Section 5.3 Questions

Understanding Concepts

1. List four non-renewable energy resources and five renewable energy resources.
2. Write the energy transformation equation for each of the following resources used to produce electrical energy:
   (a) hydraulic energy
   (b) the Sun
   (c) biomass
   (d) nuclear fusion
3. List some harmful effects to the environment resulting from each of these types of electrical generating stations:
   (a) coal-fired
   (b) hydraulic
   (c) tidal
   (d) nuclear fission

Making Connections

4. Research the means of converting renewable energy to useful energy, then list some reasons why renewable energy resources are not emphasized more throughout Canada. Follow the links for Nelson Physics 11, 5.3.

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5. Which alternative energy resource described in this section is most likely to be developed in your area? Explain why.
6. Most of Canada's electrical energy is generated at enormous centralized generating stations that use a variety of fuels, mostly non-renewable ones. The generated electricity then enters a grid and spreads out to the consumers, who are often at great distances from the stations. Suggest an alternative generation and supply system for your area that may make more sense considering the variety of renewable energy resources now available.

DID YOU KNOW ?

Fuel Cell Applications

Fuel cell technology is being used and developed for many applications. Phosphoric fuel cells, which operate at efficiencies between 40% and 85%, are used in buildings such as hospitals and schools, and in buses and other large vehicles. Solid oxide fuel cells are applied in industry and electrical generating stations. This method of generating electrical energy is cheaper to set up and more efficient than using fossil fuels. You can find information about these and other fuel cell applications on the Internet.

DID YOU KNOW ?

Thermoacoustic Refrigeration

Like a heat pump, a refrigerator uses a refrigerant. Old refrigerants pose many difficulties, so scientists try to find ways of producing better refrigerants or not using them at all. The latter case is possible with a new energy transformation technology called a thermoacoustic refrigerator. This device has a driver that is basically a high-powered loudspeaker that sends sound waves vibrating back and forth through gases in a resonating tube. The vibrating gases carry heat away from the food being cooled in the refrigerator to a radiator that emits radiant energy to the air outside the refrigerator.

5.4 Using Energy Wisely

This topic, like the others in this chapter, could fill an entire book. In this section, we will explore what we, as a society and as individuals, can do to ensure that our energy supplies will be available for future generations.

Society's Responsibilities in Using Energy

We all rely heavily on electricity. The production of most of our electricity creates much unwanted pollution and requires vast amounts of non-renewable resources. To improve the efficiency of energy production, some of the thermal energy created during electricity generation could be used as an alternative source of energy. Doing this would reduce not only thermal pollution, but also the need for other resources for heating purposes. The process of producing electricity and using the resulting thermal energy for heat is called **cogeneration**. Cogeneration is used mainly in industrial plants located near generating stations. It is likely to become more important in the future.

cogeneration: the process of producing electricity and using the resulting thermal energy for heat

Another way to improve the efficiency of generating electricity is to learn how to produce electricity for **local consumption**, so that the energy does not have to be transferred over long distances using huge transmission lines. Sources of energy for localized power include renewable resources such as solar, hydraulic, and wind energy.

local consumption: generating energy locally to avoid the transfer of energy over long distances using transmission lines

Conserving energy is another vital goal for all members of our society. Governments have provided incentives for people to improve home insulation and to replace old, inefficient furnaces with new ones that use cleaner, more plentiful sources of energy. They also promote the use of active and passive solar heating systems.

In transportation, governments support reduced speed limits, car pools, public transportation, and lanes on city roads restricted to bus use only. **Table 1** makes it clear that a person driving alone in a car consumes a relatively large amount of energy for the distance travelled.

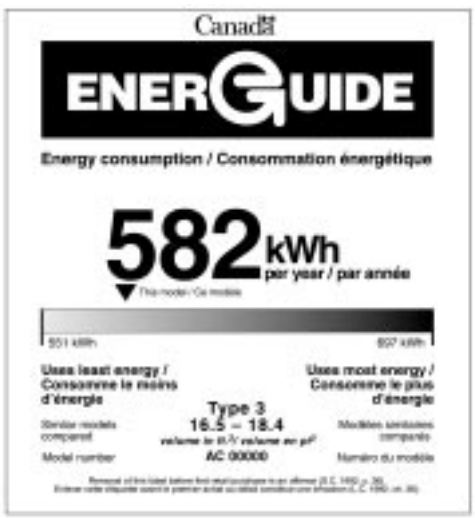


Figure 1
EnerGuide label

Table 1 A Comparison of Forms of Surface Transportation

Passenger kilometres per litre	Average number of passengers
highway bus	22
inter-city train	400
compact car	1.5
urban bus	12
large car in city	1.5

Canada's Energy Efficiency Act and Regulations require that most household appliances be tested to a prescribed standard, with the rating printed on the EnerGuide label for each appliance (see **Figure 1**). A directory that lists the ratings is published every year.

Try This **Activity**

Saving Energy

In a group, brainstorm ways in which energy savings could be realized within your school. Consider lighting, heating, air conditioning, the use of water, reusing, recycling, and any other factors you can think of. Describe your ideas, and write a proposal in which your school gains half of the savings generated by the ways you describe. The proposal can be aimed at the school board or your local school council.

Practice

Making Connections

1. Use at least one of the following questions to initiate a project, debate, or class discussion:
   (a) Is cogeneration of electricity possible in your region?
   (b) Is electricity generation for local consumption possible in your area?
   (c) Should highway express lanes in and near large cities be reserved during rush hours for cars with three or more people?
   (d) How could school officials improve energy consumption in your school?
   (e) If you were in control of time zones in Canada, would you advise the use of standard time, daylight savings time, or a combination? Explain your reasons.

Our Personal Responsibilities in Using Energy

Ideally, we all would like our lives to be carefree and happy. To achieve this state, we must all share responsibility for conserving energy. There are many ways to conserve energy at home. Consider the following questions:

- Do you use more hot water than necessary to take a bath or shower?
- Do you leave the refrigerator door open while deciding what to eat?
- Do you keep your home quite cool in the winter and wear a sweater?
- If you have a fireplace, does most of the heat it produces go up the chimney? See **Figure 2**.
- Is your home properly insulated?
- Do you leave lights and electric appliances on when they are not in use?
- Are you aware of which types of lights and appliances are most efficient?
- When you use an appliance such as a toaster, clothes washer, or clothes dryer, do you make maximum use of its energy?

Besides conserving energy in our homes, we should conserve it outside as well. Consider these questions:

- When you travel short distances, do you usually walk or take a car?
- Do you take part in entertainment and sports activities that are large energy consumers, such as water-skiing behind a motorboat? Can you think of fun activities that would consume less energy, for example, wind surfing?

These are just a few of the many important questions about energy we can ask ourselves. The answers will help determine the fate of future generations who will, no doubt, wish to be able to continue to consume energy.

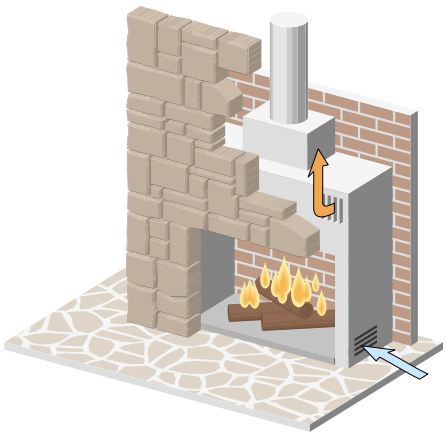


Figure 2
In a fireplace heat circulator, cool air enters through the lower vent and passes through a duct adjacent to the fire. The hot air rises and is discharged through the upper vent or passes through ducts to other rooms.

Practice

Understanding Concepts

2. Describe ways in which you can conserve energy in your own home.
3. Ice cubes that remain in the freezer compartment of a frost-free refrigerator gradually disappear. Why does this occur? Is leaving ice cubes in such a freezer an efficient use of energy? Explain.

SUMMARY Using Energy Wisely

- Governments, industries, and individuals can all work toward using energy wisely.

Section 5.4 Questions

Understanding Concepts

1. Describe what you can do to improve the efficiency of the ways in which you use energy.

Making Connections

2. Which technique would be more effective at conserving automobile fuel—fuel rationing or higher taxes? Justify your choice.
3. Should consumers pay more or less when they increase the rate of electrical energy they consume? What is the current pricing policy in your area?

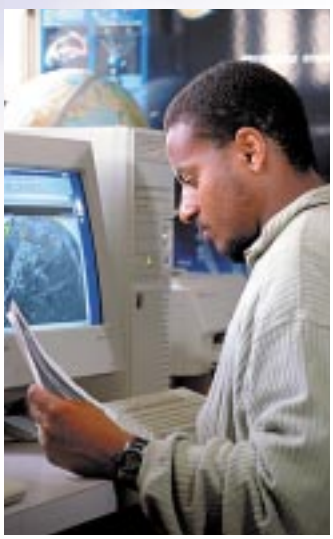
CAREER

Careers in Energy, Work, and Power

There are many different types of careers that involve the study of energy, work, and power in one form or another. Have a look at the careers described on this page and find out more about one of them or another career in energy, work, and power that interests you.

Building Systems and Engineering Technologist

For admission to this three-year community college diploma course, a high school diploma with mathematics and English is required; physics and chemistry are an asset. These technologists manage the electrical, water, and mechanical systems of a building, and access land for potential development, particularly with regard to soil quality. They work for school boards, municipalities, and major property development or property management companies to provide the best energy-use options and to stabilize contracts for energy suppliers.



Heating, Refrigeration, and Air-Conditioning Technician

To gain entry to this two-year community college program, you would need a high school diploma with an advanced mathematics credit, or you could be a mature student. Many of the on-the-job technicians are sponsored by their employers to study for this program. These technicians usually work for developers, work in factories and office buildings, or work for government agencies. They work with a variety of hand tools and must be able to read diagrams.

Meteorologist

An entry-level position in meteorology or atmospheric sciences requires a bachelor's degree in meteorology with a strong background in mathematics, physics, and computer science. Meteorologists study the atmosphere and must be familiar with the physical characteristics and the motion of Earth. They assess temperature, wind velocity, and humidity in order to forecast the weather. They also study air pollution and climate trends, such as global warming and ozone depletion. Meteorologists work with sophisticated computer models, weather balloons, satellites, and radar.

Practice

Making Connections

1. Identify several careers that require knowledge about energy, work, and power. Select a career you are interested in from the list you made or from the careers described above. Imagine that you have been employed in your chosen career for five years and that you are applying to work on a new project of interest.
   (a) Describe the project. It should be related to some of the new things you learned in this unit. Explain how the concepts from this unit are applied in the project.
   (b) Create a résumé listing your credentials and explaining why you are qualified to work on the project. Include in your résumé
   - your educational background—what university degree or diploma program you graduated with, which educational institute you attended, post-graduate training (if any);
   - your duties and skills in previous jobs; and
   - your salary expectations.

   Follow the links for Nelson Physics 11, 5.4.

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