Waste-to-Energy

(Adapted from the Heat Is On activity)

OBJECTIVE

To understand that some waste material can be burned to generate electricity, by observing a demonstration of how a turbine is turned by steam.

MATERIALS

A coffee can with plastic lid, water, hot plate, windmill toy, safety goggles, pot holder, measuring cup, nail, tape

WHAT IS WASTE-TO-ENERGY?

Most of the electricity that we use is produced by burning fossil fuels, natural gas, or heat produced in nuclear reactions. The heat produced in electric power plants is used to boil water and create steam. The steam then causes a turbine to turn, which generates electricity. In waste-to-energy facilities, electricity is produced by burning municipal solid waste instead of fossil fuel.

Waste-to-energy (WTE) is when municipal solid waste is burned in a controlled environment to create steam or electricity. Waste-to-energy plants can reduce the volume of waste by up to 90%. Most WTE processes produce electricity directly through combustion, or produce a combustible fuel commodity, such as methane. Steel cans and other ferrous discards are separated magnetically and shipped to mills for recycling. Like coal or oil, burning waste produces gases that must be controlled to protect the environment. Air pollution control devices are used to remove particles from the air emissions at waste-to-energy facilities.

In this demonstration, heat energy will be converted into energy that creates motion.

DEMONSTRATION

1. Follow all safety procedures and wear safety goggles.
2. Put approximately one cup of water in the coffee can.
3. Using a nail, punch a small hole at the outer edge of the lid.
4. Put the lid on the coffee can.
5. Tape a windmill toy to the outside of the coffee can, near the hole in the lid, so that it will catch the escaping steam and spin.
6. Place the lidded coffee can, with the windmill toy tapped to it, on the hot plate. Be sure the bottom of the windmill toy does not rest on the hot plate.
7. Plug in and turn on the hot plate.
8. As the hot plate heats, observe the windmill toy spin. Explain to the participants that in a waste-to-energy facility waste material is burned to generate the heat and that the turbine Is connected to an electrical generator.
    - Hot plate simulates the burning waste
    - Coffee can and steam simulate the boiler and steam
    - Windmill toy simulates the turbine generator that produces electricity

DISCUSSION

How is your community's electricity generated? Research "Plasma Arc Gasification" or "Plasma Gasification Process (PGP)" - the latest technology in waste-to-energy generation. What are its advantages and disadvantages?