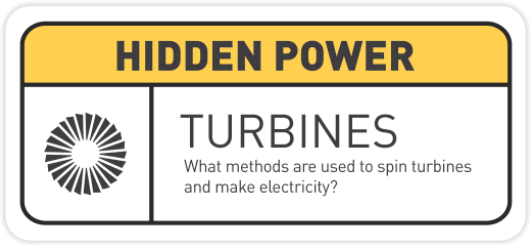

GOAL:

Visitors will recognize that many types of power sources all generate electricity by spinning a turbine.

MATERIALS:

- Turbine stand
- Hair dryer
- Power source cards
- Sources of Power pie chart graphic

PROCEDURE:

Set-up:

1. Plug the hair dryer in and stack the power cards in the slot on the base of the stand.

Doing the demonstration:

1. Ask visitors if they have ever heard of a turbine. Explain that turbines are a set of blades (like a fan or propeller) that take energy from a something flowing in one direction and convert it into a spinning motion. This rotational motion can be used to spin a magnet inside a coil of wire to generate electricity. Currently, almost 90% of the electricity generated around the world uses steam to spin turbines.

2. Ask visitors if they know what steam is. Explain that the hair dryer is going to represent steam. Have the visitor turn the hair dryer on and place it in the bottom of the tube. When the “steam” passes over the turbine, it causes the blades to spin, which, in turn, creates electricity. This electricity gets carried through transmission wires to our homes and other buildings. Point out that the LED in the house lights up when the turbine spins.

3. Turn off the hair dryer and ask visitors if they know what steam is and how it is created. Explain that water must be heated to make steam. Ask visitors if they can think of any fuel sources that are used to heat water and make steam. Go through the stack of cards from nuclear, coal, natural gas, geothermal and biomass and give a brief description of each.

4. Show visitors the Sources of Power pie chart graphic. Ask them what they notice about the percentages. Which is the greatest/least? Discuss the pros and cons of each energy source.

Clean-up:

1. Unplug the hair dryer and re-stack the power cards.

EXPLANATION:

When liquid water is heated into a gas, the molecules of the gas (steam) take up more space than the liquid water did. This expansion can be directed and used to push the blades of the turbine, which then spins an attached magnet to create a moving magnetic field. This magnetic field induces an electric current in a wire coil surrounding the magnet. The electric current then flows through transmission wires that carry the electricity to our homes, offices, and schools.

Many different fuel sources are used to heat water and produce the steam for our electric power plants. These fuel sources have both costs and benefits:

- **Coal** is a cheap fuel, but it is nonrenewable and results in environmental pollution.
- **Natural gas** (methane) combustion produces less air pollution than coal, but drilling for natural gas also creates problems for the environment, wildlife, and human health.
- **Biomass** includes garbage, wood, waste, landfill gases, and ethanol produced from corn and sugarcane. It is renewable, but collecting, transporting, and processing biomass has significant environmental impacts and its combustion contributes to air pollution.
- **Nuclear** power plants don't burn anything, but use heat from atomic reactions to create steam. They do not produce air pollutants during operation, but they produce dangerous radioactive waste and accidents can be catastrophic.
- **Geothermal** power stations are powered by heat from deep inside the earth – either by using steam directly from geothermal reservoirs or, more commonly, by extracting hot water from inside the earth and converting it to steam. Geothermal power is renewable with no fuel costs, but groundwater can be contaminated and connecting remote sources of geothermal power to the electricity grid can create environmental impacts.

Some electricity generators don't use steam at all to turn turbines. Instead, flowing water or blowing wind turns them. Wind is a renewable resource, but wind power can create noise pollution and impact wildlife. Hydropower is also a continuously replenished resource, but building dams affects river flow and habitat, water quality, and wildlife. Of these two sources of clean, renewable energy, water is more effective than wind because the density of water is 1000x greater than the density of air, and therefore (when all other variables are the same) 1000x more powerful when spinning a turbine.

Note: You may want to prepare additional background information about the pros and cons of energy issues that are relevant to your local community (e.g. a coal mine, nuclear power plant or natural gas drilling nearby).

WHAT COULD GO WRONG?

If the fan doesn't start spinning, give it a small twist to start and it should continue spinning.

GENERAL MAINTENANCE:

For safety and to prevent overheating, the hair dryer has been set to operate only on the cold setting. Make sure the switch does not come undone.

Be careful when handling the turbine stand to avoid damaging the wiring on the back.