

2012-2013


Transportation Fuels Debate

Students evaluate the advantages and disadvantages of conventional and alternative transportation fuels in an debate format.




IT'S A FACT

DISADVANTAGE



TRANSPORTATION



ADVANTAGE

(Background contains a repeating pattern of fuel types: ELECTRICITY | ETHANOL | GASOLINE | HYBRID ELECTRIC | HYDROGEN | NATURAL GAS-CNG/LNG | PROPANE-LPG | BIODIESEL | DIESEL)



National Energy Education Development Project



Grade Level:

- Elementary
- Intermediate
- Secondary

Subject Areas:

- Science
- Social Studies
- Language Arts



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Teacher Advisory Board Statement

In support of NEED, the national Teacher Advisory Board (TAB) is dedicated to developing and promoting standards-based energy curriculum and training.

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Energy Data Used in NEED Materials

NEED believes in providing the most recently reported energy data available to our teachers and students. Most statistics and data are derived from the U.S. Energy Information Administration's Annual Energy Review that is published in June of each year. Working in partnership with EIA, NEED includes easy to understand data in our curriculum materials. To do further research, visit the EIA web site at www.eia.gov. EIA's Energy Kids site has great lessons and activities for students at www.eia.gov/kids.



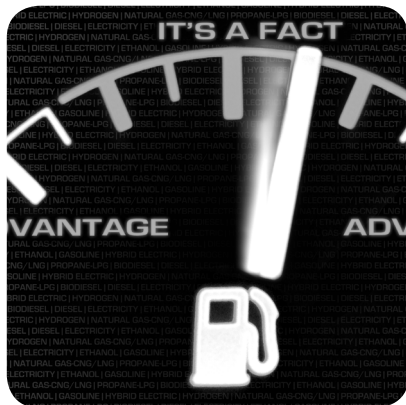
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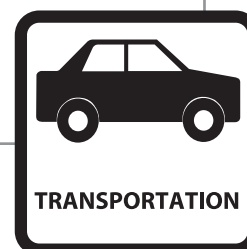
Transportation Fuels Debate

Data For This Guide is From:

- U.S. Department of Energy Office of Energy Efficiency and Renewable Energy
 - Alternative Fuels and Advanced Vehicles Data Center
 - Clean Cities Program
- U.S. Department of Energy *Transportation Energy Data Book*, 30th Edition
- Fueleconomy.gov
- U.S. Energy Information Administration

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Correlations to National Science Education Standards: Grades 5-8

This book has been correlated to National Science Education Content Standards.

For correlations to individual state standards, visit www.NEED.org.

Content Standard B | *PHYSICAL SCIENCE*

▪ **Transfer of Energy**

- The sun is the major source of energy for changes on the earth's surface. The sun loses energy by emitting light. A tiny fraction of that light reaches earth, transferring energy from the sun to the earth. The sun's energy arrives as light with a range of wavelengths.

Content Standard D | *EARTH AND SPACE SCIENCE*

▪ **Structure of the Earth System**

- The solid earth is layered with a lithosphere; hot, convecting mantle; and dense, metallic core.

▪ **Earth in the Solar System**

- The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle. Water evaporates from the earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans and rocks underground.

Content Standard E | *SCIENCE AND TECHNOLOGY*

▪ **Understanding About Science and Technology**

- Technological solutions are temporary; technological solutions have side effects and technologies cost, carry risks, and provide benefits.
- Perfectly designed solutions do not exist. All technological solutions have trade-offs, such as safety, cost, efficiency, and appearance. Risk is part of living in a highly technological world. Reducing risk often results in new technology.
- Technological designs have constraints. Some constraints are unavoidable, such as properties of materials, or effects of weather and friction. Other constraints limit choices in design, such as environmental protection, human safety, and aesthetics.

Content Standard F | *SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES*

▪ **Natural Hazards**

- Human activities can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal.



Correlations to National Science Education Standards: Grades 9-12

Content Standard B | *PHYSICAL SCIENCE*

▪ **Structure of Atoms**

- Fission is the splitting of a large nucleus into smaller pieces. Fusion is the joining of two nuclei at extremely high temperature and pressure, as in the process responsible for the energy of the sun and other stars.

Content Standard D | *EARTH AND SPACE SCIENCE*

▪ **Energy in the Earth System**

- Global climate is determined by energy transfer from the sun at and near the earth's surface.

Content Standard F | *SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES*

▪ **Natural Resources**

- Human populations use resources in the environment to maintain and improve their existence.
- The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources, and depletes those resources that cannot be renewed.
- Humans use many natural systems as resources. Natural systems have the capacity to reuse waste but that capacity is limited. Natural systems can change to an extent that exceeds the limits of organisms to adapt naturally or humans to adapt technologically.

▪ **Environmental Quality**

- Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans.



Teacher Guide

Transportation Fuels Debate

🎯 Goal

To investigate the economic and environmental advantages and disadvantages of transportation fuels.

📖 Background

In *Transportation Fuels Debate*, student teams learn about transportation fuels, then are assigned to represent the different fuels. Working cooperatively, the students develop arguments on the merits of their fuel over the others. Two debates should be conducted, one for personal vehicles and one for fleet vehicles.

🎯 Concepts

- We use petroleum products for most transportation fuels today.
- Petroleum-based fuels produce emissions that can have a detrimental effect on air quality.
- There are many conventional and alternative transportation fuels.
- Some transportation fuels affect the environment more than others.
- Some transportation fuels are widely used, others are not.
- Some transportation fuels are more expensive than others.
- Some transportation fuels are more suitable for fleet vehicles, others for personal vehicles.

🕒 Time

- Four or five 45-minute class periods (see Alternate Procedure on page 7)

📄 Materials

- A set of *Transportation Fuel Debate Sheets* for each team
- A set of YES/NO cards for the judges
- *Transportation Fuels Debate Game Board* on page 8

☑️ Procedure

Step One: Preparation

- Decide which fuels you will be using for each debate (personal and fleet vehicles), depending upon the number of students in the class or group. You need a minimum of three students in each group. For a large class, you can have half of the students participate in the personal vehicle debate and half participate in the fleet vehicle debate. For smaller groups, you can have all of the students participate in each debate.
- Make one copy of the debate sheets you will be using for each group in each debate.
- Make a master of the game board for each debate. (It is suggested that you use gasoline, electricity, CNG, hybrid electrics, ethanol, and hydrogen for the personal vehicle debate and diesel, biodiesel, ethanol, hydrogen, CNG, propane, and hybrid electrics for the fleet debate.)
- Make sets of YES/NO cards for the judges.
- Decide who will be in each of the groups. If your students are not used to working in groups, you may want to give them guidelines for group work.

🔗 Need Resources

NEED has a many guides available to expand and extend your unit on transportation fuels. All guides are available to download free of charge from www.NEED.org:

- *Biodiesel*
- *Energy Expos*
- *Ethanol*
- *Fossil Fuels to Products*
- *H₂ Educate*
- *Transportation Fuels Debate*
- *Transportation Fuels Enigma*
- *Transportation Fuels Rock Performances*

Step Two: Introduce the Unit to the Class

- Introduce the *Transportation Fuels Debate* to the class, using the concepts as a guide.
- Select a panel of judges. The teacher can serve as the judge, or each group can select one person from their team to serve as a judge. Each judge is given a YES/NO card.

Step Three: Monitor Group Work

- Once students are in their groups, explain the procedure. Answer any questions they have.
- Have each group complete the sheet for its fuel first. This should take about five minutes.
- Have the groups complete the sheets for the other fuels. This should take about twenty minutes.

Step Four: Debate (Personal Vehicles First, Then Fleet Vehicles)

- Begin the game by giving the teams the following instructions:
 - The object of this game is to be the first team to reach the top of the game board. The game is played in rounds, with each team given the opportunity to move its token up by giving an advantage of its fuel. You may instead choose to move an opponent's token down by giving a disadvantage of the opponent's fuel.
 - The teams will present their advantages or disadvantages to a panel of judges. If a team gives an advantage of its fuel and the judges agree, then the team moves up one space. An opposing team can object to the judges' decision. The opposing team must convince the judges that the statement is not an advantage. The team that stated the advantage will then have the opportunity to defend its position. The judges will vote again and one of two things will happen. The judges may vote in favor of the defending team. In this case, the defending team maintains its new position and the opposing team moves down one space. Or the judges may decide the statement is a disadvantage or irrelevant. In this case, the defending team moves back to its original position.
 - If a team states a disadvantage to try to move an opposing team down, then the opposing team can defend itself without penalty.
 - Ask the first team to give an advantage or disadvantage. Action continues until one team reaches the top line, until time is called, or until each team has had the opportunity to begin a round. Each team should have the opportunity to begin a round.
- DAY ONE—complete the first round of the personal vehicle debate.
- DAY TWO—finish the remaining rounds of the personal vehicle debate.
- DAY THREE—complete the first round of the fleet vehicle debate.
- DAY FOUR—finish the remaining rounds of the fleet vehicle debate.

Step Five: Interpret the Debate Results

- At the conclusion of the game, point out that all transportation fuels have advantages and disadvantages. Ask the class the following questions:
 - Was there an obvious winner in either game?
 - If the game continued, would the results change? Why or why not?
 - Why do we use transportation fuels that have negative impacts on the environment?
 - What are some other factors that we need to consider in our choice of transportation fuels?
- Have the students write short essays answering the following questions:
 - What was the purpose of playing this game?
 - What were the important concepts you learned from playing the game?
 - What fuel would you most likely use for a personal vehicle and why?
 - What fuel would you most likely use for a fleet vehicle and why?

Transportation Fuels Debate - Alternate Procedure

☑ Procedure

Step One: Preparation

- Make one set of debate sheets for each student participating, plus an additional set for each group.
- Make a master of the game board for each debate. It is suggested that you use gasoline, electricity, hybrid electrics, ethanol, CNG, and hydrogen for the personal vehicle debate and diesel, biodiesel, ethanol, hydrogen, hybrid electrics, CNG, and propane for the fleet debate.
- Make a master of one of the debate sheets to explain the procedure, if necessary.
- Make sets of YES/NO cards for the judges.

Step Two: Introduce Unit to the Class

- Introduce the *Transportation Fuels Debate* to the class, using the concepts as a guide.
- Assign the students to either personal or fleet debate groups. Distribute one set of debate sheets for either personal or fleet vehicles to each student. Explain the procedure for completing the sheets, using a master to show the class if necessary.
- Assign each student to complete all of the debate sheets in their debate group as classwork or as homework.

Step Three: Monitor Group Work

- Decide who will be in each of the fuel groups. If your students are not used to working in groups, you may want to give them guidelines for group work.
- Place students into groups. Distribute a set of debate sheets to each group according to topic. Have the students complete the debate sheets in their groups, using their individual sheets as guides. This should take about thirty minutes.

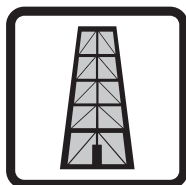
Step Four: Debate

- Play the game using the instructions on page 6.

Step Five: Interpret the Debate Results

- Use the instructions on page 6.

SAMPLE







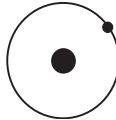




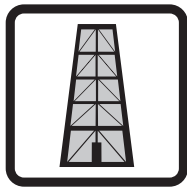
Biodiesel

	RELEVANT		
	IT'S A FACT	ADVANTAGE	DISADVANTAGE
1. Biodiesel is a fuel made by chemically reacting alcohol with organic fats, oil, or grease. Most biodiesel is made from soybeans.	X		
2. Biodiesel is a renewable fuel.		X	
3. Biodiesel is usually blended with diesel fuel in different percentages, such as B20, which is 20 percent biodiesel.	X		



Transportation Fuels Debate Game Board

 Biodiesel	 Diesel	 Electricity	 Ethanol	 Gasoline	 Hybrid Electric	 Hydrogen	 Natural Gas CNG	 Propane LPG	FUELS
									+3
									+2
									+1
									START HERE
									-1
									-2
									-3



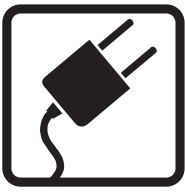
Biodiesel

	RELEVANT		
	IT'S A FACT	ADVANTAGE	DISADVANTAGE
1. Biodiesel is a fuel made by chemically reacting alcohol with organic fats, oil, or grease. Most biodiesel is made from soybeans.			
2. Biodiesel is a renewable fuel.			
3. Biodiesel is usually blended with diesel fuel in different percentages, such as B20, which is 20 percent biodiesel.			
4. Neat (or pure) biodiesel (B100) can also be used as a transportation fuel.			
5. Biodiesel fuels can be used in regular diesel engines without modifications.			
6. Biodiesel fuel can be used in the existing fuel infrastructure.			
7. Some school districts use biodiesel to fuel their school buses.			
8. Biodiesel contains no sulfur and can reduce the amount of sulfur in the nation's diesel fuel supply.			
9. Adding biodiesel in small amounts to regular diesel fuel improves the lubrication qualities of diesel fuel without sulfur.			
10. Biodiesel can improve the smell of diesel fuel.			
11. Biodiesel reduces air pollutants such as particulates, carbon monoxide, hydrocarbons, and air toxins.			
12. Using biodiesel slightly increases the emissions of nitrogen oxides.			
13. Today, biodiesel is mainly available through bulk suppliers. There are 618 fueling stations.			
14. Biodiesel is well suited for fleets with their own refueling stations.			
15. Biodiesel fuel is more expensive than regular diesel fuel.			
16. Using biodiesel can reduce maintenance costs because of its good lubricating characteristics.			



Diesel

	RELEVANT		
	IT'S A FACT	ADVANTAGE	DISADVANTAGE
1. Diesel is a petroleum-based fossil fuel made of hydrogen and carbon.			
2. The chemical formula for diesel is $C_{16}H_{34}$.			
3. Petroleum is a nonrenewable source of energy.			
4. Diesel has a very high energy content; it contains 18-20 percent more energy per gallon than gasoline.			
5. About ten gallons of diesel are produced from every 42-gallon barrel of crude oil.			
6. Diesel is used in internal combustion engines designed specifically for diesel fuel.			
7. Diesel is used in more than two-thirds of all farm equipment because it can power demanding work.			
8. Ninety-four percent of the goods in the U.S. are moved by diesel-powered vehicles.			
9. The U.S. has a vast infrastructure of refineries, pipelines, and filling stations to distribute diesel efficiently and conveniently.			
10. The construction industry uses diesel-powered vehicles to perform heavy-duty jobs.			
11. Vehicles that use petroleum-based fuels emit air pollutants.			
12. In the last 50 years, petroleum-fueled vehicle emissions have decreased an average of 95 percent per vehicle.			
13. Today, there are approximately eleven million commercial trucks and more than 750,000 buses on U.S. roads that use diesel.			
14. Diesel vehicles built today are eight times cleaner than those built 12 years ago.			
15. Using low sulfur diesel fuel and advanced exhaust control systems can reduce particulate emissions by 97 percent and nitrogen compounds by 25-50 percent.			
16. Almost half of the people in the U.S. live in areas that do not meet air quality standards.			



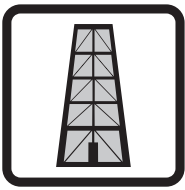
Electricity

	RELEVANT		
	IT'S A FACT	ADVANTAGE	DISADVANTAGE
1. Electricity can be produced by many sources of energy.			
2. Electric vehicles must have batteries that can be discharged and recharged repeatedly.			
3. Most batteries cannot store large amounts of electricity, so electric vehicles must carry several batteries.			
4. In some electric vehicles, the batteries constitute half the weight of the vehicle.			
5. The batteries in electric vehicles must be replaced every three–six years.			
6. A typical electric vehicle can travel 50-130 miles between charges.			
7. Weather conditions, terrain, and accessory use can reduce the range of an electric vehicle.			
8. Electric vehicles are best suited for neighborhood vehicle use, for consumers going short distances at 35 mph or less.			
9. Extensive research is ongoing to develop longer-lived batteries that will also extend the range of electric vehicles.			
10. Electric vehicles produce no tailpipe emissions.			
11. Some power plants—such as coal-fired plants—that generate electricity produce air pollution and emit carbon dioxide.			
12. It is easier to control the emissions from power plants than from vehicles.			
13. Electric vehicles are low maintenance; they require no tune-ups, oil changes, water pumps, radiators, injectors, or tailpipes.			
14. Electric vehicles can be recharged at home at night when electricity rates and demand are low.			
15. Today, there are 9,980 electric charging units at public electric refueling stations.			
16. Consumers who drive electric vehicles often receive tax incentives.			



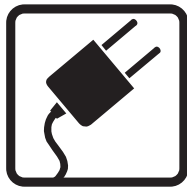
Ethanol

	RELEVANT		
	IT'S A FACT	ADVANTAGE	DISADVANTAGE
1. Ethanol is an alcohol fuel made by fermenting the sugars in grains and other plants.			
2. The chemical formula for ethanol is C ₂ H ₅ OH.			
3. The most commonly used processes today use yeast to ferment the sugars to produce ethanol.			
4. A new process being developed uses enzymes to break down the cellulose in woody fibers, making it possible to produce ethanol from trees, grasses, and crop residues.			
5. Ethanol is made from renewable sources of energy.			
6. The use of ethanol provides new markets for U.S. agriculture.			
7. Since ethanol contains oxygen, adding it to gasoline reduces ozone-forming and carbon monoxide emissions.			
8. Gasoline containing 10 percent ethanol—E10—is used in many urban areas that fail to meet air quality standards for carbon monoxide and ozone.			
9. Vehicles can use E10 without any changes to their engines.			
10. Many states and the Federal Government provide incentives to use ethanol.			
11. Conventional vehicles cannot use E85—a mixture of 85 percent ethanol and 15 percent gasoline.			
12. Flexible fuel vehicles (FFVs) are manufactured to use any combination of ethanol and gasoline up to E85.			
13. Today there are about eight million FFVs that could use E85, however, only 618,500 vehicles currently use it.			
14. The octane rating for ethanol is 110, slightly higher than that of gasoline.			
15. The energy content of ethanol is about 15 percent less than that of gasoline.			
16. There are more than 2,500 E85 fueling stations in the U.S., mainly in the Midwest and Southeast.			



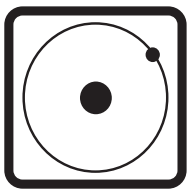
Gasoline

	RELEVANT		
	IT'S A FACT	ADVANTAGE	DISADVANTAGE
1. Gasoline is a petroleum-based fossil fuel made of hydrogen and carbon.			
2. The chemical formula for gasoline is C ₈ H ₁₅₋₁₈ .			
3. Petroleum is a nonrenewable source of energy.			
4. About forty-two percent of crude oil is refined into gasoline in the U.S.			
5. The octane rating for gasoline is 84 to 93.			
6. Gasoline has a high energy content of 116,000 Btu/gallon.			
7. More than 99 percent of the vehicles in the U.S. use petroleum-based fuels.			
8. The U.S. has a vast infrastructure of refineries, pipelines, and filling stations to distribute gasoline efficiently and conveniently.			
9. The U.S. imports about one-half of the crude oil it uses from other countries.			
10. There are about 159,000 gasoline fueling stations in the U.S.			
11. There are about 246 million cars in the U.S. that use gasoline.			
12. The average gasoline-powered vehicle travels 12,000 miles per year.			
13. Vehicles that use petroleum-based fuels emit air pollutants.			
14. In the last 50 years, gasoline-powered vehicle emissions have decreased an average of 95 percent.			
15. In many metropolitan areas, vehicles contribute about half of the air pollution.			
16. Almost half of the people in the U.S. live in areas that do not meet air quality standards.			



Hybrid Electric

	RELEVANT		
	IT'S A FACT	ADVANTAGE	DISADVANTAGE
1. Hybrid vehicles have two power sources—an energy conversion unit (such as an internal combustion engine) and an energy storage device (such as a battery).			
2. The typical hybrid on the market today has a gasoline-powered engine and an electric motor with a battery.			
3. Hybrid electric vehicles (HEVs) can have either a series or parallel design.			
4. In a parallel design, the engine and motor are connected directly to the vehicle's wheels. The primary engine is used for highway driving; the electric motor provides added power during periods of high demand.			
5. In a series design, the primary engine is connected to a generator that produces electricity. The electricity charges the batteries and drives a motor that powers the wheels.			
6. HEVs can function as purely electric vehicles for short trips, using the internal combustion engine only when longer range or more power is required.			
7. HEVs can get 1.5 times the fuel economy of comparable conventional vehicles.			
8. HEVs have generators powered by the internal combustion engines to recharge the batteries when they are low.			
9. HEVs have regenerative braking systems that capture excess energy when the brakes are engaged. This recovered energy is also used to recharge the batteries.			
10. HEVs reduce air pollutants by one-third to one half over gasoline-powered vehicles.			
11. HEVs have a higher purchase price than comparable gasoline-powered vehicles.			
12. Tax incentives and superior fuel economy produce savings over the life of the vehicles to make them competitive with gasoline-powered vehicles.			
13. Today, there are over 30 hybrid models available to consumers, from many of the major auto manufacturers. Hybrid vehicles range from two-seats, four and five seat sedans, SUVs, and even light duty trucks.			
14. HEVs on the market today average 40-60 mpg and can travel 500-700 miles on one tank of gasoline.			
15. Plug-in hybrid vehicles used in an urban setting may allow people to make their daily commute using electricity.			
16. Hybrids use established gasoline fueling stations.			



Hydrogen

	RELEVANT		
	IT'S A FACT	ADVANTAGE	DISADVANTAGE
1. Hydrogen is the most abundant element in the universe.			
2. Pure hydrogen does not exist on Earth; it is only found in molecules with other elements.			
3. Hydrogen is a gas at normal temperature and pressure.			
4. Hydrogen can be produced from water by electrolysis, a process in which water molecules are separated into hydrogen and oxygen using electricity.			
5. Today, it takes more electricity to electrolyze water than is produced by the hydrogen fuel.			
6. Hydrogen can be produced from natural gas, coal, or biomass.			
7. Today, most hydrogen comes from the steam reforming of natural gas, a nonrenewable energy source.			
8. Fuel cells use hydrogen and oxygen to produce electricity without harmful emissions; water is the main by-product.			
9. No hydrogen production or distribution infrastructure exists at this time.			
10. Hydrogen gas takes up six times as much space as gasoline per energy equivalent.			
11. The production of hydrogen is very expensive today.			
12. Fuel cells are an expensive method of producing electricity today.			
13. Hydrogen is the fuel that was used in the space shuttles.			
14. There are no hydrogen fuel cell vehicles on the market today and less than 60 fueling stations for test vehicles.			
15. There is ongoing research into hydrogen fuel cell technology.			
16. The Department of Energy has a hydrogen fuel cell initiative to support research and development of new technologies.			



Natural Gas—CNG/LNG

	RELEVANT		
	IT'S A FACT	ADVANTAGE	DISADVANTAGE
1. Natural gas can be used as a vehicle fuel when it is compressed (CNG) or liquefied (LNG).			
2. The formula for natural gas is CH ₄ .			
3. Natural gas is a nonrenewable fossil fuel.			
4. Natural gas is a cleaner-burning fuel. It produces very low emissions of ozone-forming hydrocarbons, toxins, and carbon monoxide.			
5. Methane—the main ingredient in natural gas—can be produced from biomass, a renewable energy source.			
6. When compressed, natural gas has less energy per gallon than gasoline, so vehicle range is shorter unless additional tanks are added, which reduces payload capacity.			
7. CNG has an octane rating of 120+, which provides good power and acceleration to vehicles.			
8. Today, there are about 116,000 vehicles in the U.S. that run on CNG.			
9. Conventional vehicle engines can be converted to use CNG at a cost of \$12,000-\$18,000, depending on the number of pressurized tanks installed.			
10. The production and distribution systems for natural gas are in place, but the delivery system of fueling stations is not extensive.			
11. CNG vehicles are well suited for fleets that have their own refueling stations.			
12. There are about 3,350 vehicles in the U.S. that run on LNG.			
13. LNG takes up much less space than CNG, so the tanks are much smaller.			
14. LNG tanks must be kept cold, which uses energy.			
15. CNG and LNG tanks are designed to be safe in case of accidents.			
16. There are more than 1,000 natural gas refueling stations in the U.S.			



Propane—LPG

	RELEVANT		
	IT'S A FACT	ADVANTAGE	DISADVANTAGE
1. Propane is a fossil fuel, sometimes called liquefied petroleum gas or LPG.			
2. The chemical formula for propane is C ₃ H ₈ .			
3. Propane is a by-product of petroleum refining and natural gas processing.			
4. Propane is a nonrenewable source of energy.			
5. Under normal pressure and temperature, propane is a gas. Under moderate pressure or lower temperature, propane can be converted into a liquid and stored in pressurized tanks.			
6. As a liquid, propane is 270 times more compact than as a gas.			
7. There is an infrastructure of pipelines and distribution terminals in the U.S. to transport propane.			
8. There are about 2,660 propane vehicle fueling stations in the U.S.			
9. Propane has been used as a transportation fuel for more than 80 years.			
10. About one percent of propane consumption is for transportation.			
11. After petroleum-based fuels, propane is the most widely used and accessible transportation fuel.			
12. Today, about 143,000 vehicles, mostly fleet vehicles such as mail trucks, use propane fuel.			
13. For fleet vehicles, the cost of using propane is five to 30 percent less than gasoline.			
14. Propane is cleaner burning than gasoline and produces less air pollution.			
15. The octane rating for propane (104) is higher than that of gasoline.			
16. It costs between \$4,000 and \$12,000 to convert a conventional automobile engine to use propane fuel.			



2013 Youth Awards for Energy Achievement

All NEED schools have outstanding classroom-based programs in which students learn about energy. Does your school have student leaders who extend these activities into their communities? To recognize outstanding achievement and reward student leadership, The NEED Project conducts the National Youth Awards Program for Energy Achievement.

This program combines academic competition with recognition to acknowledge everyone involved in NEED during the year—and to recognize those who achieve excellence in energy education in their schools and communities. What's involved? Students and teachers set goals and objectives, and keep a record of their activities. In April, students combine their materials into scrapbooks and send them in and write summaries of their projects for inclusion in the Annual Report. Want more info? Check out www.NEED.org/Youth-Awards for more application and program information, previous winners, and photos of past events.





Transportation Fuels Debate Evaluation Form

State: _____ Grade Level: _____ Number of Students: _____

- 1. Did you conduct the entire activity? Yes No
- 2. Were the instructions clear and easy to follow? Yes No
- 3. Did the activity meet your academic objectives? Yes No
- 4. Was the activity age appropriate? Yes No
- 5. Were the allotted times sufficient to conduct the activity? Yes No
- 6. Was the activity easy to use? Yes No
- 7. Was the preparation required acceptable for the activity? Yes No
- 8. Were the students interested and motivated? Yes No
- 9. Was the energy knowledge content age appropriate? Yes No
- 10. Would you teach this unit again? Yes No

Please explain any 'no' statement below.

How would you rate the activity? excellent good fair poor

How would your students rate the activity overall? excellent good fair poor

Did you use any of NEED's other transportation materials? If yes, which ones?

What would make the unit more useful to you?

Other Comments:

Please fax or mail to: **The NEED Project**
P.O. Box 10101
Manassas, VA 20108
FAX: 1-800-847-1820

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National Ocean Industries Association
National Renewable Energy Laboratory
Nebraska Public Power District
New Mexico Oil Corporation
New Mexico Landman’s Association
New Orleans Solar Schools Initiative
New York Power Authority
NSTAR
OCI Enterprises
Offshore Energy Center
Offshore Technology Conference
Ohio Energy Project
Pacific Gas and Electric Company
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