

Classwork-5: Personal Energy Reductions

This is CW3. When completed this Word file should be emailed to Mr. Terence Liu, Zhi.Liu@rockets.utoledo.edu.

Do not send it to Prof. Khare.

The aim of this assignment is to estimate where and how we would significantly reduce energy consumption in our lives over a period of two decades. For this purpose you are to calculate energy consumption per year at three points in your lives. These points are in year 0 which will be 2015, year 10, i.e. 2025 and year 20 i.e. 2035. There will be two sets of computations. The first set will be called a benchmark set. In the benchmark set you will compute your energy consumption in the three years i , ($i = 0, 10, 20$) with the assumption that you were completely unaware of the knowledge from our course PHYS 3400. All answers should result in a numerical result in J/year/capita units. If you already had some knowledge of our course content before January 2015 then use your knowledge base when you entered freshman year in college to compute the benchmark set. In the second set of computations you are to find reductions of **25% and 50%** respectively from these benchmark calculations for years 10 and 20 for your total energy consumption (in units of J/year/capita) of that year. This set will be called the reformed set. A total of 5 energy consumption estimates and analysis will result from this assignment, namely B-0, B-10, B-20, R-10, R-20 where B stands for the benchmark set and R for the reformed set. The numbers stand for years 0, 10 and 20. Here is a hypothetical example.

Student Bob found out that he would consume 10 GJ/year/capita in the tenth year and 22 GJ/year/capita in the twentieth year from his benchmark set. In the reformed set of calculations he should find ways for reduction so that his final consumption turns out to be less than or equal to 7.5 GJ/year/capita in year 10 and 11 GJ/year/capita in year 20.

You will be graded on the degree of: (i) *detail* and (ii) *quantitative data in your analysis* that you present in these computations. Parts of the analysis will include a correct estimate of energy consumption of your benchmark set. It will involve, describing realistically the ease or difficulty, for you, of cutting certain types of consumption in your reformed run. It will lead to properly accounting for personal life events that will influence the next 20 years. These may include marriage, child birth, care of elderly parents, health issues, changes in income resulting in increased/decreased consumption, major expenditures such as house and car buying, commuting for work, moving due to job changes, travel, engagements, weddings, birthday celebrations, baptisms, funerals, burials, cremations and so on. Note that each team of two students will submit only one assignment. You can make a hypothetical, but realistic, case of a combination of

your consumptions or consider one of you as a case to describe. Personal information sharing can be minimized as needed. *You are looking for a generic student similar to you but not specific personal data.* You are at total liberty to choose the type of reductions in energy consumption in R-10 and R-20 data sets. There will be no consequence on grading by the type of consumption items you choose to reduce.

A specific set of questions is provided below to guide you through this assignment. Follow them carefully and expand this Word file as needed to fill in your data. Your consumption is divided into four broad categories. Conversion factors for each category are listed in Table I shown here.

Table I. Table shows how a dollar spent in utilities, gasoline, and other expenses is to be converted to Joules of energy. Food items are converted from kg of mass to energy units.

Utility	\$1 = 360MJ ^a
Transportation	\$1 = 37MJ ^b
Other expenses	\$1 = 252MJ ^c
Red meat	1kg = 2131 MJ
White meat	1kg = 663 MJ
Dairy	1kg = 481 MJ
Rice	1kg = 220 MJ
Vegetables	1kg = 90 MJ
Miscellaneous food	1kg = 159 MJ

a – price of 1 kWh electric power is assumed to be \$0.10.

b – price and energy content of a gallon gasoline is assumed to be \$4 and 149 MJ respectively.

c – It is assumed that other expenses consume a fraction (1/3) of energy from gasoline and the remaining (2/3) from utility electric power at rates of \$4 for gasoline and \$0.10/kWh for electric power.

For the data set B-0, B-10 and B-20 answer the following questions.

General questions:

1. State your age in years.

2. State your gender.
3. State your annual income in \$.
4. State the size of your household. State the number of adults and children. Account for parents, siblings, room-mates, significant others and children. List anyone with special needs that may consume more energy, like an elderly parent?

Consumption related questions:

All answers should be converted to a J/year/capita unit. For each category estimate the number of J/year/capita consumed. Use proper prefixes such as M for million and G for billion and so on.

1. **Utilities:** Estimate from your utility bills the total number of \$/year spent on them. Include in your utilities: electricity, heating, water and garbage. Divide your bill by the number of people in the household to get a per capita consumption. You can scale your utility bill according to the area of your house for B-10, B-20 computations.
2. **Transportation:** Estimate \$/year/capita spent on transportation. Note this does not include the cost of owning a car. This involves only fuel costs. Include, gasoline, diesel, bus tickets, and train tickets into this category. Vacation travel will not fall in this category. For B-10, B-20 computations, you can estimate values by mileage of car and distance to work commuted on other trips. Convert finally to J/year/capita.
3. **Food:** Food is divided into six categories as shown in Table I above. List the approximate mass for each food category. Convert the masses into J/year/capita.
4. **Other Expenses:** This includes all items not listed in the above three categories. Convert all dollars spent into J/year/capita. Items to be included here are houses, cars, clothes, hobbies, entertainment, weddings, other celebrations, hospital stays for child-birth, illness, healthcare expenses, insurance, funerals, travel, vacations, student loan paybacks and all other expenses.

Note: Account for all major life events of the next 20 years. See description of life events on the first page.

For the R-10 and R-20 data sets only state the reductions that you will bring about compared to the B-10 and B-20 data set.

B-0

Write your answers to questions in the spaces provided below. Provide explanations and show computations for arriving at your J/year/capita answers. Expand the spaces below as needed.

Answer general questions here:

Answers and explanations for

Utilities:

Transportation:

Food:

Other expenses:

Final total answer: xxxx J/year/capita

B-10

Write your answers to questions in the spaces provided below. Provide explanations and show computations for arriving at your J/year/capita answers. Expand the spaces below as needed.

Answer general questions here:

Answers and explanations for

Utilities:

Transportation:

Food:

Other expenses:

Final total answer: xxxx J/year/capita

B-20

Write your answers to questions in the spaces provided below. Provide explanations and show computations for arriving at your J/year/capita answers. Expand the spaces below as needed.

Answer general questions here:

Answers and explanations for

Utilities:

Transportation:

Food:

Other expenses:

Final total answer: xxxx J/year/capita

The reformed data set computations are to be shown below. *Note that in these sets only the reductions are to be listed and how they will be achieved.*

R-10

Write your answers to questions in the spaces provided below. Provide explanations and show computations for arriving at your J/year/capita answers. Expand the spaces below as needed.

Answer general questions here:

Answers and explanations for

Utilities:

Transportation:

Food:

Other expenses:

Final total answer: xxxx J/year/capita

R-20

Write your answers to questions in the spaces provided below. Provide explanations and show computations for arriving at your J/year/capita answers. Expand the spaces below as needed.

Answer general questions here:

Answers and explanations for

Utilities:

Transportation:

Food:

Other expenses:

Final total answer: xxxx J/year/capita