probes-uranium-jump-china-amid-concerns-over-russian-import-ban-2024-09-17/. Accessed August 20, 2025.
[44] Uranium Fluoride Enriched In U-235 (kg) HTS Code 2844200020. U.S. Census Bureau, "USA Trade Online."

Given Rosatom's dominance in the nuclear fuel industry, Russian enriched uranium is sold at a much lower price than what many other providers offer. This led to an investigative effort in 1991 by the U.S. International Trade Commission into supposed antidumping by Rosatom.[45] This investigation was then suspended in 1992 out of concern that ending imports of Russian enriched uranium would harm the U.S. nuclear energy industry.[46] The suspension of this investigation has been modified five times. A 2023 sunset review of the agreement by the U.S. Department of Commerce led to a continuation of this suspension, and mandated that the next review will occur in 2028.[47]

Consequently, the Prohibiting Russian Uranium Imports Act has likely contributed to increased cost of natural and enriched uranium hexafluoride.[48] In June 2024, spot prices for uranium conversion increased 46%, compared to June 2023.[49] Spot prices for uranium enrichment increased by 23% from December 2023 to December 2024.[50]

[45] United States International Trade Commission, *Uranium from Russia,* Investigation No. 731-TA-539-C (Fifth Review), (March 2023). https://www.usitc.gov/publications/701_731/pub5416.pdf. Accessed August 20, 2025.
[46] Mark Holt, *Nuclear Energy: Overview of Congressional Issues,* Congressional Research Service, R42853 (March 26, 2025). https://www.congress.gov/crs_external_products/R/PDF/R42853/R42853.40.pdf. Accessed August 20, 2025.
[47] Enforcement and Compliance, International Trade Administration, *Uranium From the Russian Federation: Continuation of Suspension of Antidumping Investigation,* Department of Commerce (April 12, 2023). https://www.federalregister.gov/documents/2023/04/12/2023-07625/uranium-from-the-russian-federation-continuation-of-suspension-of-antidumping-investigation. Accessed August 20, 2025.
[48] "The Congressional Budget Office estimated that the bill would increase the price of nuclear fuel by 13% by prompting "a gradual replacement of Russian suppliers with higher-cost sources of enrichment services under the bill's waiver provisions Mark Holt, *Nuclear Energy: Overview of Congressional Issues,* pp. 19; Dory Castillo-Peters and Frank von Hippel, "US and EU imports of Russian uranium and enrichment services could stop. Here's how," The Bulletin of the Atomic Scientists (August 5, 2022). https://thebulletin.org/2022/08/us-and-eu-imports-of-russian-uranium-and-enrichment-services-could-stop/ (accessed August 20, 2025).
[49] Cindy Vestergaard, "Disruption and the Nuclear Industry," The Henry L. Stimson Center (September 3, 2024). https://www.stimson.org/2024/disruption-and-the-nuclear-industry/. Accessed August 20, 2025.
[50] Urenco, "Full year 2024 audited financial results," (March 12, 2025). https://www.urenco.com/news/global/2025/full-year-2024-audited-financial-results. Accessed August 20, 2025.

Table 5. Summary of U.S. Imports of Russian and Non-Russian Natural and Enriched Uranium and Domestic Purchases[51]

Stage	% Purchased from Russia (2023)[52]	% Purchased Domestically Sourced (2023)	Non-Russian Import Sources (2023)
Mining (uranium ore) and Milling (yellowcake or U3O8)[53]	N/A[54]	1%[55] 19.2 MTU U3O8 produced[56]	99%[57] Canada, Kazakhstan, Australia[58]
Conversion (UF6)	N/A[59]	Limited[60]	Canada[61]
Enrichment (enriched UF6)	27% 4.1M SWU[62]	28% 4.3M SWU produced[63]	45%[64] Russia, Netherlands, France, UK, Germany, China[65]

Notes: SWU stands for separative work units. Values are all approximate, and calculated requirements are estimates. 2023 offers the most recent complete set of data from the U.S. Energy Information Administration (EIA); 2024 data is included in footnotes. 2023 foreign purchases from Russia are slightly above average years due to stockpiling before the passage of the Prohibiting Russian Uranium Imports Act in August of 2024.

In sum, data and information from the U.S. Energy Information Administration (EIA), the U.S. Census Bureau, and trade press reporting, as displayed in table 5 above, indicate that the United States relies on foreign sources across the nuclear fuel cycle. However, the United States is mainly dependent on Russian imports for enriched uranium. Therefore, enrichment is the primary stage where the U.S. will have to focus its efforts on identifying other sources by 2028 to fulfill the impending ban.

[51] Annual purchase data doesn't fully reflect the annual amount of uranium used to power nuclear reactors, in part due to stockpiling. Some reactor owners and operators may also only buy enriched uranium at the end of the front-end fuel cycle, while others may buy uranium at each stage, and enter into milling, conversion, and enrichment agreements with providers. Purchasers may also buy natural or enriched UF6 and then sell it later without using it. Additionally, as the movement of radioactive material is minimized as much as possible, it is common for UF6 to be stored at a conversion facility in one country under the name of a company from a different country. All of this complicates the process of drawing accurate assumptions from purchase and import data. Furthermore, the EIA does not specify how much uranium from each stage is purchased from specific countries. Often, EIA data records the total "uranium" imports, written in U3O8e [the equivalent amount of uranium component to describe total uranium concentrate, natural uranium (UF6), and enriched uranium (enriched UF6)].

[52] % Purchased Columns are out of total amount purchased. Under the assumption of a steady state, where stockpiles are remaining at current levels and aren't growing or being depleted significantly, this would reflect dependency.

[53] The amount of uranium ore required to produce a given amount of U3O8 depends on the grade of the ore, or the concentration of uranium inside of it. There's not one given amount of uranium ore that will yield a given amount of U3O8, and so requirements and dependencies are hard to accurately obtain. The U.S. mined resources account for less than 1% of the global production. Nuclear Energy Agency and the International Atomic Energy Agency, *Uranium 2024 Resources, Production and Demand*, ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT, NEA No. 7683 (April 15, 2025), pp. 84-85. https://www.oecd-nea.org/jcms/pl_103179/uranium-2024-resources-production-and-demand?details=true. Accessed August 20, 2025.

[54] % Purchased from Russia for Mining and Milling is "N/A" because although USA Trade Online Data does not display any imports from Russia of U3O8, there may be some amount of purchased mining or milling services not reflected in import data (possibly circumvented though a third country). This presents an inconsistency in publicly available data which merits further investigation.

[55] United States Energy Information Administration, "U.S. nuclear generators import nearly all the uranium concentrate they use," (January 30, 2025). https://www.eia.gov/todayinenergy/detail.php?id=64444. Accessed August 20, 2025.

[56] 307 MT U3O8 was produced in 2024. United States Energy Information Administration, *2023 Domestic Uranium Production Report - Annual,* (May 2024), pp. 2. https://www.eia.gov/uranium/production/annual/ (accessed August 20, 2025); United States Energy Information Administration, *Domestic Uranium Production Report Fourth-Quarter 2024: Table 1. Total production of uranium concentrate in the United States*, (March 2025). https://www.eia.gov/uranium/production/quarterly/ (accessed August 20, 2025).

[57] United States Energy Information Administration, "U.S. nuclear generators import nearly all the uranium concentrate they use".

[58] Specific contracts between individual U.S. reactor owners/operators and mining companies are often confidential, but the countries with the top uranium reserves are Kazakhstan, Canada, Namibia, and Australia. The largest corporations that mined uranium in 2022

Alternatives and Opportunities to Displace Imported Russian Enrichment Uranium

This paper estimates that in 2028, the United States will need roughly 1,977 MTU of LEU for its civil nuclear reactors, of which 30% to 35% will likely be met with domestically enriched uranium and the rest must be imported from foreign suppliers. The expected 2028 requirement of 1,977 MTU of enriched uranium was calculated based on EIA's 2023 data and information on planned new capacity additions and retirements by 2028.[66] The 2028 requirement is similar to the calculated 2023 requirement for U.S. civil nuclear reactors of 1927 MTU.[67] This paper solely considers U.S. requirements for LEU; U.S. requirements for advanced reactors that require high-assay low-enriched uranium (HALEU) are not included.

As previously stated, in December 2024, DOE selected six companies as potential contractors for the domestic production of enriched uranium.[68] Louisiana Energy Services is the only one of the six companies that is currently producing LEU; the other five companies listed by DOE have not started production of LEU. Below is a table summarizing the readiness of these facilities. It does not appear that any of the five will be able to start producing LEU at scale by 2028.

The one possible exception to this is the American Centrifuge Plant managed by American Centrifuge Operating, a subsidiary of Centrus. This facility already has all necessary licensing for LEU production and has already demonstrated successful LEU enrichment at this facility from 2014 to 2016.[69] The corporation has plans for the commercial production of LEU and announced

were Kazakhstan's Kazatomprom, Canada's Cameco, France's Orano, China's CGN and Russia's Uranium One. U.S. Census Bureau, "USA Trade Online,"; Federal Ministry of Finance of the Republic of Austria, *World Mining Data 2025*, Volume 40 (April 10, 2025), https://www.world-mining-data.info/wmd/downloads/PDF/WMD%202025.pdf (accessed August 20, 2025); World Nuclear Association, "World Mining Production," (May 16 2025). https://world-nuclear.org/information-library/nuclear-fuel-cycle/mining-of-uranium/world-uranium-mining-production, (accessed August 20, 2025).

[59] % Purchased from Russia for conversion is "N/A" because although USA Trade Online Data does not show any imports from Russia of natural UF6, there may be some amount of purchased conversion services not reflected in import data (possibly circumvented though a third country). One source estimates purchased Russian conversion services to reflect an additional $30-60 million annually; this inconsistency in publicly available data merits further investigation. Rowen Price, Ryan Norman and Alan Ahn, "Western Reliance on Russian Fuel: A Dangerous Game," Third Way (September 20, 2023). https://www.thirdway.org/memo/western-reliance-on-russian-fuel-a-dangerous-game. Accessed August 20, 2025.

[60] The sole uranium conversion facility in the United States, the Honeywell Conversion facility, shut down from 2017-2023 due to poor market conditions. It restarted in July 2023 and had a capacity of roughly 7,000 MT U3O8 in 2024. Julie Kozeracki, Chris Vlahoplus, Katheryn Scott, Melissa Bates, Billy Valderrama, Erica Bickford, Tim Stuhldreher, Andrew Foss, Tom Fanning, *Pathways to Commercial Liftoff: Advanced Nuclear*.

[61] The leaders in conversion are Canada's Cameco, France's Orano, China's CNNC, USA's Honeywell and Russia's Rosatom. Sourced from USA Trade Online Data. World Nuclear Association, "Conversion and Deconversion" (November 20, 2024). https://world-nuclear.org/information-library/nuclear-fuel-cycle/conversion-enrichment-and-fabrication/conversion-and-deconversion (accessed August 20, 2025); U.S. Census Bureau, "USA Trade Online," https://usatrade.census.gov (accessed August 20, 2025).

[62] SWU means separative work units. United States Energy Information Administration, *2023 Uranium Marketing Annual Report: Table 16*, (June 2024). https://www.eia.gov/uranium/marketing/pdf/2023%20UMAR.pdf. Accessed August 20, 2025.

[63] United States Energy Information Administration, *2023 Uranium Marketing Annual Report: Table 16*.

[64] United States Energy Information Administration, *2023 Uranium Marketing Annual Report* (June 2024), pp. 3, 45. https://www.eia.gov/uranium/marketing/pdf/2023%20UMAR.pdf. Accessed August 20, 2025.

[65] The top enrichment companies by a wide margin are Russia's Rosatom, British-Dutch-German Urenco, French Orano, and Chinese CNNC. World Nuclear Association, "Uranium Enrichment" (June 6, 2025). https://world-nuclear.org/information-library/nuclear-fuel-cycle/conversion-enrichment-and-fabrication/uranium-enrichment (accessed August 20, 2025); U.S. Census Bureau, "USA Trade Online," https://usatrade.census.gov (accessed August 20, 2025).

[66] For more information, see Methodology section in Appendix, "*2. How much enriched uranium will the United States need in 2028*?"

[67] For more information, see Methodology section in Appendix, "*1. How much enriched uranium will the United States need in 2025?"*

[68] Office of Nuclear Energy, United States Department of Energy, "Biden-Harris Administration Announces Contracts to Buy U.S.-Sourced Low Enriched Uranium."

[69] Centrus Energy Corp., "History," https://www.centrusenergy.com/who-we-are/history/ (accessed August 20, 2025);

deals in September 2024 with Korea Hydro & Nuclear Power (KHNP) and other customers for eventual LEU production at the Piketon plant.[70] However, the company doesn't list any production goals for LEU and appears to be focusing most of its efforts on high-assay low-enriched uranium (HALEU) production. American Centrifuge Operating is the only corporation with NRC licensing for HALEU production and is currently contracted by DOE to provide HALEU through June 2026, with the possibility of an extension of up to eight years.[71] Nevertheless, if this facility switched to focus its efforts on LEU production, it could potentially contribute to national demand by 2028.

United States Nuclear Regulatory Commission, "Centrus Energy Corp./American Centrifuge Operating, LLC (formerly USEC Inc.) Gas Centrifuge Enrichment Facility Licensing," (April 01, 2025). https://www.nrc.gov/materials/fuel-cycle-fac/usecfacility.html (Accessed August 20, 2025).

[70] Centrus Energy Corp., "Centrus and KHNP Sign Long-Term Supply Commitment," (September 11, 2024). https://www.centrusenergy.com/news/centrus-and-khnp-sign-long-term-supply-commitment/. Accessed August 20, 2025.

[71] Centrus Energy Corp., "Centrus Energy Secures Contract Extension from Department of Energy to Continue HALEU Production," (June 20, 2025). https://investors.centrusenergy.com/news-releases/news-release-details/centrus-energy-secures-contract-extension-department-energy. Accessed August 20, 2025.

Table 6. Planned U.S. Enrichment Facilities

Enrichment Company	Facility	Location	Construction Dates	Technology Readiness	Regulatory/Licensing Milestones	Operable by 2028?
Louisiana Energy Services (Urenco USA)	The National Enrichment Facility	Eunice, NM	Operations began June 2010	Ready and in operation	N/A	**Production expanding by 15% by 2028**
Orano Federal Services LLC	Project IKE[72]	Oak Ridge, TN	N/A	Ready	Letter of intent submitted to NRC Jan 2025; licensing application submittal expected in 2026[73]	**No** (Hopes to start operations early 2030s)[74]
American Centrifuge Operating (Centrus)[75]	American Centrifuge Plant	Piketon, OH	Construction of HALEU cascades completed February 2023[76]	Ready and in operation	Has approval for HALEU construction; can possess uranium onsite and put feed into cascades[77]	**Potentially**
Global Laser Enrichment (Silex Systems; Cameco)[78]	Paducah Enrichment Facility	Paducah, KY	Not started; see licensing	TRL-6 achieved May 2025[79]	Licensing application for construction sent July 2025[80]	**No** (Hopes to start operations in 2030)[81]
Laser Isotope Separation Technologies[82]	N/A	Oak Ridge, TN	Not started; will build-out from existing facility[83]	TRL-4 achieved March 2025[84]	Has not begun	**No** (highly unlikely)
General Matter[85]	N/A	N/A[86]	N/A	N/A[87]	N/A	**No** (highly unlikely)[88]

[72] Orano Group, "Project IKE Enrichment," https://www.orano.group/usa/en/our-portfolio-expertise/project-ike-enrichment#faqs. Accessed August 20, 2025.
[73] Orano Group, "Orano Opens Project IKE Office in Oak Ridge, Tennessee, to Support Developing its American Uranium Enrichment Facility," (2025). https://www.orano.group/usa/en/our-news/news-releases/2025/orano-opens-project-ike-office-in-oak-ridge-tennessee-to-support-developing-its-american-uranium-enrichment-facility. Accessed August 20, 2025.
[74] If everything moves in a timely process, enrichment operations "could begin in the early 2030s". Orano Group, "Project IKE Enrichment".
[75] Centrus Energy Corp., "American Centrifuge," https://www.centrusenergy.com/what-we-do/national-security/american-centrifuge/. Accessed August 20, 2025.
[76] Centrus Energy Corp., "Centrus Achieves Key Production Milestone with Delivery of 900 Kilograms of HALEU to the Department of Energy," (June 25, 2025). https://www.centrusenergy.com/news/centrus-achieves-key-production-milestone-with-delivery-of-900-kilograms-of-haleu-to-the-department-of-energy/, (accessed August 20, 2025); Centrus Energy Corp., "Centrus Begins Enrichment Operations in Ohio," (October 11, 2023). https://www.centrusenergy.com/news/centrus-begins-enrichment-operations-in-ohio/ (accessed August 20, 2025).
[77] United States Nuclear Regulatory Commission, "New Fuel Cycle Facility Licensing and Construction," (October 4, 2023). https://www.nrc.gov/materials/fuel-cycle-fac/new-fac-licensing.html. Accessed August 20, 2025.
[78] Global Laser Enrichment, "Global Laser Enrichment," (2025). https://www.gle-us.com/ (accessed August 20, 2025); United States Nuclear Regulatory Commission, "Global Laser Enrichment (GLE)," (January 12, 2024). https://www.nrc.gov/info-finder/fc/global-laser-enrichment-nc-lc.html#panel0 (accessed August 20, 2025).
[79] Nuclear Engineering International, "GLE begins TRL-6 laser enrichment testing," (May 14, 2025). https://www.neimagazine.com/news/gle-begins-trl-6-laser-enrichment-testing/. Accessed August 20, 2025.
[80] Global Laser Enrichment, "GLE Submits Full Application to License the Paducah Laser Enrichment Facility," (July 2, 2025). https://www.gle-us.com/wp-content/uploads/2025/07/NRC-License-Submittal-Announcement.pdf. Accessed August 20, 2025.
[81] Global Laser Enrichment, "GLE Acquires Paducah, KY Property," (November 27, 2024). https://www.gle-us.com/wp-content/uploads/2024/11/GLE-Land-Announcment-Nov24.pdf. Accessed August 20, 2025.

At the time of writing, multiple new government programs are emerging to strengthen domestic fuel supply, such as the Fuel Line Pilot Program announced in June 2025.[89] Although the majority of these programs are meant to support the production of HALEU for advanced reactors, they could likely benefit LEU production as well.[90]

Nonetheless, if all of the new enrichment facilities continue as planned, it is unlikely that domestic enrichment will be able to supplement the displacement of Russian enriched uranium by 2028. Instead, decoupling from Russian enriched uranium will most likely involve a restructuring or shifting of buyers and sellers.[91] Because of Russian Tenex's (the trading arm of Rosatom) unusually low pricing, their enriched uranium is too attractive to be left on the market.[92] Other countries will increase their purchases of Russian enriched uranium, filling the gap left by the United States' absence. In turn, the United States will have to increase its imports of enriched uranium from allies, preferably British-Dutch-German Urenco and French Orano, in order to help displace Russian imports.

Urenco officials have stated that they believe the planned expansion of their enrichment facilities could cover any supply gap caused by Rosatom's absence.[93] The expansion of Urenco's U.S. facility, the National Enrichment Facility operated by Louisiana Enrichment Services is already accounted for in this paper—even with this expansion, domestic enrichment capacity will only meet at most 35% of the total 2028 requirements. However, Urenco is also expanding the production of enriched uranium at their facilities in the Germany and the Netherlands, which could

[82] LIS Technologies Inc., "Patented USA Origin Laser Technology Company," (2025). https://laseristech.com/. Accessed August 20, 2025.
[83] LIS Technologies Inc., "LIS Technologies Inc. Contracts Leading Construction Specialist to Oversee $1 Million Redevelopment of its Secured Facility in Oak Ridge, Tennessee," (September 26, 2024). https://laseristech.com/lis-technologies-inc-contracts-leading-construction-specialist-to-oversee-1-million-redevelopment-of-its-secured-facility-in-oak-ridge-tennessee/. Accessed August 20, 2025.
[84] LIS Technologies Inc., "LIS Technologies Inc. Achieves TRL-4 in an Independent Technical Readiness Assessment of its Patented Laser Enrichment Technology (CRISLA)," (March 18, 2025). https://laseristech.com/lis-technologies-inc-achieves-trl-4-in-an-independent-technical-readiness-assessment-of-its-patented-laser-enrichment-technology-crisla/. Accessed August 20, 2025.
[85] General Matter was first registered in California in early 2024 and then publicly announced in April 2024. The DOE then selected it in October of 2024 as one of four companies to potentially be contracted to produce HALEU, preceding the December 2024 selection as a potential contractor for LEU.
General Matter, Inc., "General Matter," (2025). https://generalmatter.com/ (accessed August 20, 2025); World Nuclear News, "US uranium enrichment startup emerges from stealth," (April 23, 2025). https://www.world-nuclear-news.org/articles/us-uranium-enrichment-startup-emerges-from-stealth (accessed August 20, 2025); World Nuclear News, "DOE selects HALEU enrichment providers," (October 18, 2024). https://www.world-nuclear-news.org/articles/doe-selects-haleu-enrichment-providers (accessed August 20, 2025).
[86] They have not decided on a location for a facility, but are currently between Wyoming, Texas, Washington and Utah.
[87] https://www.world-nuclear-news.org/articles/us-uranium-enrichment-startup-emerges-from-stealth
[88] The company plans to start construction by 2026 and begin operations by the end of the current decade.
[89] U.S. Department of Energy, "Energy Department Announces First Pilot Project for Advanced Nuclear Fuel Lines," (August 4, 2024). https://www.energy.gov/articles/energy-department-announces-first-pilot-project-advanced-nuclear-fuel-lines. Accessed August 20, 2025.
[90] While LEU fuel is enriched up to 5%, HALEU is enriched from 5-20%. Russia is currently the only country that commercially produces HALEU. In October 2024 the DOE contracted four companies to produce HALEU for the U.S. government – Louisiana Energy Services, France's Orano, American Centrifuge Operating, and General Matter. David Dalton, "DOE Announces Initial Contracts To Four Companies For Haleu Production," NucNet (October 18, 2024). https://www.nucnet.org/news/doe-announces-initial-contracts-to-four-companies-for-haleu-production-10-5-2024. Accessed August 20, 2025.
[91] Darya Dolzikova, *Power Plays: Developments in Russian Enriched Uranium Trade,* The Royal United Services Institute, (March 2024), pp. 62. https://static.rusi.org/SR-power-plays-web-final.pdf. Accessed August 20, 2025.
[92] U.S. Department of Commerce, *Suspension Agreement on Uranium from the Russian Federation: Final Results of Redetermination*, (September 26, 2007), pp. 41-42. https://access.trade.gov/Resources/remands/07-143.pdf (accessed August 20, 2025); United States International Trade Commission, *Uranium from Russia,* pp. 36-37.
[93] David Kramer, "Russian strikes on Ukrainian nuclear plants stir talk but little action in Western nations" *Physics Today* 1; 76 (5): 20 (May 2023). https://doi.org/10.1063/PT.3.5232. Accessed August 20, 2025.

also help to offset some of the supply gap. The expansion of their German facility is unknown, but their Dutch facility is planned to expand by an additional 750 MT of SWU each year, with initial cascades operational in 2027.[94]

Orano has similarly proposed that their expansion of their enrichment facility in France, with an additional 2,500 MT of SWU each year starting in 2028, will help to at least partially cover supply gaps of enriched uranium after the ban of Russian imports to the United States takes into effect.[95]

However, it's challenging to assess with certainty if these expansions by Urenco and Orano can fully offset displaced U.S. imports of Russian enriched uranium because contracts for enriched uranium are private, and it is unknown how much of the additional enriched uranium produced through these expansions would be dedicated to U.S. purchasers. As the European Union is also seeking to decouple from Russian uranium, it is likely that some of this production would go towards European countries as well.[96]

[94] Darya Dolzikova, *Power Plays: Developments in Russian Enriched Uranium Trade, pp*. 12.
[95] Ibid., pp. 12; Orano Group, "Orano Opens Project IKE Office in Oak Ridge, Tennessee, to Support Developing its American Uranium Enrichment Facility," (June 5, 2025). https://www.orano.group/usa/en/our-news/news-releases/2025/orano-opens-project-ike-office-in-oak-ridge-tennessee-to-support-developing-its-american-uranium-enrichment-facility. Accessed August 20, 2025.
[96] European Commission, "REPowerEU at a glance," (June 17, 2025). https://commission.europa.eu/topics/energy/repowereu_en. Accessed August 20, 2025.

Table 7. Possible Sources to Displace U.S. Imports of Russian Enriched Uranium by 2028

Stage	Calculated requirements (2028)	Forecast U.S. Domestic Production (2028)	Forecast Non-Russian Imports	How Much Russia Needs to Be Displaced	Possible Sources to Displace Russian Imports
Enrichment (enriched UF6)	1,977 MTU[97]	600 - 695 MTU [98]	897 MTU[99]	486 MTU or 20 - 25%[100]	Urenco, Orano, Secondary Sources[101]

Notes: The percentage of enriched uranium that the United States imports from Russia is dependent on the parameters used to calculate enriched uranium product generated from SWU, namely percent of tails assay and percent of product assay. This paper calculates that roughly 25% of enriched uranium used in U.S. civilian nuclear reactors are sourced from Russia, using data from 2019 to 2023, a tails assay of 0.22% and a product assay of 4.5%. See Footnote 120 and 121 for more information.
Forecast non-Russian imports and how much Russian enriched uranium needs to be replaced are calculated using five-year averages from data in Table 16 of the EIA's 2023 Uranium Marketing Annual Report. These numbers may not reflect the total enriched uranium used in U.S. nuclear reactors annually, as long-term enrichment contracts and stockpiling may mean that the added sum of non-Russian imports and the amount of Russian enriched uranium to be displaced is higher than the actual amount of foreign uranium that the U.S. will need to power civil reactors in 2028. However, drawing from this table appears to be the best way to get the most accurate representation of SWU displaced based on public data.

Secondary Sources of Enriched Uranium

There are a few other ways beyond the front-end nuclear fuel cycle that the United States could increase the domestic supply of enriched uranium. None of these secondary sources will be able to completely offset a displacement of Russian enriched uranium, but they may be able to supplement shortfalls in domestic supply.

One option is through domestic or foreign stockpiles, or inventories, of natural and enriched uranium. The International Atomic Energy Agency (IAEA) has investigated all government inventories of uranium in a 2023 study; it found that the U.S. strategic inventory of enriched uranium is estimated to only contain 230 MTU enriched uranium product (EUP), a small amount compared to the calculated 2028 requirement of 1,977 MTU.[102] Additionally, most government inventories are meant for domestic use or are largely illiquid. It concludes that the amount of

[97] See Appendix, Methodology section, under *"Back-calculations to determine UF6 and U3O8 demand in 2028."* 1,977 MTU of enriched uranium product is 2,924 MT enriched UF6.
[98] A range was provided in this section to account for the planned expansion of the National Enrichment Facility, the sole domestic enrichment facility managed by Louisiana Energy Services. For more information, see Appendix, Methodology section under *"3. How much enriched uranium does the U.S. produce?"*.
[99] This amount was calculated by taking a 5 year average from 2019-2023 of non-Russian imports from EIA data; see Appendix, Methodology section "6. *How much enriched uranium does the U.S. import from non-Russian sources?"*
[100] The percentage of enriched uranium that the United States imports from Russia is dependent on the parameters used to calculate enriched uranium product generated from SWU, namely % tails assay and % product assay. This paper calculates that roughly 486 MTU or 25% of enriched uranium used in U.S. civilian nuclear reactors are sourced from Russia, using data from up to 2023, a tails assay of 0.22% and a product assay of 4.5%. A lower tails assay would generate a result closer to 20%, and caps on enriched uranium imports from Russia under the Russian Suspension Agreement appear to indicate that purchased Russian enriched uranium services account for 20% of US requirements. Thus, a range of 20-25% is provided for in this paper. For more information see Appendix, Methodology section, under *"5.How much do imports of Russian enriched uranium account for total requirements"*. United States House of Representatives, *PROHIBITING RUSSIAN URANIUM IMPORTS ACT*.
[101] See "Secondary Sources" section.
[102] IAEA, Global Inventories of Secondary Uranium Supplies, IAEA-TECDOC-2030 (November 2023), pp. 56. https://www-pub.iaea.org/MTCD/Publications/PDF/TE-2030web.pdf. Accessed August 20, 2025.

enriched uranium and fabricated fuels could likely fuel existing global civil reactors for up to 1.5 years, making it unlikely to offset longer duration supply chain disruptions. [103]

Another secondary source is found through the IAEA's fuel bank; however, it only has 90 MT enriched UF6 (LEU), intended as a last-resort option for any member state that cannot obtain fuel in "exceptional circumstances."[104]

A third common secondary source proposed is through re-enriching depleted uranium.[105] This involves re-feeding the "tails," or depleted uranium back into a centrifuge after the initial stage of enrichment to get more enriched uranium product.[106] In 2016, Global Laser Enrichment and the DOE reached an agreement for GLE to re-enrich the depleted tails from a retired gaseous diffusion enrichment plant in Paducah, Kentucky.[107]

A fourth source can be found through underfeeding a centrifuge, or feeding less natural UF6 into a centrifuge and applying more separative work during enrichment to extract more U-235.[108] Conversely, some have proposed overfeeding, or feeding more natural UF6 fed into a centrifuge while maintaining the same amount of separative work.[109] This creates a larger amount of depleted uranium tailings with higher amounts of U-235, which could be used feed centrifuges at a later time. The viability of both underfeeding and overfeeding depend on the readiness of supply of natural uranium feed and U.S. centrifuge capacity.

Findings and Further Considerations

It is unlikely absent additional action that the United States would be able to domestically produce enriched uranium at sufficient scale to replace dependency on Russian supply by 2030, let alone by 2028. This paper estimates that in 2028, the United States will need roughly 1,977 MTU of low-enriched uranium. Even accounting for the expansion of the National Enrichment Facility in New Mexico, by 2028 the United States will only be able to domestically produce 600-695 MTU. The five other facilities selected for potential contracting for LEU will likely not be operational by 2028.[110]

[103] This report was conducted in 2023, and it is likely that global inventories have changed since then. Conversely, the demand for enriched uranium has increased in the past two years as more nuclear reactors come under construction.
[104] IAEA, "IAEA Low Enriched Uranium (LEU) Bank," https://www.iaea.org/topics/iaea-low-enriched-uranium-bank. Accessed August 20, 2025.
[105] The DOE stated in 2017 that the re-enrichment of depleted uranium and underfeeding are the "largest sources of secondary supply in the market." Lance Larson, *The Front End of the Nuclear Fuel Cycle: Current Issues,* pp. 6.
[106] The Tenex corporation in Russia commonly re-enriches the tails from depleted uranium for nuclear fuel. World Nuclear Association, "Uranium Enrichment".
[107] United States Nuclear Regulatory Commission, "Global Laser Enrichment Facility Licensing," (December 2, 2020). https://www.nrc.gov/materials/fuel-cycle-fac/laser.html (accessed August 20, 2025); Silex Systems Limited, "GLE Acquires Paducah, KY Property for the Paducah Laser Enrichment Facility," (November 27, 2024). https://www.nrc.gov/docs/ML2433/ML24332A108.pdf (accessed August 20, 2025).
[108] Uranium enrichment through centrifuges is linked to electricity cost, as a large amount of energy is used to power centrifuges. When costs of electricity are higher and it's harder to enrich uranium, enrichers may use more natural UF6 and spin it for less time to meet the required level of enrichment. This process is called overfeeding. Conversely, when it is easier to enrich (or the enrichment capacity exceeds demand), enrichers will "underfeed" the reactors (or use less natural UF6 and spin it for longer) to reach the required level of enrichment. Contracted tails assay is the amount of uranium a supplier is contracted to supply, depending on the enrichment level required and the amount of depleted uranium left over (also called tails assay). Operational tails assay is the rate of enrichment that the enrichment facility operationally provides. If an enricher has greater operational enrichment capacity than what they are contracted to supply (operational tails assay is higher than contracted tails assay), then an enricher may decide to underfeed a reactor and store the excess UF6 for stockpiling or selling. World Nuclear Association, "Uranium Enrichment."
[109] David Kramer, "Russian strikes on Ukrainian nuclear plants stir talk but little action in Western nations".
[110] The one exception would to this would be the American Centrifuge Plant owned by American Centrifuge Operating, if the facility decides to focus its efforts on the production of low-enriched uranium instead of high-assay low-enriched uranium.

That means that the United States will still need to import enriched uranium from foreign sources, a large part of which it previously imported from Russia.

This is not to say that the Prohibiting Russian Uranium Imports Act will not be effective. The United States is likely capable of stopping imports from Russia by 2028, and this will likely involve a restructuring or shifting of buyers and sellers. The United States will have to increase imports of enriched uranium from non-Russian sources, most likely through Orano and Urenco.

Decoupling from Russian supply will be more expensive. Russia historically has offered lower prices than market value for enriched uranium as an attempt to dominate market share.[111] Any other source of enriched uranium will be more expensive, as many reactor owners and operators have highlighted.[112] Given fewer options for conversion and enrichment, the U.S. fuel supply chain will also be more vulnerable to shortages of resources or capacity.

This being said, there are a few opportunities for the United States to increase domestic uranium supply. One of which would be through continued collaboration in the Sapporo 5—a partnership between the United States, Canada, the United Kingdom, Japan, and France created in April 2023 to reduce international reliance on Russia for nuclear fuel.[113] By September 2024, $5.6 billion had been mobilized by Sapporo 5 members through this partnership in order to develop a nuclear fuel supply chain without Russian influence.[114] The money that was raised went towards initiatives already covered in this paper—European investments contributed towards the expansion of Orano's enrichment facilities, and U.S. investments contributed to funding for the planned domestic enrichment facilities described in Table 6. [115] However, more detailed actions or plans for this partnership cannot be found online, and no reporting by the U.S. government on this partnership are available past September 2024. Continued, detailed action through this partnership to reduce Russian dependency and onshore U.S. nuclear fuel industry could help to offset Russian reliance.

Another opportunity lies in incentivizing the production of LEU through the American Centrifuge Plant managed by American Centrifuge Operating, which presents the greatest potential to produce LEU by 2028. This enrichment facility already has all necessary regulations from the NRC for LEU production, and it produced LEU from 2014 to 2016.[116] Despite this, its recent efforts have largely focused on the production of HALEU. This is likely because the American Centrifuge Plant is the only domestic facility currently licensed by the NRC to produce HALEU and has been contracted to deliver shipments of HALEU to DOE through June 2026, with the potential of an extended contract of up to eight years.[117] However, as this facility already has the necessary

[111] U.S. Department of Commerce, *Suspension Agreement on Uranium from the Russian Federation: Final Results of Redetermination*, pp. 41-42.; United States International Trade Commission, *Uranium from Russia,* pp. 36-37.
[112] Lance Larson, *The Front End of the Nuclear Fuel Cycle: Current Issues,* pp. 23-24.
[113] United States Department of Energy, "Statement on Civil Nuclear Fuel Cooperation Between the United States, Canada, France, Japan, and the United Kingdom," (April 17, 2023). https://www.energy.gov/articles/statement-civil-nuclear-fuel-cooperation-between-united-states-canada-france-japan-and. Accessed August 20, 2205.
[114] United States Department of Energy, "Sapporo 5 Leaders Make Significant Progress in Securing a Reliable Nuclear Fuel Supply Chain," (April 18, 2024). https://www.energy.gov/ne/articles/sapporo-5-leaders-make-significant-progress-securing-reliable-nuclear-fuel-supply-chain. Accessed August 20, 2025.
[115] U.S. Department of Energy, "Sapporo 5 Leaders Make Significant Progress in Securing a Reliable Nuclear Fuel Supply Chain".
[116] U.S. Nuclear Regulatory Commission, "Centrus Energy Corp./American Centrifuge Operating, LLC (formerly USEC Inc.) Gas Centrifuge Enrichment Facility Licensing".
[117] Centrus Energy Corp., "Centrus Achieves Key Production Milestone with Delivery of 900 Kilograms of HALEU to the Department of Energy".

licensing, technology, and know-how to produce LEU, if American Centrifuge Operating re-configured their centrifuges, it likely could help to supplement domestic capacity by 2028.

Closing Thoughts

Decoupling from Russian enriched uranium and reviving the domestic fuel cycle will be challenging, but it is likely doable even at the enrichment stage. The United States will not likely be able to generate sufficient domestic enrichment capacity by 2028 but possibly could as early as the mid-2030s.

In the meantime, decoupling from Russian uranium will likely involve a shift of buyers and sellers. As the United States stops importing uranium from Russia, it will need to increase imports from other enrichers, preferably the French corporation Orano and the British-Dutch-German corporation Urenco.

The future of the domestic front-end nuclear fuel cycle remains to be seen. However, the current efforts reflected by domestic companies pursuing enrichment and allies expanding their facilities are a strong start towards a more secure future.

Appendix

Methodology

The calculations in this report use data from the U.S. Energy Information Administration's 2023 Uranium Marketing Annual Report.[118]

1. **How much enriched uranium will the United States need in 2025?**

The total amount of enriched uranium currently consumed (per year) based on the 94 reactors currently operating was calculated using the EIA's 2023 "Uranium Marketing Annual Report" (UMAR), Table 18. Uranium in fuel assemblies loaded into U.S. civilian nuclear power reactors by year, 2019–2023.

In 2023, 43,913,000 lb U3O8e was loaded into U.S. civilian nuclear reactors.[119]

A. Converting 43,913,000 lb U3O8e to metric tons yields 19918.60 MT U3O8e.

B. Because this is a measure of the equivalent natural uranium feed and not enriched uranium product (EUP), the EUP must be calculated (in metric tons of enriched uranium, or MTU). In making these calculations, this paper assumes the following:
    a. Natural uranium = 0.711% U-235
    b. Product assay = 4.5% [120]
    c. Tails assay = 0.22 % [121]

C. Using the WISE Uranium Project Nuclear Fuel Material Balance Calculator, the total enriched uranium product consumed in 2023 from domestic civil reactors comes out to 1928.041 MTU (EUP).[122] Using the UxC Fuel Quantity and Cost Calculator, the total EUP consumed in 2023 also comes out to 1928.041 MTU (EUP).[123]

D. This means that roughly **1928 MTU of enriched uranium** was used in fuel assemblies in civil nuclear reactors **in 2023**. To calculate how much MTU of enriched uranium is needed for 2025, one must account for differences in the number of reactors in the U.S. from 2023-2025.
    a. No new reactors were decommissioned from 2023-2025. The Vogtle 4 unit came online after 2023, in March 2024.

[118] U.S. Energy Information Administration, *2023 Uranium Marketing Annual Report*.
[119] Table 18 states that this "Includes only unirradiated uranium in new fuel assemblies loaded into reactors during the year. Does not include uranium removed from reactors that subsequently will be reloaded." However, it is unknown if the 'uranium in fuel assemblies' metric actually accounts for refueling, and so this number may be slightly higher or lower than previous years due to refueling. Although this does not significantly change the data, a future report could take an average of the past 5 years (accounting for reactors that came online or offline) instead to account for refueling differences.
[120] This metric for product assay is intended to represent that "nuclear reactor typical of many operating today." World Nuclear Association, "Nuclear Fuel Cycle Overview," (March 21, 2025). https://world-nuclear.org/information-library/nuclear-fuel-cycle/introduction/nuclear-fuel-cycle-overview. Accessed August 20, 2025.
[121] This metric for tails assay is intended to represent that of "typical Western enrichment plants." World Nuclear Association, "Nuclear Fuel Cycle Overview."
[122] WISE Uranium Project, "Nuclear Fuel Material Balance Calculator", World Information Services on Energy (January 27, 2015). https://www.wise-uranium.org/nfcm.html. Accessed August 20, 2025.
[123] UxC LLC, "UxC Fuel Quantity & Cost Calculator." https://www.uxc.com/p/tool/fuel-cost-calculator. Accessed August 20, 2025.

b. One must calculate the amount of enriched uranium that the Vogtle 4 unit requires and add it to the amount of enriched uranium required in 2023 to get an estimate for 2025.
    i. The average 1000 Mwe unit uses around 27 MTU annually.[124]
c. EUP currently consumed in 2025 (1928.041 MTU) + EUP needed from the Vogtle 4 (27 MTU) = ~**1955.041 MTU currently consumed in 2025**

2. How much enriched uranium will the United States need in 2028?

A. To calculate how much MTU of enriched uranium is needed for 2028, one must account for differences in the number of reactors in the U.S. from 2025-2028.
    a. No reactors are scheduled for decommissioning from 2025-2028. The Diablo Canyon power plant has suspended its proposed decommissioning past 2028. [125]
    b. Three Mile Island Unit 1 is scheduled to restart before 2028.
        i. The estimated annual consumption of this reactor unit is 819 Mwe.[126] Assuming electricity generation is roughly linear to EUP consumption, this reactor unit would require around 22 MTU.
    c. EUP currently consumed in 2025 (1955.041 MTU) + EUP needed from the TMI Unit 1 Reactor (22 MTU) = **1977.041 MTU needed by 2028.**

3. How much enriched uranium does the U.S produce (currently, and projected to 2028)?

The only domestic enrichment facility is the National Enrichment Facility in New Mexico, operated by Louisiana Energy Services (a subsidiary of Urenco).[127] In 2023, the capacity of this facility was 4.4 million SWU (separative work units). An expansion is planned to be completed by 2028, adding an additional 700,000 SWU.[128]

A. SWU must first be translated into MTU EUP. This paper uses the calculator provided by Urenco, using the parameters as specified in 1B.[129]
    a. 4.4 million SWU comes out to 599.781 MTU.
    b. 4.4 million SWU +700,000 SWU = 5.1 million SWU. 5.1 million SWU comes out to 695.201 MTU of enriched uranium.
B. Currently, **domestic enrichment facilities produce roughly 600 MTU EUP** annually. If Urenco expands their facility in the US, **domestic production could reach roughly 695 MTU EUP** annually.[130]

[124] World Nuclear Association, "Nuclear Fuel Cycle Overview."
[125] Darrell Proctor, "California Regulators Vote to Keep Diablo Canyon Nuclear Plant Open Another Five Years," POWER Magazine, (December 15, 2023). https://www.powermag.com/california-regulators-vote-to-keep-diablo-canyon-nuclear-plant-open-another-five-years/. Accessed August 20, 2025.
[126] Kamen Kraev, "Constellation Announces Microsoft Deal To Restart Unit 1 At Three Mile Island Nuclear Plant," NucNet, (September 20, 2024). https://www.nucnet.org/news/constellation-announces-plans-to-restart-unit-1-of-three-mile-island-nuclear-plant-9-5-2024. Accessed August 20, 2025.
[127] United States Nuclear Regulatory Commission, "Louisiana Energy Services (LES)."
[128] Julie Kozeracki, Chris Vlahoplus, Katheryn Scott, Melissa Bates, Billy Valderrama, Erica Bickford, Tim Stuhldreher, Andrew Foss, Tom Fanning, *Pathways to Commercial Liftoff: Advanced Nuclear,* United States Department of Energy (March 2023), pp. 32.
[129] Urenco, "SWU Calculator," https://www.urenco.com/swu-calculator. Accessed August 20, 2025.
[130] Estimate based on parameters described above.

a. So **domestic capacity** could account for **roughly 30% to 35% of total requirements for 2028.**[131]
b. This **means** that beyond domestic production, the United States will require 1282-1377 MTU of enriched uranium imports.
c. **Estimated import requirements in 2028** (1977.041 MTU) - (599.781 MTU) = **1377.26 MTU**
d. **Estimated import requirements in 2028** (1977.041 MTU) - (695.201 MTU) = **1281.84 MTU**

4. How much do imports of Russian enriched uranium constitute total U.S. requirements of enriched uranium?

One must first determine how much enriched uranium is purchased from Russia by U.S. civilian reactor owners and operators. Purchase data was found through EIA 2023 UMAR, Table 16: "Purchases of enrichment services by owners and operators of U.S. civilian nuclear power reactors by origin country and year, 2019–2023."

A. First, the average purchased enrichment services from Russia from 2019-2023 was calculated. [132]
   a. (3,087,000+3,220,000+3,953,000+3,409,000+4,141,000) /5 = 3,562,000 SWU
   b. This was then converted using Urenco's enrichment calculator (assuming same parameters as in 1B), to get **485.550 MTU**.
B. So from 2019-2023, an average of 486 MTU of enriched uranium was purchased by U.S. civil reactor owners and operators from Russia. This number will be used as a metric for the average amount of Russian enriched uranium purchased annually by reactor owners and operators.[133]
   a. One must divide the amount of Russian enriched uranium purchased annually by the estimated requirements for 2028.
      i. (Average of purchased Russian enrichment)/(Estimated requirements for 2028) = 4855.550 MTU / 1977.041 MTU = 24.559 %
   b. Decoupling from Russia leaves a gap of **roughly 486 MTU, roughly 25% of our demand in 2028.**

5. How much enriched uranium does the U.S. import from non-Russian sources?

A. First, the average purchased enrichment services from foreign countries from 2019 – 2023 was calculated. [134]
   a. (7,992 + 10,012 + 11,481+ 10,301 + 10,926) SWU /5 = 10,142,400 SWU

[131] Assuming that Urenco's facility remains the sole domestic facility producing enriched uranium in 2028.
[132] United States Energy Information Administration, *2023 Uranium Marketing Annual Report: Table 16*.
[133] Purchase data varies annually, and this may not reflect future years. This paper uses the most recent available data to provide an estimate for dependency.
[134] An average was used to minimize any outlying data due to the stockpiling of enriched uranium by reactor owners and operators.

B. The Russian number was then subtracted from total foreign services purchased to find a rough estimate of MTU imported from countries excluding Russia.[135]
    a. (Average of total foreign purchases) 10,142,400 – (Average of purchased Russian enrichment) 3,562,000 = 6,580,400 SWU
    b. This was then converted using Urenco's enrichment calculator (assuming same parameters as in 2), to get **897.001 MTU.**

Back-calculations to determine UF6 and U3O8 demand in 2023:

A. EIA's 2023 UMAR Table 18 states 19918.60 MT U3O8e was loaded into U.S. nuclear reactors (see first paragraph under methodology)
B. Using the WISE Nuclear Fuel Material Balance Calculator and UxC Fuel Quantity and Cost Calculator, this is roughly **24855 MT natural UF6** and **2851 MT enriched UF6.**[136]

Back-calculations to determine UF6 and U3O8 demand in 2028:

A. The previous section calculated that **1977.041 MT EUP will be required by 2028.**
B. Using the WISE Nuclear Fuel Material Balance Calculator and UxC Fuel Quantity and Cost Calculator, this is roughly **20425 MT U3O8**, **25486.77 MT natural UF6** and **2923.832 MT.**

[135] This might not account for Uzbekistan or Kazakhstan, which are very reliant on Russia for enrichment. Table 16 omits the names of two countries- one is listed as "Other" and the other is listed as "Specific country in Europe". United States Energy Information Administration, *2023 Uranium Marketing Annual Report: Table 16*.
[136] WISE Uranium Project, "Nuclear Fuel Material Balance Calculator," UxC LLC, "UxC Fuel Quantity & Cost Calculator."