

What's in a Label?

Exploring Fuel Economy and the Environment

- **Grade Level**
9-12
- **Subject Areas**
Language Arts
Mathematics
History
Social Studies
Environmental Science
- **Duration**
10 minutes for warm-up
15-20 minutes for background
30-45 minutes for activity
- **Setting**
Classroom
Computer Lab
- **Skills**
Information gathering
Analyzing data
Presentation of data
- **Vocabulary**
Fuel economy
Greenhouse gas rating
Miles per gallon
Vehicle label
- **Related Websites**
www.fueleconomy.gov
www.epa.gov/otaq/carlabel

Summary

Students will learn how to read and understand fuel economy and environment labels.

Objectives:

Students will:

- Understand fuel economy
- Compare and contrast fuel economy and environment labels for various vehicles and fuel types.

Materials:

- Student Worksheet
- Internet access or printed Vehicle Information sheets

National Science Content

Standards:

- Unifying Concepts and Processes
Systems, order and organization
Change, constancy, and measurement
- Science and Technology
Understandings about science and technology
- Science in Personal and Social Perspectives
Natural resources
Environmental quality
Natural and human induced hazards
Science and technology in local, national and global challenges.

Background:

The Energy Policy Act of 1992 requires the U.S. Environmental Protection Agency and the U.S. Department of Energy to provide consumers with accurate miles per gallon (MPG) information. In May 2011, the U.S. EPA and the National Highway Traffic Safety Administration announced a new design for fuel economy labels, where

consumers will be able to see the vehicle's fuel economy (miles per gallon), energy use, fuel costs, and environmental impacts. These labels will be available on all 2013 models. Formerly, the fuel economy labels only included estimated city and highway miles per gallon, and estimated annual fuel cost.

Procedure:

Warm-Up:

Have students brainstorm what his/her dream car would be. Find out what features are most important to you students. Is it color and stereo, or fuel economy and environmental impact? As homework, assign students to research their dream car including price, fuel economy, and estimated annual fuel cost. If needed, introduce the concept of fuel economy (MPG).

Activity:

1. Review the student's homework in class. Ask a few students to share what they learned about their cars: how many miles per gallon? How much will they pay for fuel each year? How much does the vehicle cost?
2. Is fuel economy now a factor in what type of car they would choose?
3. Show students examples of what the new fuel economy and environment labels look like. Access sample labels at <http://www.epa.gov/otaq/carlabel/basicinformation.htm>. These labels now provide all the information consumers need to make an informed decision about buying a vehicle.
4. Discuss the various components of the label, including fuel economy,



Figure 1: A sample gasoline fuel economy and environment label.
Source: <http://www.epa.gov/otaq/carlabel/basicinformation.htm>

annual fuel cost, fuel economy and greenhouse gas rating, and fuel costs savings over 5 years.

Fuel economy—An estimate of miles per gallon, usually refers to combined city/highway

Fuel consumption rate—gallons per 100 miles. This relates directly to the amount of fuel used.

Annual fuel cost—The estimated fuel cost for a year, based on the assumptions in the fine print: cost is based on 15,000 miles per year at \$3.70 per gallon.

Fuel economy and greenhouse gas rating—A rating based on a scale of 1 to 10 with 10 being the best. This is based on how much carbon dioxide the car emits from the tailpipe. When cars burn fuel, they release carbon dioxide, a greenhouse gas. This means that the fuel economy of a car affects the amount of greenhouse gases the car emits.

Smog Rating—The rating from 1 to 10 with 10 being the best based on vehicle tailpipe emissions that cause smog and local air pollution, including nitrogen oxide, carbon monoxide, particulate matter, non-methane organic gas, and formaldehyde

Fuel cost savings or spending—Shows the difference in fuel cost over a 5 year period between the chosen vehicle compared to the average new vehicle. When calculated, a positive number indicates that the consumer saves money compared to a new average

vehicle, while a negative number would indicate that a consumer spends that much more on fuel compared to the new average vehicle. The new average vehicle is estimated to get 22 MPG, driving 15,000 miles per year at a cost of \$3.70 per gallon, coming to \$12,600 over a five year period. The label on a new car would state “you save X” or “you spend X more” in fuel costs. For the purpose of this activity, have students indicate saving with a positive number and spending with a negative number.

5. Have students Use FuelEconomy.gov’s Find A Car tool to look up fuel economy and environmental emissions. (To access, visit www.fueleconomy.gov. Click “Find a Car” on the upper left side of the page). You may wish to demonstrate this first for the class.
6. Using the tool’s information, instruct students that they will research two vehicles to compare and fill in blank fuel economy and environment labels. You can either provide students with various car makes and models or allow students to research cars of his/her choice. Tell students to research two different fuel types (i.e.: gasoline, gasoline-electric hybrid, plug-in electric vehicles).
7. After students have completed his/her fuel economy and environmental emissions, compare and contrast the various vehicles by having each student or group summarize the cars they researched. Which are more efficient, SUVs or compact cars? How do gasoline powered vehicles compare to electric vehicles? What cars have higher greenhouse gas ratings? How are fuel economy and greenhouse gas rating related to each other? What type of fuel provide a lower annual fuel cost? How are annual fuel costs and fuel economy related?

Wrap Up:

1. Review fuel economy and environment labels. How will these labels help consumers? Are there any drawbacks to

the labels?

2. Ask students if his/her criteria for choosing a car has changed. Will they take fuel economy and environmental impact into consideration when choosing a car in the future?

Assessment:

Ensure that students have completed his/her fuel economy and environment labels and answered the discussion questions on the student worksheet. See the sample student page as an example of acceptable answers. Note that numbers will vary based on the vehicles chosen.

Extensions:

1. Have students research the legislation related to the fuel economy and environment labels. What did the old labels look like? How do they compare to the new 2011 labels? Why would this change be important?
2. Have students design their own car labels. What information would be important for them to include on a label?
3. Research the history and use of both fossil and alternative fuels in transportation. Examine the origin of fuels, such as where does gasoline come from and what do we use to generate electricity for plug-in vehicles. Study the implications of all fuel types discussed, including the advantages and disadvantages, the economics and environmental impact of each.

Resources and Related Links:

U.S. Department of Energy and U.S. Environmental Protection Agency. Fuel Economy Information
<http://www.fueleconomy.gov>

U.S. Department of Energy and U.S. Environmental Protection Agency. Find a Car Tool
<http://www.fueleconomy.gov/#findacar>

U.S. Environmental Protection Agency. Fuel Economy and Environment Labels
<http://www.epa.gov/otaq/carlabel>

U.S. Environmental Protection Agency. Tips to Save Gas and Improve Mileage. August 1994 Factsheet. Access via National Service Center for Environmental Publications <http://www.epa.gov/nscep/index.html>

What's in a Label? Worksheet

Car 1 Year, Make & Model: *2006 Toyota Corolla*

EPA
DOT

Fuel Economy and Environment

Gasoline

Fuel Economy

29

combined city/hwy

MPG

26

city

35

highway

3.4

gallons per 100 miles

You save

\$3100

in fuel costs over 5 years
compared to the average new vehicle.

Annual fuel COST

\$1900

Fuel Economy & Greenhouse Gas Rating (tailpipe only)

8

1

8

10

Best

Smog Rating (tailpipe only)

6

1

6

10

Best

This vehicle emits _____ grams CO₂ per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create emissions; learn more at fueleconomy.gov

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 22 MPG and costs \$12,600 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$3.70 per gallon. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

fueleconomy.gov

Smartphone
QR Code

Calculate personalized estimates and compare vehicles

Car 2 Year, Make & Model: *2011 Toyota Prius*

EPA
DOT

Fuel Economy and Environment

Hybrid

Fuel Economy

50

combined city/hwy

MPG

51

city

48

highway

2.0

gallons per 100 miles

You save

\$7200

in fuel costs over 5 years
compared to the average new vehicle.

Annual fuel COST

\$1110

Fuel Economy & Greenhouse Gas Rating (tailpipe only)

10

1

10

10

Best

Smog Rating (tailpipe only)

7

1

7

10

Best

This vehicle emits _____ grams CO₂ per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create emissions; learn more at fueleconomy.gov

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 22 MPG and costs \$12,600 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$3.70 per gallon. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

fueleconomy.gov

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Instructions:

1. Go to Fueleconomy.gov and click on “Find a Car”. Select the year of the vehicle(s) you wish to view, then click the make and model. Use the information presented to fill in your fuel economy and environment labels.
2. To find gallons per 100 miles, click “Gallons/100 miles” under the heading “Switch Units”
3. To calculate the savings over 5 years, multiply the annual fuel cost by 5. Subtract from the 5 year cost of an average new vehicle, which is \$12,600 (this is listed in the fine print on the label. Note that a negative number implies that you are spending more instead of saving money.
4. Round all costs to the nearest \$50. This is how EPA/DOT present costs to consumers.

Discussion Questions:

1. How do your two vehicles compare? Which is more fuel efficient? Which has a lower annual fuel cost?

Answers will vary. Look for answers that are based on the student's data.

2. Which vehicle had a higher greenhouse gas rating? What does this rating mean? How is fuel economy related to the greenhouse gas rating?

Answers will vary. Look for answers based on the student's data. The greenhouse gas rating is a score based on how much carbon dioxide the car emits from tailpipe only. The higher the rating, the better the car is for the environment. A high greenhouse gas rating means the car emits less carbon dioxide than other vehicles, and is one of the “best”. The higher the fuel economy, the less fuel the car uses per mile, and the less greenhouse gases it emits. Higher fuel economy correlates to higher greenhouse gas ratings. A car with a higher MPG burns less fuel to go the same distance. Less fuel burned means less greenhouse gases emitted from the car, and corresponds to a higher greenhouse gas rating.

3. Of the two vehicles you researched, which would you choose to buy? Why?

Answers will vary. Look for a rational argument supported by evidence from the activity.

What's in a Label? Worksheet

Car 1 Year, Make & Model:

EPA
DOT

Fuel Economy and Environment

Fuel Economy

MPG

city

highway

combined city/hwy city highway

gallons per 100 miles

You **save**

in fuel costs
over 5 years

compared to the
average new vehicle.

Annual fuel COST

Fuel Economy & Greenhouse Gas Rating (tailpipe only)

1

10

Best

Smog Rating (tailpipe only)

1

10

Best

This vehicle emits _____ grams CO₂ per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create emissions; learn more at fueleconomy.gov

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 22 MPG and costs \$12,600 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$3.70 per gallon. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

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Car 2 Year, Make & Model:

EPA
DOT

Fuel Economy and Environment

Fuel Economy

MPG

city

highway

combined city/hwy city highway

gallons per 100 miles

You **save**

in fuel costs
over 5 years

compared to the
average new vehicle.

Annual fuel COST

Fuel Economy & Greenhouse Gas Rating (tailpipe only)

1

10

Best

Smog Rating (tailpipe only)

1

10

Best

This vehicle emits _____ grams CO₂ per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create emissions; learn more at fueleconomy.gov

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 22 MPG and costs \$12,600 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$3.70 per gallon. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

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