Engl 3550 War and Peace – Physics Section
Fall 2018
Assignment 1

The data below[taken from 1] shows the different means by which electricity in the US is generated. The units are Quads[2], although since we shall always be calculating ratios the units will cancel and are not important.

Source	Energy produced (in Quads)	Source	Energy produced (in Quads)
Solar (renewable)	0.0849	Natural Gas	8.34
Nuclear	8.27	Coal	16.5
Hydroelectric (renewable)	2.53	Biomass (renewable)	0.465
Wind (renewable)	1.59	Petroleum	0.262
Geothermal	0.157		
		Total	38.2

1. Using the numbers from the table estimate the percentage of the total amount of electricity that is produced from nuclear energy.
   a. Amount from nuclear sources: 8.27
   b. Total amount: 38.2
   c. Percentage from nuclear sources = 8.27 / 38.2 = 0.216 = 21.6 %

2. Suppose that (as some suggest, and as Germany is doing) that the US completely phases out nuclear power and replaces it with renewable resources (the combination of solar, wind, and hydro). Suppose that the United States were to follow the same path and totally eliminate electricity from nuclear power. By what percentage would we need to increase the amount of electricity from all renewable resources to make up for the lost electricity from nuclear power?
   a. Required increase in amount from renewable sources: 8.27 (to replace that no longer from nuclear sources
   b. Current amount from renewable sources: 0.0849 + 2.53 + 1.59 + 0.465 = 4.67
   c. Percentage increase = 8.27 / 4.67 = 1.77 = 177 %

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1 Date taken from graphic courtesy of Lawrence Livermore Labs (https://flowcharts.llnl.gov/content/energy/energy_archive/energy_flow_2013/2013USEnergy.png)

2 A quad is a unit of energy equal to 10^{15} BTU (a quadrillion BTU), or 1.055×10^{18} joules. It is the unit of energy used by the U.S. Department of Energy.

3. Suppose that (as some suggest) that instead of eliminating electricity from nuclear sources that instead the United States completely phases out coal from the production of electricity, since it is the 'dirtiest' method of doing so. By what percentage would we need to increase that amount of electricity from all non-coal resources to make up for the lost electricity from coal? (You can easily determine the amount currently generated from non coal resources from the total amount less that from coal itself.)
   a. Required increase in amount from non-coal sources: 16.5 (to replace that no longer from nuclear sources
   b. Current amount from renewable sources: 38.2 – 16.5 = 21.7
   c. Percentage increase = 16.5 / 21.7 = 0.76 = 76 %

4. Suppose that by 2025 we need to increase the total amount of electricity to 50 Quads. What would be the percentage increase in the total amount of energy?
   a. Increase = 50 – 38.2 = 11.8
   b. Current total = 38.2
   c. Percentage increase = 11.8 / 38.2 = 0.31 = 31 %

5. Now suppose that we want the same increase, but don't want to increase the amount from any non-renewable source. What would be the percentage increase in the amount of electricity from renewable sources to achieve the same overall increase? (38.2 → 50 Quads)
   a. Increase = 50 – 38.2 = 11.8
   b. Current total from renewable sources only = 4.67
   c. Percentage increase = 11.8 / 4.67 = 2.53 = 253 %