

Lesson 1:

SNC1P

Lesson 1

4.1 How do the sources used to generate electrical energy compare?

1. Different sources of energy can be converted into electrical energy.

- Most of the electrical energy in Canada is made by converting **k**_____ energy (the energy of motion) into **e**_____ energy. This is done with a device called a **g**_____.
- Any type of energy that can be used to turn a turbine can be used to generate electrical energy.
- The vast majority of electrical energy used in Ontario (and Canada) is generated from three sources of energy: **f**_____, **f**_____, and **u**_____.
- The processes that convert these three sources to electrical energy are described below.
 - A) **H**_____ sources of energy convert **k**_____ energy of moving water to electrical energy. Water flowing through a **d**_____ spins giant turbines, which spin a generator to produce electrical energy.
 - B) **T**_____ sources of energy convert the chemical energy of burning fossil fuels (mostly **c**_____) into heat that boils water into steam. The kinetic energy of the hot steam spins a turbine to generate electrical energy. Burning fuel boils water to make **s**_____, and then steam spins giant turbines, which spin a generator to generate electrical energy.
 - C) **N**_____ sources of energy convert the energy released from the **s**_____ of uranium atoms into heat that boils water into steam. The kinetic energy of the hot steam spins a turbine to generate electrical energy. Thus, heat from a nuclear reactor boils water to make steam, and then steam spins a generator to generate electrical energy.

2. Energy sources have advantages and disadvantages.

- A **r**_____ energy source can be replaced or restocked within a short period of time. The water that is used to generate hydroelectric energy is an example of renewable energy source. **w**_____, **s**_____, **b**_____, **t**_____, and **g**_____ are other examples of renewable energy sources.
- Two energy sources used to generate electrical energy:
 - A generator is located directly behind the blades of each **w**_____. As the blades turn the shaft, electrical energy is generated.
 - **s**_____ convert solar energy directly into electrical energy.
- A **n**_____ energy source is one that cannot be replaced or restocked within a human lifetime. **f**_____ and **u**_____ are examples of non-renewable energy sources. Fossil fuels took millions of years to form on Earth, and millions of years will be needed to create new stocks of them. Uranium was formed in the **e**_____ of stars before Earth was formed. Some of the uranium condensed with the dust that formed Earth billions of years ago. It can never be replaced. So when all available supplies of fossil fuels and uranium on Earth are used up, they are gone forever.

Homework: p. 124 and 127

Sources of Electrical Energy

Textbook pages 244–251.

Before You Read

One source of electrical energy is water flowing through a dam. What other sources of electrical energy can you think of?



Mark the Text

Identify Concepts

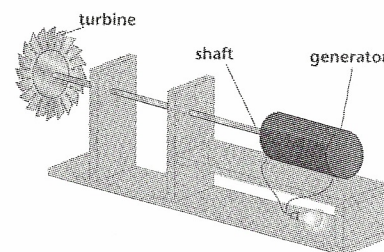
Highlight each question head in this section. As you read, highlight the answers to the questions using a different colour.

What are some different forms of energy?

Energy comes in many different forms, including kinetic energy (the energy of motion), chemical energy (energy stored in the bonds of atoms and molecules), nuclear energy (energy stored in the nucleus of an atom), and electrical energy (electricity). All forms of energy can be converted into other forms. In Canada, most electrical energy is made by converting kinetic energy using a device called a *generator*.

How does a generator work?

The key parts of a generator system are a *turbine*, a *shaft*, and the generator itself. When the turbine turns, it spins the shaft, which spins a rotor in the generator. The kinetic energy of the spinning rotor is converted into electrical energy inside the generator.



Reading Check

1. Name the three main sources of energy used to generate electrical energy in Ontario.

What sources of energy are used to generate electrical energy?

Any form of energy that can be used to turn a turbine can be used to generate electrical energy. The three main sources of energy used to generate electrical energy in Ontario are:

- hydroelectric (moving water)
- thermoelectric (burning fossil fuels)
- nuclear (heat from nuclear reactions of uranium atoms) ✓

What are renewable and non-renewable energy sources?

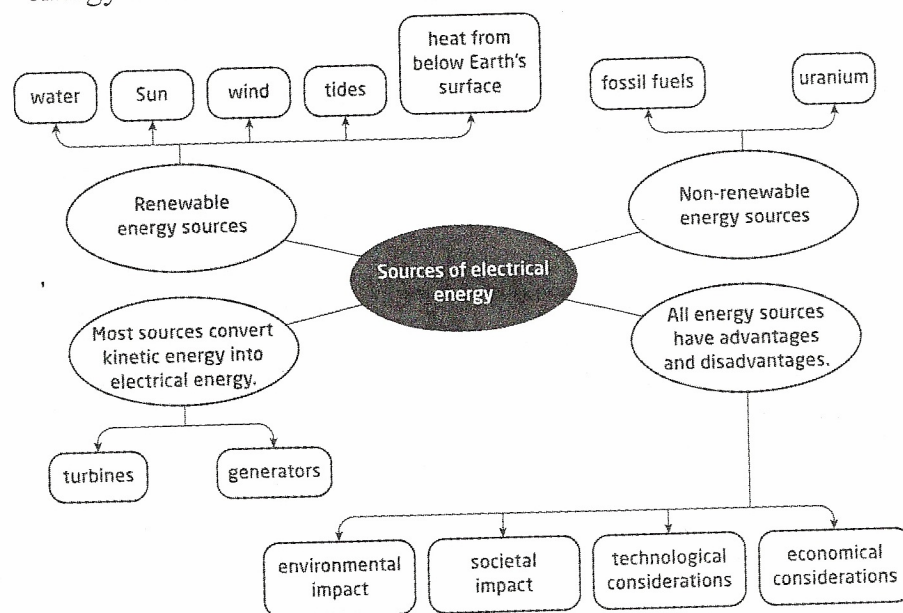
Renewable energy sources can be replaced or restocked within a human lifetime, or less. They include water, wind, the Sun, biomass, tides, and heat from below Earth's surface (geothermal energy).

Non-renewable energy sources, such as fossil fuels and uranium, cannot be replaced or restocked within a human lifetime. These sources of energy take from millions to billions of years to form. When all available supplies are used up, they are gone forever. ✓

What factors are considered when assessing an energy source?

Each energy source has advantages and disadvantages. Factors to consider when assessing an energy source include:

- impact on ecosystems (What are the effects of extracting and using the energy source?)
- impact on society (What are the effects on where and how people live?)
- the technology required (Is the technology available, energy-efficient, and cost-effective?)
- economic considerations (Are there abundant supplies of the energy source? Can the energy source be used everywhere?)



✓ Reading Check

2. What is the difference between renewable and non-renewable energy sources?

Use with textbook pages 246–249.

Energy

Vocabulary

biomass	nuclear
chemical	renewable
fossil fuels	shaft
generator	Sun
heat from below Earth's surface	thermoelectric
hydroelectric	tides
kinetic	turbine
moving water	uranium
non-renewable	wind

Use the terms in the vocabulary box to fill in the blanks. You will not need to use every term. You may use terms more than once.

1. Energy associated with movement or motion is called _____ energy.
2. Energy that is stored in the nucleus of an atom is called _____ energy.
3. Kinetic energy can be converted into electrical energy using a device called a _____.
4. The key parts of a generator system are a _____, _____, and _____.
5. Coal, oil, and natural gas are types of _____ that took millions of years to form on Earth.
6. Most electrical energy used in Canada is generated from three sources of energy: _____, _____, and _____.
7. _____ and _____ sources of energy both convert energy into heat that boils water into steam to spin a turbine.
8. An energy source that can be replaced or restocked within a human lifetime, or less, is called a _____ energy source.
9. Two examples of renewable energy sources are _____ and _____. Two examples of non-renewable energy sources are _____ and _____.

Name _____

Date _____

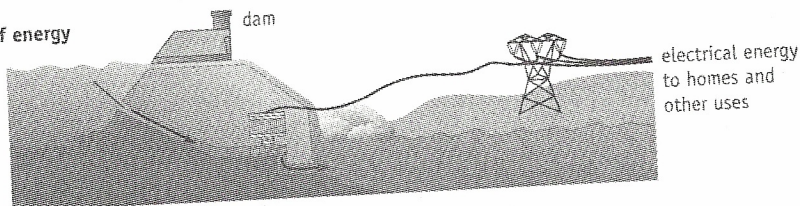
Use with textbook pages 246–247.

Resources for generating electrical energy

Examine the following diagrams, which show three ways to generate electrical energy.

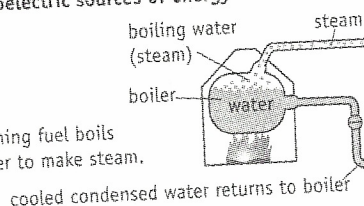
A Hydroelectric sources of energy

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



B Thermoelectric sources of energy

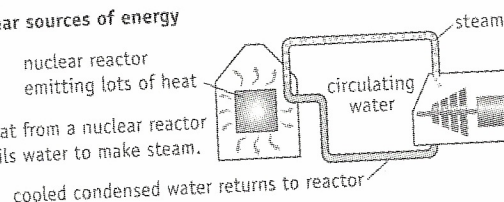
1. Burning fuel boils water to make steam.



2. Steam spins giant turbines, which spin a generator to generate electrical energy.

C Nuclear sources of energy

1. Heat from a nuclear reactor boils water to make steam.



2. Steam spins giant turbines, which spin a generator to generate electrical energy.

1. Label the **turbine** and the **generator** in diagrams A, B, and C.
2. Use checkmarks to show which of the three sources of energy have each of the characteristics listed. A characteristic may apply to more than one source of energy.

Characteristic	Source of energy		
	Hydroelectric	Thermoelectric	Nuclear
The process of generating electrical energy using these resources involves spinning turbines, which spin a generator.			
These resources convert the kinetic energy of moving water to spin giant turbines.			
Using these resources produces lots of heat that boils water into steam.			
Using these resources involves burning fossil fuels.			
The process of generating electrical energy using these resources involves circulating water through a closed system of pipes.			

Use with textbook pages 248–249.

Renewable or non-renewable?

For each of the following statements, identify whether it applies to a renewable energy source, a non-renewable energy source, or both.

1. This energy source can be replaced within a short period of time.

2. Fossil fuels and uranium are examples of this type of energy source.

3. Wind and the Sun are examples of this type of energy source.

4. The water cycle helps to make water this type of energy source.

5. This type of energy source has advantages and disadvantages.

6. This energy source takes millions to billions of years to form on Earth.

7. Once this energy source is used up, it will be gone forever.

8. Environmental, societal, technological, and economical factors must be considered when assessing this type of energy source.

Sources of electrical energy

Use with textbook pages 244–251.

Match each Term on the left with the Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ geothermal	A. part of a generator system
2. _____ uranium	B. heat from below Earth's surface
3. _____ turbine	C. released from the splitting of uranium
4. _____ hydroelectric energy	D. took millions of years to form on Earth
5. _____ coal	E. formed in the explosions of stars before Earth formed
6. _____ fossil fuels	F. is generated by moving water
	G. uses steam to spin giant turbines
	H. a type of fossil fuel

7. Copy and complete the table below to compare three ways used to generate electricity. Place each of the following descriptions under the correct heading(s) in the chart. You can place a description under more than one heading.

- uses fossil fuels
- uses uranium
- uses water
- converts chemical energy to electrical energy
- converts kinetic energy to electrical energy

- converts nuclear energy to electrical energy
- falling water spins giant turbines
- steam spins giant turbines

Hydroelectric	Thermoelectric	Nuclear

8. a) What is the name of the device that converts kinetic energy into electrical energy?

b) Name the three main parts of this device.

9. a) What is the difference between a renewable and non-renewable energy source?

b) Give two examples of renewable energy resources.

c) Give two examples of non-renewable energy resources.

10. List two factors that should be considered when assessing an energy source for its advantages and disadvantages.