

# Nonrenewable Energy Sources

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<b>Strand</b>	Earth Resources
<b>Topic</b>	Nonrenewable resources
<b>Primary SOL</b>	3.11 The student will investigate and understand different sources of energy. Key concepts include c) sources of nonrenewable energy.
<b>Related SOL</b>	3.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which c) objects with similar characteristics or properties are classified into at least two sets and two subsets; j) inferences are made and conclusions are drawn; m) current applications are used to reinforce science concepts.

## Background Information

Generators use two forms of mechanical energy to produce electricity: mechanical energy derived from *nonrenewable* energy sources, and mechanical energy derived from *renewable* energy sources.

Nonrenewable energy sources include fossil fuel oil, nuclear energy, coal, and natural gas. When coal, oil, and natural gas are burned in a power plant, the heat is applied to water in order to create steam, which then turns the turbine in a generator, and produces electricity. Nuclear energy is produced when uranium atoms are split apart through a chemical process called fission. This reaction produces a massive amount of heat, which turns water into steam. This steam then turns the turbines in a generator in order to produce electricity.

There are advantages and disadvantages to using each of the nonrenewable energy sources. Coal is relatively inexpensive, and there is a large supply of it, so it is an economical resource for energy production. However, mining for coal damages ecological systems, and burning coal releases air pollution. Oil is also an economical energy source, however, there is not a reliable supply because oil deposits are localized. Oil mining also damages the environment when it results in oil spills. Natural gas is another moderately economical approach to energy production, but supplies are limited to specific areas, and must be transported long distances to supply regions that do not contain natural gas fields. Nuclear fission, unlike the other nonrenewable energy sources, does not produce air pollution. However, building nuclear reactors to generate electricity is very expensive, and there is no known way to dispose of the extremely hazardous waste products which nuclear fission produces.

Though all four kinds of nonrenewable energy sources have individual advantages and disadvantages, there is one surmounting problem with them that will likely never be solved. The earth contains only a limited supply of each of these resources, and there is no way to produce more of them once we deplete our natural deposits. Many people fear what will happen when energy production exhaust the



environment of these natural resources, and this concern has led to a new push in the energy industry to transition to renewable energy sources.

## Materials

- Construction paper
- One simple circuit kit for each group in your class.  
Each kit should include:
  - one electrical circuit setup board
  - one AA battery
  - two wires, stripped on each end
  - one light bulb holder
  - one battery holder
  - one light bulb



## Vocabulary

*energy, nonrenewable energy source, fossil fuel oil, nuclear fission, coal, natural gas,*

## Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

### Introduction

1. Review the definition of electricity.  
Electricity is a kind of energy that makes heat, light, and movement.
2. Ask students where electricity comes from and how it is generated.  
Electricity travels to schools and homes through power lines, from power plants where it is generated through mechanical or chemical processes.
3. Ask students to name resources that are used to produce electricity.  
Electricity is usually generated when coal, oil, or natural gas is burned. Other methods of generation include nuclear fission, burning biomass, solar, wind, geothermal, and hydropower. It is not necessary to study the renewable generation methods until the next lesson.

### Procedure

1. Have students work in groups to create electrical circuits with one light bulb and battery, following the Build a Simple Circuit instruction packet. Students will watch their lights in order to learn about nonrenewable energy sources. This experiment will work more quickly if you use batteries with very little electrical charge left in them. Therefore previously-used batteries are best, because the electric charge will run out sooner. Allow the simple circuit lights to continue burning somewhere where students can see them while you continue with the lesson. Revisit the lights occasionally. **10 minutes**  
*If circuit building materials are not available, this concept may be demonstrated with a candle or a battery-operated flash light. For the flashlight, follow the instructions in Step*



7. For the candle, explain how fuel sources (like the wick and wax) eventually run out. Include the concepts in Step 7.
2. Discuss the four nonrenewable energy sources: fossil fuel oil, nuclear, coal, natural gas. Explain what it means for these sources to be nonrenewable.  
Nonrenewable energy sources are limited, and cannot be replenished once used.
3. Explain how each is used to generate electricity.  
Oil, coal, and natural gas are burned to produce heat. Nuclear fission is a chemical process which also produces heat. In either case, the heat is used to boil water. The steam produced turns a turbine which generates electrical energy when it spins.
4. Ask students why it could be harmful to continue using these resources.  
These resources may eventually run out, leaving fewer options for energy production.
5. Give each student a piece of construction paper. Fold each sheet in half, and have students illustrate the four nonrenewable energy sources one half of the paper. They may use paper cutouts, magazine clippings, or their own drawings. Under each picture, have students list the advantages and disadvantages of using each energy source to produce electricity. Save this paper until after the lesson on renewable energy sources. After students have completed the lesson on renewable energy sources, they will illustrate the five renewable energy sources and list the advantages and disadvantages of each on the other half of the paper. Use the Renewable and Nonrenewable Energy Sources Factsheet to check answers. Allow struggling students to use the factsheet as a guide while creating their booklets. **15 minutes**
6. Revisit the circuit kits or flashlight once the battery charges are depleted and the bulb/s turn off.
7. Use batteries as an example of the effects of using nonrenewable energy sources. Explain how a battery generates electricity through chemical reactions, and how batteries lose their electric charge when the supply of chemicals is exhausted.  
A battery functions as a small-scale example of our environment. When the environment runs out of nonrenewable energy sources, producers will either run out of energy or have to turn to renewable energy sources to produce more electricity.

### Conclusion

1. Have students research Virginia's natural energy sources and locate them on a map, or reference the Virginia's Nonrenewable Energy Sources map. **30 minutes**  
Good web links for research include:  
[www.deq.virginia.gov](http://www.deq.virginia.gov)  
[www.dmme.virginia.gov](http://www.dmme.virginia.gov)  
[www.eia.gov](http://www.eia.gov)
2. Discuss the size and location of these resources. Discuss which nonrenewable energy sources benefit Virginia the most, and the advantages they provide for local energy production.  
Coal is Virginia's largest nonrenewable resource supply. Most of Virginia's natural gas is produced through natural chemical reactions in Virginia's



coalfields. Very little oil is harvested in Virginia. Virginia’s local energy resources allow electricity to be produced within the state, which cuts down on transportation costs and provides more jobs to local residents.

### Assessment

- **Questions**
  - Why are oil, nuclear energy, coal, natural gas considered nonrenewable?  
Oil, coal, natural gas, and the supplies for nuclear fission are limited, and cannot be replenished once used
- **Other**
  - Write a journal article or create a story answering this question: Even though nonrenewable energy sources seem to be inexpensive options now, can you think of ways they could end up costing more in the long run? Explore the ideas of pollution, damages to the environment, effects on the ecosystem etc. Include the following vocabulary word bank for students to use.

Energy	Nonrenewable	Fossil fuel oil	Nuclear fission
Coal	Natural gas	Environment	Pollution

- Grade students’ books on nonrenewable energy sources.

### Extensions and Connections (for all students)

- Have students draw and label diagrams of oil, nuclear, coal, or natural gas generators, depicting how the nonrenewable energy source is used to generate electricity.
- Show videos about fission or mining.
  - Coal generator: <https://www.youtube.com/watch?v=rEJKiUYjW1E>
  - Gas Generator: <https://www.youtube.com/watch?v=Em1crnEt45Q>
  - Nuclear generator: <https://www.youtube.com/watch?v=VJflbBDR3e8>  
<https://www.youtube.com/watch?v=cnjGYHOePu0>
  - Oil Drilling: <https://www.youtube.com/watch?v=VY34PQUiwOQ>
- Have students identify the uses of nonrenewable energy sources in their communities.

### Strategies for Differentiation

- Give clues to struggling students that point them in the right direction when building their circuits.
- Allow students to use the Nonrenewable/Renewable Energy Sources factsheet as they complete their Renewable and Nonrenewable Energy Sources booklets.
- Work with struggling students in small groups to provide extra guidance as they assemble circuits.

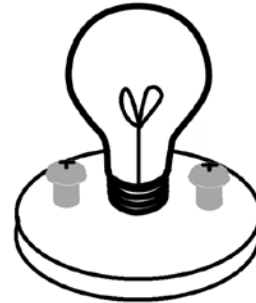


- Place struggling students in groups with gifted or excelling students, and have them work together.



# Build a Simple Circuit

1. Collect your materials.
  - 1 battery
  - 1 light bulb and bulb holder
  - Two plastic-coated wires
  - Tape

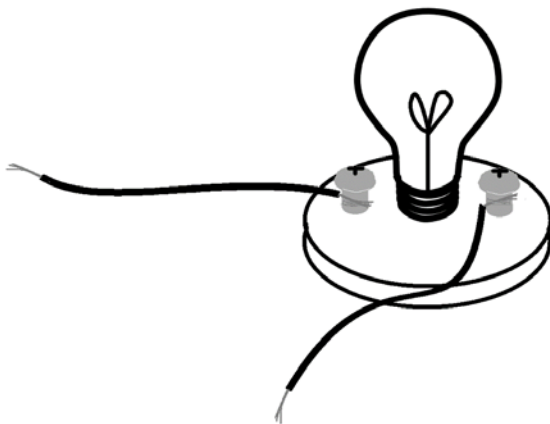


2. If the bulb is not already in the holder, screw it into place.

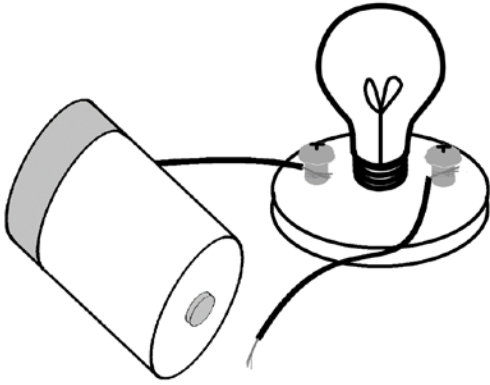
3. Carefully use your scissors to strip about ½ an inch of the plastic coating off of the two ends of each wire.



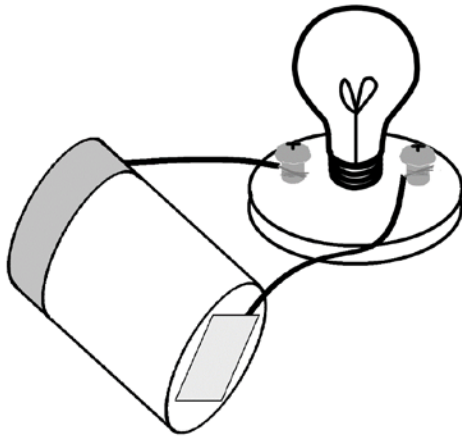
4. Attach one wire to each mount on the bulb holder by wrapping the wire twice around the metal screw.



- Using tape, attach the other end of one wire to the negative end of the battery.



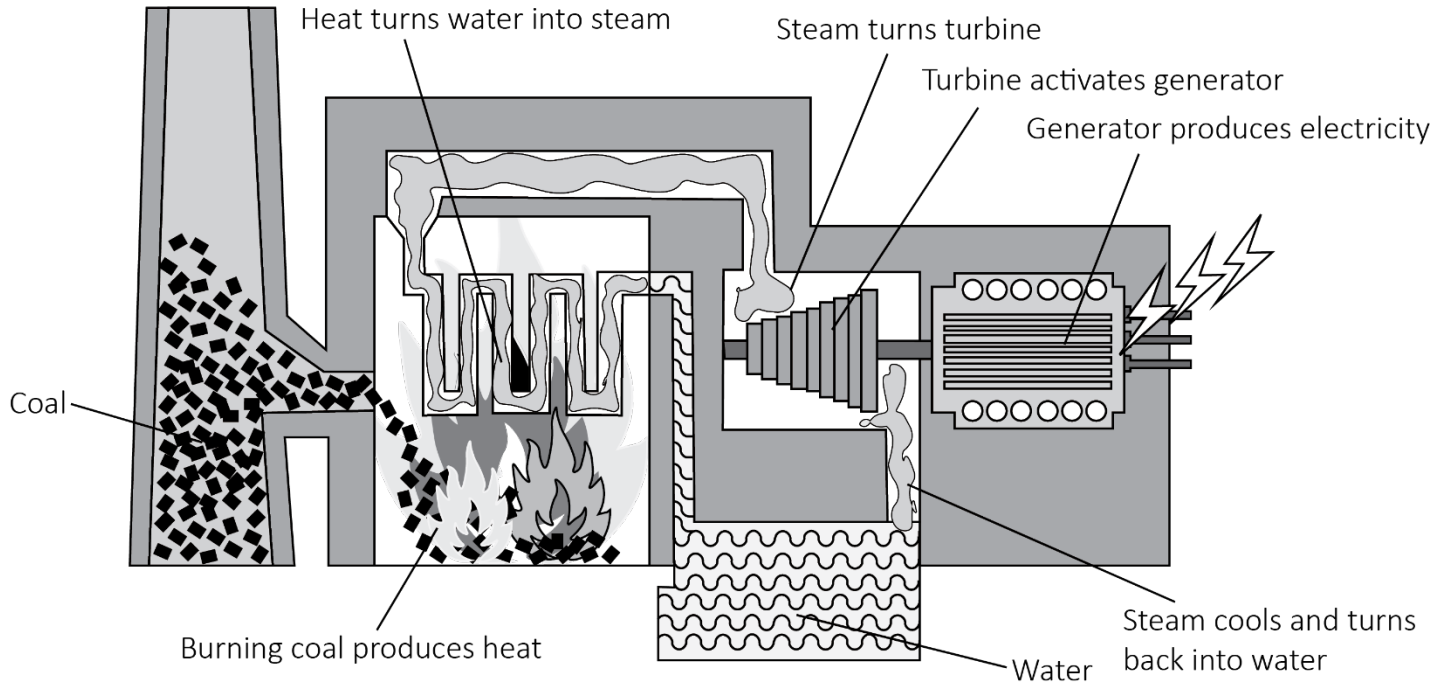
- Then tape the free end of the second wire to the positive end of the battery.



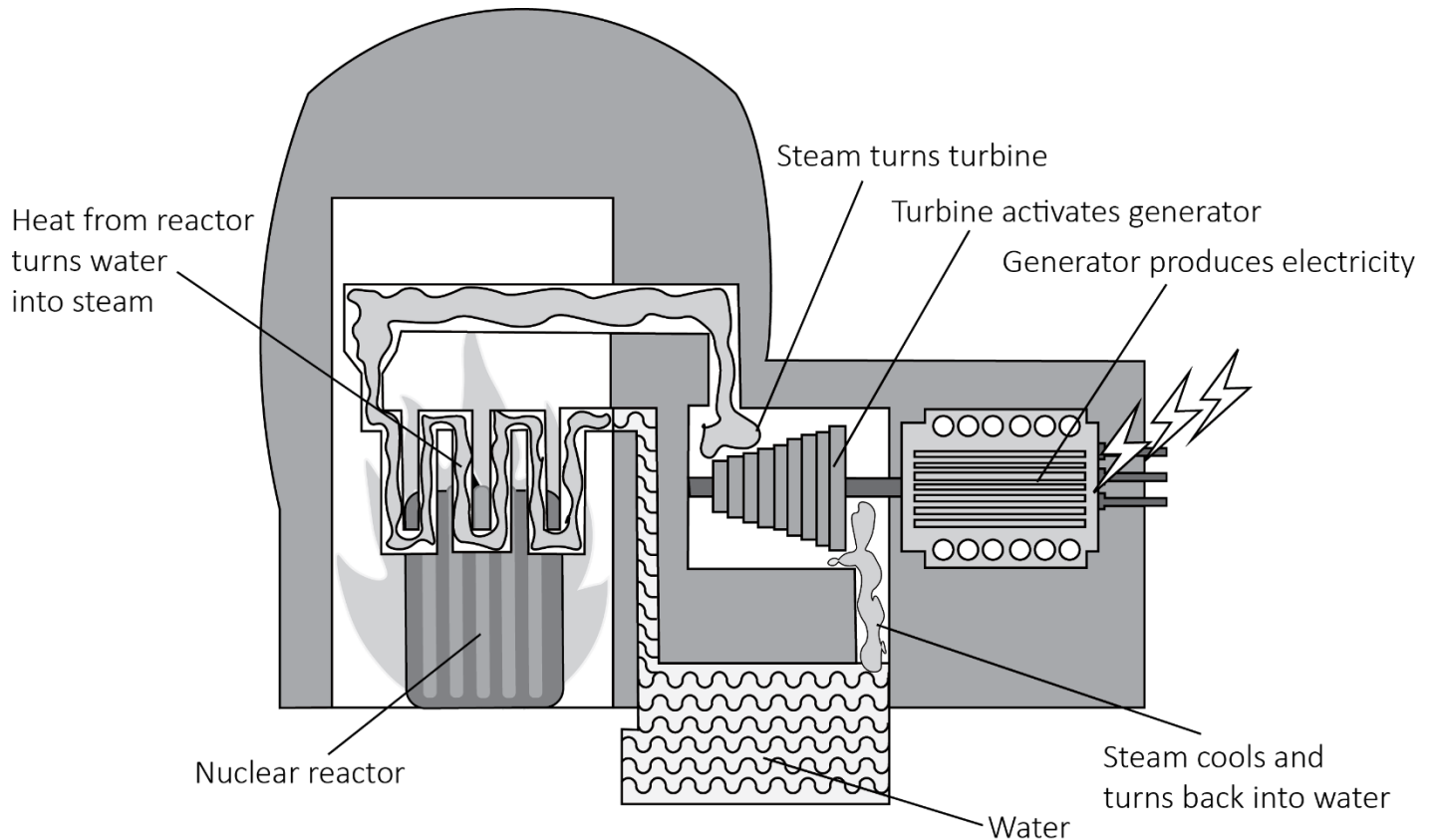
- See what happens.



### Sample Diagram of a Coal Generator



### Sample Diagram of a Nuclear Generator





### Nonrenewable Energy Sources



**Oil**

**Pros:**  
 Cost-efficient, adequate supply  
**Cons:**  
 Access to oil fields is restricted.  
 Oil spills harm the environment.



**Nuclear Fission**

**Pros:**  
 No air pollution  
**Cons:**  
 Reactors are expensive and dangerous. There is no known way to dispose of hazardous waste.



**Coal**

**Pros:**  
 Cost-efficient, large supply  
**Cons:**  
 Burning coal produces air pollution.  
 Mining harms the environment and is dangerous for miners.



**Natural Gas**

**Pros:**  
 Cost-efficient, adequate supply  
**Cons:**  
 Access to deposits is limited.

### Renewable Energy Sources



**Solar power**

**Pros:**  
 No waste, unlimited supply  
**Cons:**  
 Building solar generators is expensive. Sunlight is not consistent.



**Hydropower**

**Pros:**  
 Cost-efficient, no waste  
**Cons:**  
 Unused dams are rare.  
 Damming harms the environment and displaces wildlife.



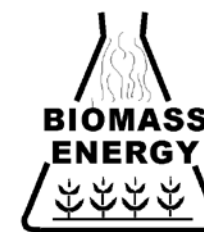
**Geothermal**

**Pros:**  
 Cost-efficient  
**Cons:**  
 Geothermal sites are rare, and may produce air pollution as well as steam.



**Wind**

**Pros:**  
 Cost-efficient, no waste, unlimited supply  
**Cons:**  
 Winds are not consistent.  
 Wind plants require large amounts of land.

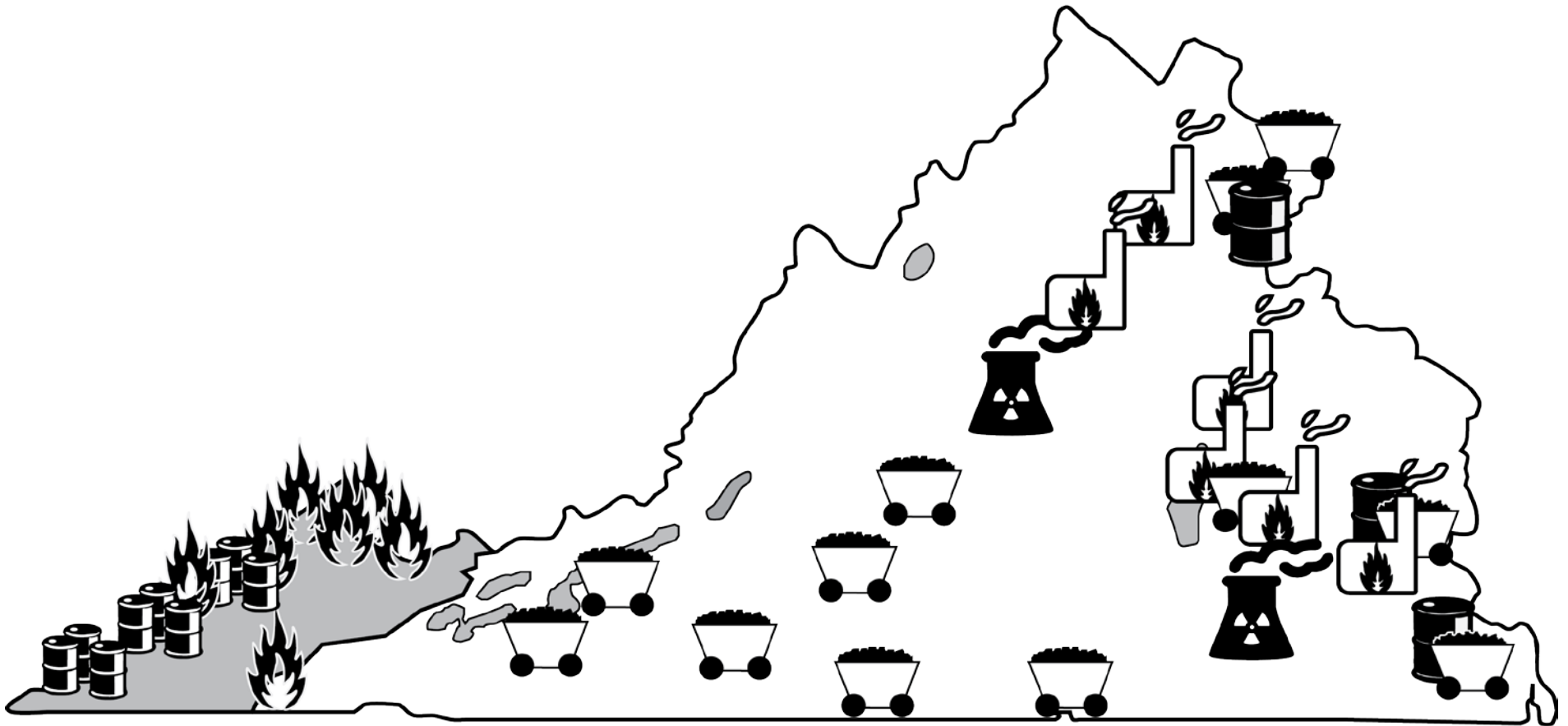


**Biomass**








**Pros:**  
 Cost-efficient, unlimited supply  
**Cons:**  
 Biomass plants may produce air pollution.



### Virginia's Nonrenewable Energy Sources



**Legend**

 Coalfields	 Oil field	 Natural gas field	 Nuclear power plant
 Coal power plant	 Petroleum power plant	 Natural gas power plant	

