

# NAVIGATING™ NUCLEAR

Energizing Our World



## NUCLEAR ENERGY



# Nuclear Power: Fact or Misconception?

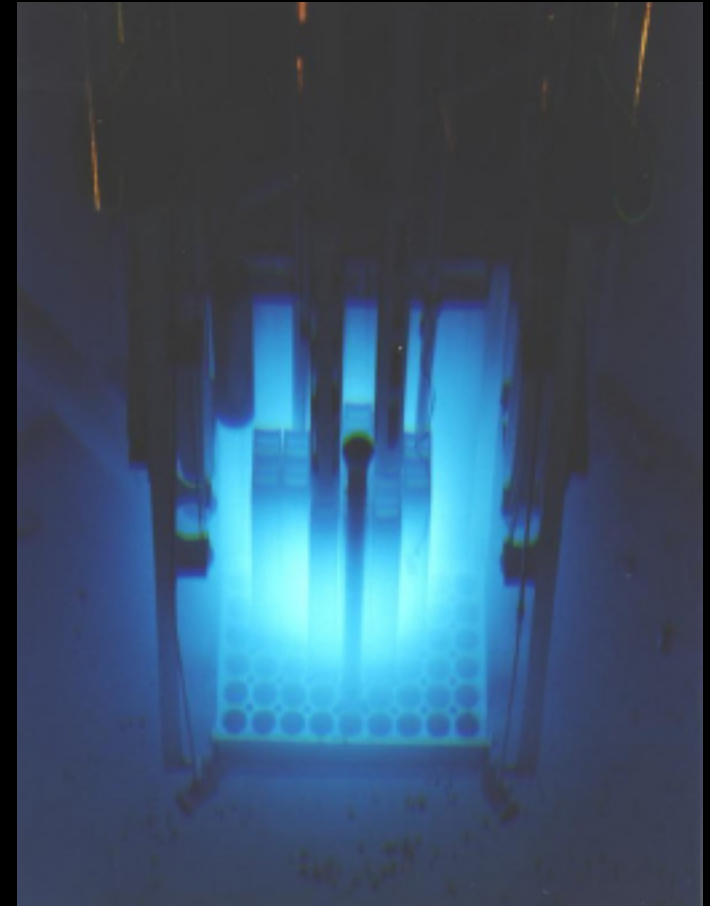
- **Claim 1:** A nuclear reactor can explode like a nuclear bomb.
- **Claim 2:** Nuclear energy is bad for the environment.
- **Claim 3:** Nuclear power releases dangerous amounts of radiation into the atmosphere.
- **Claim 4:** Nuclear power plants are some of the safest and most secure workplace facilities in the U.S.



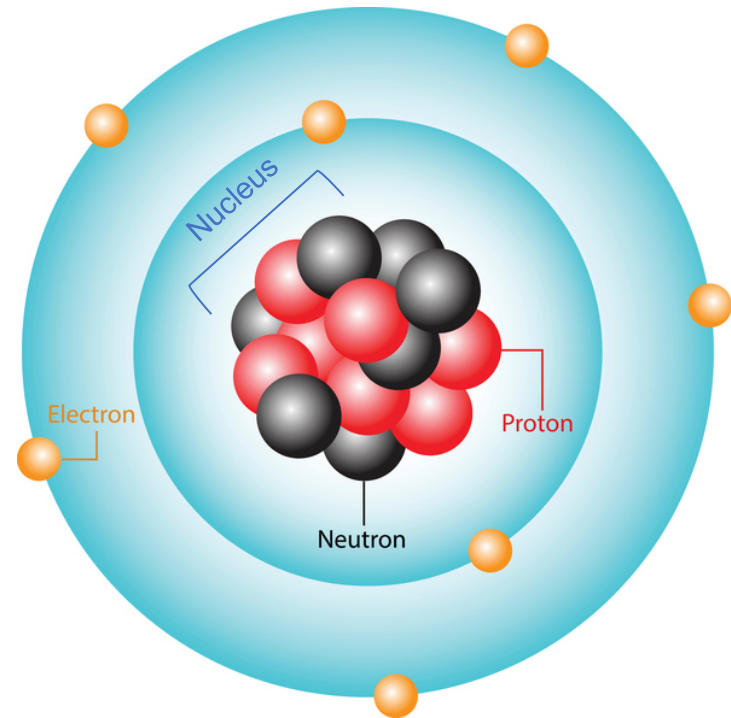
# Lesson Objectives

## You will:

- Model the natural physical process of nuclear fission.
- Evaluate the benefits and risks of nuclear power, especially in comparison to other power sources.
- Analyze and communicate the science behind uses of nuclear power.

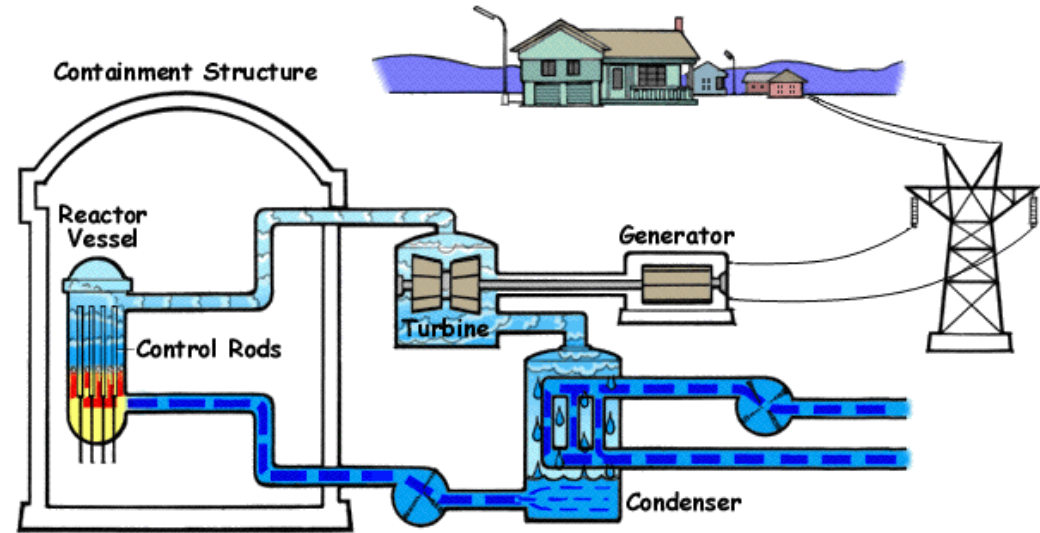


- Atoms make up all matter, and they are made up of three smaller particles.
- The atom's nucleus contains two of the small particles, known as neutrons and protons.
- Each element can have different numbers of neutrons, but always the same number of protons. Elements with different numbers of neutrons are called isotopes.

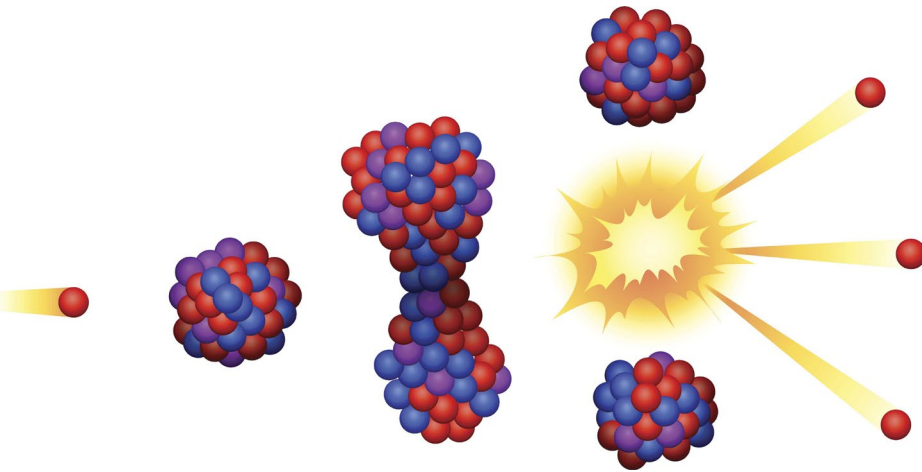


# Boiling Water Reactor

- What do you think is happening in this animation?
- What do you predict is the purpose of a boiling water reactor?
- Can you explain where you have seen or heard the words turbine or generator before?



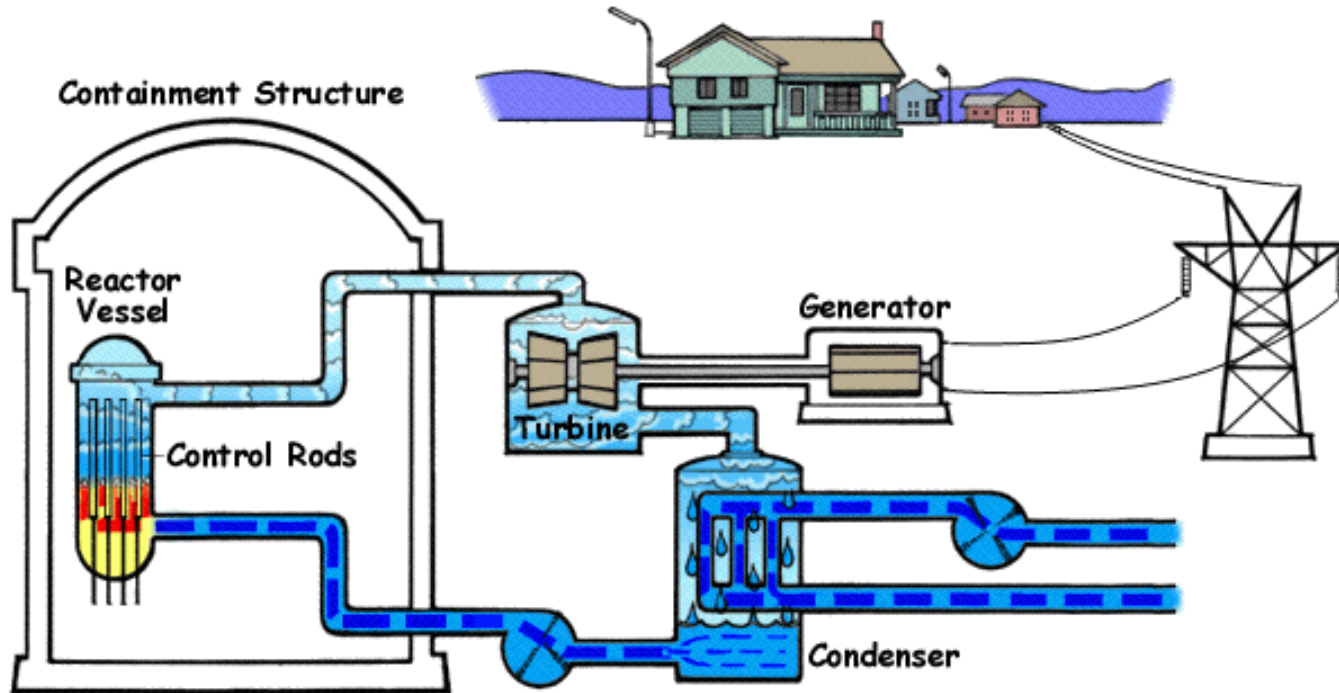
# Nuclear Fission



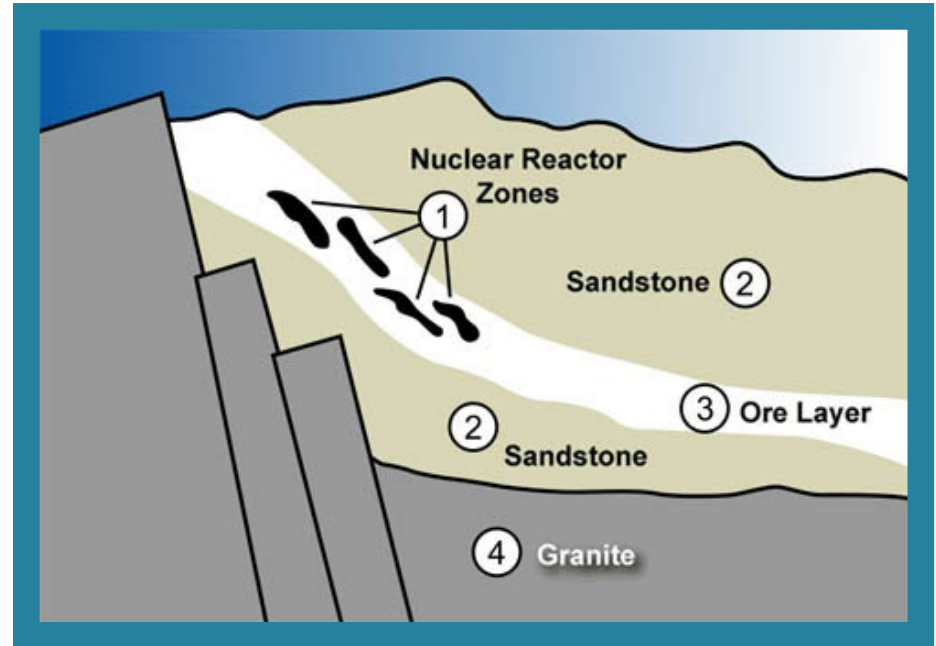
- The nucleus vibrates and splits.
- A neutron strikes the nucleus of a heavy and unstable isotope.
- A nucleus being split results in fission.
- Heat energy is produced.
- The nucleus becomes unstable.

# Boiling Water Reactor

- Where in the nuclear reactor is fission occurring?
- What is the water being used for?



# Oklo, the two Billion Year Old Nuclear Reactor!

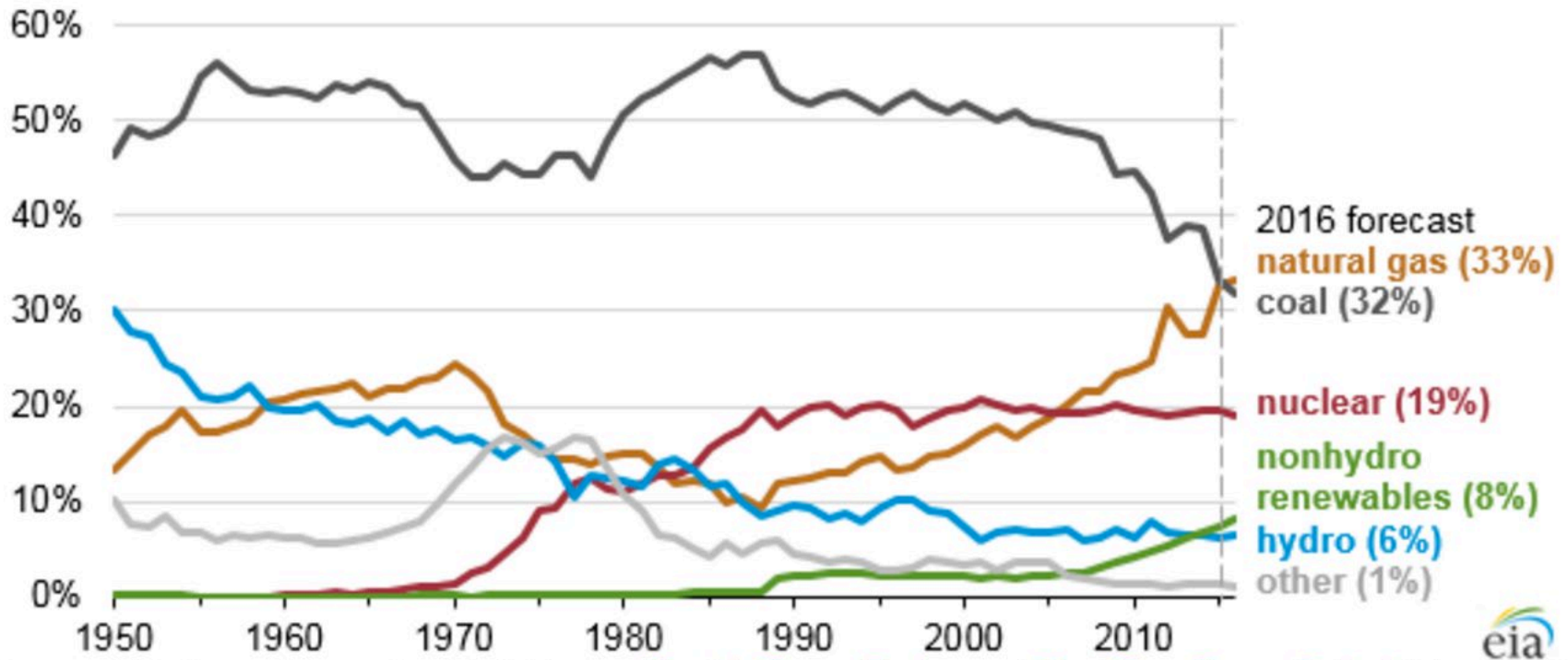


[Click to view video](#)



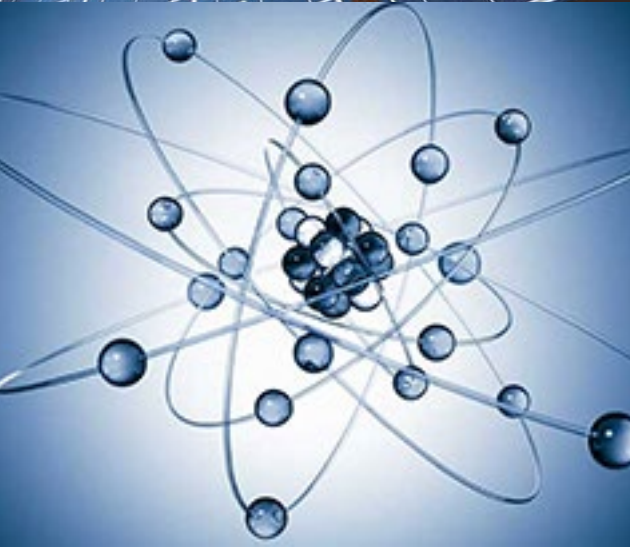
# Historical Use of Nuclear Power Data

**Annual share of total U.S. electricity generation by source (1950-2016)**  
percent of total



Source: U.S. Energy Information Administration, *Monthly Energy Review*, and *Short-Term Energy Outlook* (March 2016)

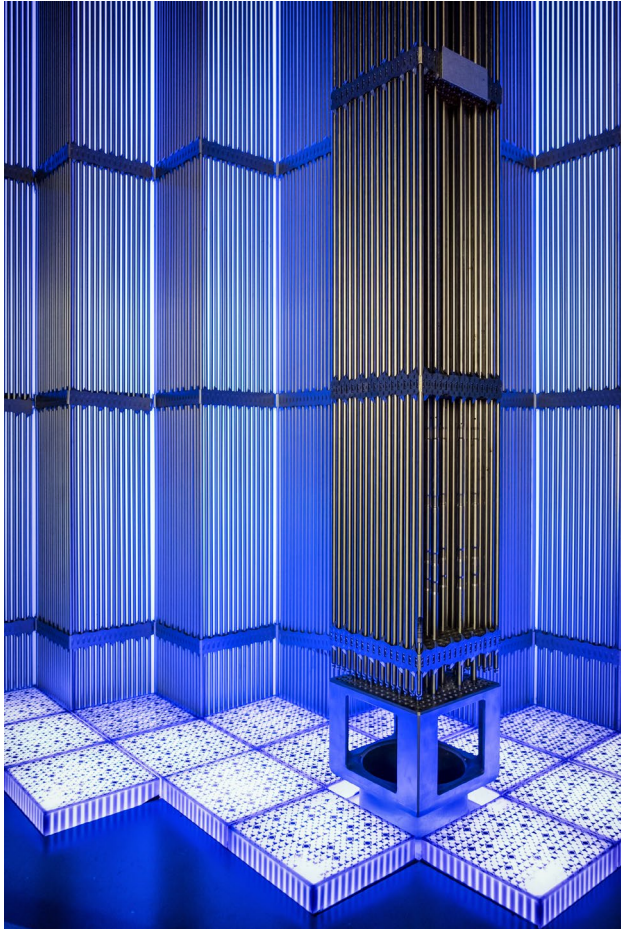
# What Powers our World?



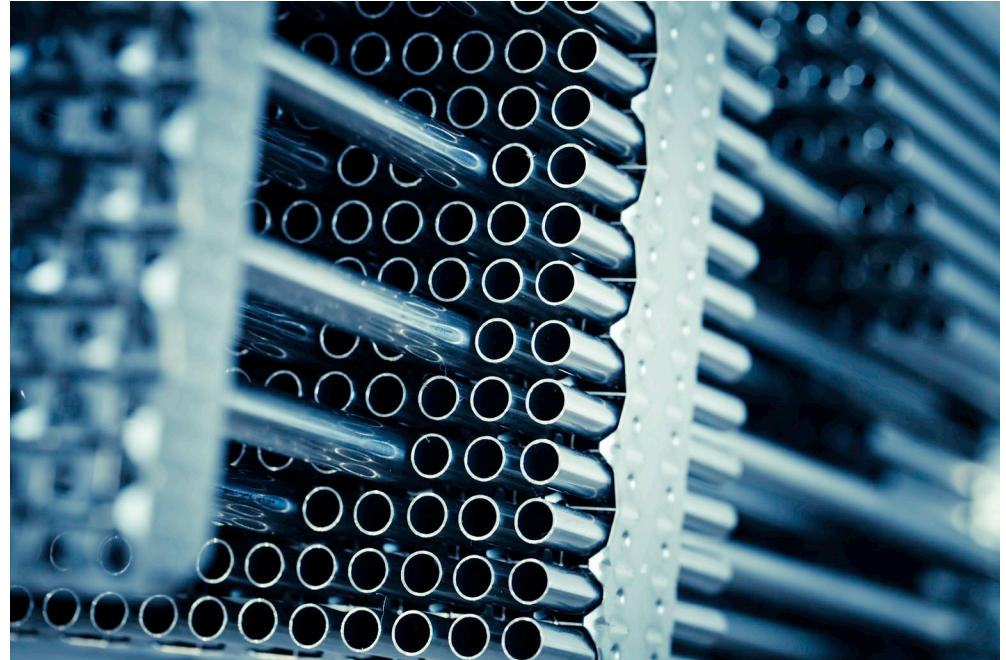
# Benefits of Nuclear Power

- **No carbon emissions:** The primary benefit of nuclear power over fossil fuel power is that it is a low-emission power source
- **Low fuel costs:** The uranium fuel for a nuclear reactor costs roughly 20% of the cost of energy generated.
- **Stable power source:** Unlike renewable energy sources like solar and wind, nuclear provides continuous, reliable power.
- **Safety:** Considering the effects of mining, drilling, and pollution, nuclear power is safer than fossil fuel power plants.





How a bundle of fuel rods fits into the reactor



Up close image of the fuel rods

- Nuclear power consists of nuclear reactions that generate heat.
- Many stated risks of nuclear energy will be inaccurate, including the explosive potential, radiation release, and the hazards to people near the nuclear reactors.
- The biggest benefits of nuclear power include that it is a low-emission energy source, the fuel is cheap, and that it is safer than other power sources such as fossil fuel plants.
- Nuclear power generally generates electricity by heating water into steam that turns a turbine attached to a generator, which generates the electricity.

# Using Nuclear to Generate Electricity

