

8 Teacher Demonstration 2: Energy Conversions

Equipment:

- electric cell / battery
- two conducting wires with 4 mm terminals attached
- Reversible electric motor to be connected to an ammeter or LED
- small electric motor (with fan attached)
- two conducting wires with 4 mm terminals attached
- sensitive electric meter
- source of wind, for example a hair dryer with the heater switched off

Show pupils a small electric motor turning blades of a fan, driven by a cell (battery). Explain that, in the motor, electrical energy (from the cell in this demonstration) is converted to kinetic rotational energy. If necessary, explain that rotational means going in a circle, and kinetic energy is just energy of something moving, either in a straight line or a circle.

Ask pupils what they expect to happen if the system is reversed, and the blades are turned by a fan. Energy conversion in a motor is opposite to what we want from a generator: the motor converts electrical energy to rotational energy, in a turbine we want rotational energy to be converted to electrical energy. Now, connect the meter to the input terminals of the motor, and blow the fan. What happens? *The motor generates alternating current, and the meter needle oscillates.*

In the motor, electrical energy is converted to kinetic rotational energy. Energy is conserved, including some which is converted to heat energy. In a turbine this energy conversion is reversed and kinetic rotational energy is converted to electrical energy. Emphasise: This is true no matter where the rotation comes from: wind, water, steam or nuclear. Ask pupils: how do we get rotation? Ask them to provide as many sources of (kinetic) rotational energy as possible, and to give local examples. Wind and hydroelectric (river and tidal) and wheel turning movements are obvious (direct conversion).

Background:

Pupils might be asked to try this at home.

Hold your hand under a water tap. Feel the water hitting your hand. The moving water has energy. Your hand catches and feels this energy. Increase the water flow. The harder the water

hits your hand, the more energy it transfers to your hand. Try a similar experiment with a fan or hairdryer (with the heater switched off).

A turbine can catch this energy of moving water or air and convert this to electrical energy. The vanes of a wind turbine catch energy from moving air. Similarly, a hydroelectric turbine catches energy from flowing water (originally potential energy stored at a higher level, or kinetic energy in a flowing stream). A steam turbine catches kinetic energy from expanding steam (water in gas form, expanded by conversion from liquid water by heat energy) heated by burning fuel, like oil, coal or gas. All turbines catch energy from moving fluid (liquid or gas) flowing through vanes which are free to rotate. This rotation is transmitted through a magnetic field / wire coil system to be converted to electrical energy in wires in a generator.