Alternative Fuel Cars

A Reading A–Z Level V Leveled Book
Word Count: 1,866

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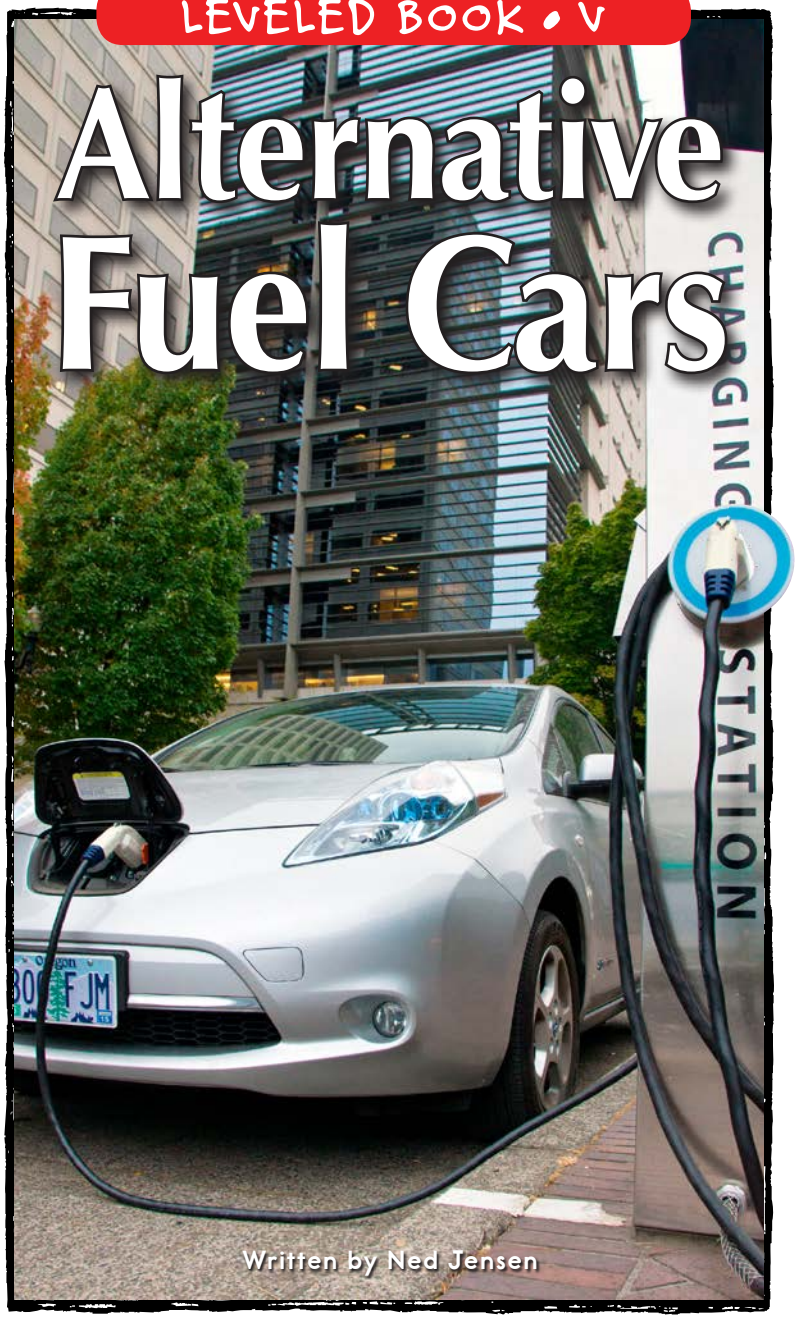
Alternative Fuel Cars



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Level V Leveled Book

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Introduction

Every day, people around the world burn huge amounts of gasoline as they drive their cars and trucks. As a matter of fact, in 2005, more than 870 million gallons of gasoline were burned. In the United States alone, people burned more than 380 million gallons, or 44 percent, of the amount of gasoline burned in the world. Year after year, the amount of gasoline people consume just keeps increasing.

But this gas-guzzling appetite can't last forever. The world's supply of gasoline is limited. Someday we will run out of the oil that is used to make gasoline. By some estimates, the world only has about 120 years of oil left. Some oil-supply experts estimate that after about 2050, oil production will begin dropping, and by 2125 oil will be scarce.

Think About It

If you were 10 years old in 2006, by the time you are 60 and it is 2056, you will begin experiencing fuel shortages. If you have children, by the time they are 60 years old, oil for making gasoline will be in short supply.

Running out of gasoline is not the only problem our gas-guzzling appetites cause. The gasoline we burn to drive our cars and trucks releases **pollutants** into the air. Most scientists believe these pollutants trap excess heat near Earth's surface. This heat is the major cause of global warming, which is slowly heating up Earth's atmosphere, changing weather patterns and melting Earth's ice sheets and glaciers.

Earth's ice sheets and glaciers are slowly melting.

This does not paint a very bright picture for people driving gasoline-powered cars. So inventors, with an eye toward solving the present-day problem of global warming and the future problem of running out of oil, are looking for new ways to power cars and trucks. They are looking for **alternative fuels** and inventing cars that can run on these fuels. This book is about possible fuels of the future and vehicles that can use these fuels.

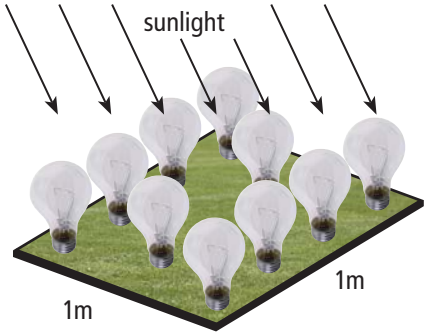
Solar-Powered Cars

Most of the energy we use comes from the big star in our sky—the Sun. Even coal and oil, because they formed from things that were once living, got their energy from the Sun. When we burn coal, oil, and gasoline made from oil, we are actually releasing energy from the Sun—energy that has been stored in these fuels for long periods of time. It is also important to know that it took millions of years for coal and oil to form. For this reason, once these fuels are used up, supplies cannot be replaced quickly.

Coal mining in Virginia

Scientists have found a way to change **radiant** energy from the Sun directly into electricity. That's right—electricity can be made from sunlight. This electricity can then be used to light cities and power cars.

Solar cells collect energy from the Sun



Do You Know?

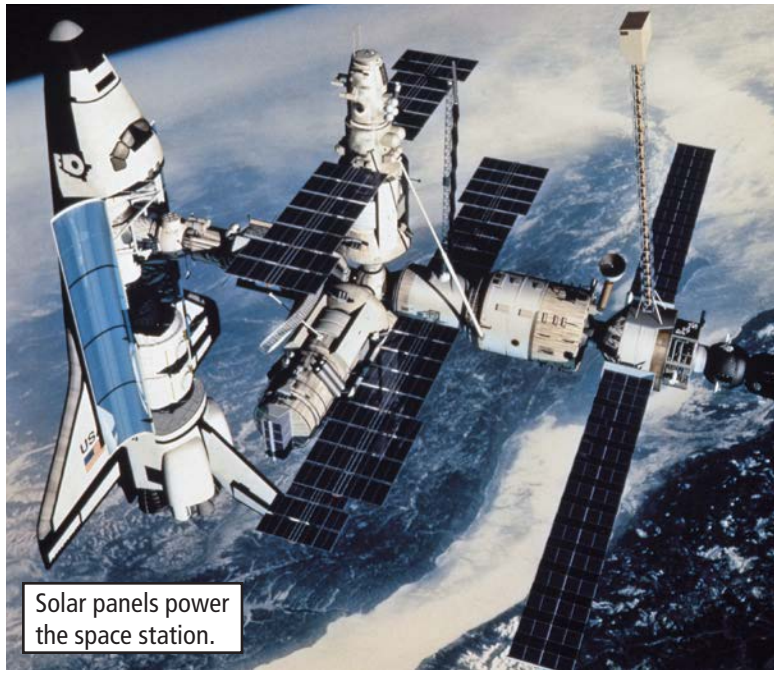
The sunlight falling on just one square meter (10.8 sq ft) of land can produce enough electricity each day to light ten 100-watt lightbulbs.

All of this is possible because of **solar cells**. You have probably seen solar cells on calculators. They are also used to supply electricity to spacecraft and to devices found where no source of electricity exists. Solar cells do not get used up as batteries do. Instead, they keep on supplying electricity as long as there is light energy for the cells to absorb.

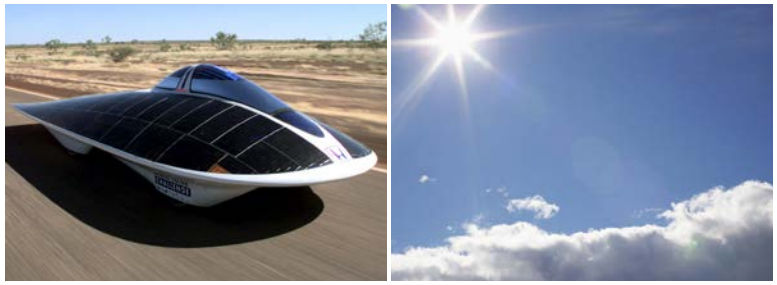
A group of solar cells placed together is a solar panel. Solar panels are placed on the roofs of buildings. They can also be attached to satellites and space stations. A solar-powered car is covered with solar panels. All these panels produce enough electricity to run a special motor in a solar car, light homes, and supply a space station with all its energy. And all of this energy comes without releasing pollutants into the air.

Do You Know?

The most common solar cells are made from one of Earth's natural elements. The element, silicon, is the same element that makes up sand.



Solar panels power the space station.



Scientists are working on inexpensive ways to convert sunlight to electricity.

So why aren't we powering all of our cars with solar cells, you may ask? The first reason is the cost of manufacturing solar cells. Scientists have not found a way to inexpensively manufacture solar cells that can produce adequate amounts of electricity. So while sunlight as a fuel is free, the cost of manufacturing the solar cells to convert this free energy to electricity offsets the savings.

Math Minute

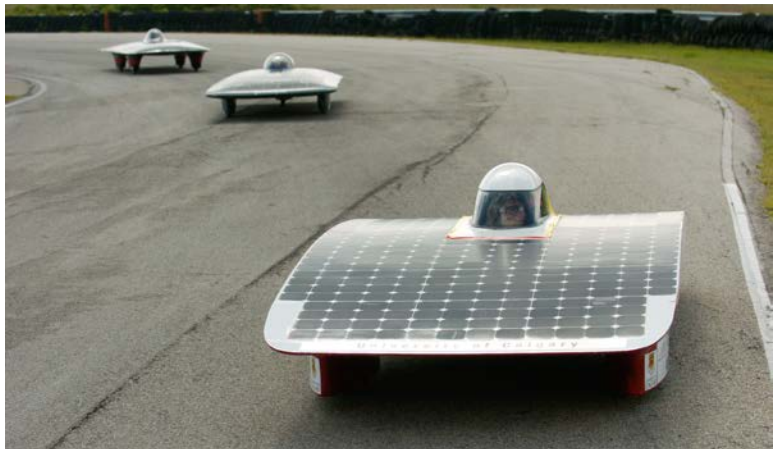
The fuel used to power Car A is made up of 90% nonrenewable gasoline and 10% renewable ethanol. The car's gas tank holds 20 gallons of fuel. The fuel used to power Car B is 100% nonrenewable gasoline. It also has a 20-gallon tank. How much nonrenewable gasoline is saved with each tank of fuel in Car A when compared to Car B?

Answer: 2 gallons

Energy output is another issue. While newer solar cells produce far more energy than the first models did, they still cannot equal the energy produced by burning gasoline in an engine. The top speed of a typical solar-powered car is about 60 mph (96.6 kph). Even then, it takes hundreds of solar cells to generate enough electrical power to reach this speed.

Then, of course, there is the issue of night driving and low-sunlight days. For cars to operate around the clock, there has to be a way of storing the energy produced during daylight hours for use when there is no sunlight. Or there has to be a backup power supply.

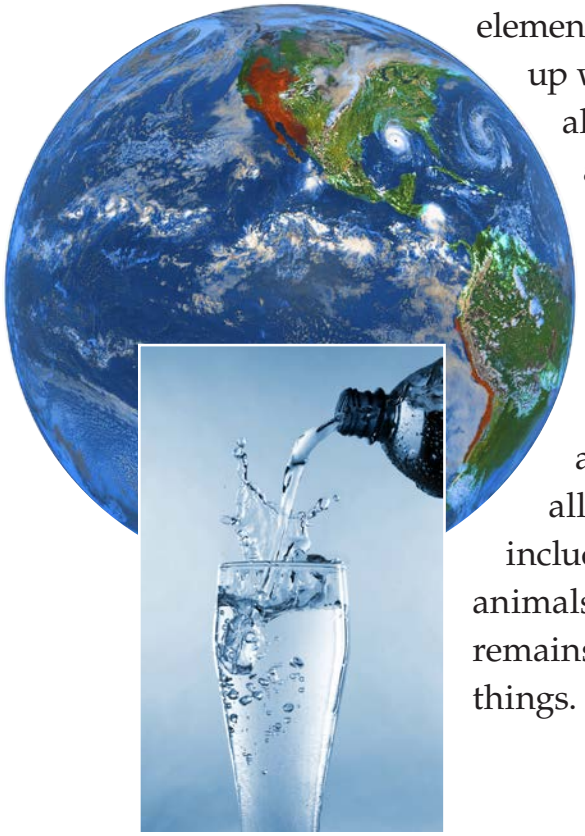
Nighttime and cloudy days are times that solar panels wouldn't work.



In time, all these problems may be solved, and with oil supplies diminishing, you can safely bet that an army of scientists is working on solving these problems. In fact, every year, teams of students from colleges in the United States and Canada compete in a North American race of solar-powered cars. It is events like these that continue to push advances in solar-cell technology.

Hydrogen-Powered Cars

Elements are simple substances from which all things on Earth are made. There are just 92 natural elements, and they combine to make thousands of other substances such as water, plastic, and sugar. **Hydrogen** is both the lightest and the most abundant of these 92 elements. As a pure element, it exists as a **gaseous** state of matter. You cannot see it, and it has no odor.



Hydrogen is one of two elements that make up water, and we all know how abundant water is, since it covers almost 75 percent of Earth's surface. It is also found in all living things, including plants and animals, as well as the remains of all living things.

Hydrogen reacts, or combines well, with other elements to make new substances. When it combines with other elements, it releases energy. It is the energy that hydrogen reactions release that has scientists so excited.

Scientists imagine someday filling car gas tanks with hydrogen gas instead of liquid gasoline. But hydrogen is not found in a pure form on Earth. So where will we get this hydrogen? Well, one of the most obvious places is from water.

In the future, we may fill up our cars with hydrogen gas instead of gasoline.

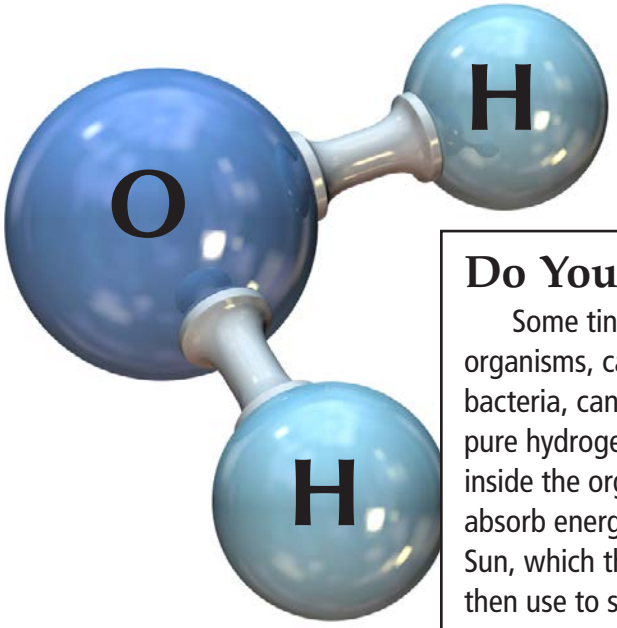
Water is made up of two elements, oxygen and hydrogen. All elements are made of tiny particles called **atoms**. Atoms of hydrogen and oxygen are held together by a chemical **bond** that makes a new substance—water. Breaking these bonds produces pure hydrogen and oxygen. The hydrogen can then be used as a fuel.

There are several ways to break the bond between hydrogen and oxygen atoms in water. One way is to use a charge of electrical energy to break the bond. Another way is to use extreme heat.

Other substances like methane, a natural gas, are made of hydrogen along with oxygen and another element called carbon. Heat from steam can break the bond between hydrogen atoms and the atoms of carbon and oxygen. This also produces pure hydrogen.

Once you have pure hydrogen, you can use it to power cars and trucks. Pure hydrogen is used in one of two ways. One way is to burn it in an engine in much the same way that cars burn gas. The other way is to use it to make electricity that can then power vehicles. Electric cars that use hydrogen have **fuel cells** that make electricity. These fuel cells are somewhat like batteries.


General Motors hydrogen-powered concept car



A model of a water molecule showing two hydrogen atoms joined to one oxygen atom

Do You Know?

Some tiny invisible organisms, called bacteria, can produce pure hydrogen. Chemicals inside the organisms absorb energy from the Sun, which the organisms then use to split the bond between hydrogen and oxygen in water.

In a fuel cell, hydrogen is combined with oxygen to form water. When the two elements join together, they release energy in the form of electricity. This energy can then be used to power all kinds of vehicles.

No matter how hydrogen is used, it is combined with oxygen to release its energy and pure water is the only waste product. Since water is not a pollutant, it does not harm the environment. This fact, along with the abundance of water on Earth, makes hydrogen a great alternative fuel, although a lot more research is needed to make it work well.

Battery-Powered Cars

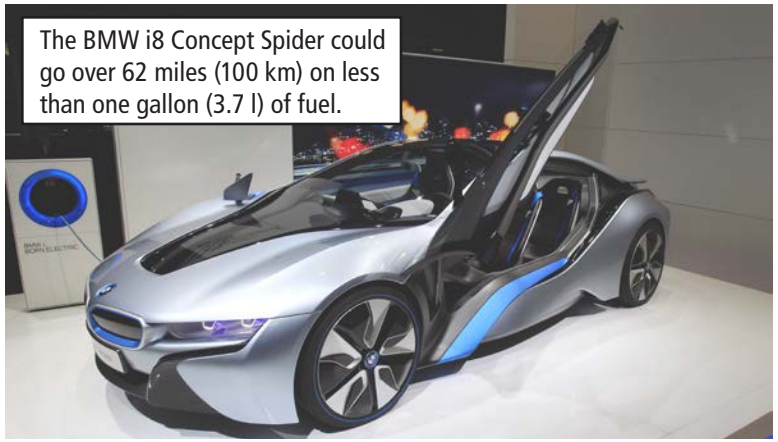
Scientists are currently working on cars that are powered entirely by rechargeable chemical batteries. If you look under the hood of one of these cars, you will find an electric motor. Under the hood of a gasoline-powered car, you will find the hoses that carry water to cool an engine and exhaust pipes that carry away waste products. By contrast, there is a mass of wires under the hood of an electric car. In an electric car, there is no need to cool the engine and there are no exhaust gases produced that pollute the air.

The engine of a standard gasoline-powered car

Instead of driving your car up to a gas pump to fill the tank with gasoline, you simply plug your battery-powered car into an outlet to recharge the car's batteries. And instead of a fuel bill, you pay an electric bill.

Under the hood of a hybrid gasoline-electric Chevrolet Volt

Hybrid cars have an electric motor and a small gasoline engine. They both provide kinds of power to run a car. The electric motor runs on batteries, but the motor has the ability to draw electricity from the batteries as well as to put electricity back into the batteries. This means the batteries do not have to be plugged into an electrical source for recharging. The electric motor, when not powering the car, is putting energy back into the batteries.



The BMW i8 Concept Spider could go over 62 miles (100 km) on less than one gallon (3.7 l) of fuel.

1=3+5+2=10−4+10÷2=14×2−3=25−5−5×2=17+3×2−20÷2−1=3+5+2=10−4+10÷2=14×2−3=25−5−5×2=17+3×2−20÷2−1

Math Minute

Gasoline costs $2.75 a gallon. Connor drives an SUV that gets 12 miles per gallon. Each week he drives 120 miles. Sara drives a hybrid car that gets 40 miles per gallon of gasoline. She also drives 120 miles each week. How much more does Connor spend for gas each week than Sara does?

Answer: $19.25

Electric Car Supremacy

The Electric offers in its diversified uses, a car of exceptional merit—as the family car it stands supreme.

Every member of your family can drive it—no chauffeur needed. It offers all of the best qualities of a gasoline car without any disagreeable features—danger from gasoline—offensive odors of oil—grime, dirt and the difficulties attending its operation.

The electric car will do everything a gasoline car does (except tour) with greater ease—cleaner and better. Its upkeep is far below that of the gas car, to say nothing of the depreciation difference. It can be driven over any road over which a gasoline car can be propelled—up any hill on which the wheels can find traction.

No machinery to get out of order—no mechanician needed—no engine trouble—no nerve racking gear clashing—no exhaust noise to disconcert the timid—nothing, but *just* the enjoyment of rapid transit in an easy, luxurious, delightful manner—*that* is what you secure in a Rauch & Lang Electric—the only Top-Mounted, Straight-Type, Worm Drive Electric built.

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Dealers in principal cities will demonstrate.
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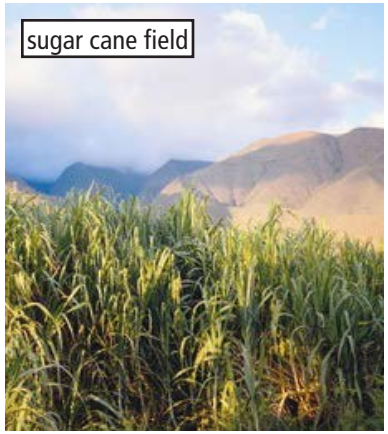
The RAUCH & LANG CARRIAGE Co.
2180 W. 25th St.
CLEVELAND, O.

An advertisement for an electric car that was available in 1910

Do You Know?

Alternative-fuel vehicles are nothing new. Starting in the 1830s, the first battery-powered vehicles were being produced alongside steam-powered vehicles and gas-electric hybrids. According to a poll from 1900, electric cars were actually preferred by drivers because they ran more cleanly and more safely than their gasoline-powered counterparts. However, technological innovations with gasoline-powered cars, which could be made more cheaply than their electric or hybrid counterparts, made these cars the cars of choice for drivers by the 1920s. Many companies stopped producing alternative-fuel vehicles until a gas shortage in the 1970s brought renewed interest in them.



Ethanol can be made from grain crops.

Ethanol-Powered Cars

Ethanol is an alternative fuel that is gaining popularity in many places around the world. What makes ethanol so popular is that it is a **renewable resource**. Fuels like coal and oil cannot be renewed. Once they are used up, they are gone forever.

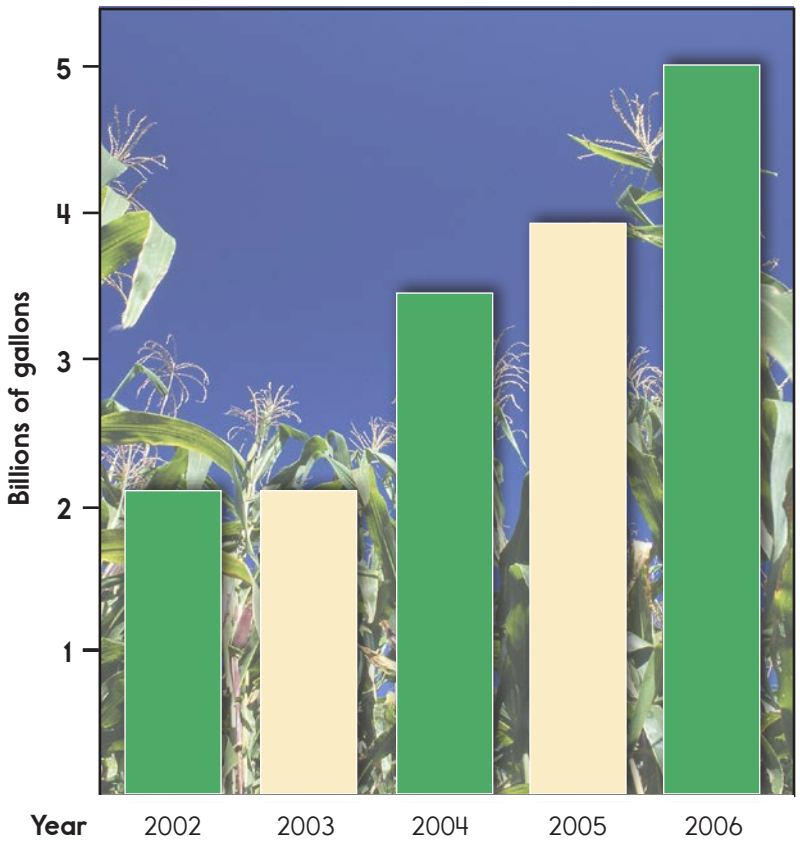
Ethanol can be made from plant and animal material. Most ethanol is made from grain crops like corn, barley, and sorghum. Ethanol is also made from potatoes and sugar cane. But it can also be made from ground-up wood and other plant and animal materials. So, if we want to produce more ethanol, we just have to plant more crops like corn and sugar cane. In a matter of months, the crop has grown, can be harvested, and then used to make ethanol.

To make ethanol from **biomass** means changing the plant matter into sugar. The sugar is then changed to alcohol in a process called **fermentation**. The diagram below shows the steps of one way of making ethanol from corn.

Ethanol Production from Corn

1. The corn grain is ground into a fine powder.
2. The powder is mixed with water to make a wet mash.
3. A chemical is added to the mash to change it to sugar.
4. Yeast (tiny living organisms) are added to the sugar to cause fermentation.
5. Fermentation changes the sugar into ethanol and carbon dioxide gas.
6. The ethanol is removed from the mash.
7. Any remaining water is removed from the ethanol.
8. A small amount of gasoline is added to the ethanol and it is ready to burn.
9. The left-over mash grain is used as feed for livestock.

Ethanol Production in the United States



Pure ethanol can be burned in vehicles with special engines designed to burn it, or it can be mixed with gasoline and then burned in a regular engine. When ethanol is mixed with gasoline, it reduces the consumption of fossil fuels and reduces pollution.

Word Wise

The combination of ethanol and gasoline is called *gasohol*.

More places need to adopt this type of technology.

What's in the Future?

One thing you will have concluded by now is that the supply of oil to make gasoline won't last forever. We can look at ways to make the current oil supply last longer by conserving gasoline. This can be done by driving cars with greater fuel efficiency, car-pooling, or simply driving less.

Whatever we do to conserve, we still have to plan for the day when there will be no oil for making gasoline. Scientists are hard at work seeking alternative means for powering our cars and trucks. Will the popular choice be ethanol, hydrogen, solar energy, or chemical batteries? The alternative that wins out likely will depend on economic factors. Two important economic factors will be the cost to produce the alternative power supply and the eventual cost of the alternative fuel to the driver. What do you think you will be using to power your car when you are 70 years old?

Glossary

alternative fuels *(n.)* fuels that are different from those most commonly used today (p. 5)

atoms *(n.)* the smallest units of an element (p. 13)

biomass *(n.)* living, or recently living, plant or animal material (p. 20)

bond *(n.)* a connection between atoms that are joined together to form a molecule (p. 13)

ethanol *(n.)* fuel made from crops such as corn and sugar cane (p. 19)

fermentation *(n.)* the process by which a substance is broken down into a simpler form, such as in the creation of cheese and vinegar (p. 20)

fuel cells *(n.)* devices that produce electricity by combining a fuel with oxygen (p. 14)

gaseous *(adj.)* in the form of gas (p. 12)

hydrogen *(n.)* a chemical element in the periodic table (p. 12)

pollutants *(n.)* dirt or debris in the air or on the ground (p. 5)

radiant *(adj.)* brightly shining (p. 7)

renewable resource *(n.)* a supply of something that can be replaced; a source of energy that is not depleted by use (p. 19)

solar cells *(n.)* devices that convert light into electricity (p. 7)

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