9.3 Reading – Solar Power Plants

Getting Ready

In class, you are investigating how light can be used to heat water. What are some reasons people would want hot water or steam?

Did you know that steam can also be used to generate electricity? In this reading, you will learn more about how light makes things happen. For example, light can be used to generate steam, which can generate electricity.

Using Steam to Do Things

Almost all of the electricity that people use to light lamps, to keep food cold in refrigerators, or to watch television is generated by a machine called a *steam turbine*. You do not have a steam turbine in your home. Somewhere, at some power plant, a steam turbine generates electricity and sends it through wires.

A steam turbine is a machine with giant fan blades inside. When the fan blades turn, the machine uses the turning motion to generate electricity. The trick is to figure out a way to make the fan blades turn.

You can think of the blades inside a steam turbine like a giant pinwheel. When you blow on a pinwheel, the air you breathe out hits the blades of the pinwheel and move them. Now, imagine that you could hold the pinwheel above a pot of boiling water. The steam would also make the pinwheel turn, just like with you blowing on it.

Making a pinwheel turn by holding it above boiling water is the same idea as using steam to turn the fan blades inside a steam turbine. Long ago, someone needed to figure out how to heat water enough so that it turns to steam. Then the steam could operate the turbine and generate electricity for people's homes.

Most of the electricity generated in the United States is produced by coal power plants, which burn coal to heat water until it becomes steam.

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Solar Power

In class, you are investigating how light from a light bulb can be used to heat water in a beaker. Some power plants, called *solar power towers*, use light from the sun to heat water until it becomes steam. A solar power tower uses thousands of mirrors to reflect light from the sun to a tower that holds water. Look at the photo to see how this looks.

When light reflected by the mirrors hits the tower, the water inside is heated. If the water is heated enough, it becomes steam. The steam is transported through pipes to a steam turbine, which produces electricity.

One drawback of a solar power tower is that it can only heat water during the day. Once the steam cools down and becomes water again, it cannot turn the steam turbines. People still need electricity at night or when the sun is blocked by clouds. To produce electricity at these times, some solar power towers heat a different liquid instead of heating water. Once the fluid is heated, it can be transported through pipes to come in contact with a container of water. There, it heats the water to make steam. It takes the special fluid a long time to cool down, so it can remain very hot throughout the night. Because the fluid stays hot, it can heat water to create steam even when the sun is not shining.

Solar Chimneys

Another way to use light from the sun to generate electricity does not involve heating water at all. In a solar chimney, light from the sun heats the air underneath a large glass roof. The hot air rises and is forced through a giant chimney. As the heated air rises, it turns fan blades to generate electricity. The sun can only heat air during the day, so solar chimneys have pipes filled with liquid that remains hot at night. That means the solar chimney works even when the sun is not shining.

Light from the sun can heat an object when it hits it. This is why your skin feels warm in the sunlight. In the investigation you are doing in class, you will determine how light heats things and why some materials get hot faster than others.

What are the differences between a solar power tower and a solar chimney?

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The light your teacher uses to heat beakers of water is called a *flood lamp*. Notice that a flood lamp has silver sides designed to reflect light. In what way does the flood lamp work to heat water faster than a regular light bulb?

You have learned that light can be scattered (or reflected if the object is smooth) or transmitted when it reaches an object. In class, you used light to heat two beakers of water. If all the light that reached the beakers was scattered or reflected, how hot would the water be?

How hot would the water be if all the light reaching the two beakers had been transmitted?