

13 Car Quest

OVERVIEW



Assess the environmental impacts of a fleet of cars and then research and prepare a report about greener transportation choices.

SUBJECTS

science, social studies, mathematics

SKILLS

gathering (collecting, researching, recording), organizing (charting), analyzing (comparing and contrasting, calculating, discussing), interpreting (generalizing, inferring, drawing conclusions), applying (hypothesizing), evaluating (assessing), presenting (writing, illustrating, reporting), citizenship (working in a group)

FRAMEWORK LINKS

13, 29, 50, 52, 63, 68, 72

VOCABULARY

airborne pollutant, climate change, emissions, fuel-efficient, global warming, greenhouse gas or heat-trapping gas, trade-off

TIME

four sessions and time for Web research

MATERIALS

copies of the "Vehicle Fleet Environmental Impact Summary" chart (page 199); copies of "Web Quest Group Tasks" (pages 200–201); computers with Internet access

CONNECTIONS

For more on the impacts of climate change, try "Coral Bleaching: A Drama in Four Acts" in Oceans of Life.

According to many scientists who study the effects of consumer actions on the environment, no purchase we make has a bigger effect than our choice of car. After all, our choices about which car we drive can mean the difference of thousands of pounds of carbon dioxide released into the atmosphere, a significant amount of airborne pollutants, and the amount of strain we place on nonrenewable resources.

Unfortunately, there are no cars available today that are perfectly clean. Although we might be able to walk, bike, or use public transportation to get around, most of us rely on cars for at least some of our transportation needs. And many people simply enjoy driving. Regardless of whether they're old enough to drive, most of your students are probably thinking about the kinds of cars they'd like to have—weighing different factors such as speed, looks, cost, comfort, and safety. But how many of your students also weigh environmental factors when they think about their dream cars? How many are even aware of the effects that different kinds of cars can have on the environment?

In this activity, your students will determine the environmental effects of cars—real cars in a parking lot, a fleet consisting of all of their dream cars, or a fleet of your choosing. They'll compute how many tons of heat-trapping gases are produced each year, how much it costs to fuel the cars, and so on. Then they'll research and prepare reports on "greener" transportation alternatives.

Before You Begin

Familiarize yourself with the Web sites recommended for student research (see Step 4 and the "Web Quest Group Task" cards on pages 200–201). Decide what fleet of cars you'd like students to evaluate—the cars parked outside in the parking lot, a fleet of the students' own dream cars, or a fleet of your own creation (see "Choosing the Fleet" below). Make enough copies of the "Vehicle Fleet Environmental Impact Summary" chart (page 199) for each pair of students and create a large version that can be filled in by the entire class (see Step 5 under "What to Do"). Make one copy of the "Web Quest Group Tasks" cards (pages 200–201) and cut out each of the cards so that you can distribute one task topic to each of four student groups.

Choosing the Fleet

This activity is written to evaluate the fleet of cars in your school or institution's parking lot. But you should feel free to adapt it so that students evaluate their dream car fleet or a fleet you've made up. If you have students evaluate their dream car fleet, you may not see as much variety in the cars they evaluate, and it will be less of a hands-on experience, but they may be more interested in their research. If the students evaluate a fleet you've come up with, they'll have less of a hands-on experience, but you'll be able to be very clear and specific about years, models, and so on—considerations that may not be obvious when students look at cars firsthand.

What to Do

1. Discuss "dream cars."

Ask the students if they've ever thought about what kind of car they'd most like to own. What cars do they have in mind? Has anyone considered a lifestyle without a car? What factors have influenced their choices? Has anybody considered environmental factors when selecting a dream car? Why or why not?

(If students don't have any ideas, you might give them a few minutes to browse some major carmakers' Web sites. Also, if any students in your group hope never to own a car, suggest that they might someday need to rent a car for a special trip or other purpose. Those students can also browse the Web briefly for ideas about the kind of car they'd want in the short term.)

Explain to the students that this activity will enable them to learn more about the environmental effects of the cars that people drive.

2. Organize the group for a fleet survey.

Tell the students that they'll be going outside and taking an inventory of the cars parked in the lot. Divide the students into teams of two, and give each team a copy of the "Vehicle Fleet Environmental Impact Summary." Explain that you'll be assigning each team a different section of the lot, and they'll record the make (for example, Honda), model (for example, Accord), type (sedan, SUV, small pick-up, sports car, and so on), and, if possible, year of the vehicles in their section. In other words, they'll be filling in only the first three columns of their chart for now, keeping a tally in column one of the total number of vehicles of each type they find (see "Sample Vehicle Fleet Environmental Impact Summary" on page 195). Later they'll be researching the information for the final columns.



Note: If the students can't tell the year of a vehicle by looking at it, they should either make an estimate or put the current year.

Before you head outside, review some basic parking lot safety tips. Tell the students to be attentive to the movement of cars in and out of spaces and to assume that drivers probably don't see them unless the drivers indicate otherwise. Explain that most drivers won't expect to find students walking in and around the cars. You may want to assign two students the task of warning people going out to their cars and the parking area that there are students carrying out research in the lot.



3. Begin the fleet survey.

Head outside and gather your group around as you assign their study areas. Divide the parking lot into as many equal areas as needed so that each team of two students is responsible for surveying approximately the same number of cars. Then have students fill in the first three columns of their chart.

4. Investigate the fleet's environmental effects.

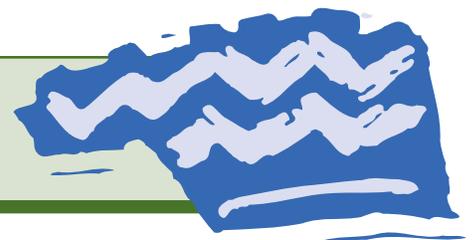
Once back in the classroom, have the students use the Internet to investigate the environmental effects of the vehicles in their parking lot and complete the data in the remaining columns of their chart. Tell the students that as they visit the Web sites that have this data, they may need more information about the vehicles in their area than they actually know. Tell them that if they don't know whether the car they saw was an automatic or manual transmission, they should use data for an automatic; if they don't know what type of engine it had, they should use the smallest size (usually V-4 or V-6).

Environmental information (particularly regarding mileage, annual fuel costs, and greenhouse gas emissions) for most cars can be found at the Department of Energy's Web site on fuel economy (www.fueleconomy.gov). Greenhouse gases emitted are listed in tons per year, assuming that the average car is driven 15,000 miles per year. (If your students are not familiar with the term "greenhouse gas," use the information in the "Change Is in the Air" box on page 35 to lead a short discussion. You might explain to them that, while the Department of Energy Web site uses the term "greenhouse gas," they may also see them referred to as "heat-trapping gas" in other publications.) Airborne pollutants are listed with a rating system and may have several scores, so students should determine an approximate average.

Safety information is available from the National Highway Traffic Safety Administration's "Buying a Safer Car" Web site (www.nhtsa.dot.gov/NCAP). This information assigns stars in various categories, so students should determine an approximate average for their vehicles.

5. Interpret the fleet data.

After each team has completed its "Vehicle Fleet Environmental Impact Summary," have the teams pool their data onto a single large chart. Invite the first team to enter its data, using tally marks instead of numerals in Column 1. Then, as other teams add their data, they can simply add another tally mark beside any vehicle that they also researched. Once all the data have been recorded, have the students determine the total number of cars and overall averages for each column. Ask the students to review the chart and share any observations or interpretations they have made. If the students don't



ON THE ROAD AGAIN: An average of 10,000 miles of new roads are built each year in the United States.

Sample Vehicle Fleet Environmental Impact Summary							
# of Cars in Lot	Make/ Model/ Year	Type	mpg City/ Hwy	Average Safety Rating	Green- house Gases in Tons/Year	EPA Airborne Pollutants Score	Annual Fuel Cost
III	2003 Honda Accord	sedan	24/33	5	6.9	6	\$1028
II	2002 Nissan Xterra	SUV	19/24	4	9.1	4	\$1371
I	2004 Toyota Prius (hybrid)	sedan	60/51	5	3.5	9	\$524
III	2004 Ford Explorer	SUV	15/20	5	11.4	7	\$1693
Total							
9	--	Averages:	29.5/32	4.75	7.7	6.5	\$1154

address them on their own, you might ask the following questions:

- Which cars have the highest and lowest safety ratings?
- Are the more fuel-efficient cars any more or less safe than the cars with less fuel efficiency?
- How important do you think the car's safety rating is in weighing the pros and cons of different car choices? Would different individuals be likely to value safety differently? (Encourage the students to think about different user groups such as parents, people who use their car for long commutes, and so on.)
- Which types of vehicles have the greatest environmental effects?
- What are some of the trade-offs a buyer has to weigh when deciding which car to buy (for example, fuel cost, safety, and emissions)?
- Does this kind of research help consumers make more informed decisions? Do the students think that in the future they'll do this much research to find

out about a car they intend to buy? Other products?

- Did this research affect anyone's thoughts about their dream cars? How? Encourage the students to calculate the environmental impacts of their dream cars. Do they seem like good or bad choices from an environmental standpoint?

The students might note that few consumers have the time to thoroughly research each purchase they make. But by knowing where to look for information and gathering as much data as possible, consumers can make better and more informed decisions. For products as expensive and with as large an environmental effect as a car, it's important to gather as much information as possible before making a decision.

You may also want to have students run through some calculations to compare the environmental effects of different fleets. For example, have the students calculate the total annual amount of

greenhouse gas emissions and consumption of nonrenewable fuel for the entire parking lot fleet, assuming each parking lot vehicle drove 15,000 miles per year. Does this number seem high? Is it hard to visualize? Now have them make the same calculation assuming an entire fleet of very fuel-efficient cars, and again for an entire fleet of their dream cars. How do the numbers compare? Do the students start to see how the collective effects of our car choices can really add up?

6. Conduct Web quests.

Now that the students have sharpened their skills as car shoppers, tell them that they'll have a chance to investigate some of the options they might have for purchasing "cleaner" cars when they're ready to hit the dealers' lots. And, if the students are given hand-me-down cars and don't get the chance to shop for one, they'll learn about some ways that they can improve that car's fuel efficiency. Finally, for those students who are more interested in other modes of transportation, they'll get the chance to investigate what other ways of getting around are available in your community.

Divide the students into four groups and have each group conduct a Web quest to answer a different question. (You can either let the students divide themselves according to the topics that most interest them, or you can randomly assign students to groups.) Each group will focus on one of the following topics:

Hybrid Cars: What are hybrid cars? How do they work? Why are they so fuel efficient? Are they available for purchase in your community?

Alternative Fuels: What are "alternative" fuels? What materials are used as alternative fuels?

Increasing Fuel Efficiency: How can people increase the fuel efficiency of the cars they already own? How much savings (in tons of greenhouse

gases emitted as well as in dollars) could one person get from making these changes?

Non-Car Transportation: What are some of the non-car transportation options in your community?

Do they use less fuel per person than cars?

Give each group the appropriate sheet from the "Web Quest Group Tasks" pages. Students can either write answers to their guiding questions, create a poster that contains both written answers to their questions and visual aids such as pictures and diagrams, or prepare a PowerPoint presentation that summarizes their results. If some of the groups choose to develop a PowerPoint, the presentation should include four or five slides that address the guiding

questions. No matter which format the groups choose, they should all cite the Web sites or other resources that they consulted.

7. Discuss findings.

After each group has presented its findings, discuss the pros and cons of that particular approach to reducing greenhouse gas and other pollutant emissions. How effective is it? How expensive is it? How feasible is it? Does it seem like a reasonable option for most people?

In conclusion, ask students to recall their dream car. Has this activity changed

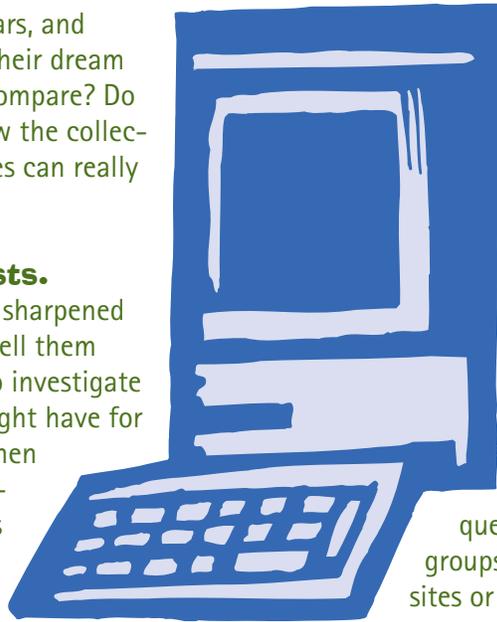
their priorities with regard to cars and other transportation options?

Do they think they'll consider a car's environmental im-

impact if they go car shopping? Will they think about making

other choices to get around? If so, in what kinds of situations will they choose other options?

Will some students try not to own a car in the future? Why or why not?



WRAPPING IT UP

Portfolio

The students' "Vehicle Fleet Environmental Impact Summaries" and Web quest reports can be saved in their portfolios.

Writing Idea

In many parts of the country, people concerned about highway safety and the health of the planet use strong words to condemn the drivers of traditional sport utility vehicles (SUVs) and other big cars that have low fuel-efficiency. In turn, many SUV owners use strong words about the freedom to choose the kind of car they want. Have the students research and write a brief essay stating their own opinions about this controversial topic. With which side do they sympathize? How do they think we should balance out individual and public considerations when it comes to the cars we drive?

Assessment

Remind the students that, at the start of the lesson, they had to think of their dream car. Have them write down that type of car. Below this, have them answer the following questions: (1) Would you still want this type of car? Why or why not? (2) What are the environmental benefits or problems with your dream car? (3) What might be a different car that would give you the same

benefits of your dream car but would be a better choice environmentally? How do you know?

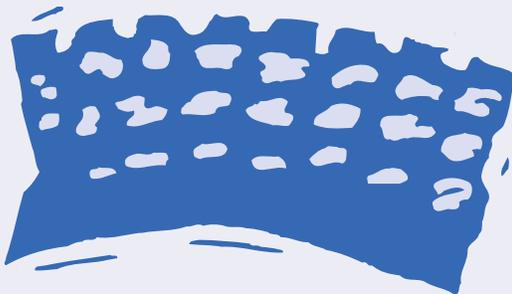
Unsatisfactory—One or more elements from the assignment are missing. The student fails to incorporate evidence from the class activities to support his or her position. Arguments are not presented logically or rationally.

Satisfactory—The student is able to logically present why he or she would or would not want the same vehicle now. Using information from class, benefits or problems with the student's dream car are identified. A rational alternative is presented and supported with solid argumentation.

Excellent—The student presents convincing arguments why he or she would or would not want the same vehicle. Benefits or problems are backed up with data and sources that were identified and used in the class. The student's rationale reveals critical reflection.

Extensions

- Develop and carry out a plan to help educate the drivers of the parking lot vehicles about reducing the environmental effects of their cars.
- Research the availability of "green" cars (including hybrids) at car dealerships in your community. How many green cars have been purchased since the cars have become available? When, if at all, do dealers expect to have those cars available in the future if they don't have them now?
- While most forms of public transportation are more efficient than having each passenger drive a car, many buses and other public transportation vehicles are responsible for



WRAPPING IT UP (Cont'd.)

large amounts of pollution and fuel use. But more environmentally friendly mass transportation alternatives are available, and growing numbers of cities are beginning to turn to "clean" buses, light rail, and other greener options in public transportation. Challenge students to compare the environmental effects of the use of school buses to carpooling in personal vehicles. Also have students research the next generation of public transportation options.

- Research how the construction of roads threatens biodiversity in different parts of the world.



RESOURCES

The Department of Energy provides information on gas mileage, greenhouse gas emissions, air pollution ratings, and safety information for new and used cars and trucks. www.fueleconomy.gov

The National Highway Traffic Safety Administration's "Buying a Safer Car" supplies consumers with safety information, including frontal and side crash test results, to aid them in their vehicle purchase decisions. www.nhtsa.dot.gov/NCAP

Consumer Reports provides expert advice and information that guides consumers to the best new and used vehicles on the market. www.consumerreports.org

The Environmental Defense Fund's "Tailpipe Tally" is a simple interactive tool that calculates fuel consumption, fuel cost, and vehicle emissions for any vehicle built from 1978 to the present. www.environmentaldefense.org/tool_pop.cfm?tool=tailpipe

The National 4-H Council's *Going Places, Making Choices* is a curriculum produced for high school students, focusing on the history of transportation, natural resources, land use and energy use, climate change, and community action. www.4hgpmc.com

The Public Transportation Partnership for Tomorrow provides information on who uses public transportation, who provides it, and what the benefits of public transportation are. It also reports on various transportation issues and links to local public transportation information by state. www.publictransportation.org

The American Public Transportation Association provides statistics and online documents about energy consumption, environmental benefits, history, and various other public transportation-related issues. www.apta.com

Hybrid Cars

What's all the hype about hybrids? It's your job to find out. Search the Web to answer to the following questions.

What is a hybrid car?

How does it work?

Why are hybrids more fuel-efficient than conventional cars?

What are some types of hybrid cars that are available today? What are some that are still in the planning stages? Are any hybrid models available for purchase in your community?

Here are some tips that might help you on your quest:

- "How Stuff Works" provides an overview of hybrid cars.
www.howstuffworks.com/hybrid-car.htm
- The U.S. government is also getting on board with hybrids. The Office of Transportation Technologies has a Web site on hybrids (also called hybrid electric vehicles, or HEVs). www.ott.doe.gov/hev
- Honda (www.hondacars.com) and Toyota (www.toyota.com) are the two major automakers that currently have hybrid cars for sale in the United States. In addition, Ford (www.ford.com), General Motors (www.gm.com), and others are developing hybrids, some of which are hitting markets now or in the near future.

Alternative Fuels

You may listen to alternative music, but do you use alternative fuels? What are they, anyway? Your group is going to find out by taking on a Web quest to answer these questions:

What are alternative fuels?

What are some materials being used in alternative fuels?

What are the benefits of alternative fuels?

What are some of the barriers to using alternative fuels?

Here are some tips that might help you on your quest:

- The government is taking a lot of interest in alternative fuels, and has a Web site focused on this new technology. www.eere.energy.gov/cleancities/afdc
- The Environmental Protection Agency (the government division that helps create and enforce environmental regulations) has collected information about alternative fuels.
www.epa.gov/otaq/consumer/fuels/altfuels/altfuels.htm
- The Rocky Mountain Institute studies energy issues and educates the public about the best ways to conserve energy. Their Web site includes information about alternative fuels.
www.rmi.org/sitepages/pid577.php
- The Union of Concerned Scientists provides information on biodiesel and natural gas. See FAQs under www.ucsusa.org/clean_vehicles/trucks_and_buses.

Improving Fuel Efficiency

There are a lot of advanced technologies available that are making new cars more fuel-efficient. But what if you can't afford a new car? Can you teach an old dog new tricks? Go on a Web quest to answer these questions:

What things can people do to increase the fuel efficiency of the cars they already own?

Would it be expensive to make the changes? How much savings (in greenhouse gas emissions and in dollars) could one person get from making those changes?

Here are some things that might help you on your quest:

- The U.S. government provides information about how to improve a car's fuel efficiency. www.fueleconomy.gov/feg/drive.shtml and www.epa.gov/otaq/consumer/17-tips.pdf
- More tips on improving fuel efficiency can be found at www.whatprice.co.uk/tips/fuel-efficiency.html.

Alternatives to Cars

So, what if you'd rather just say "no thanks" to cars? Or what if you live in a place where it's easier not to drive? In this Web quest, you'll find out more about other ways of getting around and how to use those other transportation options in your community. Look online for answers to these questions:

Besides cars, what are some other ways of getting around where you live?

Which of those alternatives require no gasoline? Which require less gasoline per person than a car? Do any of your alternatives require more gasoline per person?

What are the pros and cons of using other modes of transportation in your community?

Here are some tips that might help you on your quest:

- City governments around the Monterey Bay, California, area provide information for local residents about alternatives to using cars. www.ambag.org/sharing.html
- The city of Victoria in British Columbia, Canada, has information on how it is working to limit the use of cars in the city with a program called Transportation Demand Management, or TDM. www.vtapi.org/tdm
- Drivers.com provides information on drivers and driving, as well as information for people who want to get out from behind the wheel. www.drivers.com/topic/54
- Visit your city, town, or region's official Web site, a local chamber of commerce Web site, or other town sites for information about transportation options in your community.