# Energy Calculations

1. The conventional gasoline-powered 2008 Honda Civic is one of the best fuel efficient cars in its class for mileage. The conventional Honda Civic gets 35 mpg during city driving (40 mpg highway). When the exact same car is given a hybrid-electric engine, mileage is 40 mpg city and 45 mpg highway.

    $20, 650 Honda Civic Hybrid
    $16, 000 Honda Civic conventional *average, depending on features

You plan to drive mostly in the city, to and from work and for weekend errands. You expect to drive 8,000 miles a year in the city, plus another 4,000 miles in longer trips that would count as "highway".

a) How much would you spend on gas for the hybrid Civic in a year, assuming gas cost $3.50 per gallon)?
b) How much would you spend on gas for the conventional Civic in a year, assuming gas cost $3.50 a gallon?
c) How long would it take for the saving in gas costs offset the increase in the price of the hybrid Civic?


2. The 2008 Toyota Prius gets 48 mpg city and 45 mpg freeway. The "best-selling car in America" is the ford F-150 truck. The 4WD, V6 version of the F-150 gets 14 mpg city and 19 mpg highway.

a) The average American drives 12,000 miles per year. Assume that most people do ¾ of their driving in stop and go city traffic and ¼ in highway traffic. (We will ignore the stop and go traffic on I-95 for now!) How many gallons of gas would be saved per person by driving the Prius over the F-150?
b) Assume that every gallon of gas consumed contributes approximately 20 kg of $CO_2$ to the atmosphere. How many extra kg of $CO_2$ are put into the atmosphere by the F 150 in a year, when compared to the Prius?
c) F-Series trucks (all Ford trucks like the F-150) were the best-selling vechicles in America for the 26nd consecutive year in 2007. Sales totaled 845,586 trucks for the year. Calculate hoe many gallons of gas and kg if $CO_2$ would be saved saved if all of these truck purchasers brought Prius instead (unlikely, and perhaps unreasonable, but lets just see).
d) If the vehicle is in-service for 10 years, how much $CO_2$ is saved over the life of the vehicle? How much money is saved? (Assuming gas still costs $3.50 a gallon.)

3. One pound (lb) of bituminous coal contains 12,000 BTUs of energy. A BTU is a British Thermal Unit, or the amount of heat required to raise the temperature of one pound of water (one pint) one degree Fahrenheit. A typical coal fired power plant needs 3,400 BTUs of heat to produce one kilowatt-hour of electricity. This plant has a one Megawatt output.

   Showing all steps calculate the following:

   a) How much coal is required to produce one kilowatt-hour of electricity?
   b) How much coal must be burned to keep the plant at full output for 24 hours?
   c) Assuming the coal is 2% sulfur by mass, how many pounds of sulfur would be released in a 24 hour period?