

Name:

Period:

What's the problem?

Directions: Read all of the passages and come up with ten yes or no questions to help determine what you think the problem is then state the problem in one sentence.

Passage 1.

Particulate matter is the term used for a mixture of solid particles and liquid droplets found in the air. PM pollution is made up of soot (from diesel and coal burning), dust, and vehicle emissions. In Utah it is usually a winter time problem (or from wildfires at other times of year), especially during inversions. It is the smallest particles that are of the most concern. Specifically those measured as 10 micrometers or less in diameter (or approximately 1/10 the diameter of a human hair) and 2.5 micrometers or less in diameter (approximately 1/30 the size of a human hair). Both sizes of PM can cause health problems. PM2.5 is of significantly more concern, however, because of its small size it can be inhaled deeply into the lungs and be trapped and cause damage. PM10 is often simply "dust" and can typically be filtered by nose hair and lung cilia and then coughed out (1).

Passage 2

A recent study estimated that approximately 64,000 people in the United States die prematurely from heart and lung disease every year due to particulate air pollution -- more people than die each year in car accidents. Among children, air pollutants are associated with increased acute respiratory illness, increased incidence of respiratory symptoms and infections, episodes of longer duration, and lowered lung function (2).

Passage 3

What is U.S. electricity generation by energy source? In 2013, the United States generated about 4,058 billion kilowatthours of electricity. About 67% of the electricity generated was from fossil fuel (coal, natural gas, and petroleum), with 39% attributed from coal. In 2013, energy sources and percent share of total electricity generation were

Coal 39%

Natural Gas 27%

Nuclear 19%

Hydropower 7%

Other Renewable 6%

Biomass 1.48%

Geothermal 0.41%

Solar 0.23%

Wind 4.13%

Petroleum 1%

Other Gases < 1% (3)

Passage 4

People who own all-electric cars where coal generates the power may think they are helping the environment. But a new study finds their vehicles actually make the air dirtier, worsening global warming. Ethanol isn't so green, either. "It's kind of hard to beat gasoline" for public and environmental health, said study co-author Julian Marshall, an engineering professor at the University of Minnesota. "A lot of the technologies that we think of as being clean ... are not better than gasoline." The key is where the source of the electricity all-electric cars. If it comes from coal, the electric cars produce 3.6 times more soot and smog deaths than gas, because of the pollution made in generating the electricity, according to the study that is published Monday by the Proceedings of the National Academy of Sciences. They also are significantly worse at heat-trapping carbon dioxide that worsens global warming, it found.

Passage 5

The amount of fuel used to generate electricity depends on the efficiency or heat rate of the generator (or power plant) and the heat content of the fuel. Power plant efficiencies (heat rates) vary by types of generators, power plant emission controls, and other factors. Fuel heat contents also vary. Two formulas for calculating the amount of fuel used to generate a kilowatt-hour (kWh) of electricity: Amount of fuel used per kWh = Heat rate (in Btu per kWh) / Fuel heat content (in Btu per physical unit)

Kilowatt-hour generated per unit of fuel used = Fuel heat content (in Btu per physical unit) / Heat rate (in Btu per kWh) Calculation examples using these two formulas and the assumptions below:

Amount of fuel used to generate one kilowatt-hour (kWh):

Coal = 0.00054 short tons or 1.09 pounds

Natural gas = 0.00786 Mcf (1,000 cubic feet)

Petroleum = 0.00188 barrels (or 0.08 gallons)

Kilowatt-hour generated per unit of fuel used:

1,842 kWh per ton of Coal or 0.9 kWh per pound of Coal

127 kWh per Mcf (1,000 cubic feet) of Natural gas

533 kWh per barrel of Petroleum, or 12.7 kWh per gallon

Passage 6: A few facts

1. Coal can be converted to gasoline or diesel by a couple of different processes.
2. Coal is mainly used for generating electricity (more than 90 % of US coal).
3. Coal usually has a negative impact on the environment, mining can damage ground and surface waters and when coal burns as the fuel it releases CO₂ which is the main greenhouse gas that causes global warming.

Questions:

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

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