

Energy Use Audit

Read the background on fossil fuels below. Follow the procedure outlined in each step to determine your energy usage in the following areas: transportation, electric appliances, home heating/cooling. Then answer the analysis questions that follow the procedure. Complete your work on a separate sheet of paper, then staple THIS sheet ON TOP of your work before submitting it.

The economics of the industrialized world run on fossil fuels. Coal, gas, and petroleum, formed hundreds of millions of years ago by decaying plants and animal, have provided modern civilization with a supply of stored energy from the sun. Fossil fuels have allowed us to move from a society based primarily on energy from people and living plants, to one based on fossil fuels. Special conditions that existed when coal, gas, and petroleum formed are essentially not present now. This means that fossil fuel production currently taking place within the Earth is insignificant. Furthermore, the production of fossil fuels is a very slow process, too slow to keep up with the current pace of consumption. Since fossil fuel reserves are limited, and they are used faster than they are generated, they are said to be non-renewable.

Limited supplies, however, are not the only concerns. When fossil fuels are burned, they produce carbon dioxide, the principal contributor to the greenhouse effect. Unprecedented increases in the atmospheric levels of carbon dioxide have been observed during the last half-century, and are theorized to be a major contributing factor to climate change. Other gases emitted by fossil fuels contribute to air pollution and acid rain. Coal mining, particularly the above-ground strip mining, damages the landscape, while dust and noxious gases in the underground mines are a health hazard for miners. Finally, major concerns exist regarding the dependence on fossil fuels from the Middle East, a socio-politically tenuous region of the globe.

The three largest causes of energy consumption are: transportation, home electricity, and home heating. You will keep track of your energy consumption for one continuous week. For this study, you must use Excel (or some other equivalent) to keep track of your energy consumption. You can set up your spreadsheet in any way you see fit.

1. To estimate the amount of fossil fuel you consume in transportation: (in joules, J)
 - a. Keep a detailed log of your mileage for each trip you make, every day for one week including:
 - i. each trip's mileage and miles per gallon (mpg) of fuel
 - ii. the traffic conditions (light, moderate, heavy, etc.)
 - iii. the average speed travelled (25 mph and below, 25 – 40 mph, 40 – 60 mph, 60+ mph)
 - iv. the purpose for the trip (school, work, grocery store, etc.)
 - b. Calculate the number of gallons of fuel consumed for each trip you made by dividing the trip's mileage by the miles per gallon for that trip
 - c. Calculate how many joules of energy each trip consumed with the following information:
1 gallon of gasoline = 1.32×10^8 J

2. To estimate the amount of fossil fuel equivalent you consume by using electric devices/appliances: (in kilowatt-hours, kWh)
 - a. Use the “Energy Requirements of Electric Appliances” table to identify the devices you use
 - b. Keep a detailed log of the length of time you use each device
 - c. Some appliances (refrigerator, freezer, etc.) run continuously, so be sure to include them in your calculations
 - d. Calculate the energy you consumed for each appliance using the same table as above
 - e. Add up the total amount of energy consumed for the week and convert it to joules using the following information:

$$1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$$

3. To estimate the amount of fossil fuel you consume in home heating:
 - a. If your home is heated by electricity, use your most recent heating bill and convert the kWh to joules using the conversion above
 - i. For the purpose of this assignment, assume that electricity usage is either by appliances or heating
 - ii. Subtract the amount of energy consumed that you calculated in step #2 to determine the energy used in home heating
 - iii. Divide that value by 4 to estimate the energy consumed in home heating for the week
 - b. If your home is heated by natural gas use your most recent heating bill and convert the fuel used to joules using the conversions below:

$$1 \text{ ft}^3 \text{ natural gas} = 1.09 \times 10^6 \text{ J}$$

$$1 \text{ CCF (or ccf)} = 100 \text{ ft}^3$$

4. Add up the total amount of energy you consumed in one week. Multiply that value by 52 to calculate your annual energy consumption. For the purpose of this process, assume that your energy consumption remains the same throughout the year.
5. The figures you calculated represent the energy you used directly. It does not include the energy you used indirectly. Indirect energy use includes energy used in manufacturing products you buy, growing and processing food, and transporting food and products to you. For perspective, approximately 75% of the energy we use is consumed indirectly. Therefore, you need to multiply your calculated energy consumption value by 4 to obtain your total energy usage. Compare this to the average total energy consumption per person in the United States of $3.165 \times 10^{11} \text{ J}$.
6. Prepare a bar graph of each of the “purposes” of your car trips using the data from step #1.
7. Each gallon of gasoline burned produces about 11 kg of carbon dioxide. Carbon dioxide is the principal contributor to the greenhouse effect. Calculate the number of kilograms of carbon dioxide your car produces per year. This is just your transportation total; all other energy you use (except for solar, wind, hydroelectric, etc.) also produces carbon dioxide. Compare this to the average production of carbon dioxide per person in the United States which is about 4,535 kg per year.
8. What are some ways that you can reduce your transportation-related carbon dioxide production?
9. What are some ways you can reduce your energy consumption due to electric devices/appliances and home heating?

Energy Requirements of Electric Appliances

Device	kW per hour	Device	kW per hour	Device	kW per hour
Electric Furnace	10	Espresso Machine	0.33	Stereo	0.059
Central Air Conditioner	5	Dehumidifier	0.33	Incandescent Bulb (60 W)	0.059
Clothes Dryer	3.33	Plasma TV	0.33	Laptop (plugged in/charging)	0.05
Oven	2.5	Blender	0.33	Printer	0.045
Dishwasher	1	Freezer	0.25	DVR	0.033
Space Heater	1	LCD TV	0.2	Aquarium	0.03
Room Air Conditioner	1	Refrigerator	0.2	Cable Box	0.02
Iron	1	Game System	0.2	CFL Bulb (60 W equivalent)	0.018
Electric range	1	Standard TV	0.14	DVD Player	0.017
Hair Dryer	1	Computer Monitor	0.14	VCR	0.011
Coffee Maker	1	Computer	0.125	Clock radio	0.01
Toaster	1	Electric Blanket	0.1	Wireless Router	0.007
Popcorn Popper	1	Portable Fan	0.1	Cell Phone Charger	0.004
Toaster Oven	1	Can Opener	0.1	Cordless Phone	0.003
Microwave	1	Stand Mixer	0.1		
Clothes Washer	0.5	Curling Iron	0.09		
Vacuum	0.5	Ceiling Fan	0.077		
Water Heater	0.47	Humidifier	0.077		