

Nuclear Fuel 101



Nuclear reactors rely on fuel rods to create chain reactions and generate electricity. These fuel rods begin as unprocessed uranium ore and undergo several manufacturing processes before they can be used as nuclear fuel. Because the United States currently imports most of its uranium used for nuclear fuel from countries like Russia, our national security and clean energy goals are at risk.

Overview

- After mining, uranium undergoes an enrichment process to increase its concentration from 0.7% to 3-5%, making it suitable for use as nuclear fuel. Some advanced reactors require enrichment levels of 5% to 20%.
- When nuclear fuel is burned, atoms are broken down by nuclear fission to generate electricity in two reactor types: pressurized water reactors and boiling water reactors.
- After nuclear fuel is used, 90% of its energy is still usable, presenting an opportunity to produce more energy from the spent fuel.

Current Standing In The U.S.

- Uranium production peaked in the United States in 1980 and has been declining since, leading to increased reliance on Russia to supply the uranium needed to power our nuclear fleet. In fact, around 1 in 20 homes in the United States were powered by Russian-enriched uranium in 2022.
- In early 2023, three uranium mines owned by Energy Fuels—the only active uranium mines in the U.S.—opened in Utah and Arizona, beginning operations after 8 years of stagnation. This came in response to price increases and growing support for nuclear energy.
- Presently, the United States has only one active uranium mill in Utah owned by Energy Fuels and two operating uranium enrichment facilities in New Mexico and Ohio.
- With the passage of the Prohibiting Russian Uranium Imports Act, imports of Russian uranium are effectively banned and the Department of Energy will invest \$2.7 billion to revitalize our domestic uranium production capabilities.

Economics

- Uranium prices have skyrocketed to \$90 per pound following Russia's invasion of Ukraine and a global agreement at COP28 to triple nuclear energy production by 2050.
- In 2023, the average salary for mining jobs stood at \$94,848, significantly greater than the national average of \$72,609.
- The Southeast region of the United States hosts 25 of the nation's operating 93 nuclear reactors. Annually, nuclear energy in this area contributes nearly \$43 billion to the economy and generates \$3.7 billion in tax revenues.

Challenges

- The average mining project takes an average of 16 years to become operational in part because of bureaucratic delays and red tape associated with the permitting process.
- Currently, the United States does not recycle spent nuclear fuel, despite there being enough energy in the U.S.'s spent fuel to power the country for 100 years. Volatile uranium prices, concerns about proliferation, and high costs associated with reprocessing are all reasons the US has not yet capitalized on this potential nuclear fuel source.
- There are hundreds of abandoned uranium mines that have yet to be cleaned up, many on Tribal land. This raises doubts among communities affected that the industry will properly and safely manage new mines.

What's Next?

- Mines in the United States are held to much higher operational and environmental standards than other countries. It is imperative that the United States unleashes domestic uranium production to ensure a sustainable and ethical nuclear fuel supply chain that will meet the increasing demand for clean nuclear energy.
- The Department of Energy continues to intensify its efforts in developing solutions for recycling spent nuclear fuel which will maximize fuel use and secure domestic energy independence.