



Debating the Energy Source [MC]

Adapted from National Energy Education Development Project

Grades: 9-12

Time: 45 minutes to 1 hour

Goals: To conduct a civil debate to investigate the economic and environmental advantages and disadvantages of the major energy sources.

Objectives:

Students will be able to: describe different energy sources; understand the advantages and disadvantages of each energy source; and debate the merits of each energy source.

Materials:

- Energy source debate sheets (provided)
- Yes/No cards
- Great Energy Debate tally sheets (provided)
- Pencils or pens

Preparation: Decide how many resources your class will use for the debate based on how many students in each group. Make copies of all of the energy debate sheets for each group prior to the day of the lesson, so that the students can learn all of the energy sources, not just the ones they will be using for the debate. If you feel you will run out of time, give these sheets to the students prior to the debate to fill them out and then have them bring them in on the day of the debate.

Procedures:

1. Pre-Activity (introduction): If the students have already had the opportunity to fill out the energy source debate sheets, then you can begin by dividing them into debate teams. If this is the first time they will receive the debate sheets, give them up to 10 minutes to fill them out on their own. Explain that there are many forms of energy resources out there and some have been used extensively, while others have not been used to their full potential. Students must be aware that during a debate, every team has the opportunity to argue FOR their specific energy source, and they must keep in mind that even if they personally disagree with the use of their particular energy source, they are to work together to find the best advantages.
2. Activity: Assign three students as “judges” and hand them Yes/No cards. Divide the remainder of the students into “resource teams.” Assign each team to a specific resource and ensure their energy source debate sheets are consistent with each other. The object of the debate is not to be right or wrong, but to have the least amount of impact on the environment into the future. “Judges” are in charge of deliberating each advantage given and assigning points based on this environmental impact.



Each team will have the opportunity to give the “judges” an advantage of their energy resource and wait for the point value, to then be recorded on their tally sheets. Three points will be awarded to each advantage that is safe for the environment, can be used over an extended period of time, and is the least costly. Two points will be awarded if any one of these is not true. One point will be awarded if two of these are not true. No points will be awarded if the team is unsuccessful in reaching this goal for their advantage. After all teams have had the opportunity to present three advantages, they must tally up their points.

3. Post-Activity (review): Review the differences between a renewable and a non-renewable resource and ask the students to decide which type of resource they have. Would this have any bearing on their advantages? How would these energy sources withstand dramatic changes to the environment, such as global warming, global climate change, and ecosystem alteration?

Key Words:

Energy source

Non-renewable resource

Renewable resource

Environmental impact

Cost efficient

Global warming

Climate change

Industrial growth

Background Information:

Adapted from National Energy Education Development Project

We use energy for everything we do and need. We use energy in the electricity to power our appliances and homes; we use energy in the form of fuel for our vehicles; we even use energy within ourselves to stand and walk across the street. We often hear people talk about alternative energy. Instead of burning fossil fuels like coal, we turn to the power of water or wind as a more natural form of energy. Energy allows us to travel around the world or just to the couch in our homes. It allows us to heat our homes and power our computers.

Energy sources can be grouped into two categories: renewable and nonrenewable. Renewable resources are those that can be replenished within a short amount of time. Examples of these are water, solar, and wind. Nonrenewable resources are those that take sometimes millions of years to replenish. Eventually, they may be gone for good. Examples of these are coal, petroleum, and natural gas.

Energy can also be designated based on whether it is used by a residential home, a commercial business, a major industry, or for transportation. Commercial businesses include office buildings, hospitals, stores, and schools. Industries can include construction, mining, farming, and manufacturing. The majority of this energy comes from petroleum products.

Following is a listing of the types of energy used in this lesson and a short discussion of each.



Biomass: organic matter such as wood, crops, animal waste. It is considered a renewable resource and is advantageous over fossil fuels, since it contains sulfur and nitrogen and will not contribute to acid rain. Plants and plant matter also remove carbon dioxide from the atmosphere.

Coal: fossil fuel created from plant matter from millions of years ago. It is considered a nonrenewable resource because it takes millions of years to form. At one time it was used for home heating, but it is now only used for industrial electricity. Environmentally, burning coal has contributed to greenhouse gasses in the earth's atmosphere and is partially responsible for global climate change.

Hydropower: power and energy gathered from moving water. It is considered a renewable resource because through the water cycle, water moves continuously and replenishes itself. Its fuel is considered the cleanest and most renewable, but it can also cause damage to wildlife habitats when dams are created to harvest its power.

Natural gas: fossil fuel created from underwater plant and animal matter from millions of years ago. It is considered a nonrenewable resource because it takes millions of years to form. In the United States, natural gas comes in second after petroleum in energy use. It is advantageous over coal because it produces less sulfur, carbon, and nitrogen than other fossil fuels.

Petroleum: fossil fuel, similar to natural gas, created from underwater plant and animal remains from millions of years ago. It is considered a nonrenewable resource because it takes millions of years to form. In the United States, it has become our number one energy source. Unfortunately, the production, distribution, and consumption has contributed to air and water pollution, and transportation harms wildlife and ecosystems in the event of an oil spill.

Propane: fossil fuel gas derived from natural gas and petroleum. It is also considered a nonrenewable resource because of the way it is formed and processed. It can easily be stored as a liquid and it is a clean-burning fossil fuel. It was approved as an alternative fuel under the Clean Air Act, as well as the National Energy Policy Act of 1992.

Solar energy: radiant energy produced by the sun. It is considered a renewable resource because it produces more energy in one day than the entire world uses in one year. It does not contribute to air or water pollution, it is free, and it is widely available. Unfortunately, to manufacture the photovoltaic cells used to harness the energy, it uses silicon and produces waste. Solar farms can have an adverse effect on desert ecosystems without proper management.

Wind: air in motion, produced by uneven heating of earth's surface by the sun. It is considered a renewable resource because as long as the sun is still producing heat, wind will still be produced. Wind energy is mostly used to produce electricity for residential and commercial use and is an alternative to power plants. It is clean and does not contribute to air or water pollution. Wind turbines may impact some species of flight such as birds or bats and they take away from the aesthetic value of the land.



Energy Debate Sheets

BIOMASS	Fact	Advantage	Disadvantage
Source of energy from plant and animal waste			
Difficult to transport and store because it decays			
Renewable energy source; we can grow more			
Abundant and can be produced anywhere in the U.S.			
Can produce odors and emissions when burning			
Alcohol fuels from biomass can be domestically produced			
Burning biomass can reduce garbage in landfills			
As it decays, more energy is available for use as fuel			
Process captures energy from the sun in photosynthesis			
Burning biomass produces electricity and heat			

COAL	Fact	Advantage	Disadvantage
One of the most abundant fuels in the United States			
When burned, oxides (carbon, sulfur, nitrous) are produced			
Large amounts of land are disturbed to mine coal			
Coal can be turned into gas, but the process is expensive			
Coal mining can be dangerous for miners			
Methane found in coal can be a great resource			
Cleaner coal technologies use less coal than others			
Electricity industries spend billions to reduce emissions			
Coal can be turned into other products we can use			
Surface mines can be turned into grasslands after use			

HYDROPOWER	Fact	Advantage	Disadvantage
Moving water has been used as an energy for centuries			
Moving water is considered a renewable energy source			
Dams can disturb the migration and spawning of fish			
Reservoirs from dams are built for recreational purposes			
Dams can alter the natural flow of rivers			
This energy resource is not expected to increase in the U.S.			
Some countries use this energy source solely for electricity			
The federal government uses the most hydropower			
Considered one of the cleanest and cheapest energy sources			
Dependent on rainfall to produce electricity			



NATURAL GAS	Fact	Advantage	Disadvantage
Formed by the decomposition of ancient sea creatures			
Cleanest burning fossil fuel			
Found together with petroleum in underground deposits			
Just as valuable as oil to drillers when they dig			
Leaks, fires and explosions can occur in pipelines			
Considered a renewable resource			
Used equally by homes and businesses to run electricity			
Methane is considered to be a greenhouse gas			
The U.S. supply comes mainly from the Gulf of Mexico			
Odorless and must add odorant for safety purposes			

PETROLEUM	Fact	Advantage	Disadvantage
It is a nonrenewable energy source			
Oil deposits are found both offshore and on land			
As crude oil, straight from the well, it is not usable			
We get many fuels from refining petroleum			
Oil drilling and production are regulated by the government			
Oil spills can cause damaged to wildlife and ecosystems			
Efficient, economic transportation fuels			
Leading source of energy in the United States			
Transported by pipeline, truck, or tanker to be refined			
Burning causes harmful emissions			

PROPANE	Fact	Advantage	Disadvantage
Normally a gas, becomes a liquid under extreme pressure			
It is a nonrenewable energy source			
Colorless and odorless and an odorant is added for safety			
Cleaner burning fossil fuel			
Mostly used in rural areas that do not have natural gas			
Much cleaner as a vehicle fuel than petroleum			
Heavier than air and can explode if ignited			
More expensive that natural gas, heating oil or kerosene			
An automobile engine must be adjusted to use propane			
Not as conveniently available as gasoline for vehicles			



SOLAR

	Fact	Advantage	Disadvantage
Only a small part of radiant energy reaches the earth			
It is considered a renewable resource			
Usable amount depends on season, time of day, clouds			
Does not pollute the air			
Solar energy systems can take up large amounts of land			
Generates a small amount of electricity			
Most of the energy we use every day cannot be measured			
Radiates more heat than we have used since time began			
A solar collector is used to capture light and convert it			
Harnessing energy is difficult because it is so spread out			

WIND

	Fact	Advantage	Disadvantage
Is air in motion caused by an uneven heating of the planet			
It is a renewable source of energy			
Wind turbines have turning blades to harness kinetic energy			
Without wind blowing, other sources of energy must be used			
Farms privately owned to sell electricity to utility companies			
Turbines can injure birds or bats that fly into the blades			
Can be located offshore where wind is more plentiful			
Almost every state has the ability to harvest this energy			
New technologies have dealt with noise control			
Do not cause air or water pollution, no fuel being burned			