Personal Energy Inventory

Introduction

Energy use is an important part of all our lives. Energy is available from many sources including oil, coal, natural gas, electricity, and hot water. Each one of these sources of energy has different costs associated with it. Many of our energy resources are nonrenewable and inefficient use unnecessarily decreases their supply to posterity.

Worldwide energy consumption differs greatly among different nations. The United States makes up only 6 percent of the world's population, yet Americans use 25 percent of the world's energy resources. On a per person basis, the average American uses twice as much energy as someone in Europe or Japan and 16 times as much energy as someone in a developing nation. Clearly, it is important to use energy resources judiciously and responsibly, both for ourselves and for the world.

As a consumer you can help decrease energy use. Think about the ways you use energy. Do you let the hot water run when you brush your teeth? Do you have a water efficient shower nozzle? Do you leave the lights on in a room even when you are not there for an extended period? Do you drive somewhere you could easily walk? Do you find yourself making multiple trips when you could combine all your errands into one trip? With a little forethought you can save energy without a major change in your lifestyle.

In this exercise, you will monitor your own energy usage in various categories for one typical day. For each category, you will calculate kilowatt hours used and then sum the categories to get your total energy usage. You can then compare your usage to typical energy usage in the US and to that of your classmates.

Procedure

1. Chose a day between now and next week's lab session which is typical (or merely convenient) to monitor your energy usage by category.
2. For one day, monitor and record your energy use in three categories; 1) non-transportation, without hot water demand, 2) non-transportation, with hot water demand, and 3) transportation.
3. **Non-transportation, without hot water demand energy use** will be recorded in Data Table 1. Use this table to record non-

transportation uses that DO NOT involve hot water.

a. Column A is the category name.
   i. multiple rows have been provided for incandescent and fluorescent light bulbs since your usage will probably include bulbs of more than one wattage.
b. Column B is for the watts used by the item.
   i. if possible, try to record the actual watts used by an item (look for a label on the device with this information)
   ii. if you cannot determine the actual watts used by a specific item, refer to Table 1 which provides typical watts used for various household appliances.
c. Column C is for kilowatts, which you will **calculate** by dividing the watts (column B) by 1000
d. Column D is a measure of usage in minutes
e. Column E is for the number of hours the item was used, which you will **calculate** by dividing the minutes used (column D) by 60
f. Column F is for kilowatt hours used, which you will **calculate** by multiplying the kilowatts (column C) by the hours used (column E)
g. Total the values for kilowatt hours used (column F) and record this number in the last row of the table as your total non-transportation, without hot water demand, energy usage

4. **Non-transportation, <u>with</u> hot water demand energy use** will be recorded in Data Table 2. Use this table to record non-transportation uses that **DO** involve hot water, such as showers, baths, dishwashers and clothes washers. **PLEASE NOTE** that for this category you must determine the minutes the appliance was used as well as determining the quantity of water used.
   a. Column A is the category name and there are two main subcategories;
      i. electricity used by the appliance
         1) Column B is for the watts used by the item
            a) if possible, try to record the actual watts

used by an item (look for a label on the device with this information)

b) if you cannot determine the actual watts used by a specific item, refer to Table 1 which provides typical watts sued for various household appliances.

2) Column C is for kilowatts, which you will **calculate** by dividing the watts (column B) by 1000

3) Column D is a measure of usage in minutes

4) Column E is for the number of hours the item was used, which you will **calculate** by dividing the minutes used (column D) by 60

5) Column F is for kilowatt hours used, which you will **calculate** by multiplying the kilowatts (column C) by the hours used (column E)

ii. electricity/energy used to heat water

1) for dish washing and clothes washing

a) **record** in column B the number of loads

b) **calculate** the number of gallons of hot water used by multiplying column B times column C and record the result in column D

c) **calculate** the kilowatt hours used by multiplying the # gallons used (column D) by the conversion factor (column E) and record in column F

2) for showering

a) **record** in column A the length of the

shower in minutes

b) **calculate** the number of gallons of hot water used by multiplying column B times column C and record the result in column D

c) **calculate** the kilowatt hours used by multiplying the # gallons used (column D) by the conversion factor (column E) and record in column F

3) for bathing

a) **record** in column A the number of baths taken

b) **calculate** the number of gallons of hot water used by multiplying column B times column C and record the result in column D

c) **calculate** the kilowatt hours used by multiplying the # gallons used (column D) by the conversion factor (column E) and record in column F

b. Total the values for kilowatt hours used (column F) and record this number in the last row of the table as your total non-transportation, with hot water demand, energy usage

5. **Transportation energy use** will be recorded in Data Table 3.

a. record in column A the total miles traveled

i. **record** miles traveled regardless of whether those miles were traveled by your own car, in a friend's car, in a taxi, or on a bus

ii. if multiple people were in the travel vehicle (as in carpooling, sharing a taxi, taking a bus), divide the miles by

the number of people in the vehicle

b. **record** in column B the fuel mileage (in miles per gallon) of the vehicle
   i. if you don't know the vehicle's fuel mileage, select an approximate figure from Table 2.
c. **calculate** the gallons of fuel used by dividing the miles traveled (column A) by the miles per gallon (column B) and record in column C
d. **calculate** the transportation energy use in megajoules by multiplying the total gallons used (column C) by 10 (because each gallon of gas contains energy equivalent to 10 megajoules) and record in the last row of the table as the total energy use in megajoules

6. Convert the non-transportation energy use to megajoules.
   a. Transfer the total non-transportation energy use, without hot water demand, in kilowatt hours from the last row and column of Data Table 1 to Data Table 4
   b. Transfer the total non-transportation energy use, with hot water demand, in kilowatt hours from the last row and column of Data Table 2 to Data Table 4
   c. Calculate the energy used in megajoules by multiplying kilowatt hours (column B) times the conversion factor (column C) and record the result in column D
   d. Add the values in column D and record the result in the last row of the table as the total non-transportation energy use in megajoules
7. In Data Table 5 record the non-transportation and transportation energy use totals in megajoules
   a. Add the values and record the result in the last row of the table as your total daily energy use in megajoules
8. Record your non-transportation and transportation energy use in megajoules on the board with other classmates' data
9. From the class-wide data recorded on the board (or overhead transparency), record in Data Table 6 the maximum, median and minimum values for non-transportation, transportation and total energy use

Table 1. Watt usage assumptions for various household appliances.

Household Appliance	Watts
Blender	300
Ceiling fan	50
Clock	5
Clothes dryer (high)	5000
Clothes dryer (med)	3000
Clothes washer	1200
Coffeemaker	600
Computer	250
Dehumidifier	550
Dishwasher	1300
DVD	50
Hair dryer	1000
Iron	1200
Microwave	650
Oven @ 350°F	3500
Portable heater	1500
Radio	50
Range (high, 1 burner)	5000
Range (med, 1 burner)	2500
Refrigerator (when running, assume its running 5% of the time)	250
Shaver	15
Stereo system	300
Sewing machine	100
Television	300
Toaster	1000
Vacuum cleaner	450
VCR	50

Table 2. Transportation vehicle fuel mileage assumptions

Vehicle	Fuel mileage
Compact car	25 mpg
Full-size car	25 mpg
Mini-van, SUV, PU	20 mpg
Bus	10 mpg

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Personal Energy Inventory LAB WRITE-UP: Submit pages 7-11

Student Name: _____ Lab Date: _____
Lab Instructor: _____ Lab Section: _____

Results (Data)

Data Table 1. Personal daily non-transportation energy use for activities without hot water demand, by category, in kilowatt-hours.

A	B	C	D	E	F
Category Name	**Watts**	**Kilowatts (Watts/ 1000)**	**Minutes Used**	**Hours used (minutes /60)**	**Kilowatt Hours Used (CxE)**
Incandescent bulb					
Incandescent bulb					
Incandescent bulb					
Fluorescent bulb					
Fluorescent bulb					
Fluorescent bulb					
Refrigerator					
Electric stove					
Microwave oven					
Television					
VCR					
DVD player					
Stereo w/CD player					
MP3 player					
Radio					
Computer					
Clothes dryer					
Coffee maker					
Clock					
Non-Transportation Energy Use, WITHOUT Hot Water Demand				**TOTAL:**	

Data Table 2. Personal daily non-transportation energy use for activities with hot water demand, by category, in kilowatt-hours.

A	B	C	D	E	F
Category: **Electricity to run appliance:**	**Watts**	**Kilowatts (B/ 1000)**	**Minutes Used**	**Hours used (D/ 60)**	**Kilowatt Hours Used (CxE)**
Dishwasher					
Clothes Washer					
Electricity to heat water:	**# loads**	**Gallons/ load**	**# gallons**	**Conversion Factor**	**Kilowatt Hours Used (C*D)**
Dishwasher		15		0.195	
Clothes washer		5		0.195	
	# minutes	**Gallons/min**	**# gallons (BxC)**	**Conversion Factor**	**Kilowatt Hours Used (C*D)**
Showers		2		0.195	
	# taken	**Gallons/ bath**	**# gallons (BxC)**	**Conversion Factor**	**Kilowatt Hours Used (C*D)**
Baths		20		0.195	
Non-Transportation Energy Use, WITH Hot Water Demand				**TOTAL:**	

Data Table 3. Personal daily transportation energy use in megajoules.

	A	B	C	D
	Miles traveled	**Miles/gal**	**Gallons used (A/B)**	**Megajoules (Cx10)**
Travel				
Transportation Energy Use			**TOTAL:**	

Data Table 4. Personal daily energy use, all non-transportation categories, in megajoules.

A	B	C	D
Category	**Kilowatt-hours**	**Conversion Factor**	**Megajoules (BxC)**
Non-transportation w/o hot water demands		3.6	
Non-transportation w/hot water demands		3.6	
Non-transportation Energy Use		**TOTAL:**	

Data Table 5. Personal daily energy use, non-transportation versus transportation, in megajoules.

Energy Use Category	**Megajoules**
Non-transportation	
Transportation	
Energy Use **TOTAL:**	

Data Table 6. Class minimum, median and maximum energy use for non-transportation versus transportation uses, in megajoules.

Category	**Minimum**	**Median**	**Maximum**
Non-transportation			
Transportation			
Total			

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Conclusions (Questions)

1. What household item used the greatest amount of energy in your table? What item used the least? Did you find this surprising?

2. If everybody cut energy use by 20% we could save a tremendous amount of energy, certainly enough to not need to drill in sensitive environments and to decrease our dependence on foreign energy sources. Based on your energy inventory, what would you do realistically to decrease your household use by 20%?

3. How did your transportation energy use compare with the non-transportation use? How might you decrease your transportation energy use?

4. How much variation was there in energy usage among class members? To what do you attribute this variation?

5. Each gallon of gas produces 24 pounds of CO_2. Carbon dioxide is a major contributor to the greenhouse effect. Assuming that your transportation energy use for the day you monitored for this exercise is typical, how many pounds of CO_2 do you produce in a year from your transportation? The average annual CO_2 production per person in the US is 5 tons. Assuming that your annual average CO_2 production is typical of the US average, what percentage of that annual total does your transportation use represent? Does this surprise you? If your transportation use does not account for 100 percent of your annual production, what is the source of the remaining CO_2 that you produce?

6. The average annual total energy consumption per person in the US is approximately 317,000 megajoules. Assuming that your total energy use for the day you monitored for this exercise is typical, how much energy, in megajoules, do you consume in a year? How does your total annual energy use compare to the national average?