

CONCEPT 3

Electrical energy is generated in different ways from different sources.

Activity

Charge It

You are at school working on a group science project late one afternoon. An unexpected snowstorm hits your region. It knocks out all the electrical energy, and none of the school phones work. It looks like you may be here a while. Luckily the cafeteria is stocked with food, and you have warm clothing. You do have one cellphone, but it needs to be charged. As a group, brainstorm how you could charge the phone to tell your families that you are safe. You can only use materials and objects found in your school. When you are done, share your ideas as a class.



Many different types of energy can be transformed into electrical energy, but how? Several different methods are explored in this Concept.

Kinetic Energy to Electrical Energy

Most of the electrical energy in Canada is generated by transforming kinetic energy into electrical energy. The source of kinetic energy may be moving water or wind. It may also be moving steam produced by thermal energy generated in nuclear reactions, or by burning fossil fuels. In each case electrical energy is generated using a **generator system**. **Figure 3.3** shows a model of a simple generator system. The system has three parts: a *turbine*, a *shaft*, and a *generator*.

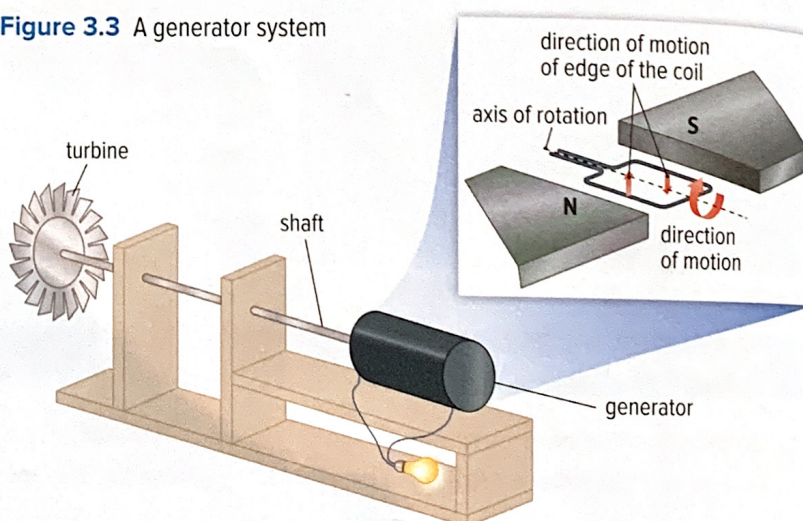
generator system a system that transforms kinetic energy to electrical energy

Turbine: Steam, water, or wind cause the turbine to spin.

Shaft: The shaft connects the turbine to the generator. As the turbine spins, it makes the shaft spin.

Generator: The kinetic energy of the spinning shaft is transformed into electrical energy inside the generator. This happens when energy from the shaft turns a wire loop or coil. A magnet surrounds the rotating wire, as shown in the inset. As the wire turns, electrons flow in the wire. This flow of electrons powers electrical devices.

Figure 3.3 A generator system



Generating Electrical Energy in Canada

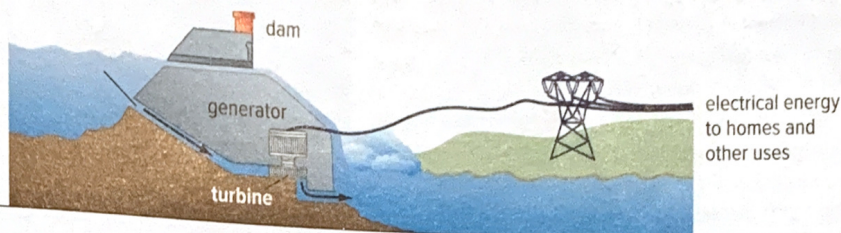
Most of the electrical energy used in Canada comes from river flow, fossil fuels, and nuclear reactions. In B.C., river flow is the main source. B.C. also uses fossil fuels to generate electrical energy, but it has no nuclear reactors. **Figure 3.4** outlines how river flow, fossil fuels, and nuclear reactions generate electrical energy.

Figure 3.4 Comparing how river flow, fossil fuels, and nuclear reactions generate electrical energy

Hydroelectric Energy from River Flow

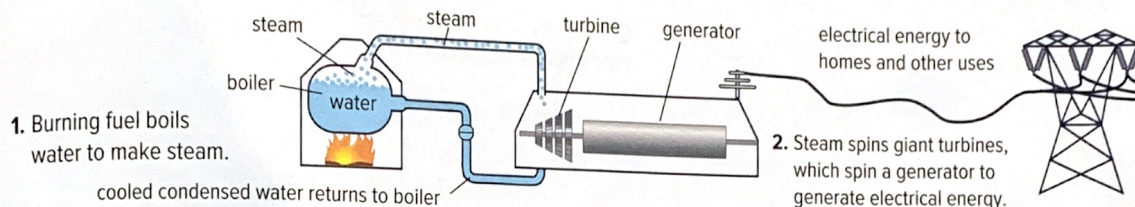
Electrical energy from river flow is called *hydroelectric energy*. Two systems generate hydroelectric energy. At the dam station below, water stored behind the dam has potential energy. As it flows downhill, it gains kinetic energy, which turns a turbine connected to a generator. At a run-of-river station, water flowing freely in a river turns a turbine.

Water flowing through a dam spins giant turbines, which spin a generator to produce electrical energy.



Electrical Energy from Fossil Fuels

In the generating station shown here, thermal energy from burning coal is used to boil water into steam. Pressure associated with the moving steam turns the blades of turbines connected to generators.



Electrical Energy from Nuclear Reactions

Inside a nuclear reactor, uranium or plutonium atoms undergo fission reactions. Splitting one atom sets off a chain reaction that causes more atoms to split. The nuclear reactor contains and controls these reactions and the energy they release. Most of this energy is thermal energy, which is used to boil water into steam. Pressure associated with the moving steam turns turbines connected to generators.

