STEM Sims™

Electric Power

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Do you need an idea for a scientific study?
Try out one of our ideas or make one of your own.

Start learning right now about how electricity is produced for home consumption using a variety of fuels. Take the following brief quiz to see how much you already know about electrical power production. See the bottom of page 4 to check your answers.

1. Currently, about how many kilowatt-hours of electricty were generated in the United States?
   a. 4.1 million
   b. 410 million
   c. 4.1 billion
   d. 4.1 trillion

2. Which fuel resource currently provides the largest amount of electricity in the United States?
   a. nuclear
   b. biomass
   c. coal
   d. hydrogen

3. About what percentage of electricity in the United States is currently produced using nuclear fuels?
   a. 2%
   b. 20%
   c. 40%
   d. 60%

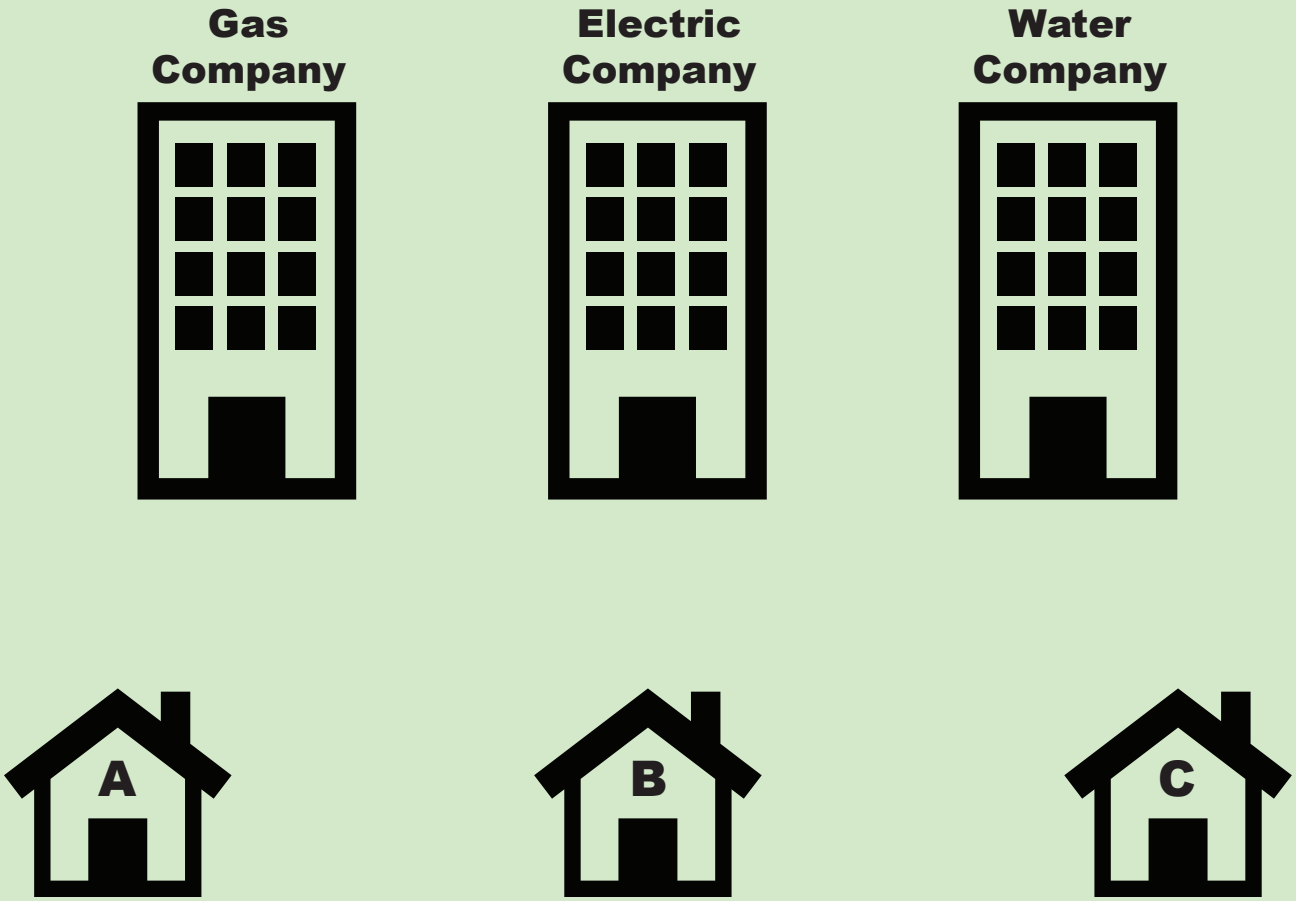
4. Currently, which home use accounts for the largest percentage of electricity usage in United States' homes?
   a. water heating
   b. electronics, lighting, and small appliances
   c. refrigeration
   d. space heating

5. Currently, which part of the country uses the largest amount of electricity in their home?
   a. north
   b. south
   c. east
   d. west

Making a Connection

Utility companies deliver their services to homes through lines and pipes. Imagine that you are a contractor working with three utilities to provide services tothe homes described below. Your job is to first plan a route, lay the lines and pipes, and then bury the utility connectors in the ground.

Three homes are situated on the street as shown in the figure below. Three different utilities companies, gas, electricity, and water, must provide their services to each home. The lines and pipes from each company to each house must be placed in the ground at exactly the same depth. No line or pipe can cross another or be placed at different depths. Using a pencil and the figure below, can you show how the three utilities can be connected to the three homes without any of the lines or pipes crossing? See the bottom of page 4 to check your answer.



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More Power

Coal, nuclear, hydrogen, propane, or biomass; no matter what the fuel source, electrical power is most often produced by heating water and converting the water to steam. The steam is then directed towards a fan blade that is connected to a shaft. The high pressure steam causes the fan to spin, which turns the shaft. The spinning shaft and surrounding assembly has an array of wires and electromagnets that create moving charges as the rotating wires cut through the stationary magnetic field. This process, called induction, produces an electrical current in the wires, which can be converted to useful work. The current made by this type of generator is called alternating current (AC) because the current flows back and forth, changing its direction during the course of its rotation. Most household appliances operate using AC.

Photo credit: Brandy Frisky

In 1831, Michael Faraday discovered electromagnetic induction quite by accident as he struggled to understand how to consistently make electrical power. He built a number of electrical generators that failed to operate as he intended. However, he did notice on one of the devices he built that it produced electricity for a brief period, but only during the short time when the device was being turned on and off. This insight led him to develop the first induction generator that still to this day operates much like the successful model he crafted.

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Answers: Page 2 Answers: 1) c. 2) c. 3) b. 4) d. 5) b. **Page 3 Answers:** The solving of the problem is *not* possible. It is impossible to connect all three utilities to all three homes without having at least one line or pipe cross another.

The Green Engineering Magnet (GEM) project was funded in part under the National Science Foundation grant contract #IIP-1127544. Its contents are solely the responsibilities of the authors and do not necessarily represent the official views of the National Science Foundation.