SYNOPSIS:

The automobile industry is going through revolutionary changes. The standard petroleum gasoline fueled engine has some new competition from gas-electric hybrids, electric vehicles, hydrogen fuel cell vehicles, natural gas vehicles and even some automobiles that get some of their power from the sun.

Alternative fuel vehicles produce less harmful emissions and are better for the environment. Many of these fuels can be derived from renewable resources. Hybrid vehicles such as ones that are powered by a combination of gasoline combustion engines and electric motors are becoming more common. Other vehicles that are in development are powered by fuels such as ethanol, biodiesel, natural gas, propane, and hydrogen fuel cells.

CURRICULUM UNITS:

Biology
Chemistry
Ecology
Environmental Science
Physical Science

CAREER OPPORTUNITIES:

Chemist
Engineer
Mechanic

PROGRAM OVERVIEW:

Manufacturers of alternative fuel vehicles hope to offer transportation that will have little or no emissions that are harmful to our environment. In addition they hope to lessen our reliance on foreign oil. Rising taxes on liquid petroleum based fuel and the potential for peak oil are putting pressure on the industry to make these changes.

Electric vehicles use electric motors powered by rechargeable battery packs. They have no tailpipe emissions and are extremely energy efficient as they convert roughly 75% of the chemical energy from the batteries to power the wheels as opposed to internal combustion engines which convert 20% of the energy stored in gasoline.

The United States government plans to help put 1 million plug-in hybrid vehicles on America's roads by 2015. They are investing heavily in research and development of the next generation plug-in hybrid vehicles and advanced battery components. The government is also implementing several plans such as the National Low Carbon Fuel Standard, which will reduce the carbon in our fuels 10% by 2020 and require 60 billion gallons of bio-fuels to be phased into our fuel supply by 2030.

ISSUES & CRITICAL THINKING:

1) Divide students into groups and direct each to go to the Alternative Fuels and Advanced Vehicles Data center website and choose a fuel type. For each fuel type, identify its strengths and weaknesses.

2) Compare and contrast the following vehicle types: gas-electric hybrids, electric and fuel cell.

3) Have students research what steps the goverment is taking to encourage automobile manufacturers to improve their fuel efficiencies and emissions.

4) A difficult obstacle for alternative fuel vehicles to overcome is establishing an infrastructure. For hydrogen fuel cell vehicles to be a success, predict how generation, delivery, and refueling infrastructure will have to be developed.

GLOSSARY:

Anode- The positively charged element of an electrical device, such as a vacuum tube or a diode, to which electrons are attracted.

Cathode- The negative electrode in an electrolytic cell, toward which positively charged particles are attracted.

Electrolyte- A conducting medium in which the flow of current is accompanied by the movement of matter in the form of ions.

Ethanol- An alcohol obtained from the fermentation of sugars and starches or by chemical synthesis. It is used as a solvent, in explosives, and as an additive to, or replacement for petroleum-based fuels.

Fuel cell- A device that produces electricity by combining a fuel, usually hydrogen, with oxygen. In this reaction, electrons are freed from the hydrogen in the fuel cell by a catalyst, and gain energy from the chemical reaction binding hydrogen and oxygen; this provides a source for electric current.

Hydrocarbons- Numerous organic compounds, such as benzene, that contains only carbon and hydrogen.

Lithium-ion battery- Rechargeable battery in which lithium ions move from a negative electrode to positive electrode during discharge, and back when charging.

Methane- A colorless, odorless, flammable gas that is the simplest hydrocarbon. It is the major constituent of natural gas and is released during the decomposition of plant or other organic compounds, as in marshes and coal mines.

Peak oil- The point in time when the maximum rate of global petroleum extraction is reached. At this point, it is speculated that the rate of production will enter a terminal decline.

Petroleum- A thick, flammable, yellow-to-black mixture of gaseous, liquid, and solid hydrocarbons that occurs naturally beneath the Earth's surface. It is believed to originate from the remains of fossil plants and animals.

Regenerative braking- Converts the energy generated by braking into electrical energy to charge the batteries for the electric motor portion of the propulsion system.

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