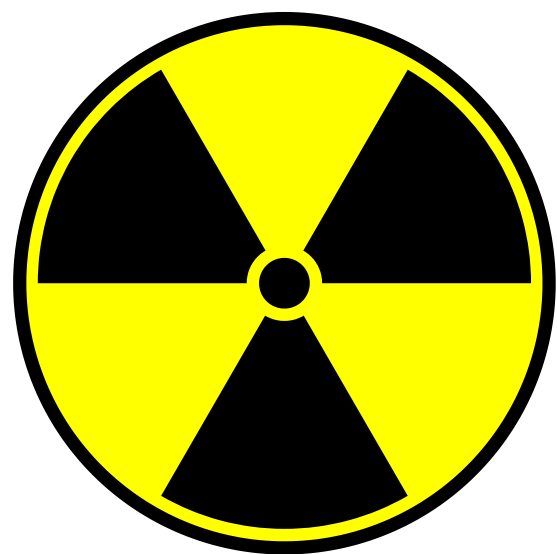


# Nuclear Energy

## What Is It?

Nuclear power refers to electricity that is generated in nuclear reactors from energy released by **nuclear fission**, decay, or fusion reactions.



## How Clean Is It?

Nuclear power does not emit any greenhouse gases from its operation. However, nuclear plants require large amounts of concrete, steel, and other building materials that do create emissions. It also requires large volumes of water and creates manageable radioactive waste.



## What Does It Cost?

Per kilowatt-hour (kWh), nuclear is one of the cheapest forms of energy. However, construction of a nuclear plant is costly due to safety measures, engineering considerations, and advanced materials cost as well as insurance and regulatory compliance, which make U.S. nuclear far costlier to build than in other countries.

## Space



On average, an active U.S. nuclear power plant is estimated to require 832 acres of land. Given its capacity factor and energy output, this is the smallest land-use footprint of any carbon-free energy source.

## Point

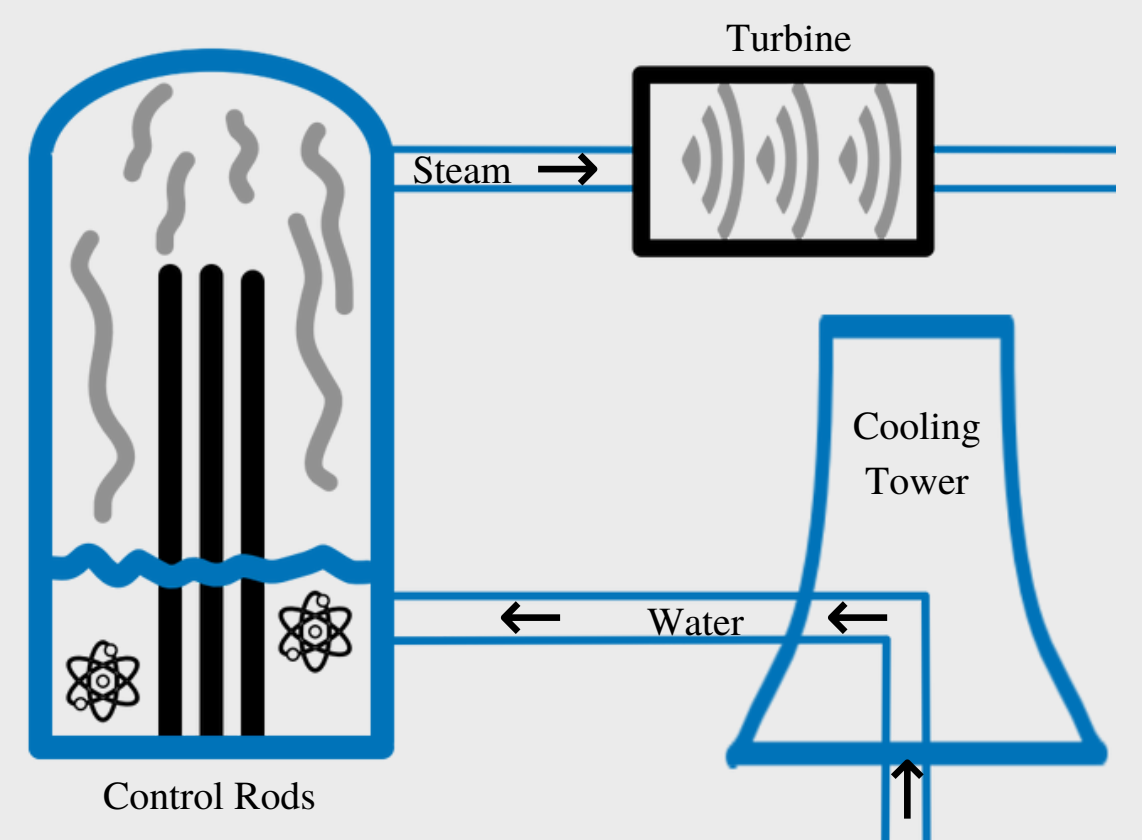
- A single 10-gram uranium pellet contains the equivalent of over 10 million kilowatt-hours of electricity, enabling nuclear energy to power large populations with few inputs.
- Nuclear power generates carbon-free energy and has a low land-use footprint.
- Nuclear has nearly the lowest fatality rate of any energy source worldwide, and plants are designed to withstand natural disasters.
- New nuclear reactors can improve U.S. energy security, operate continuously at full capacity, and displace emissions and impacts from traditional fuels.
- Only a small volume of waste is highly radioactive. Most is only radioactive for decades and is safely handled in a compact manner on site and stored in highly secure concrete and steel canisters.

## Counterpoint

- Despite having our own reserves, the U.S. imports nearly 90 percent of its uranium, making us dependent on foreign actors to supply this valuable resource.
- Mining activity for uranium is environmentally intensive, and nuclear plants require large volumes of water.
- Highly publicized accidents at Chernobyl, Three Mile Island, and Fukushima have stoked irrational fears and dampened public demand for nuclear power.
- Costs to build a nuclear plant in the U.S. regularly cost upwards of \$6 billion regardless of innovative models, and often struggle to get approval.
- There are over 90,000 metric tons of nuclear waste in the U.S. some of which will remain radioactive for up to 10,000 years, but no permanent national storage site exists for nuclear waste.

## How Does It Work?

1. Nuclear energy relies primarily on uranium or plutonium. For U.S. nuclear power, nearly 90 percent of uranium is imported.
2. Uranium is a naturally occurring, exhaustible mineral that must be mined, refined, converted, enriched, and eventually made into fuel pellets.
3. These thimble-sized fuel pellets are assembled into 13-foot fuel rods which are combined into assemblies and inserted into a reactor.
4. Fission reactions are controlled inside the nuclear reactor, splitting atoms to release high levels of energy.
5. The heat produced from the fission reactions is applied to water to produce steam, which turns a generator to produce electricity.
6. Plants generally shut down to replace one-third of the reactor's nearly 50,000 fuel rods every two years.
7. Spent fuel can sometimes be recycled and is otherwise contained and stored for permanent disposal.
8. The waste material is packed into concrete and steel containers, which are filled with inert gas and built to withstand natural disasters. These dry casks are secured on site until a permanent, national waste storage location is designated.



## Did You Know?

The United States operates over 80 nuclear powered marine vessels, including submarines, aircraft carriers, and more.

## What's Next?

Smaller advanced and modular nuclear reactors have been developed that do not require as much costly material to construct without sacrificing safety. These smaller reactors will soon begin powering college campuses, industrial parks, small towns, and more with less extensive new infrastructure.