Key Terms
bias
carbon footprint
carbon offset

9.3 Taking Action to Slow Climate Change

Scientists do not know how rapidly climate change may occur or how much damage it may cause to ecosystems and human society. However, we do know that human activities affect the climate, and our best choice for the future is to reduce those effects. We can do this as individuals, as a nation, and as an international community.

A changing climate will bring changes in our technologies and personal habits. It will affect the political and economic structures that define our world. For example, a warmer Arctic will have less sea ice. This change will open up sea routes for year-round shipping. The newly available routes may change international trade agreements and influence treaties about fishing grounds and shipping routes.

The first step in taking action to slow climate change is to educate ourselves and each other about factors that cause climate change, including human activities. We must learn to evaluate our everyday activities and determine which activities we can take to slow climate change. It is important to be realistic about the effect that our behaviours have, but a little change can make a big difference. For example, hanging clothes out to dry, as shown in **Figure 9.18**, instead of using an electric clothes dryer prevents the release of 310 kg of carbon dioxide per year. Other small lifestyle changes that can slow climate change include recycling materials, walking or biking instead of driving, and installing low-flow showerheads and toilets in your home.

Figure 9.18 Small lifestyle changes, such as drying clothes on a line instead of using an electric clothes dryer, can result in large reductions in your contribution to climate change.

Educating Yourself About Climate Change

"Scientists Disagree Over Global Warming." "Future Climate Uncertain." You may have seen headlines like these on web sites or in newspapers and magazines, or heard similar claims in the media. Both statements are true. However, non-scientists and scientists often interpret disagreements and uncertainties in different ways.

New data about climate change are added to our knowledge every year. As part of the scientific process, hypotheses are revised and re-tested as new information becomes available. As more and more evidence is published, the scientific community reaches a general agreement or consensus.

Outside of the scientific community, people also have disagreements and uncertainties. People are more likely to disagree over topics that are complex. Although data and hypotheses provide evidence on these topics, people also make decisions based on their beliefs and values.

Making Decisions About Climate Change

The combination of satellites and computers now allows anyone who has access to the Internet to view environmental changes for themselves. Internet sites and their tools allow you to gather information about hurricanes, floods, deserts, sea ice, air pollution, deforestation and reforestation, dust storms, crop growth, forest fires, and many other conditions on Earth. However, understanding the relationship between climate change and human activities is complex. Not all scientists, governments, politicians, or individuals agree on how the scientific data should be interpreted.

The interpretation of scientific and nonscientific information guides how decisions are made at home, at school, in businesses, and at all levels of government. Many different organizations are suggesting many different solutions to a variety of different climate-change issues. How we evaluate the advantages and disadvantages of these solutions is almost as complicated as understanding climate change itself.

Detecting Bias in Information About Climate Change

Magazines and other news sources commonly use dramatic photos and startling headlines to advertise articles about climate change. These photos and headlines are designed to elicit emotional responses from readers and influence opinions. When you read about climate change, it is important to evaluate the fairness and accuracy of the information presented.

bias a tendency toward a particular perspective or point of view that prevents objective assessment of a topic

Information from different sources commonly contains bias. **Bias** is a tendency toward a particular perspective or point of view that prevents objective assessment of a topic. Biased sources generally present only the information that supports one point of view. The process of detecting and evaluating bias in scientific reports on climate change is not easy. The following questions can help you evaluate sources of information for bias.

- Is the information in a respected scientific journal that is reviewed by professional scientists?
- What is the source of the information? For example, is it based on research at a university, a government department, or a private corporation or institute?
- Does the author of the source have an agenda? For example, is a report trying to raise support for a political party or organization, to influence behaviour, or to sell a product or service?
- Does the report misrepresent information or interpret it in a way that is not supported by evidence?

Study Toolkit

Creating a Word Map The illustrations and examples in a word map can help clarify the definition of a term. Create a word map for *bias*.

Calculating Your Carbon Footprint

Most climatologists agree that an increase in greenhouse gases is the largest single cause of current climate change. The main human causes of this increase are activities that produce air pollution and activities (such as cutting down forests) that reduce the ability of natural cycles to absorb greenhouse gases.

Fossil fuels are burned to produce electricity and heat, to power our vehicles for transportation, and to manufacture and transport consumer goods. The burning of fossil fuels releases carbon dioxide into the air, which may lead to climate change. Our net contribution to climate change varies from person to person, business to business, and country to country. To help compare different degrees of impact, researchers developed the concept of a **carbon footprint**. A carbon footprint measures the amount of greenhouse gases produced in units of carbon dioxide. For example, you can calculate how many tonnes of carbon dioxide production you are responsible for in your daily life through such activities as driving or travelling by plane, cooking food, and buying manufactured goods, as shown in **Figure 9.19**. All of these activities involve burning fossil fuels. Many web sites have carbon footprint calculators that let you find out how the carbon footprint of your household compares with that of other families.

Suggested Investigation

Real World Investigation 9-B, Evaluating the "Food Miles" Initiative, on page 384

carbon footprint the effect that human activities have on the environment in terms of the amount of greenhouse gases produced, measured in units of carbon dioxide

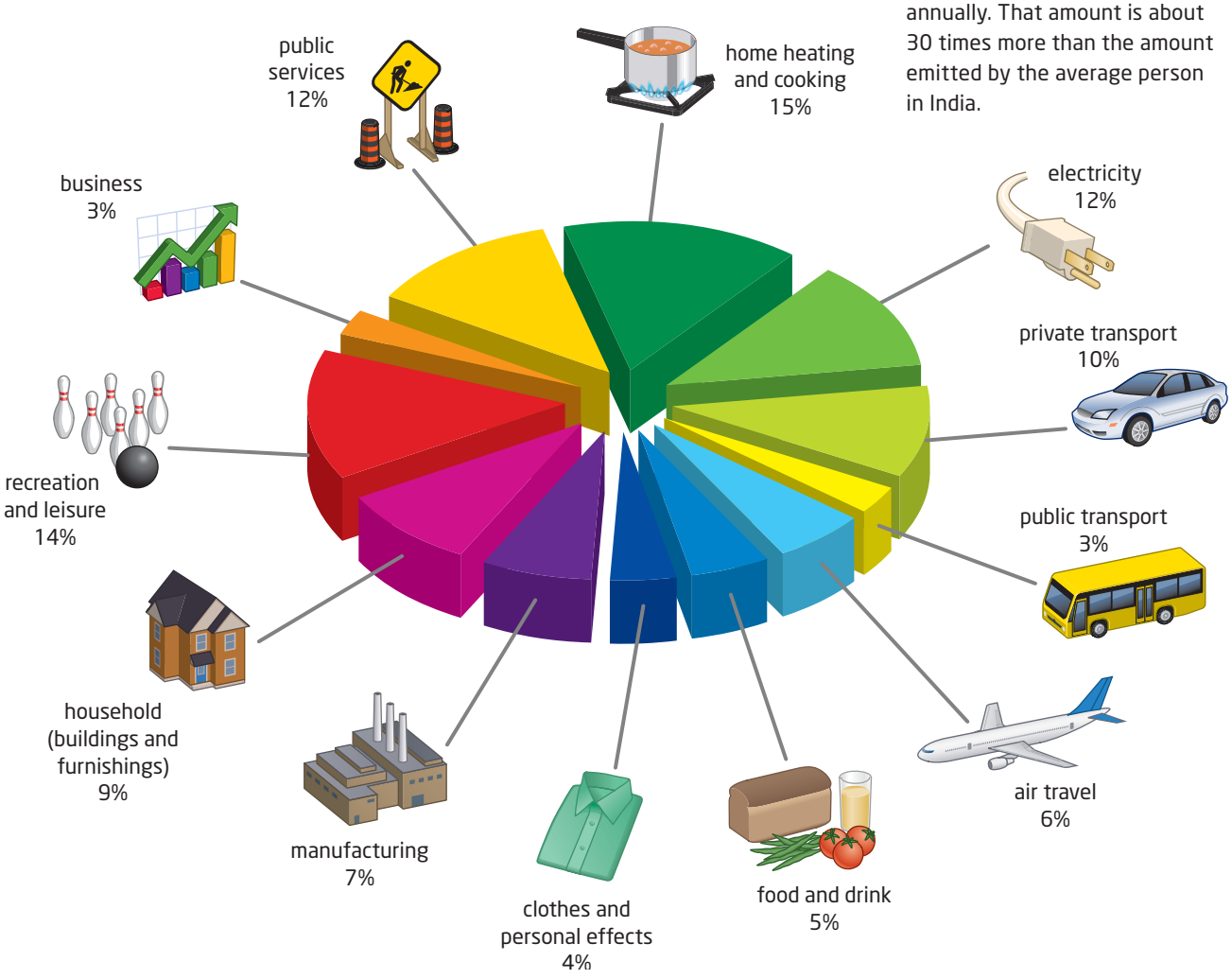


Figure 9.19 Canada emits over 630 million tonnes of carbon dioxide per year. Therefore, every Canadian is responsible for releasing an average of about 19.5 tonnes of carbon dioxide annually. That amount is about 30 times more than the amount emitted by the average person in India.

Reducing Your Carbon Footprint

carbon offset a means of reducing or avoiding greenhouse gas emissions by purchasing credits to reduce your carbon footprint

People who are skeptical about anthropogenic climate change argue that the carbon footprint is a misleading or unhelpful concept. Some skeptics argue that the influence average individuals have on climate is less significant than the influence that governments and corporations have. They also claim that the calculations of carbon footprints are very crude and inaccurate. However, the combined actions of every person on Earth equal a significant portion of the human contribution to climate change. Therefore, responsibility on the individual level plays an important role in reducing global greenhouse gas emissions.

You can reduce your carbon footprint by choosing activities that reduce or eliminate the need to burn fossil fuels. Simple ways to reduce your carbon footprint include unplugging your mobile phone charger when it's not in use, drinking tap water instead of bottled water when possible, and taking shorter showers to use less heated water. As **Figure 9.20** shows, making a difference doesn't have to be difficult.

Go to **scienceontario** to find out more

You may also choose to purchase **carbon offsets** to minimize your carbon footprint. Carbon offsets are credits that an individual or organization can purchase to compensate for performing a different carbon-dioxide emitting activity. For example, someone who has travelled by airplane may offset the carbon emissions caused by that flight by donating money to a tree-planting program. Other activities that are supported by the purchase of carbon offsets include development of alternative sources of energy, recycling programs, and methane capture from landfills.

Learning Check

1. Why is it important to educate yourself about climate change?
2. According to **Figure 9.19**, what three actions contribute most to the carbon footprint of the average Canadian?
3. What are the two main strategies for reducing your carbon footprint?
4. Create a table that has two columns and several rows. In the left-hand column, list daily actions that emit greenhouse gases. In the right-hand column, list potential actions that would help you reduce your carbon footprint.

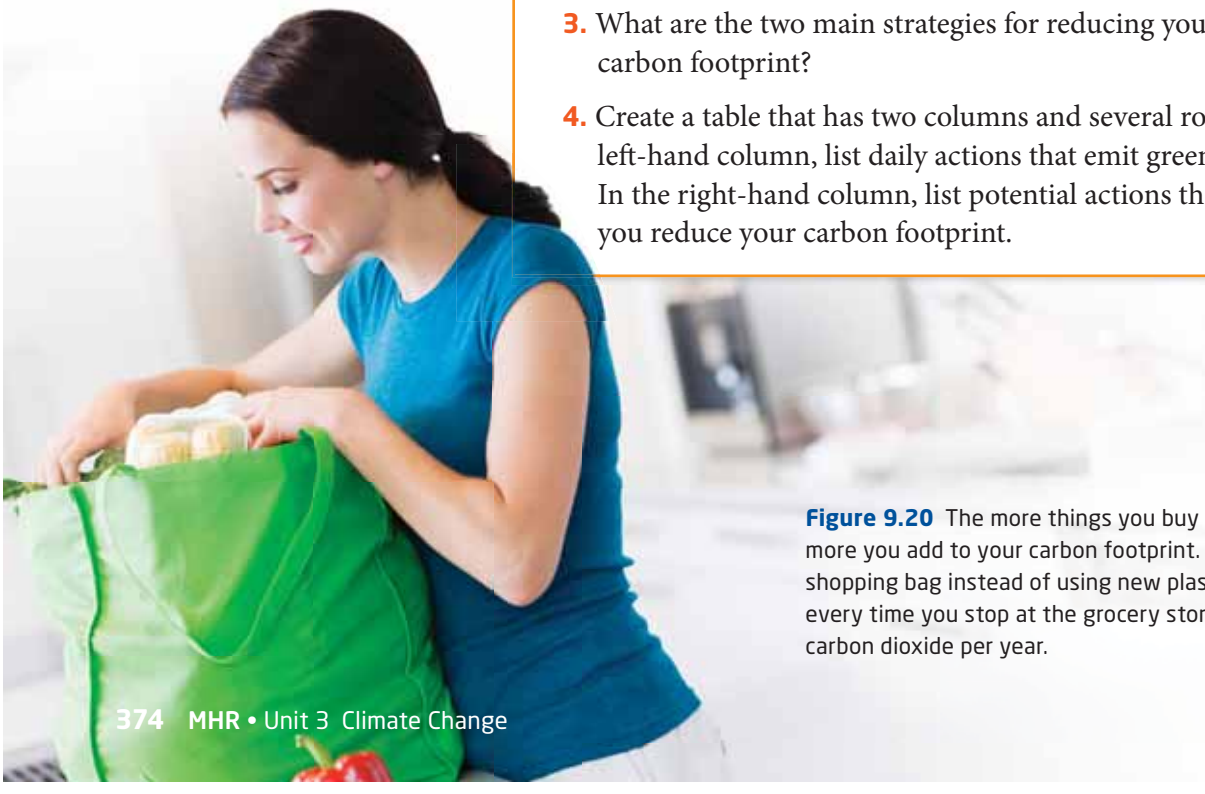


Figure 9.20 The more things you buy and throw away, the more you add to your carbon footprint. Carrying a reusable shopping bag instead of using new plastic carrier bags every time you stop at the grocery store can save 5 kg of carbon dioxide per year.

Advocating for Actions to Slow Climate Change

Advocating for awareness and action is another powerful way to affect climate change. For example, as an advocate, you can help educate others and influence how governments and individuals respond to the issue of climate change. The following actions can help you be an effective advocate:

1. identify and join groups or individuals who champion actions that you support
2. learn about the processes by which governments and advocacy groups enact and influence environmental laws
3. set an example by reducing your carbon footprint
4. write letters to corporations and government representatives to encourage them to support initiatives to slow climate change

Activity 9-4

Talking the Talk, Walking the Walk

How much of a difference can a little lifestyle change make in terms of global warming? In this activity, you will choose one action that you can take to slow climate change.

Materials

- Computer with Internet access

Seemingly small actions, like plugging electrical devices into a power strip that is turned off when the devices are not in use, can have a big impact on climate change.

Procedure

1. Choose one of the following actions: washing only full loads of laundry instead of partial loads, drying clothes on a clothesline instead of in an electric dryer, using reusable shopping bags instead of single-use plastic bags, using a power strip to eliminate standby power for electrical devices that are not in use, and listening to the radio instead of watching television.
2. Using the Internet and other sources, identify the daily and annual carbon savings that result from performing each action.
3. Create a plan for making each action part of your daily life. How would your lifestyle have to change in order to implement each action?
4. Choose one action and perform the action for one week.

Questions

1. Calculate the amount of carbon dioxide you prevented from entering the atmosphere by performing that one action for one week.
2. Choose a different action and make a commitment to performing that action every day for a year. Explain which action you chose and why you chose that action.
3. Based on the information provided in **Figure 9.19**, what percentage of your total carbon footprint could you reduce by performing this action?

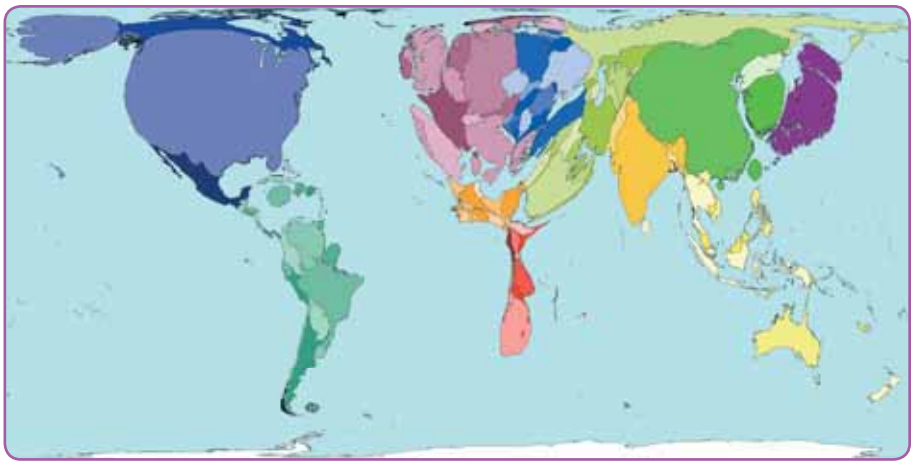


Figure 9.21 The larger the land area of a country appears in this distorted map, the more greenhouse gases are emitted by that country.

Global Contributions to Climate Change

The map in **Figure 9.21** shows the global warming potential (GWP) of the greenhouse gases emitted by different areas of the world in 2002. Europe, Japan, the United States, and China are disproportionately large because their populations are large and the average lifestyle in those locations expends large amounts of energy. Producing this energy emits much more gas per person and creates more types of greenhouse gases.

On the map, Africa appears smaller than its land area or population would suggest because poverty prevents most people who live there from using electricity or performing activities that would emit greenhouse gases. However, some developing countries contribute to the anthropogenic greenhouse effect by clearing their forests, which removes trees that help absorb carbon dioxide from the atmosphere. Recent studies also indicate that soot, or black carbon, from small cooking stoves in developing countries may be a major contributor to global climate change. In fact, black carbon may be responsible for 18 percent of Earth's warming and as much as half of Arctic warming. Converting to newer stoves that do not release as much soot may have a major positive influence in terms of slowing climate change.

Figure 9.22 Key Stages in the International Response to Climate Change

1979
The first **World Climate Conference** was organized by the World Meteorological Organization (WMO). Scientists expressed concern that continued human activities may cause significant climate change.

1985
The United Nations set up the **Advisory Group on Greenhouse Gases (AGGG)** to assess the implications of climate change.

1987
The **Montréal Protocol on Substances That Deplete the Ozone Layer** was established by the United Nations to phase out production of substances believed to be responsible for creating the ozone hole.

1988
The WMO and the United Nations Environmental Program (UNEP) established the **Intergovernmental Panel on Climate Change (IPCC)**. This panel includes climate and policy experts from about 130 countries. The IPCC regularly reports on

- the available scientific information on climate change
- the environmental, social, and economic effects of climate change
- effective strategies to combat climate change

International Initiatives to Combat Climate Change

The impacts of climate change vary from country to country, depending on location, population, and way of life. However, the climate system is global. Winds and ocean currents do not stop at national borders. Effective solutions to climate change must involve a great deal of international cooperation. **Figure 9.22** summarizes the important steps that have occurred in international cooperation in dealing with climate change.

The Intergovernmental Panel on Climate Change (IPCC)

In 1988, the United Nations Environment Programme and the World Meteorologic Organization formed the Intergovernmental Panel on Climate Change (IPCC). The IPCC is composed of hundreds of scientists from all over the globe. The goals of this panel are to assess the role of human activities in producing climate change and to recommend ways to respond.

The IPCC regularly reports on the available scientific information on climate change; the environmental, social, and economic effects of climate change; and effective strategies to combat climate change. The IPCC also regularly organizes conferences and summits in which delegates from participating governments and organizations, such as Chief Bill Erasmus shown in **Figure 9.23**, meet to discuss new scientific data and policies.

Figure 9.23 In December 2008, Chief Bill Erasmus of the Dene nation in northern Canada attended the United Nations Climate Change Conference in Poland. Erasmus wanted to raise awareness of the effects of climate change on Canada's native species and Aboriginal peoples.

The Kyoto Protocol

In 1997, the Kyoto Protocol was developed. This international treaty was produced as a result of the Earth Summit in Rio de Janiero, Brazil, and acts as a legally binding commitment between nations. The industrialized nations that signed the treaty agreed to reduce their collective emissions of four greenhouse gases and two halocarbons by 5.2 percent compared to the emissions of those gases in 1990. By 2008, 183 nations and the European Union had signed the agreement. At that time, the United States was the only developed country that had not ratified the agreement.

1992
An international treaty called the **United Nations Framework Convention on Climate Change (UNFCCC)** was produced at the Earth Summit held in Rio de Janeiro. Its aim was to stabilize greenhouse gas concentrations in the atmosphere by imposing limits on emissions from individual nations.

1999 — 2009

1997
The **Kyoto Protocol** was an update of the UNFCCC that commits participating nations to reducing emissions of greenhouse gases to levels specified for each country. The Kyoto Protocol has been signed and approved by 181 countries and the European Union. Together, these countries produce only 60 percent of global greenhouse gas emissions. Participating countries must meet their commitments by December 2012 or face penalties.

2007
The **IPCC Fourth Assessment Report:** Climate Change 2007 concluded that the global climate is warming and that most of the increase in average global temperature since the mid-20th century was due to an increase in anthropogenic greenhouse gas concentrations. It predicted future increases in heat waves and rainfall, and a rise in sea levels.

Educating and Empowering Consumers

Governments also help individuals combat climate change by passing laws or regulations and by educating consumers to make choices that benefit the environment. Canada's Office of Energy Efficiency (OEE) has implemented a program called the ecoEnergy Efficiency Initiative. One ecoEnergy program provides financial incentives to homeowners and businesses to retrofit older buildings to make them more energy efficient. It also provides helpful tips to the public on buying, driving, and maintaining vehicles to save fuel. In addition, Ontario's Drive Clean program requires all Ontario cars to pass strict emissions inspections.

Imagine that your family wants to buy new light bulbs that use less energy. The task of choosing is made easier by the international ENERGY STAR® symbol, as shown in **Figure 9.24**. The symbol is found on many different energy-efficient products, from CFLs or LED light bulbs to furnaces, refrigerators, and other major appliances. The ENERGY STAR® symbol indicates that a product meets specifications for reduced energy consumption, which helps lower production of greenhouse gas emissions.

Figure 9.24 This logo on a product indicates that the product meets high standards of energy efficiency.

STSE Case Study

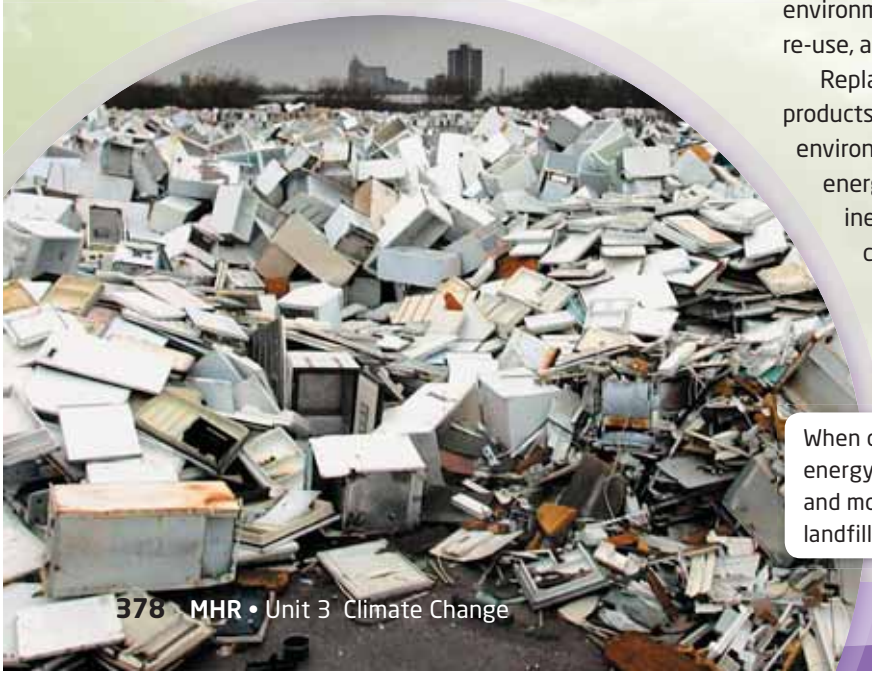
Reduce, Re-use, Recycle, and Upgrade

Canada's federal government promotes the ENERGY STAR® program, which helps consumers make smart, energy-efficient decisions about items they purchase. The ENERGY STAR® symbol makes identifying products that exceed Canadian federal standards for energy efficiency easy for consumers. The program, run by the Office of Energy Efficiency at Natural Resources Canada, helps consumers choose the most energy-efficient products.

Reducing energy use indirectly reduces greenhouse gas emissions and it saves money for the consumer. The federal, provincial, and municipal governments offer grants and incentives for the purchase of ENERGY STAR® qualified products. For example, the Province of Ontario has a point-of-sale retail sales tax exemption for qualifying energy-efficient products.

However, encouraging consumers to buy new products and throw away the old ones seems to contradict other environmentally friendly messages, including "reduce, re-use, and recycle."

Replacing inefficient products with high-efficiency products is a popular way to conserve energy and benefit the environment. However, this action uses up resources and energy to make these new products. As well, the inefficient products are difficult to dispose of and they cannot be recycled into efficient products. Disposal of inefficient products is a concern because Canada has a limited amount of space in which to dump garbage, especially large appliances.



When consumers replace their old appliances with new energy-efficient appliances, the consumers save energy and money. However, many old appliances end up in landfills, like the refrigerators piled in this dump.

Economic Initiatives to Reduce Greenhouse Gas Emissions

Governments must find ways to support both economic growth and climate change initiatives. How do politicians encourage individuals and corporations to reduce greenhouse gas emissions and encourage the growth of new "eco-friendly" industries? The following two responses have been developed:

Cap-and-Trade Systems In a cap-and-trade system, an authoritative body, most commonly a government, establishes a ceiling (or cap) on how much carbon may be produced. Corporations that produce *less* carbon than their limit may sell or trade their credits to corporations that produce *more* carbon than their limit. Over time, the caps are gradually lowered.

Carbon-Tax Systems In a carbon-tax system, the government levies a tax on either the source of carbon compounds or the emission of greenhouse gases. Under this policy, the price of anything that depends on carbon fuels goes up. As a result, consumers have an incentive to spend their money on alternatives that do not produce carbon emissions. Without the carbon tax, these alternatives are usually more expensive than their carbon-producing counterparts.

Study Toolkit

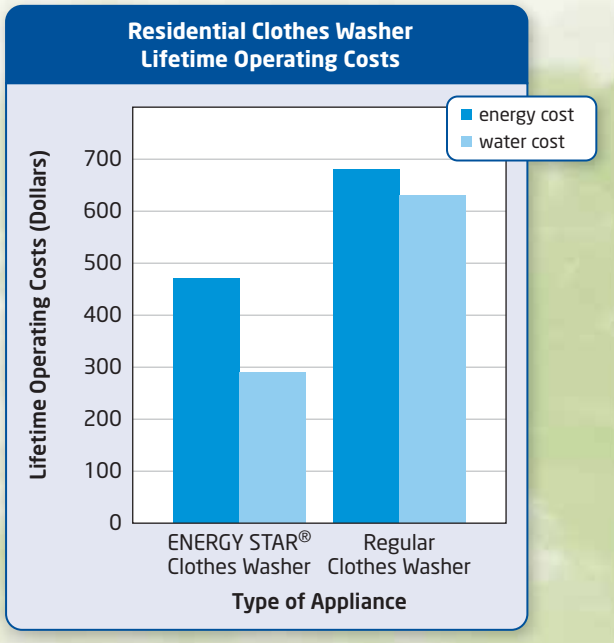
Identifying Cause and Effect Cap-and-trade systems are designed to reduce the amount of carbon compounds being emitted by industry. Use a cause-and-effect map to explain how a cap-and-trade system works.

Your Turn

1. Consider the ENERGY STAR® program from the viewpoints of an appliance recycler, an appliance manufacturer, and a consumer. Write a statement that describes how each of these interested parties might evaluate the costs and benefits of the ENERGY STAR® program.
2. Make a list of four energy-using products or appliances in your home. Identify whether they are ENERGY STAR® products. For each item, research how much energy it consumes in a month (use an energy calculator, available on-line). Compare your item with another similar model. Look at the price, the energy consumption, and the typical lifespan of the product (time until it needs replacement). Do you think your home is energy efficient? Support your answer with the results of your research.

The purchase price of products that meet the ENERGY STAR® standards may be higher than the price of competing products. However, the amount of money saved on utility bills adds up quickly.

3. Research an energy-efficiency program from a different region of the world. Write a brief newspaper article that explains how this program compares to Canada's ENERGY STAR® program. Make sure your article identifies at least three costs and three benefits of the other country's energy conservation program.



Making a Difference

While in high school, Jasmeet Sidhu realized that students at other schools must have knowledge they could share about how to start environmental projects. To help student environmentalists collaborate, she created a forum called PEYA (Peel Environmental Youth Alliance). PEYA has grown to more than 400 members in schools throughout Ontario's Peel Region.

In 2008, Jasmeet blogged for the *Toronto Star* from the United Nations Climate Conference in Poland. For Jasmeet, communicating complex scientific and political issues clearly to the public is important. She plans to work as a journalist and is studying peace and conflict studies at the University of Toronto. Jasmeet has been named one of Canada's Top 20 Under 20 and one of the 100 Most Powerful Women in Canada.

How could you communicate your ideas about climate change in a way that could help make a difference?

Lowering Greenhouse Emissions by Using Alternative Sources of Energy

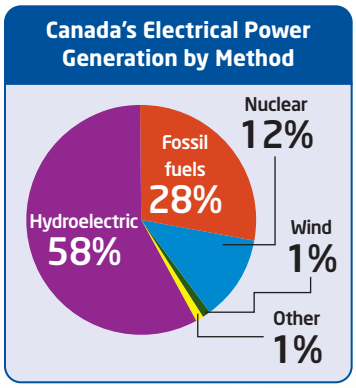


Figure 9.25 Most of Canada's electrical energy is provided by methods that release few greenhouse gases, but more progress can be made.

Approximately 18 percent of the greenhouse gases produced by Canada result from the burning of fossil fuels to generate electricity. Probably the best long-term way to reduce the production of greenhouse gases is to develop sources of energy that produce fewer greenhouse gases or none at all. Canadians already use many of these power sources, including wind, solar, biomass, hydroelectric, tidal, and nuclear power. **Figure 9.25** shows the methods by which Canada's energy is generated.

Converting the existing power-generation infrastructure to a more climate-friendly system, such as the wind farm shown in **Figure 9.26**, will take many years and cost a large amount in both dollars and carbon emissions. However, individuals don't need to wait for major power companies to switch to alternative energy. Geothermal heating and cooling systems are available for most homes, and single-home solar and wind power systems can provide all of the energy needed for many standard households. By switching to these local systems, individuals can reduce the total amount of fossil fuels that are burned for electrical generation. As a result, Canada's total carbon footprint, and therefore Canada's contribution to climate change, can be reduced.

Figure 9.26 Wind farms, such as this one in Alberta, provide electricity for more than 680 000 Canadian homes.

Section 9.3 Review

Section Summary

- Educating yourself about the facts related to the issue of climate change is important in making informed decisions about how your actions affect climate change.
- Everybody has a carbon footprint, which means that everyone's actions influence the amount of greenhouse gases emitted into the atmosphere. As a result, everybody is responsible for reducing greenhouse gas emissions.
- You can reduce your carbon footprint by performing actions that lower your dependence on burning fossil fuels and by purchasing carbon offsets.
- Governments and international panels are trying to reduce greenhouse gas emissions by passing laws, by educating consumers, and by using economic means to combat climate change.

Review Questions

T/I **1.** Why is the source of information important for identifying bias in information?

A **2.** How does modern technology affect how people make decisions about climate change?

K/U **3.** What is the difference between a carbon offset and a carbon footprint?

K/U **4.** List three actions you can take to reduce your carbon footprint.

A **5.** The chart on the right shows the "carbon facts" for a cheeseburger. If a person reduced the number of cheeseburgers he or she eats by one burger per week, how many fewer kilograms of carbon dioxide and of methane would his or her actions emit in one year?

K/U **6.** What is the IPCC, and what does it do?

K/U **7.** Identify three major milestones in the international response to climate change.

C **8.** Which system, carbon tax or cap-and-trade, would you recommend for use in Canada? Explain your answer by comparing the advantages and disadvantages of these programs.

Carbon Facts

Product size 1 Cheeseburger (130 g)

Amount Per Serving	
Kilograms CO_2 240	Kilograms CH_4 120
Total C: Energy Sources	243 g
Transportation	
Fossil Fuel (Diesel)	120 g
Fossil Fuel (Gasoline)	48 g
Electricity Production	
Fossil Fuel (Natural Gas)	75 g
Fossil Fuel (Coal)	0 g
Total C: Non-Energy Sources	2840 g CO_2E
Cattle digestion	81.0 g
Manure	26.8 g
Other	5.2 g
Sustainable Production Rating	D+
Overall Carbon Code: ORANGE	

This chart shows the carbon emissions that result from the production of a single cheeseburger.