

ELECTRICITY AND YOU!

HOW IS ELECTRICAL ENERGY PART OF YOUR WORLD?



ACTIVITY: POWER FAILURE

- What would a day in your life look like WITHOUT electrical energy?



That was then...



Doing dishes inside a log cabin



Washing clothes in a washtub

History of electric household appliances



From 1890 to 1910, many experiments took place to find new ways to cook and heat using electric technology

- The first small electric appliance was the fan, but the most popular was the clothes iron
- Disc stoves, heaters, and sewing machine motors followed soon after

Live better electrically



Early, elegantly styled electric stoves started to become integral to kitchen decor.
(CSTM Trade Literature Collection)

From 1920 to 1940, the use of electricity gradually became widespread across Canada

- By 1940 approximately 700,000 to 1,000,000 Canadian households used electricity
- Canada's population was 8,000,000 at that time

Appliances of the past



Electric stove, Findlay Brothers Company Limited,
(CSTM 1992.0875)



Early Electric Washing Machine

ELECTRICAL ENERGY HAS MANY APPLICATIONS

Electrical energy: the energy of charged particles

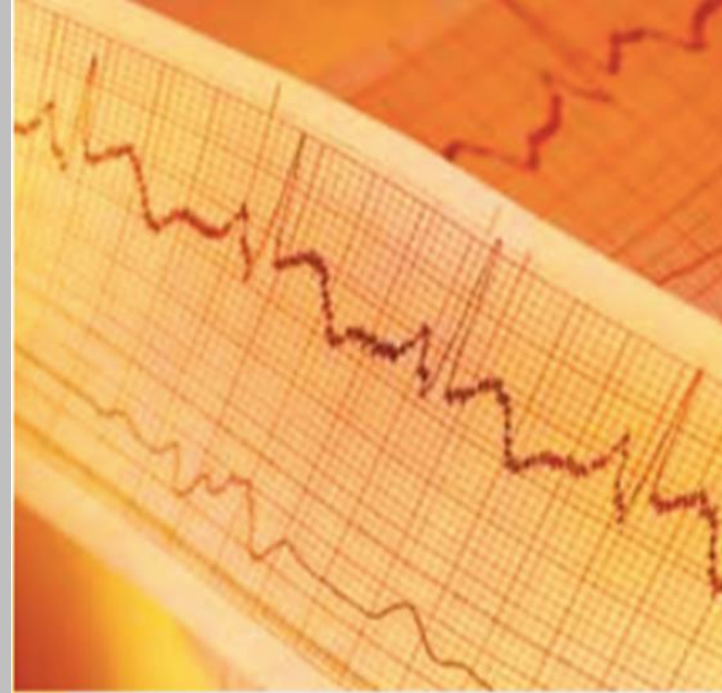
What uses electrical energy?

- Technology (touch-sensitive screens, robots, maglev trains)
- The human body

ELECTRICAL ENERGY APPLICATIONS: THE HUMAN BODY

The human body uses electrical energy

- Moving your eyes to read relies on electrical signals in your muscle and nerve cells
- Electrical signals help maintain breathing and heart beat



ELECTRICAL ENERGY APPLICATIONS: TECHNOLOGY

Different types of technology use electrical energy

- Touch-sensitive screens
- Televisions
- Hair Straighteners
- Cell phones
- Christmas lights 😊



CHECKPOINT

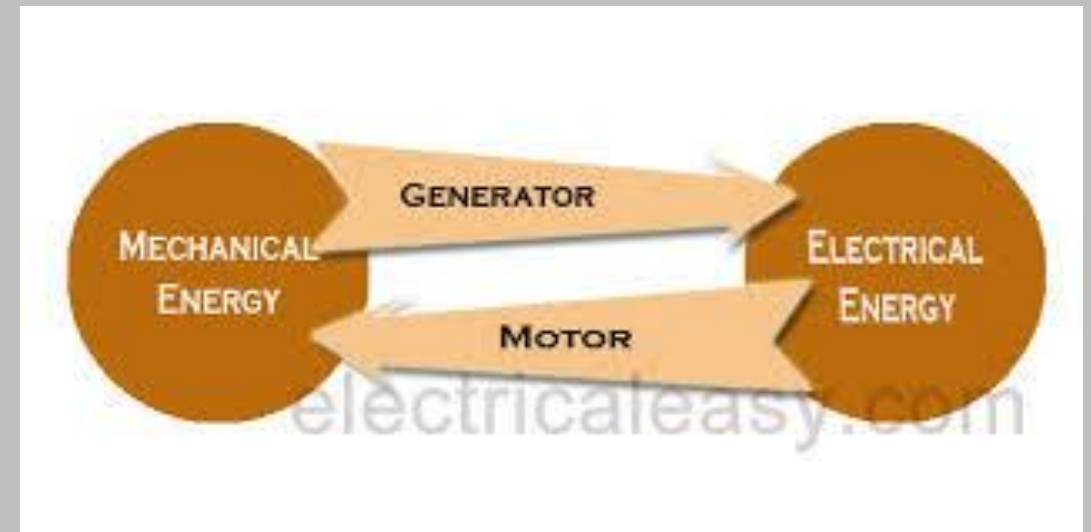
- Describe three ways that you have depended on electrical energy since you woke up this morning?



MANY DIFFERENT TYPES OF ENERGY CAN BE TRANSFORMED INTO ELECTRICAL ENERGY

Energy is neither created or destroyed

- It is transformed from one kind of energy to another kind of energy
- Many types of energy can be transformed into electrical energy



TYPES OF ENERGY CHART

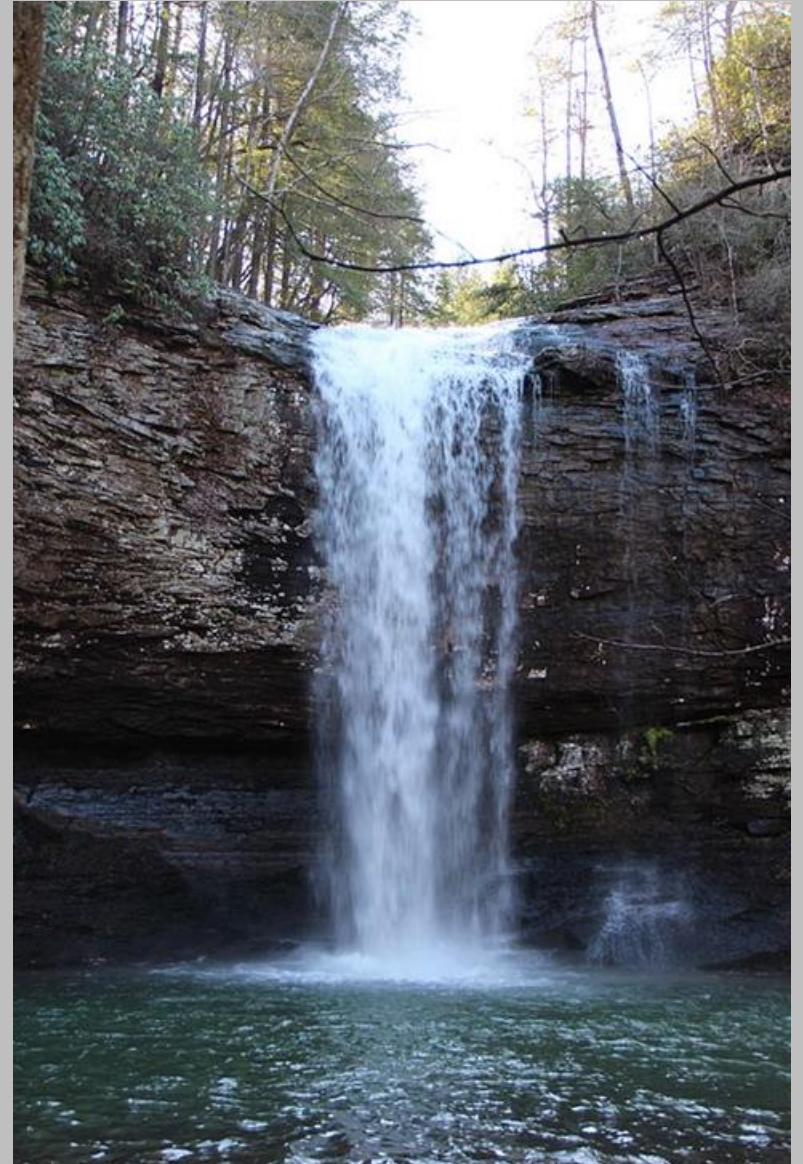
- Using pages 192-193 fill in the chart



MECHANICAL ENERGY

Mechanical energy: The sum of kinetic energy and potential energy

- **Kinetic energy:** Energy of motion
- **Potential energy:** Stored energy that a system has due to its position or condition
- **Example:** Water at the top of a waterfall, just before it falls, has *potential energy* because of its position, and *kinetic energy* because it is moving



CHEMICAL ENERGY

Chemical energy: Energy stored in chemical bonds, and released when a chemical reaction occurs

- Batteries store chemical energy
- Chemical energy stored in animals and plants is called *biomass*
- Fossil fuels (coal, oil, natural gas) store chemical energy



SOLAR ENERGY

Solar energy: Energy carried by electromagnetic radiation given off by the Sun

- Fossil fuels and biomass result from energy from the Sun being captured by plants and plant-like organisms



NUCLEAR ENERGY

Nuclear energy: Energy generated by forming new atoms

- **Nuclear fusion:** New atoms are made as smaller atoms collide and fuse (occur in the Sun and stars)
- **Nuclear fission:** New atoms are made by splitting larger atoms (carried out in reactors on Earth)



THERMAL ENERGY

Thermal energy: Energy due to the rapid motion of particles that make up an object; detected as heat

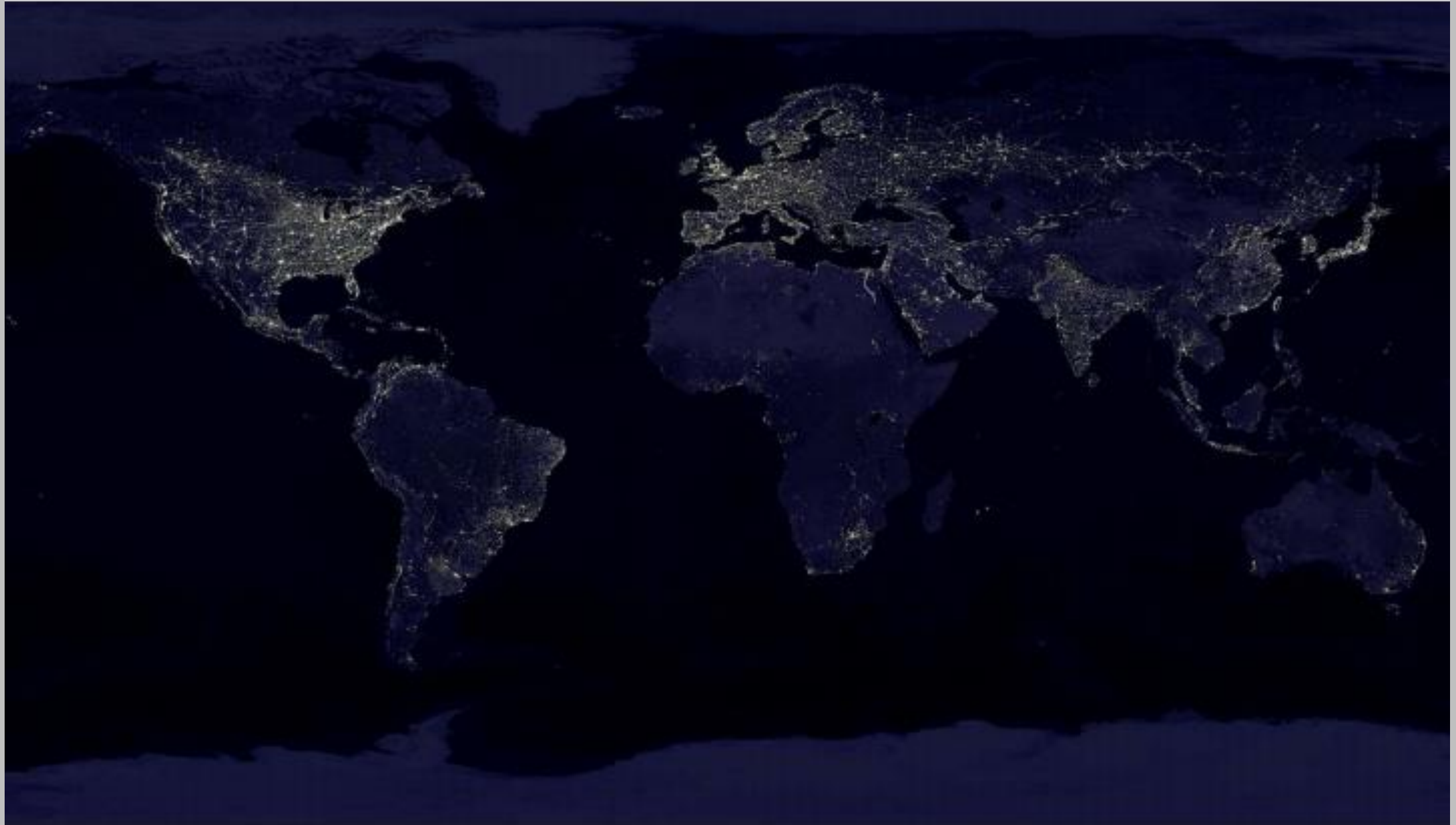
- Sources include nuclear reactions or from Earth's interior (geothermal energy), where steam and hot water form naturally
 - **Example:** Geysers, volcanoes, hot springs



CHECKPOINT

1. Explain the difference between kinetic energy and potential energy.
2. What types of energy can be transformed into electrical energy?

Earth at Night



ELECTRICAL ENERGY DETECTIVE

- Where does the electrical energy in your community come from?



HOW CAN WE GENERATE ELECTRICAL ENERGY?

Different types of energy can be transformed into electrical energy

- Most of the electrical energy in Canada is generated by transforming kinetic energy into electric energy
- Source of kinetic energy may be moving water, wind, or moving steam produced by nuclear reactions or burning fossil fuels



KINETIC ENERGY TO ELECTRICAL ENERGY: GENERATOR SYSTEM

Generator system: A system that transforms kinetic energy to electrical energy

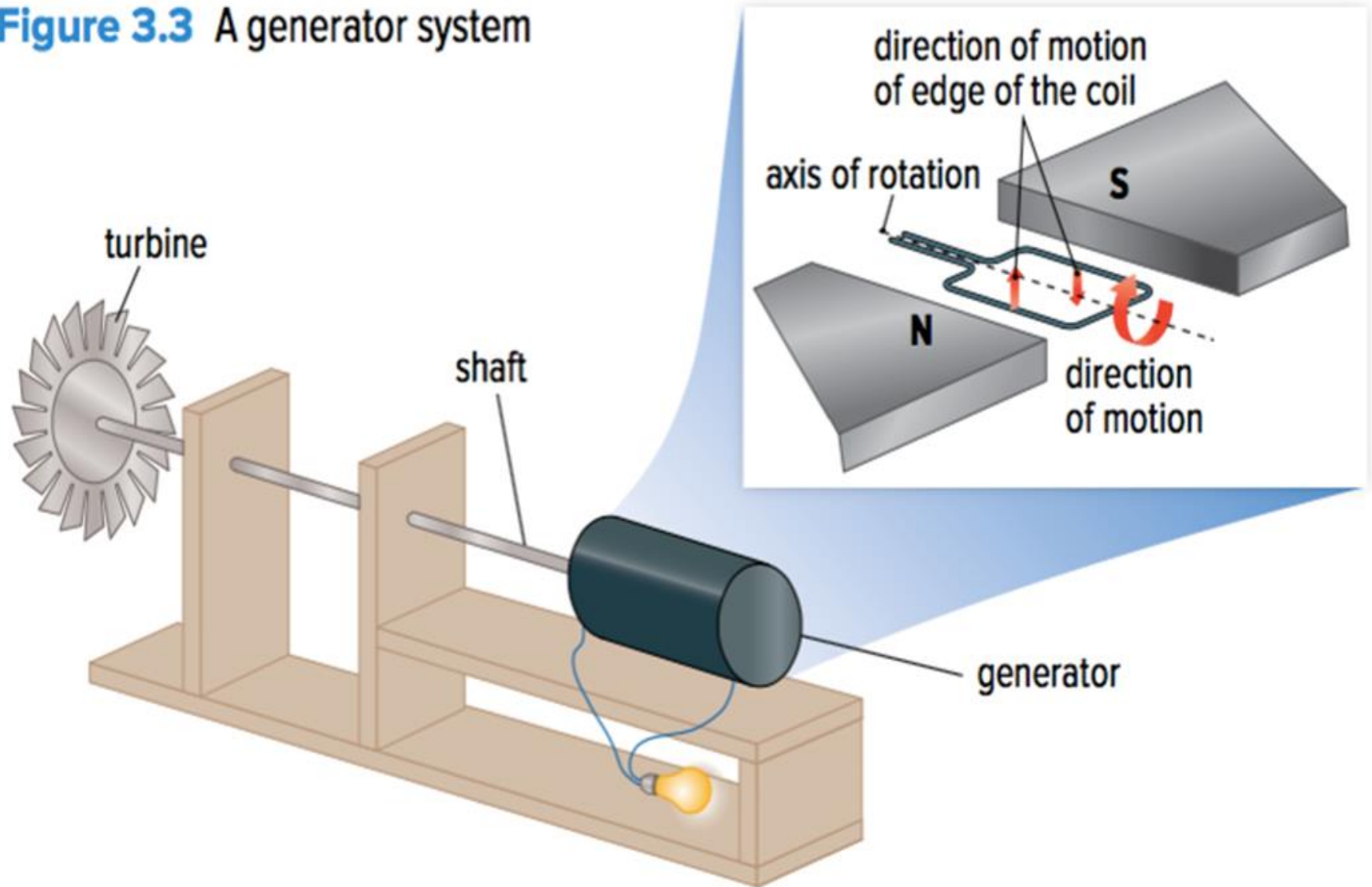
- **Turbine:** Steam, water, or wind cause the turbine to spin
- **Shaft:** As the turbine spins, the shaft spins
- **Generator:** Kinetic energy of the spinning shaft is transformed into electrical energy inside the generator

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 in Canada comes from river flow, fossil fuels, and nuclear reactions

British Columbia:

- River flow is the main source (hydroelectric energy)
- Also uses fossil fuels
- No nuclear reactors

Electricity in B.C.

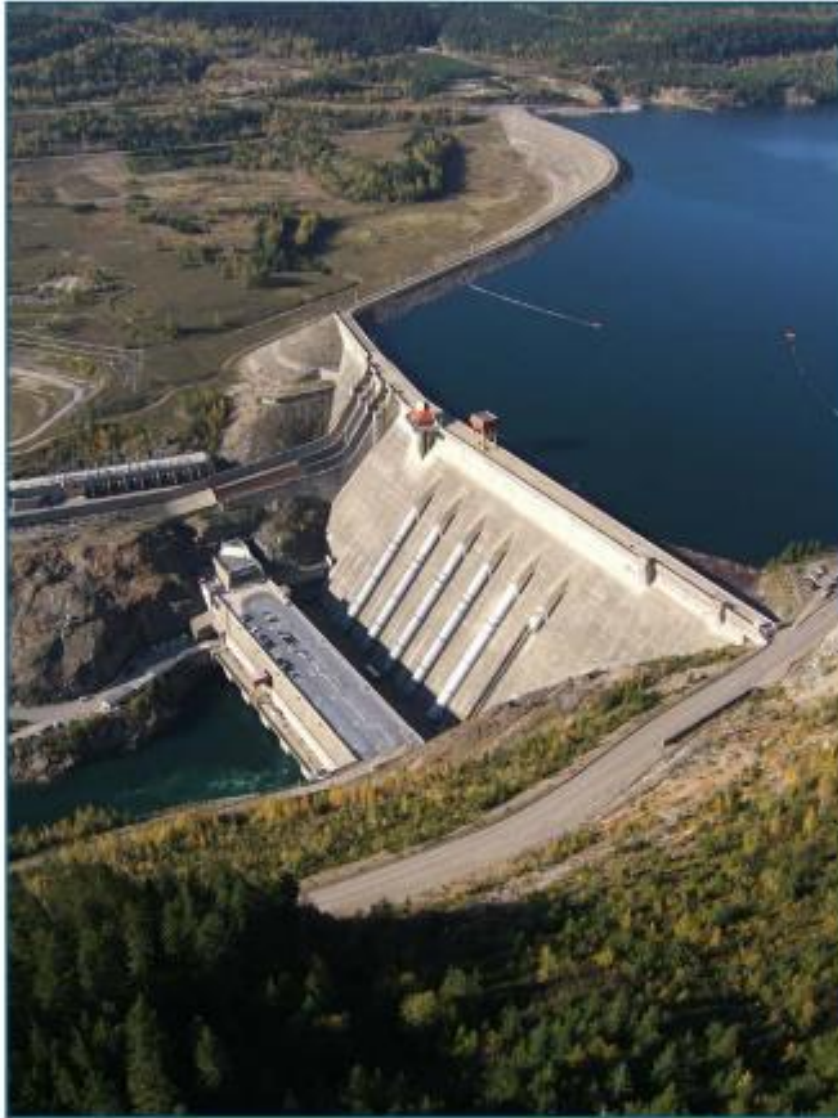
Over 90% of BC Hydro's electricity is produced by hydroelectric generation



Hydroelectricity in B.C.



Generating Electricity



Over 80% of BC Hydro's power comes from the Peace and Columbia Rivers

- Revelstoke Dam and Powerhouse on the Columbia River in Revelstoke, BC

Transmission

The transmission system moves electricity from generating stations (near the dam sites) to distribution substations



Substation

The high voltage electricity then flows through substations and distribution transformers



Transformer and Distribution Lines

Over 55,250 km of distribution lines (also known as power lines) carry the electricity to power homes and businesses



Distribution

Padmount transformers lower the voltage in the power lines so the electricity can be safely used in our communities



Electricity at Home

Lighting accounts for 20% of total household energy use



9

Electricity Usage

Today we have many more gadgets, appliances and devices in our homes that use electricity



10

Our Choices

Our everyday choices have an impact on the world



LETS WATCH HOW IT HAPPENS

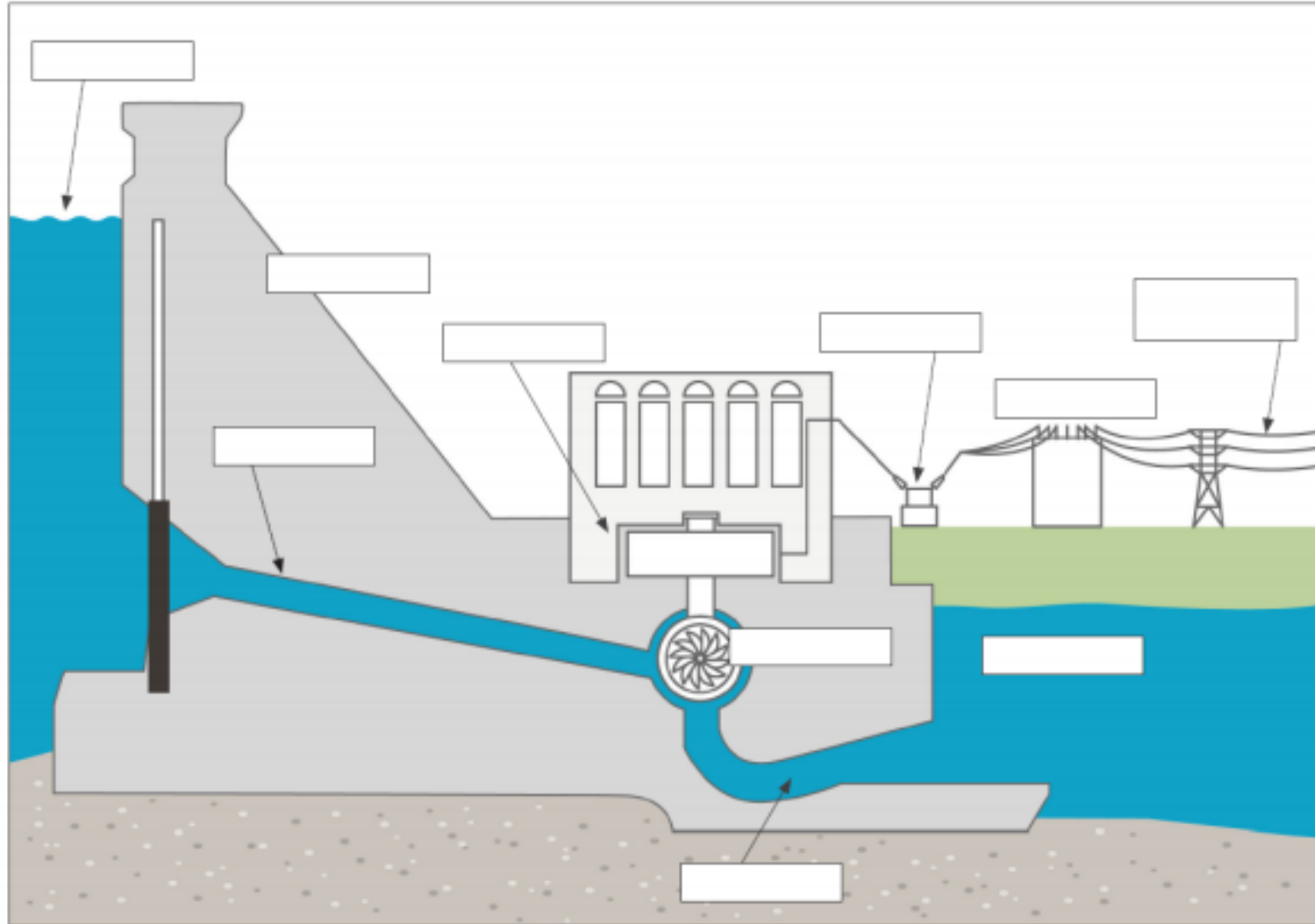
- After watching the video try to Label the parts of a Dam

Use these words to explain the process that happens within the dam:

- Penstock
- Transformer
- Turbines
- Generator
- Tailrace
- Transmission lines
- Draft tube
- Switch yard

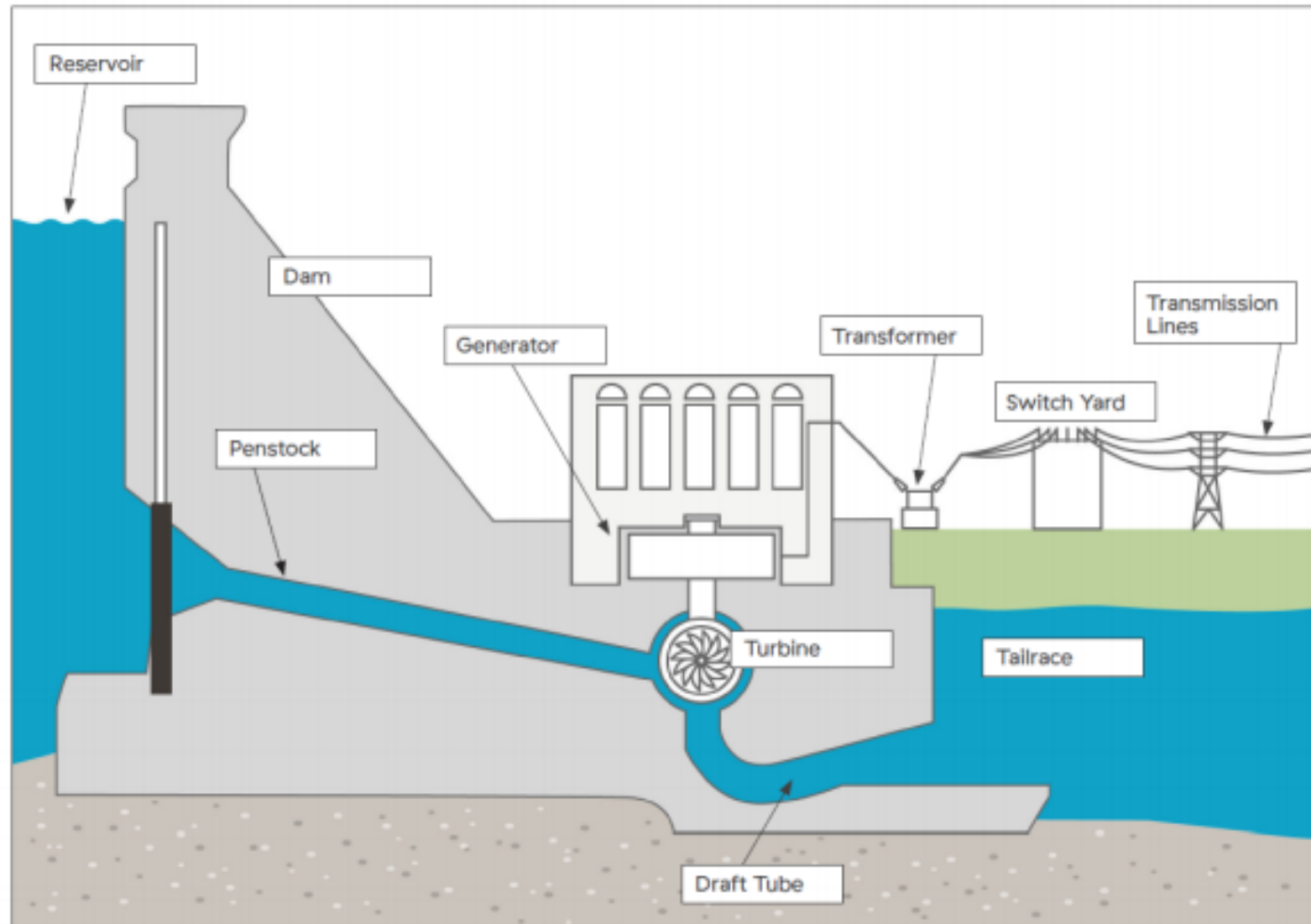
How dams generate electricity

Name the parts of the dam



How dams generate electricity

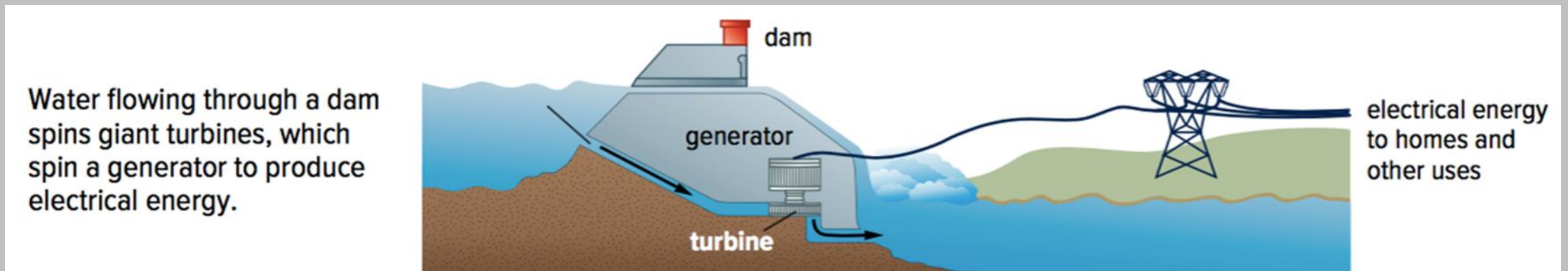
Answer key



HYDROELECTRIC ENERGY FROM RIVER FLOW

Two systems generate hydroelectric energy:

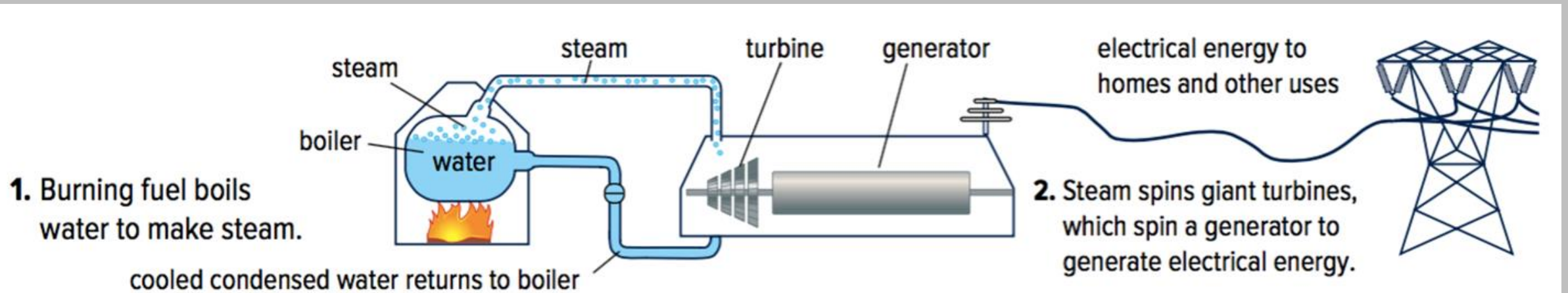
- Dam station (shown below)
 - Water stored behind dam has potential energy
 - As water flows downhill, it gains kinetic energy, which turns a turbine connected to a generator
- Run-of-river station
 - Water flowing freely in a river turns a turbine



ELECTRICAL ENERGY FROM FOSSIL FUELS

Generating station:

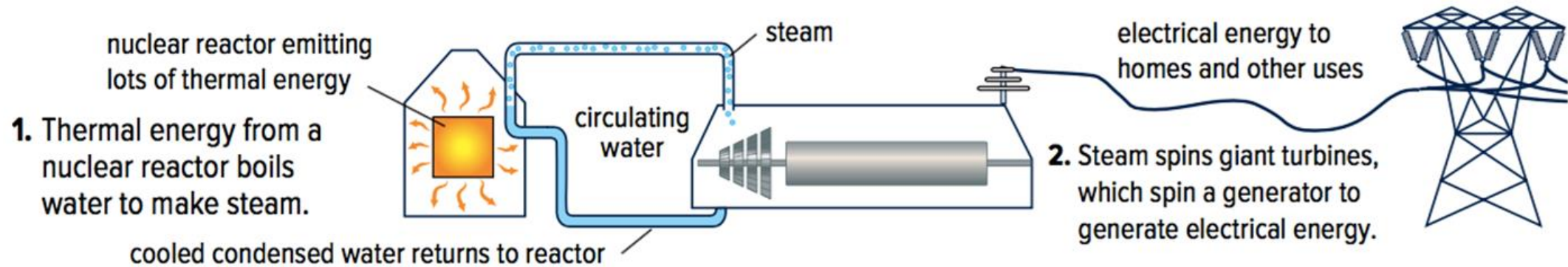
- Thermal energy from burning coal is used to boil water into steam
- Pressure associated with moving steam turns the blades of turbines connected to generators



ELECTRICAL ENERGY FROM NUCLEAR REACTIONS

Nuclear reactor:

- Uranium or plutonium atoms undergo fission reactions
- Splitting one atom sets off a chain reaction that causes more atoms to split, which releases energy
- Most of the energy is thermal energy, which is used to boil water into steam
- Pressure from the moving steam turns turbines connected to generators



GENERATING ELECTRICAL ENERGY FROM OTHER ENERGY SOURCES (RENEWABLE)

Other energy sources include:

- Wind
- Sunlight
- Geothermal sources
- Waves and Tides



COMPLETE CHART ON HOW ELECTRICITY IS GENERATED THROUGH ALTERNATIVE SOURCES

ELECTRICAL ENERGY FROM WIND

- Kinetic energy of wind is transformed into electrical energy as the moving air turns the turbine of a generator system
- Wind turbines have an anemometer is used to measure wind speed

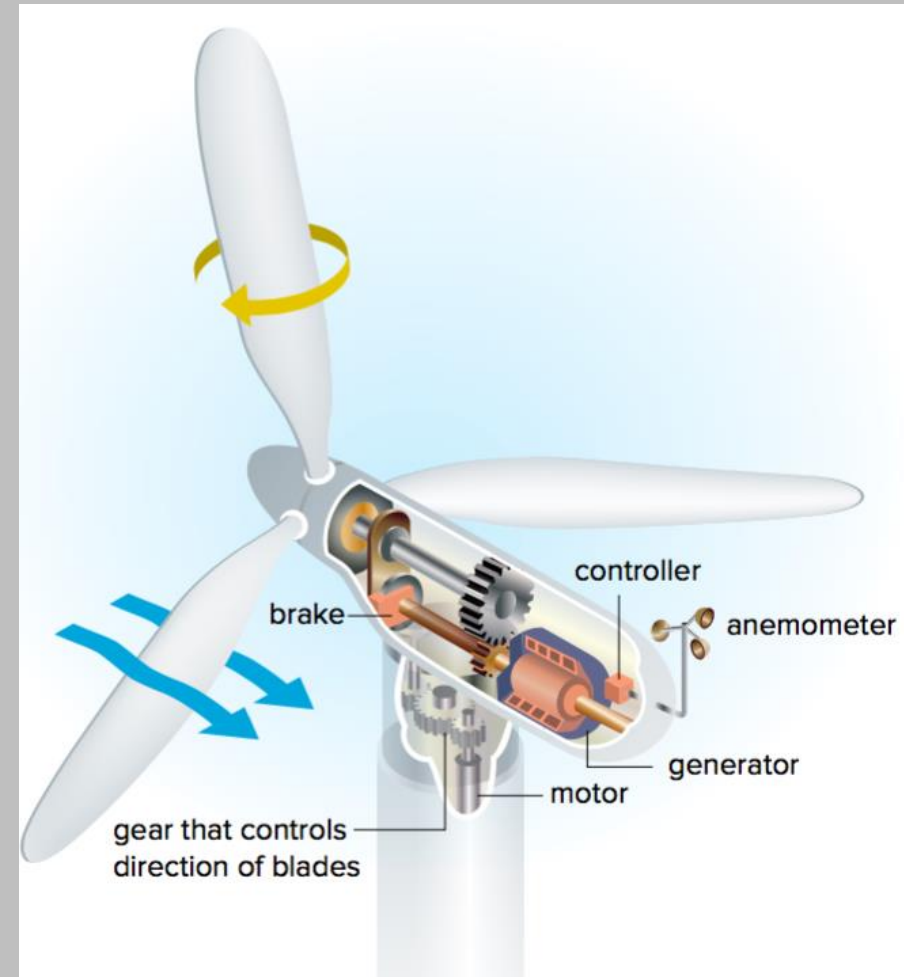


Figure 3.5

ELECTRICAL ENERGY FROM SUNLIGHT

- Photovoltaic cells transform the energy of visible light to electrical energy
- When visible light strikes electrons in the photovoltaic cells, the electrons absorb enough energy to flow freely and generate electrical energy



Figure 3.6

ELECTRICAL ENERGY FROM GEOTHERMAL SOURCES

- Where Earth's crust is thin and molten rock comes close to the surface, hot steam can be used to turn turbines to generate electrical energy



Figure 3.7

ELECTRICAL ENERGY FROM WAVES AND TIDES

- Tides and the rise and fall of waves can turn turbines to generate electrical energy



Figure 3.8

WHAT ARE THE PROPERTIES OF AN IDEAL ENERGY SOURCE?