



**TITLE OF LESSON PLAN:**

Energy and Cars: What Does the Future Hold?

**LENGTH OF LESSON:**

Two to three class periods

**GRADE LEVEL:**

9-12

**SUBJECT AREA:**

Earth Science

**CREDIT:**

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**OBJECTIVES:**

Students will understand:

1. The reasons why attitudes toward fossil fuel use and alternative energy sources may change over the next 50 years.
2. How changing attitudes toward fossil fuel use and alternative energy sources may affect car technology.
3. The types of alternative energy sources that are currently under research, particularly for use in cars.

**MATERIALS:**

For this lesson, you will need:

- Pens or pencils and paper
- Poster board or construction paper (for group presentations)
- Markers or crayons
- Computers with Internet access (optional for research)

**PROCEDURE:**

1. Ask students to discuss what they already know about fuel efficiency in cars. Pose the

following questions:

- Which types of cars are the most fuel efficient and why?
- What factors might contribute to a desire for increased fuel efficiency in cars?
- How fuel-efficient are cars today compared to 50 years ago?

2. Divide the class into small groups of approximately four students each. Read the following scenario to the class: Pretend that you live in the year 3000. Your group is a team of archaeologists who have been studying the very interesting time period of A.D. 2000-2050. You've just excavated a site that reveals a great deal about transportation during this time period. At this site, you've found dozens of old cars and car pieces. You've also found an old sign that says "Joe's Junkyard, Established 2015." Therefore, you assume the oldest cars in this junkyard are from about the year 2000. You know that in 2050, a catastrophic earthquake leveled this part of town and all businesses ceased to operate. You can assume that cars in this junkyard are models from about 2000 to 2050. Your assignment is to present a report to the country's leading archaeologists explaining the following things:

- The ways in which attitudes toward fossil fuel use and the use of alternative energy sources changed between 2000 and 2050, and the reasons for these changes.
- Changes to automobile technology and power sources between 2000 (the year when the oldest cars junked in 2015 would probably have been built) and 2050, and the ways in which these changes reflected changing attitudes toward fossil fuel use and alternative energy sources.

3. When students take themselves out of this futuristic scenario and into the present time, they will therefore need to make predictions about the following things:

- How and why (or whether) attitudes toward fossil fuel use will change over the next 50 years.
- The reasons why we might see changes in the way cars are powered.
- The changes that will occur in car technology in order to accommodate changing attitudes toward fuel efficiency and energy sources.

4. Ask groups to use the Internet, the library, and any other relevant resources they can find to answer the following questions:

- How do present-day internal-combustion car engines work? How is fuel processed in the engine in order to make the car operate?
- What can be done to increase a car's fuel efficiency?
- What types of alternative energy sources are being developed for future cars? How do these energy sources power the car? What are the advantages and disadvantages of each type of energy source? Which energy sources seem most likely to be commonly used in

cars of the future?

- What environmental, political, and cultural factors might contribute to a desire for cars with higher fuel efficiency or cars that use alternative energy sources?
- What factors might detract from creating cars with higher fuel efficiency or cars that use alternative energy sources?

The following Web sites will be helpful in students' research:

Energy Quest

Fuel Economy Site

Alternative Fuels Data Center

5. Once they've finished their research, have groups prepare their reports. The reports should have two components:

- Oral presentation: Have groups make oral presentations to a panel of archaeologists (i.e., the rest of the class) describing the things that their team has found in Joe's Junkyard and the conclusions it has reached concerning changes in automobile energy sources and attitudes toward energy use from 2000 to 2050. Their presentations should address the questions they investigated in step 4 of this lesson and should include visual aids when appropriate. For example, they can include diagrams of car engines that use different energy sources (traditional versus hybrid, for example) or charts showing the projected supply of fossil fuels or smog reduction goals for a particular city.
- Written paper: Have each student individually write a two- to three-page paper describing the conclusions his or her group has drawn from Joe's Junkyard and summarizing the group's predictions for the ways in which energy sources and attitudes toward energy sources will change over the next 50 years (2000-2050).

Note: It's entirely possible that students will conclude that the public is not likely to change its attitudes toward fossil fuel use, that car companies will not follow through with plans to create cars powered by alternative energy sources, and that things won't be all that different 50 years from now. It's fine for them to draw this conclusion, but they must support their argument with detailed evidence from their research. They can claim that the cars in Joe's Junkyard didn't change much during this 50-year period (or that they became less fuel efficient), but they must justify their reasoning by showing evidence from current trends and predictions they've found in their research.

### **ADAPTATIONS:**

Have younger students research alternative energy sources for cars and predict which energy sources currently under research today are the most likely to be used in the next 50 years. Have them report on the archaeological dig by explaining which alternative energy source became the most widely used and describing the reasons why this energy source was selected to replace or be used in conjunction with fossil fuels. Students will not need to describe the technological details of the engines or the political processes by which attitudes toward fossil fuels might change. They'll instead keep their research focused on the types of energy that might be used in cars and the reasons why these types of energy might be practical.

**DISCUSSION QUESTIONS:**

1. Hypothesize the design features that could increase a car's fuel efficiency. Discuss how aspects of the engine, body, and other components of the car could be modified to minimize the amount of fuel the car requires.
2. Explain why you think there are many more sport utility vehicles on the road today than there were 10 years ago. Compare the design features of a sport utility vehicle with those of a car in terms of their fuel efficiency.
3. Describe the reasons why car manufacturers dramatically increased their cars' fuel efficiency over the past 50 years.
4. Explain the environmental effects that a large number of cars might have on a city like Los Angeles, which is very spread out and surrounded by mountains.
5. Describe the reasons why people might be reluctant to abandon their sport utility vehicles and trucks in favor of more fuel efficient cars or to give up their traditional cars for electric vehicles or other alternative energy cars.
6. Discuss what events could cause car manufacturers to drastically change the fuel efficiency or energy sources of their cars.

**EVALUATION:**

Evaluate students' oral presentations with a rubric that addresses the following questions:

- Did the group present its information in a serious and mature manner?
- Did the group provide clear details from its research to illustrate its points?
- Did the group provide interesting and easy-to-understand visual aids?

Evaluate students' papers with a rubric that addresses the following questions:

- Did the student do a good job of explaining what his or her group found and the conclusions that the group drew?
- Did the student use examples and details from the group's research to illustrate his or her points?
- Did the student write in a clear and convincing manner?

**EXTENSION:****Car Advertising**

Have students look through car magazines and/or brochures and identify design features that are more and less fuel efficient. Ask them to figure out which cars are being marketed as fuel efficient and which are not.

**Changing Attitudes**

Have students interview their parents, grandparents, and teachers to find out how they

think attitudes toward fossil fuel use and alternative energy sources have changed in their lifetime. Have they noticed significant changes? If so, have they noticed these changing attitudes reflected in car design? Have these changes affected their behavior as consumers? For example, do they take fuel efficiency into consideration when purchasing a vehicle? Why or why not?

#### **SUGGESTED READINGS:**

##### **Great Automakers and Their Cars**

Robert Italia. Oliver Press, 1993.

Nine of the most influential automobile designers and manufacturers from around the world are profiled in this book. Biographical information is included about Americans like Henry Ford and the Dodge brothers, Europeans like Ferruccio Lamborghini, and Japanese like Soichiro Honda, as well as the history of the company that each founded.

##### **"Your Next Car?"**

Jim Motavalli. Sierra, July/August, 1999.

This article discusses the pros and cons of three types of alternative-fuel cars that are in various stages of development – one type powered solely by electricity, hybrid vehicles that use both gasoline and electricity, and cars that have fuel-cells powered by hydrogen. Also discussed are the economic forces within the auto industry that are driving the developments.

##### **Forward Drive: The Race to Build "Clean" Cars for the Future**

Jim Motavalli. Sierra Club Books, 2000.

New methods of powering automobiles are being developed to reduce the global-warming and fossil-fuel depleting effects of today's gasoline-powered cars. This book is an in-depth examination of the history of automobile development including early electric vehicles and an exploration of the new technologies that will be used to create "clean" cars.

#### **WEB LINKS:**

##### **Automotive Learning Online**

Animations and clickable diagrams of your automobiles inner parts will help you to know everything you ever wanted to know about your family car.

<http://www.innerauto.com/innerauto/htm/auto.html>

##### **DOE's Hybrid Electric Vehicle Program**

HEV's are Hybrid Electric Vehicles that combine electrical power with some other power source. Learn all about HEV's here and download free software that allows you to design your own HEV.

<http://www.ott.doe.gov/hev/>

##### **Celebrating 100 Years**

Celebrate 100 years of the automobile and learn about its history with timelines, historical photographs and essays, and a virtual field trip to "Carhenge."

<http://www.azstarnet.com/auto100>

## **CREATING THE INTERSTATE SYSTEM**

A fascinating history of the greatest engineering undertaking of the 20th century, the construction of America's Interstate Highway System. Learn how this achievement has unified our Country and assured the defense of our national interests?

<http://www.tfrc.gov/pubrds/summer96/p96su10.htm>

## **An Introduction to Building a Model Solar Car**

Future automotive engineers will want to practice their skills by building their very own solar powered model car. Complete project plans are available at this website.

<http://freenet.msp.mn.us/org/mres/carmanual/top.html>

## **VOCABULARY:**

### **emissions**

The output of a car's engine (the car's exhaust).

#### **Context:**

Stricter governmental emissions standards have forced car companies to produce more fuel efficient cars.

### **ethanol**

Grain alcohol, commonly produced from corn.

#### **Context:**

Ethanol can be blended with gasoline to create a cleaner-burning fuel than gasoline alone.

### **hybrid**

Something of mixed origin or composition.

#### **Context:**

Car manufacturers may soon introduce hybrid vehicles, which will still use gasoline but will also have batteries to store energy and thus increase the car's fuel efficiency.

### **internal combustion**

An engine that produces power by burning fuel within the engine.

#### **Context:**

Most cars today still have internal combustion engines rather than batteries, solar panels, or other alternative power capabilities.

### **natural gas**

A mixture of hydrocarbons commonly produced along with crude oil.

#### **Context:**

Natural gas is a fossil fuel that is distributed through all 50 states and burns more cleanly than gasoline.

### **OPEC**

Organization of Petroleum Exporting Countries. A consortium of oil-producing countries, mainly in the Middle East.

**Context:**

OPEC's oil embargo of the 1970s led the United States into a nationwide energy scare, skyrocketing oil prices, and rationing of gasoline.

**ACADEMIC STANDARDS:****Grade Level:**

9-12

**Subject Area:**

Science: Earth and Space

**Standard:**

Understands basic features of the Earth.

**Benchmarks:**

Knows the major external and internal sources of energy on Earth (e.g., the sun is the major external source of energy; the decay of radioactive isotopes and gravitational energy from the Earth's original formation are primary sources of internal energy).

**Grade Level:**

9-12

**Subject Area:**

Geography

**Standard:**

Understands how human actions modify the physical environment.

**Benchmarks:**

Understands the global impacts of human changes in the physical environment (e.g., increases in runoff and sediment, tropical soil degradation, habitat destruction, air pollution; alterations in the hydrologic cycle; increases in world temperatures; groundwater reduction).

**Grade Level:**

9-12

**Subject Area:**

Geography

**Standard:**

Understands how human actions modify the physical environment.

**Benchmarks:**

Knows how people's changing attitudes toward the environment have led to landscape changes (e.g., pressure to replace farmlands with wetlands in flood plain areas, interest in preserving wilderness areas, support for the concept of historic preservation).

**Grade Level:**

9-12

**Subject Area:**

Geography

**Standard:**

Understands the changes that occur in the meaning, use, distribution, and importance of resources

**Benchmarks:**

Understands programs and positions related to the use of resources on a local to global scale (e.g., community regulations for water usage during drought periods; local recycling programs for glass, metal, plastic, and paper products; different points of view regarding uses of the Malaysian rain forests).

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