

## ELECTRIC & FLEX-FUEL VEHICLES

**Objective:** This data gathering exercise utilizes raw data from the U.S. Department of Energy in order to evaluate the energy costs of electric and flex-fuel vehicles and economic consequences of gas taxes. **Video instructions:** <https://vimeo.com/933396838>

**Introduction:** There is a growing interest in alternative fuel due to environmental concerns over fracking and vulnerability of shipping routes. One alternative that was widely promoted in recent years was the “flex-fuel” vehicle that uses ethanol as a substitute for gasoline. Unfortunately, ethanol contains only half the energy-to-mass ratio of gasoline and American agriculture is highly fossil fuel-dependent. Consequently, the widespread use of agricultural land to grow this biofuel would be disastrous in that it will accelerate deforestation while having little or no impact on oil consumption.

Electric vehicles are the ultimate flex-fuel vehicle because power plants have the widest range of fuel options, but they are limited by the large mass-to-energy ratio of the batteries and the severe environmental impact of lithium mining. Fuel-cell cars overcome the energy/mass ratio problem by using hydrogen to generate electricity. Unfortunately, hydrogen is a very difficult fuel to deliver and contain. All things considered, the technological breakthroughs that are most needed to reduce consumption of petroleum are lighter batteries and affordable fuel cells that run on energy carriers that are more practical.

### Questions:

1. What is the main advantage of lithium batteries over lead batteries?
2. What is the main advantage of lead batteries over lithium batteries?
3. What are two advantages of gasoline-powered vehicles over electric vehicles?
4. How many square miles of switchgrass are needed to satisfy current gasoline demand in the US?
5. Which state is closest in size to the total land needed?
6. What is the biggest problem with relying on biofuels grown on land?
7. Does combustion or fermentation more miles per 100 lbs of switchgrass? Explain:

8. Which technology is more convenient; flex-fuel or electric vehicles? Explain:
9. What are two main disadvantages of electric cars? *Hint: Re-read the introduction.*
10. What is the average miles per pound of coal for the electric Honda Fit when all the electricity is obtained entirely from coal?
11. Under what conditions does the widespread use of electric cars result in more air pollution than the widespread use of cars that use internal combustion engines?
12. What is the average miles per gallon for the electric Honda Fit when all the electricity is obtained entirely from oil? Is this significantly different ( $>10\%$ ) than the mpg of the gasoline-powered Honda Fit?
13. What is the average miles per cubic foot for the electric Honda Fit when the electricity is obtained entirely from natural gas?
14. A 2013 Honda Civic that runs on compressed natural gas gets a combined average 0.25 miles per cubic foot of natural gas (3). Is this significantly different ( $>10\%$ ) than the miles per cubic foot of the electric Honda Fit described in the previous question?
15. Why do most economists oppose punitive taxes on fuel?
16. What happens to the price per barrel when Americans consume less oil?

**Assignment Checklist:**

1. Did you completely answer all the questions?
2. Did you fill out the items on Tables 1-10?