

# Sourcing Uranium

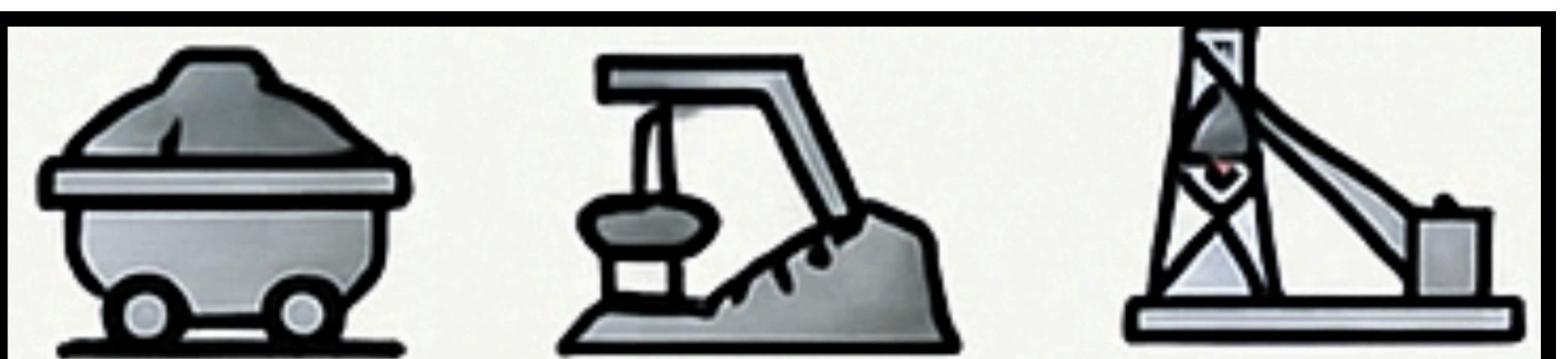
## What is Uranium?

Uranium ore is a naturally occurring heavy metal that is a black, brown, or grey lusters color.

It's found in rocks, soil, and seawater.

The mining of uranium ore is to primarily provide fuel for nuclear reactor cores across the globe.

## How is it Mined?



Open Pit Mining      Underground Mining      In-Situ Recovery

In-Situ Recovery (ISR) is the most common method for uranium mining. It includes dissolve the uranium ore in a solution and pumping it back up to the surface. This has the smallest impact on the surface land.

## Where in the world is Uranium Mined?



Country	Global Production (%)
Kazakhstan	43%
Canada	18%
Namibia	11%
Australia	8%
Uzbekistan	7%
Other (Russia, Niger, etc.)	13%

Uranium is found on every continent.  
Data from World Nuclear Association,  
based on uranium mined in 2022.

## Why does it matter?

Uranium ore is mined, and then is put into the nuclear fuel cycle. After the manufacturing process, the uranium ore is used to help create 20% of the United States electricity, and about 15% of Canada's electricity.

Understanding uranium sourcing is important for politics, energy security, and climate change.

## Did you know?

If we started to extract uranium ore from seawater, it would be considered a renewable source as oceans are receiving trace amounts of uranium from river runoff and minerals on the ocean floor!

# Reactor Types

## Classifying Reactors

Reactors are technically classified based on the coolant they use - not the fuel. While uranium is the most common type of fuel, materials like thorium could be used. Reactors are not based on the fuel - they're based on the coolant, like water, graphite, molten salt, gas, and more!

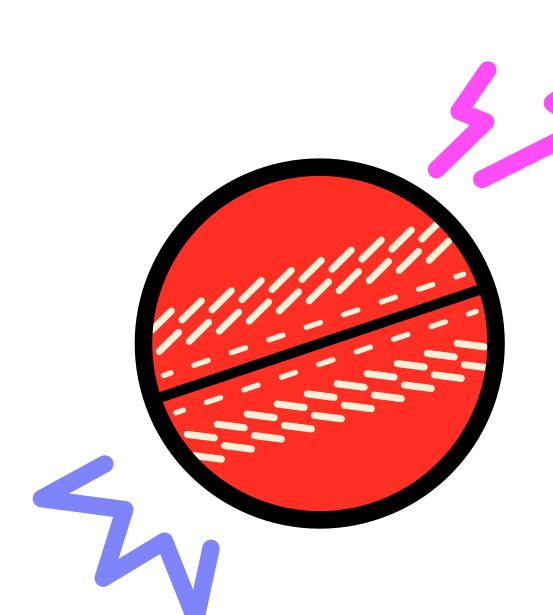
## Coolant vs. Moderator



**Coolant** is used to help remove heat from the reactor core.

That coolant is then used to make steam - either directly in a BWR, or through heat exchangers in a PWR.

**Moderator** is a material used to slow down neutrons in the reactor core.



The nuclear fission process causes fast neutrons to be created, which need to be slowed down. The solution? Bounce those fast neutrons off other atoms - that's the moderator!

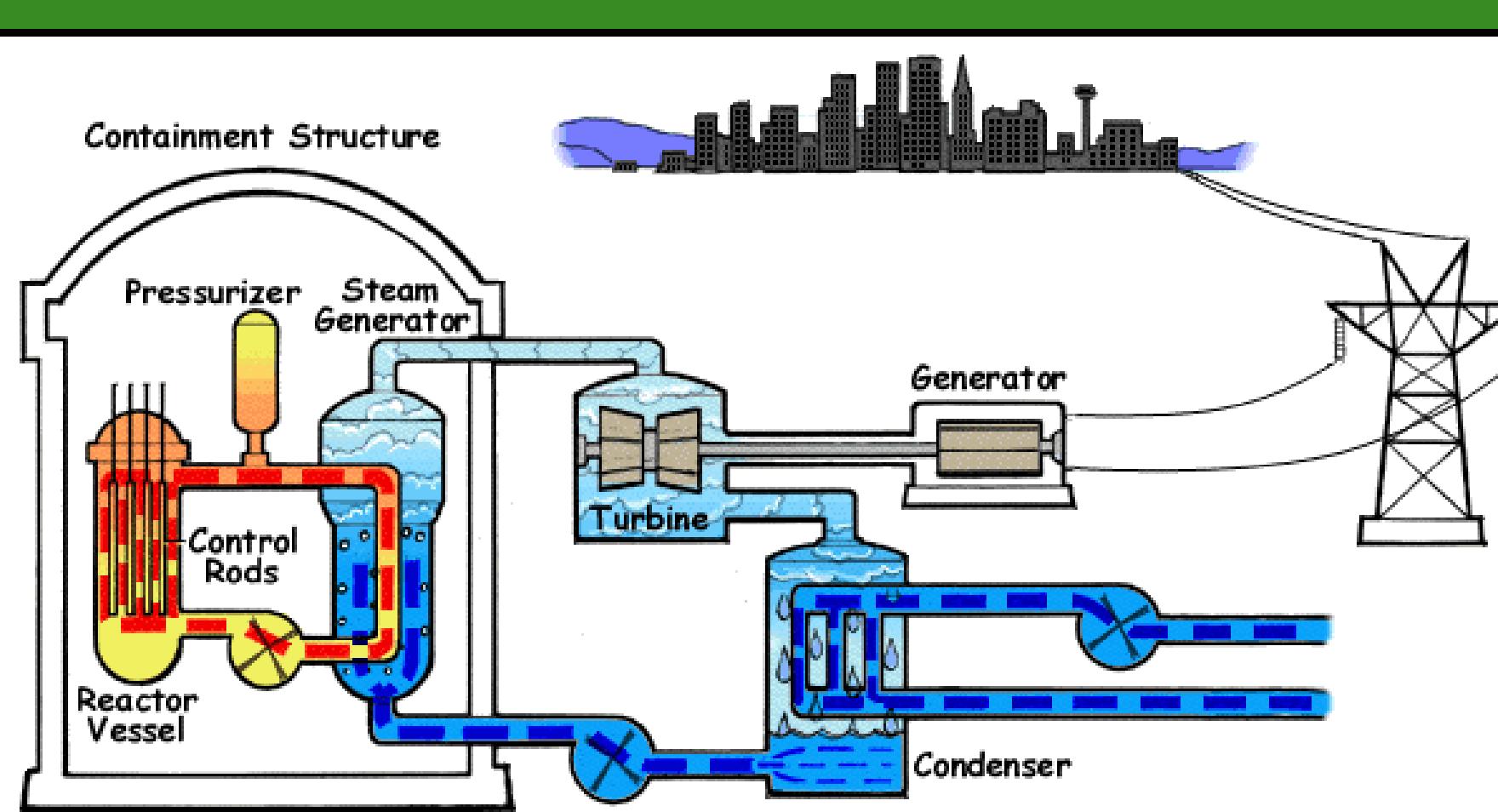
Coolant and Moderator can be the same material (ex. water)

## PWR vs. BWR

Feature	PWR	BWR
Water Loops	Two	One
Where Steam is Made	Steam Generator	Reactor Core
Turbine Radioactivity	Non-radioactive	Slight radioactivity
Commonality	Most common	Less common
Core Pressure	High	Lower
Control Rods Inserted	From top	From bottom

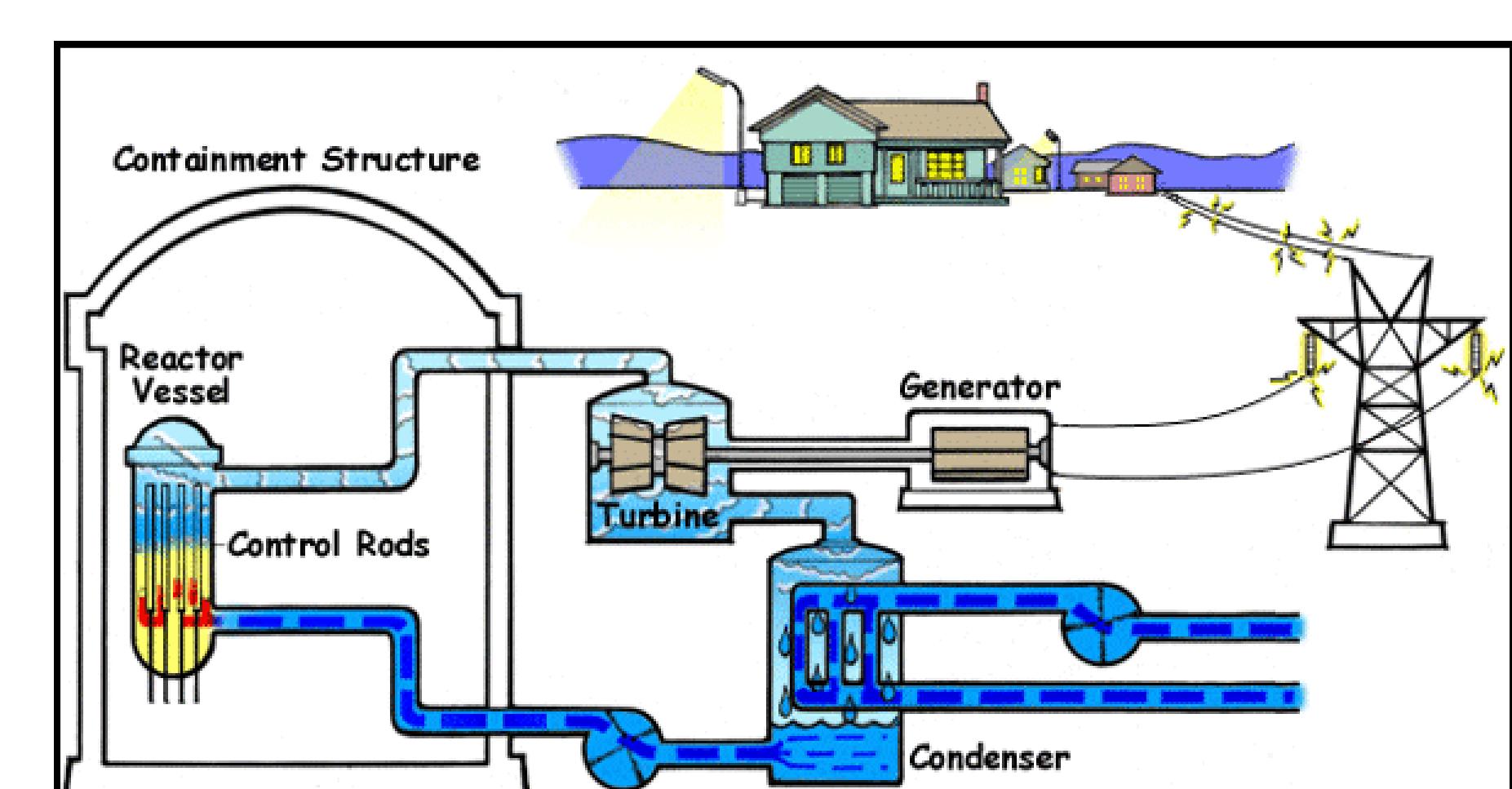
### PWR = Pressurized Water Reactor

A pressurized water reactor uses a reactor loop (the primary loop) and the steam generator loops (the secondary loop).



### BWR = Boiling Water Reactor

A boiling water reactor uses only one loop - heat from the reactor boils water, which makes steam, which turns a turbine to spin a generator.



CANDU Reactors are considered PWRs. CANDU Reactors use Heavy Water as their coolant.

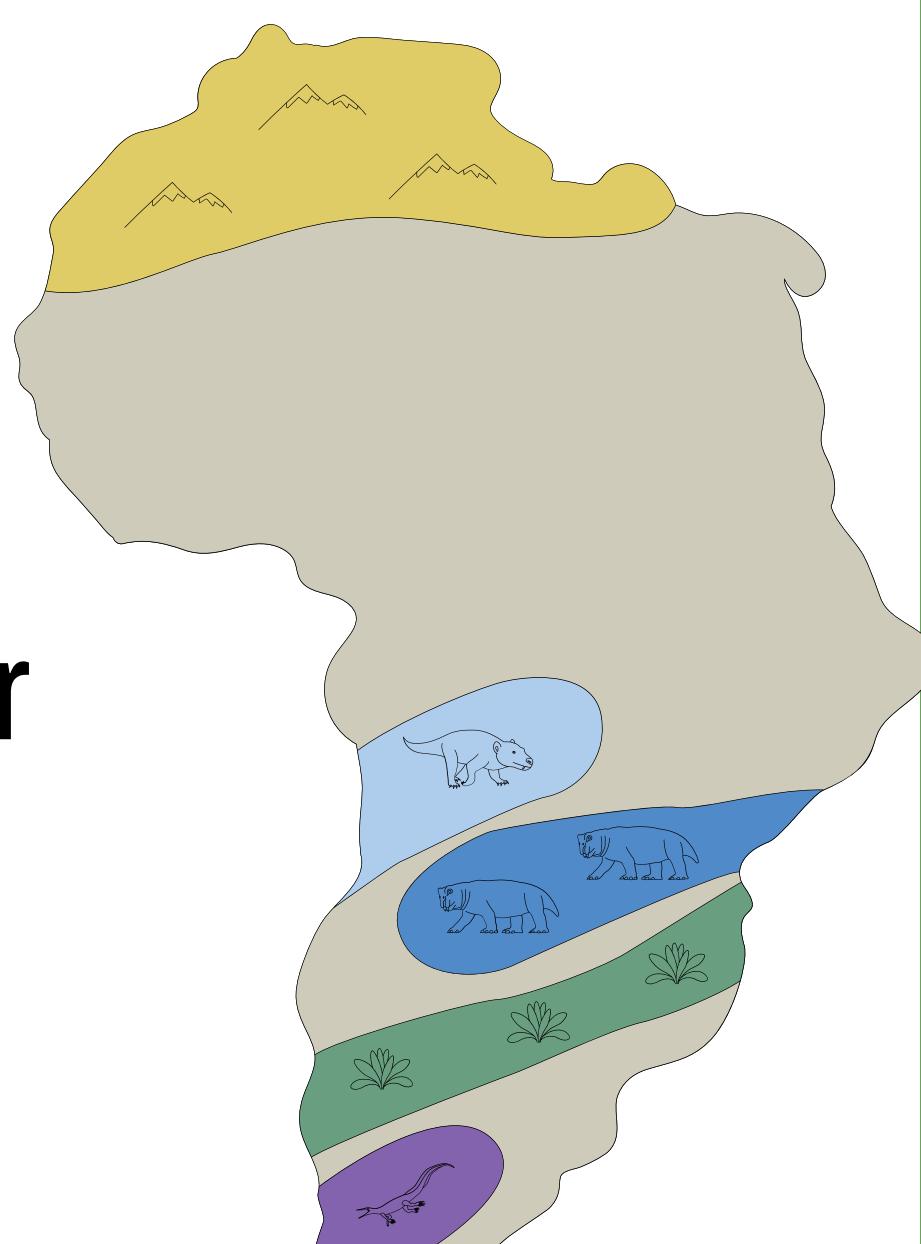
## Other Reactors

There is more then just PWRs and BWRs. There are a variety of reactors!

1. Gas Cooled Reactors
2. Light Water Graphite Reactors
3. Molten Salt Reactors
4. High-Temperature Gas-Cooled Reactors

## Did you know?

Over 2 billion years ago in Africa, there was a **natural reactor** in what is now Oklo, Gabon!

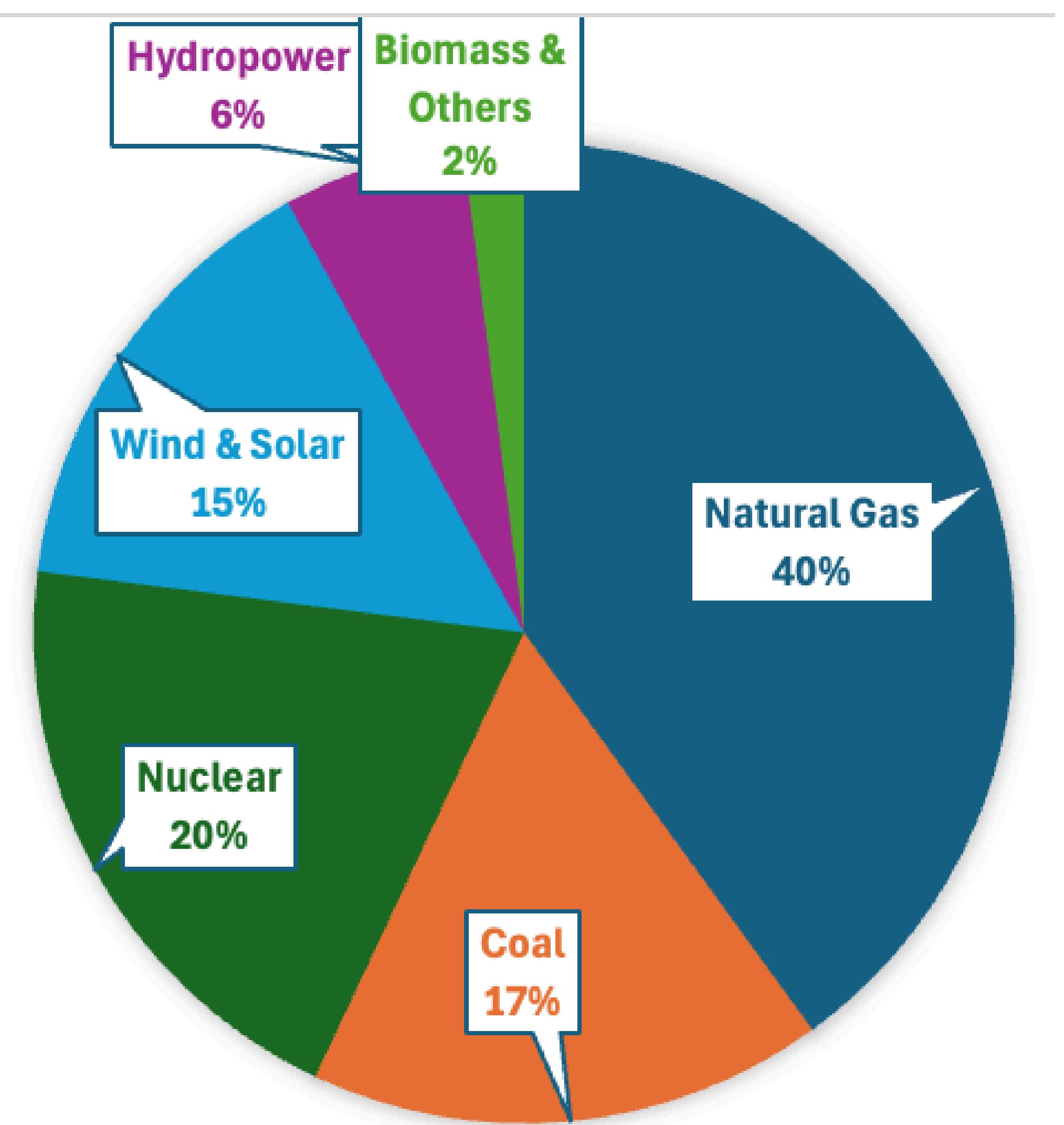


The uranium concentration was high enough for a sustained fission reaction, and the groundwater acted as a moderator. It ran intermittently for hundreds of thousands of years!

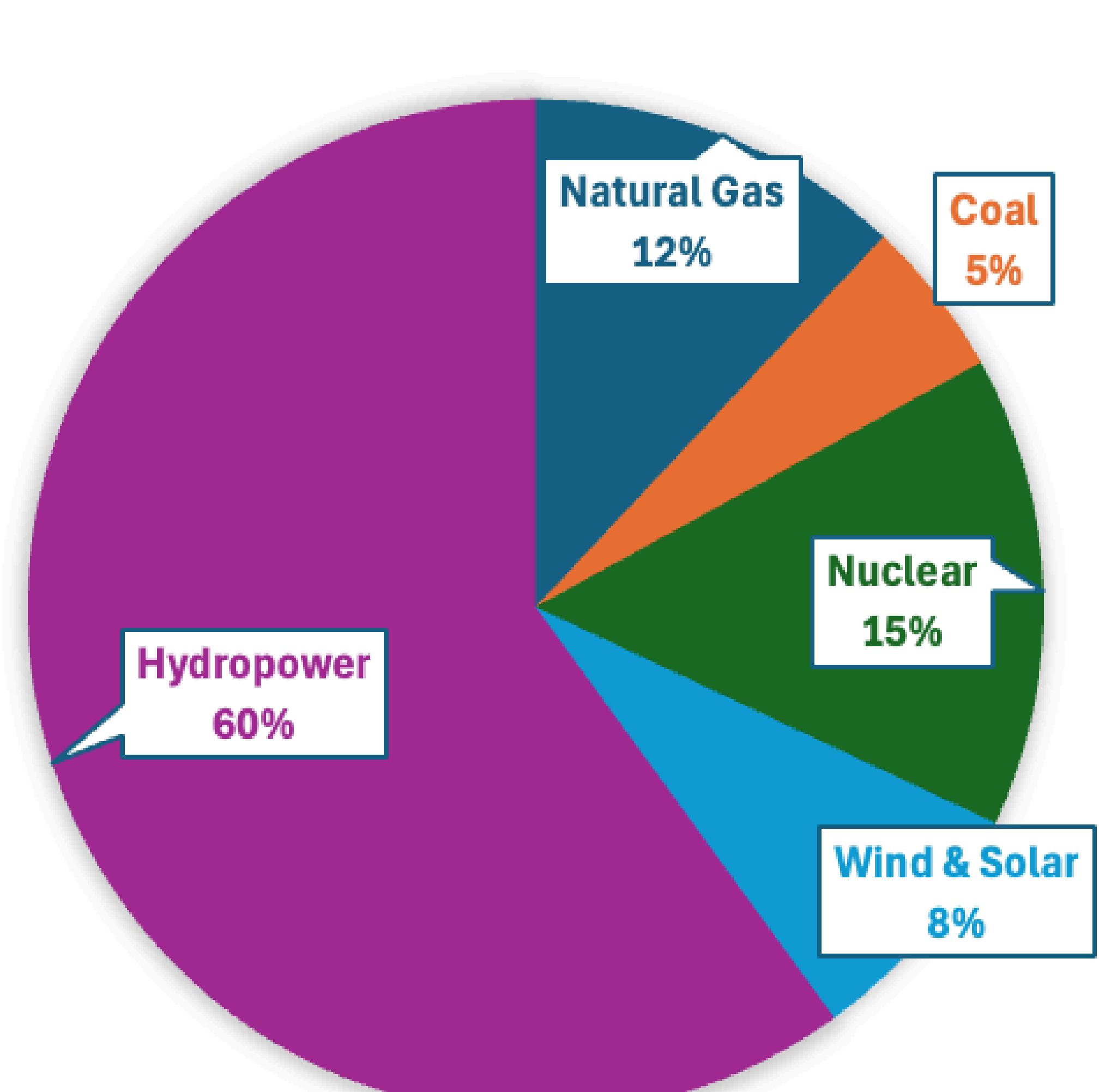
That's a wild reminder that nuclear fission is a natural process on Earth!

# North American Energy

## United States



## Canada



## Why is the Grid Important?

Where our energy comes from is like deciding what type of fuel to put into your car. Some is more efficient, some is more expensive, some makes more emissions.

### Cost and Affordability

Consumers pay for electricity. Things like nuclear and renewables have a more stable price, and fossil fuels tend to have a much more varying price due to power peaking.

### Energy Security

Relying on foreign nations for energy or for the fuel for energy can make countries vulnerable to supply disruptions or political conflict. Reliable energy is usable energy.

### The Environment

Different energy sources produce different byproducts - fossil fuels create carbon dioxide which can cause accelerated climate change, while nuclear and renewables don't.

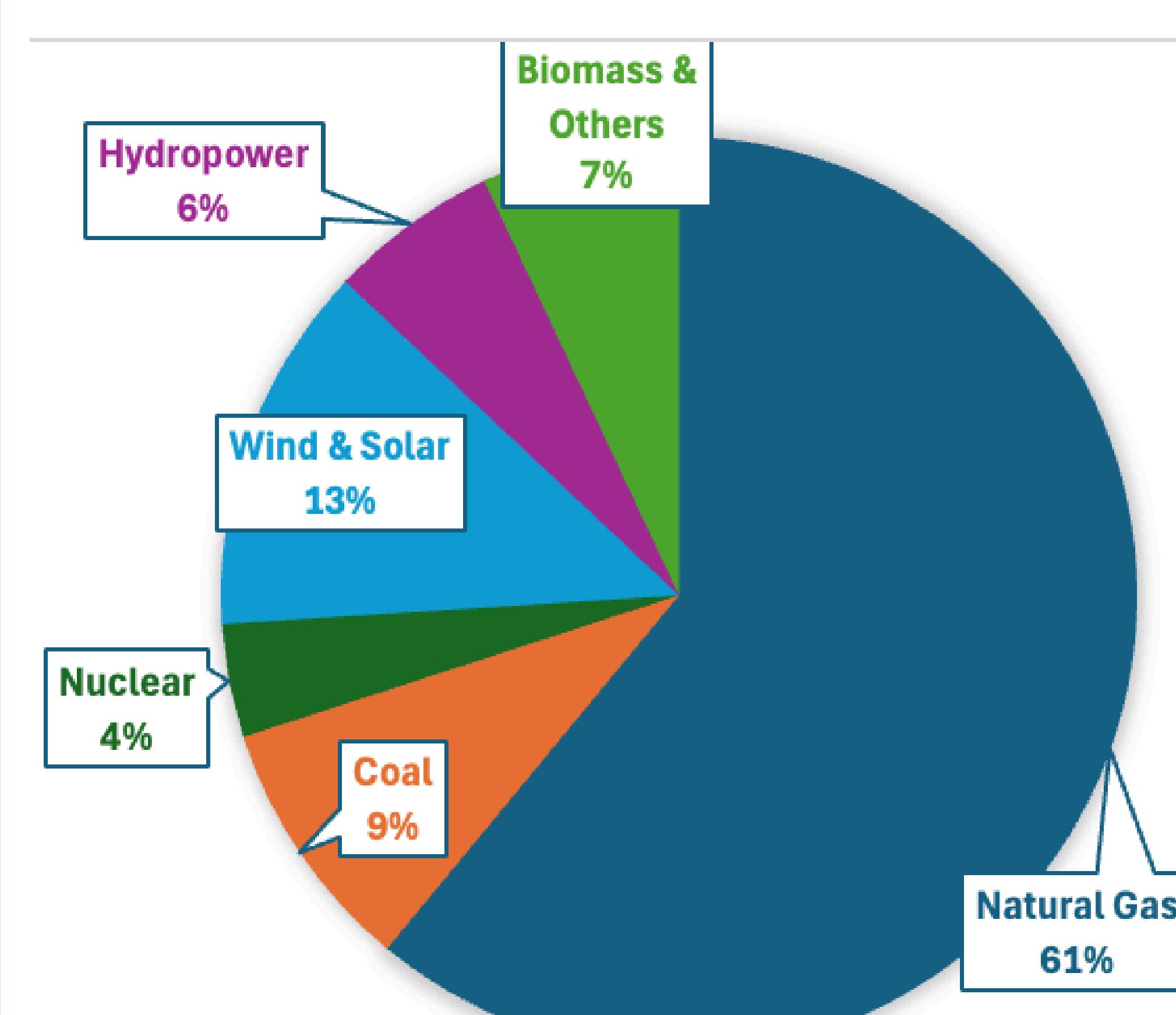
### Future Sustainability

Fuel types or construction capabilities are limited by materials available. There are finite sources for electricity generation. A good balance maintains sustainability.

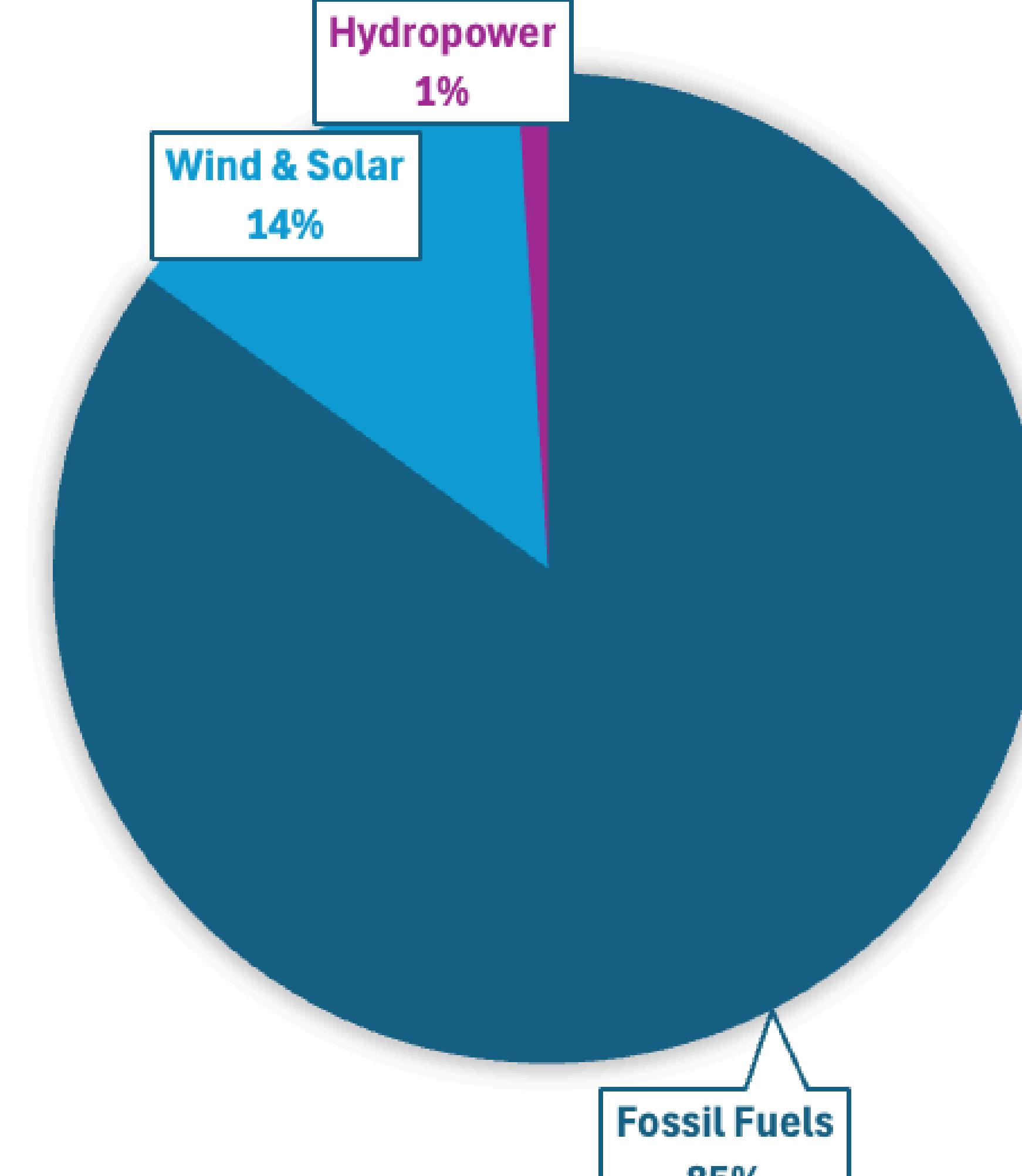
### Did You Know?

The United States electric grid is one of the largest machines in the world. Every part of it must operate at 60Hz, or it could ripple across the grid!

## Mexico



## Caribbean



Limited Information available

# Jobs in Nuclear

## A Role for You



There truly is a job for everyone in nuclear energy - ranging from a reactor operator, to an alligator wrangler, to security personnel.

Required education backgrounds can vary from high school level, all the way to PhD. And education doesn't stop you from making a strong career!



## Location



There are 54 nuclear power plants with 94 operating reactors as of 2025, in a variety of states.

Labs, medical facilities, and more have continued location access. Some utility companies have corporate offices away from the stations that is closer to bigger cities as well. Most stations and offices are in the midwest, south, and east coast with a few options in the western region too.

## There's a Job For You!

Job Category	Title Examples
Skilled Trades & Technical Work	Nuclear Reactor Operator, Radiation Protection Technicians, Welders, Electricians, & Pipefitters
Science & Engineering	Nuclear Engineer, Health Physicists, Core Designer, Material Scientists, Systems Engineering
IT & Cybersecurity	Grid Security Analysts, Data Analysts, Cyber Security Specialist, Software Development
Policy & Communications	Government Affairs, Regulatory Specialists, Environmental Specialists, Public Affairs, Marketing

and MORE!

- Nuclear jobs are
- 1. High Pay
- 2. Industry Growth
- 3. Mission-Driven

Various roles in a utility, at a vendor, at a supplier, at a research lab, and more! Nuclear is a large industry.

Nuclear energy provides 70,000 primary jobs and 250,000 secondary jobs

## Salary & Pay

The average nuclear worker has a salary of \$87,706 in 2025. According to the Bureau of Labor Statistics, nuclear technicians have a median annual salary of \$104,240. Senior Reactor Operators can make upwards of \$200,000 in salary.

## Did you know?

Astronauts and nuclear workers have one thing in common, and that is extensive radiation training!



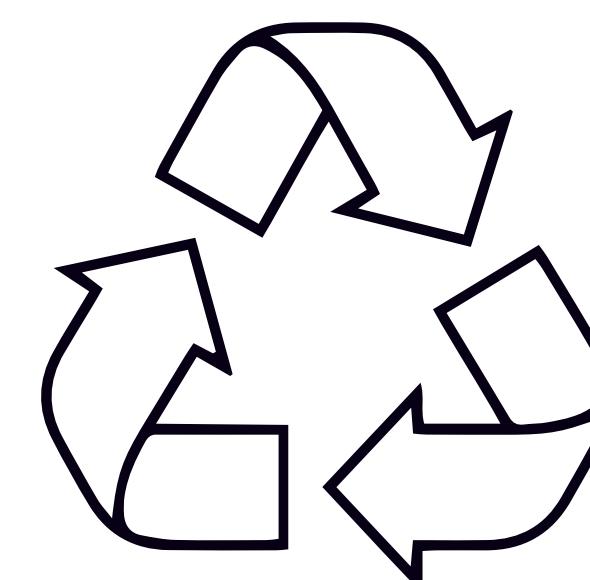
Similar principals of radiation apply to astronauts who have a bigger concern about cosmic radiation. So, if you work in nuclear, think of yourself as a terrestrial astronaut - you use science to help safely harness some universal forces for mankind's benefit!

# What About Waste?

## What is Nuclear Waste?

Nuclear waste refers to radioactive material that is left over after some type of process. This could be contaminated gloves or shoes after entering containment. However, most people refer to the spent nuclear fuel bundles when asking about waste. Many other industries produce radioactive waste, including the medical, industrial, and research industries.

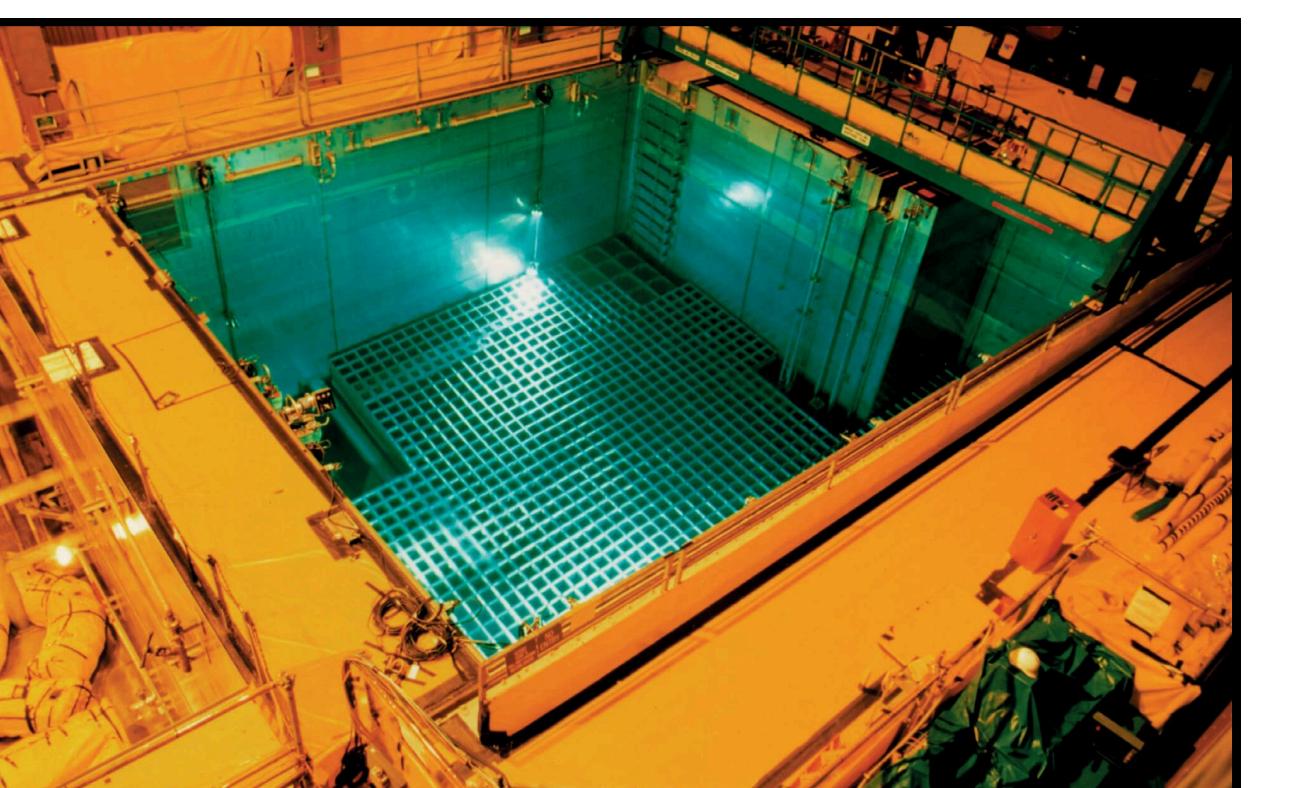
## Reprocessing

 Spent nuclear fuel bundles can be reprocessed or reused!

Because a spent nuclear fuel bundle only uses approximately 5% of its overall energy over the course of three cycles, there is still 90-95% of the material that can be reused. Nations like France, Japan, and Russia are already doing reprocessing by separating out the usable material.

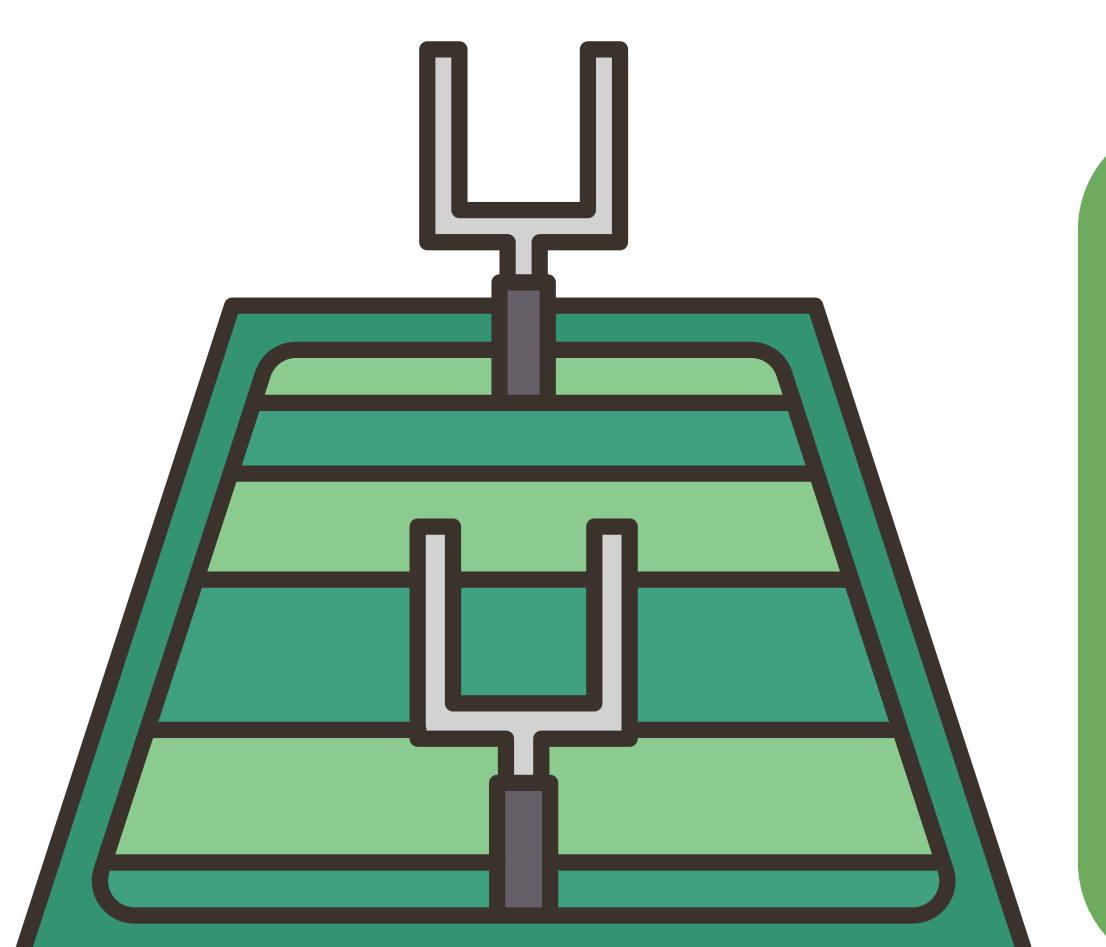
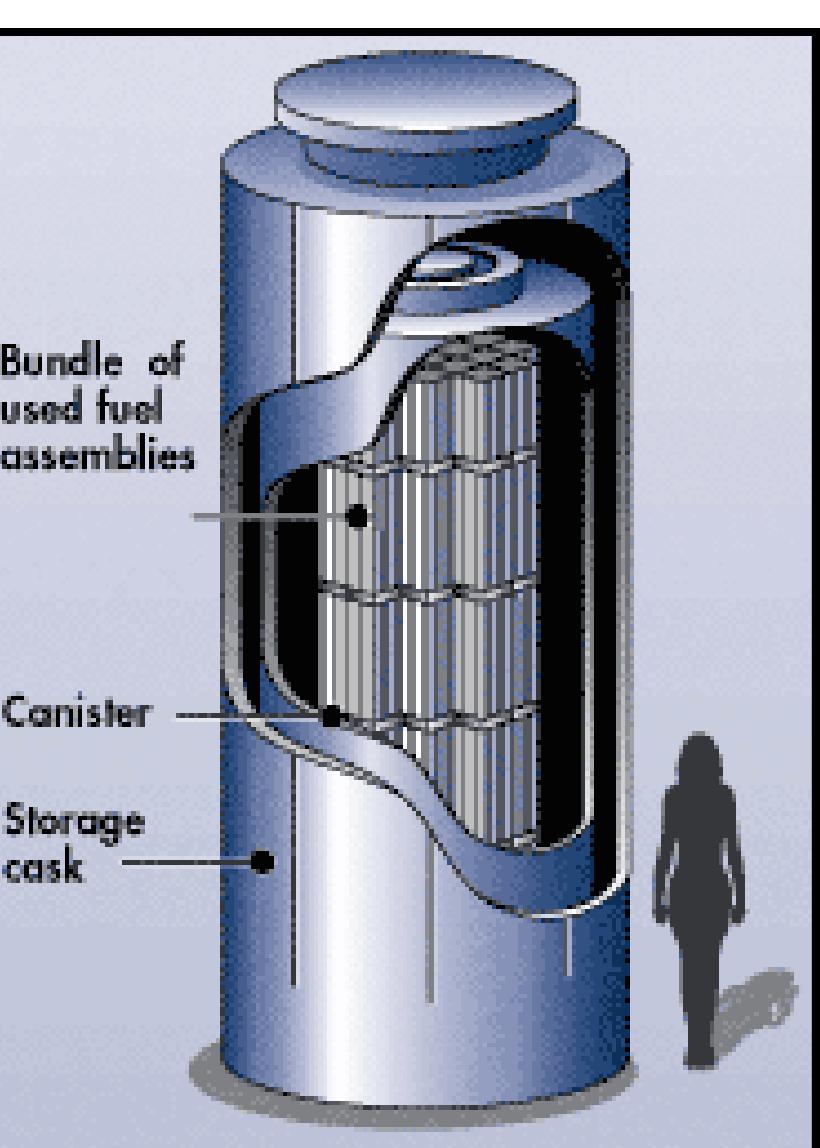
## Today's Storage

The United States has approximately 90,000 metric tons of spent nuclear fuel as of 2023. That is after about 60 years of generating 20% of America's electricity. This spent nuclear fuel is currently stored in what is called dry cask storage.



After being in operation for about three cycles (6-8 years), spent fuel bundles sit in the spent fuel pool to cool down. They can spend 7-30 years in the pool.

After sitting in the spent fuel pool, the bundles are moved to dry casks. Dry casks can fit multiple bundles in each cask. These casks are then stored on site and under security protection.



All of the spent nuclear fuel in the United States would fit on a football field, stacked about 30 feet high. Think the same size as a super size Walmart!

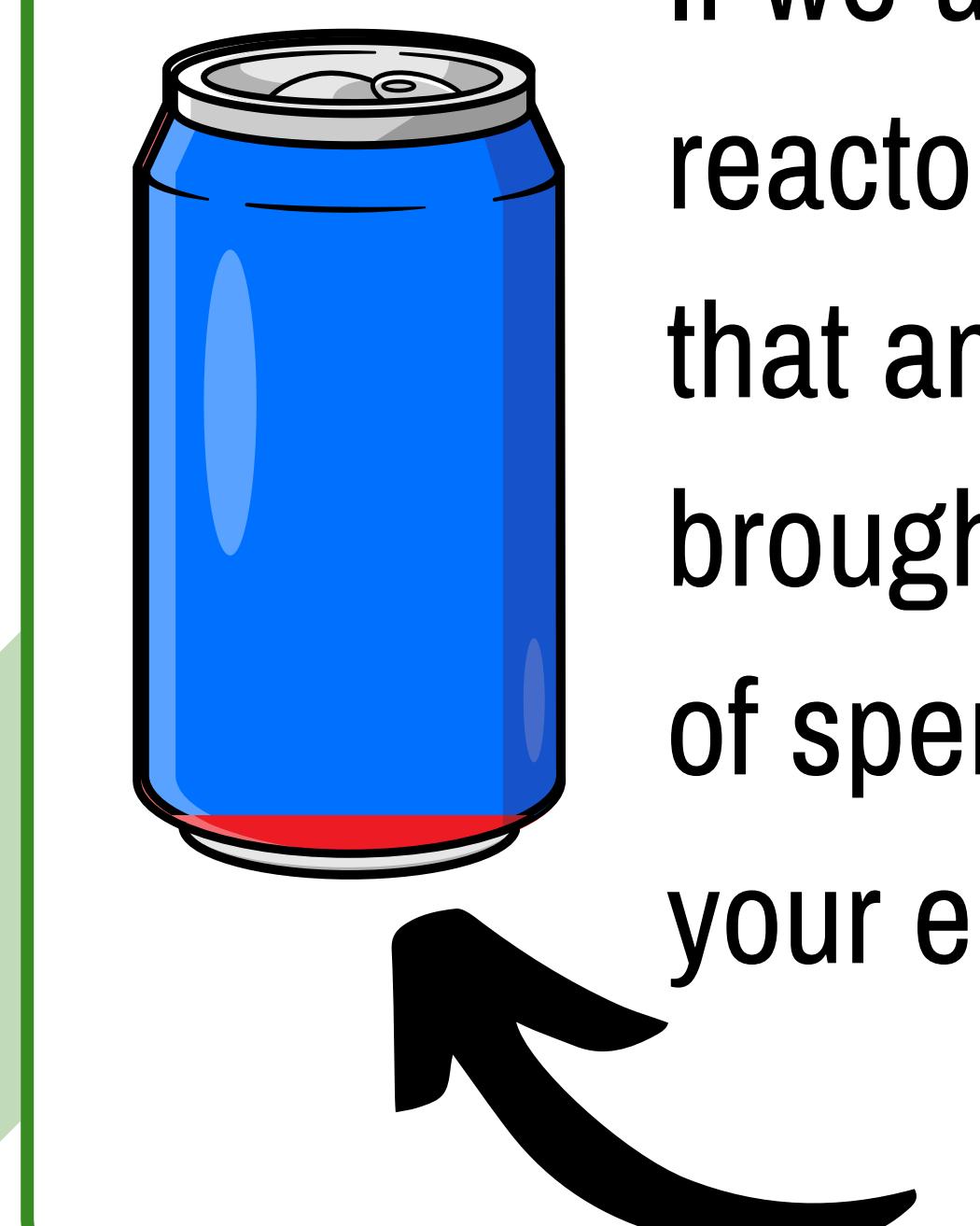
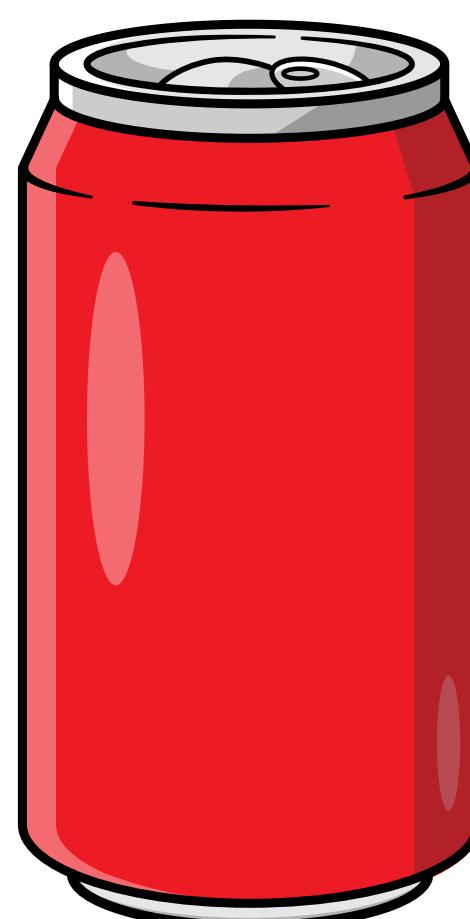
Policy is a primary reason that there is no permanent waste storage facility in the United States. The science to store nuclear waste is safely there - we see it with this technology already!

## Long-Term Waste

While the US does not have a long term storage facility, Finland is constructing the first permanent waste depository. It is expected to be operational by 2025. It stores the material approximately 430 meters (1410 feet) underground.

## Did you know?

If your entire life was powered by nuclear energy, the amount of spent nuclear fuel you would create would fit inside of this soda can!



If we use breeder reactors and reprocessing, that amount can be brought down to 0.83 fl oz of spent nuclear fuel for your entire lifetime!