Nonrenewable Energy

by Sophia

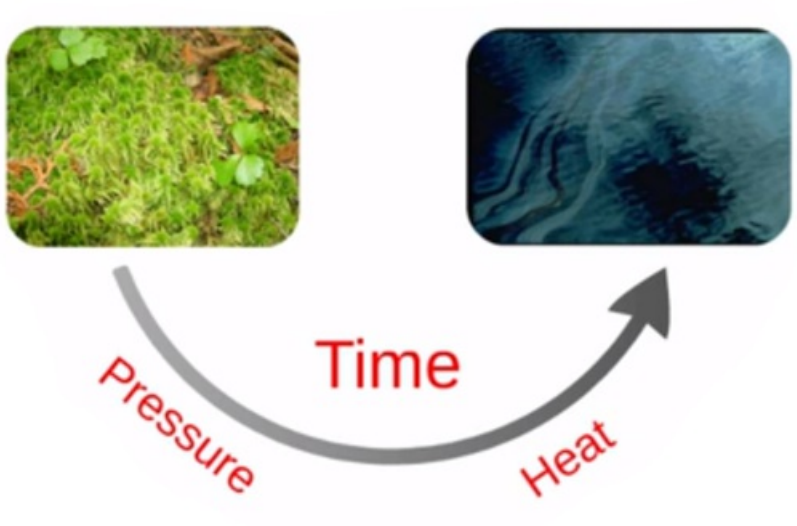
WHAT'S COVERED

In this lesson, we will cover the topic of nonrenewable energy. We will discuss its production from finite fuel sources and the formation of its primary source, which is fossil fuels. We will discuss the four major sources of nonrenewable energy: oil, natural gas, coal, and nuclear energy, as well as their impacts. Lastly, we will explore the future of fossil fuels. Specifically, this lesson will cover the following:

1. Formation of Nonrenewable Energy

Unlike renewable energy, nonrenewable energy is produced using finite fuel sources, the vast majority of which are fossil fuels such as coal, natural gas, and oil.

Fossil fuels that we use today were created millions of years ago. Fossil fuels are formed when microorganisms and organic matter, such as peat moss decay, get buried under sediment and undergo high levels of pressure and heat over a long period of time, which could be thousands or millions of years, until they eventually become a fossil fuel.



One of the primary reasons fossil fuels are so useful is that their formation compresses large amounts of organic matter and its energy into a small space. The result is an extremely energy-dense fuel source. While this process has not stopped and is even happening right now, the organic material currently being turned into fossil fuels won't be ready for millions of years.

HINT

Because of the long durations needed for their formation, fossil fuels are generally considered to be finite because they won't be replenished in a reasonable human lifespan or else would be too costly to access.

2. Sources of Nonrenewable Energy

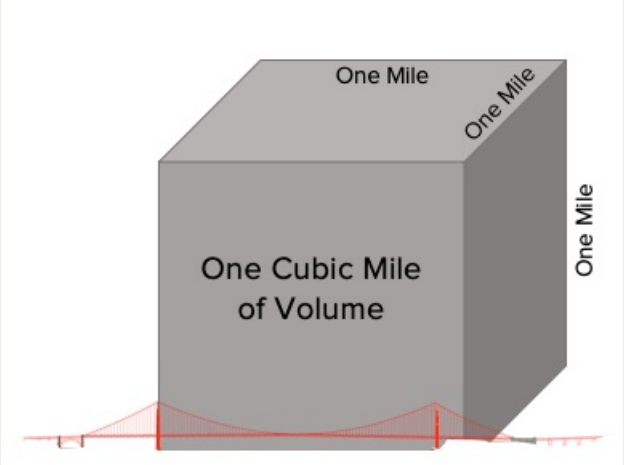
There are four major sources of nonrenewable energy. The first three are fossil fuels—coal, oil, and natural gas—and the fourth is nuclear energy, which is a nonfossil fuel.

2a. Oil

Oil is a hydrocarbon liquid found underground, and it is burned for energy. Oil is prized worldwide as one of the most valuable substances on Earth. It has a wide variety of uses, from providing fuel for transportation to being an ingredient in petrochemical products, such as plastic.

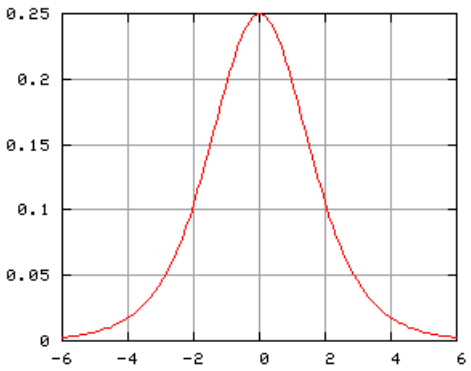
IN CONTEXT

To provide some context on just how valuable oil is globally, look at the diagram below. At the time of making this tutorial, annual worldwide oil production and consumption is 1 cubic mile, meaning that if you made a glass cube one mile across, one mile deep, and one mile high, it would just about hold the oil used by all humans in one year.



A cube that size makes the Golden Gate Bridge look small!

Peak oil is a point in time where the historical maximum rate of oil production will be reached before it begins to decline. Peak oil looks something like the graph below. Currently, world oil supplies are peaking, yet global demand for oil is still increasing.



If not managed properly, oil can have widespread negative impacts.

Negative Impacts of Oil	
Environmental	**Human Health**
Water and land pollution from oil spills and leaks, which can damage flora and fauna. Air pollution from burning, which can lead to climate change.	Respiratory diseases from fumes Cancer from exposure to benzene compounds

2b. Natural Gas

Natural gas, which is a fossil fuel, comes from pockets of hydrocarbon gas, such as methane. These pockets are found underground and occur naturally. They are harvested to be burned for heating and electricity.

Natural gas has both environmental and human health concerns.

Negative Impacts of Natural Gas	
Environmental	**Human Health**
Distribution lines can damage habitat It can contaminate water supplies. Burning it produces carbon dioxide and other air pollutants that can contribute to climate change.	Respiratory illnesses like asthma, emphysema, and bronchitis, which can be exacerbated by the gases and air pollution it produces.

IN CONTEXT

In recent years, natural gas production and consumption have drastically increased because of new technology such as hydraulic fracturing, also called fracking. Fracking is used to allow humans to reach previously challenging pockets of natural gas. Fracking can cause water pollution issues because it requires liquids being pumped underground at high pressures to fracture the earth. These liquids can then leak into the water table.

2c. Coal

Coal, another fossil fuel, is widely available and used to heat water boilers. The boilers produce steam that, in

turn, spins a turbine in a generator to create electricity.

Coal can have impacts on the environment and human health.

Negative Impacts of Coal	
Environmental	**Human Health**
Acid rain from sulfur dioxide Respiratory problems in animals, which can result from inhaling particulate matter Mining operations, which generate water pollution if not properly managed Carbon dioxide production, which can contribute to climate change	Respiratory problems Heavy metal toxicity

HINT

Despite coal's rise over the last century, it has recently been declining as the use of natural gas has increased and government regulations have enforced emission requirements.

2d. Nuclear Energy

Nuclear energy, which is not a fossil fuel, harnesses the heat generated from the radioactive decay of a

particular form of uranium. Nuclear energy is considered finite and nonrenewable because it is dependent on mined minerals, which take long periods of time to form. Nuclear energy is used for electricity production and accounts for 6% of the world's energy, and 13–14% of its electricity.

Nuclear energy also has negative impacts on the environment and human health.

Negative Impacts of Nuclear Energy	
Environmental	**Human Health**
Damage flora and fauna if its reactor or storage tanks leak Hazardous far beyond its immediate vicinity because radioactive material can travel long distances and affect locations thousands of miles away	Linked to cancer

While nuclear energy produces no air emissions and is considered a clean source of energy, by far one of the biggest issues with nuclear energy is the storage of materials that remain after the energy is created or the radioactive nuclear waste. The amount of time it takes for 50% of a radioactive element to decay is called its **half-life**. Depending on the elements created during fuel production, some of this waste will remain radioactive for thousands of years. As a result, nuclear waste must be stored in a way that will minimize damage to the natural environment and humans for thousands of years.

IN CONTEXT

Most nuclear waste is stored deep underground in holding pools with very thick concrete walls, but this is not a permanent solution. Currently, there are no long-term storage facilities for nuclear waste in the United States, but there is a proposed site in Nevada called Yucca Mountain. This project is

currently on hold as it faces strong opposition from the public, including the Western Shoshone tribe, the original inhabitants of the land.

THINK ABOUT IT

How would you feel about a nuclear waste site being built in your state or in your neighborhood?

BIG IDEA

Nuclear energy becomes particularly problematic when it comes time to shut down a plant because the waste stays radioactive for hundreds of thousands of years, so storing it is a challenge.

TERM TO KNOW

Half-Life

The amount of time it takes for 50% of a radioactive element to decay.

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3. Future of Fossil Fuels

The worldwide popularity of fossil fuels as an energy source has resulted from their abundance globally and their energy-dense nature. However, at their current rate of use and given the fact that they take millions of years to form, they are eventually going to be depleted. This means that renewable energies and alternative forms of energy are going to have to make up for the deficit of fossil fuels in future. If not that, our energy demand will need to drastically decrease.

SUMMARY

In this lesson, we learned about the **formation of nonrenewable energy**, which is produced using finite fuel sources, the vast majority of which are fossil fuels such as coal, natural gas, and oil. We learned about the formation of fossil fuels and discussed the four main **sources of nonrenewable energy**: **oil**, **natural gas**, **coal** (which are all fossil fuels), and **nuclear energy** (which is not a fossil fuel). Lastly, we learned about the impacts of nonrenewable energy sources and the **future of fossil fuels**.

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TERMS TO KNOW

Half-Life

The amount of time it takes for 50% of a radioactive element to decay.