

Engl 3550 War and Peace – Physics Section  
 Fall 2016  
 Assignment 1 – Answers

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An accompanying diagram shows the different means by which electricity in the US is generated.

1. Using the numbers on the sheet estimate the percentage of electricity that is produced from nuclear energy.  $8.27/38.2 = 0.216$  (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 (solar, wind, hydro, and geothermal). By what factor would we need to increase that amount of electricity from renewable resources to make up for the lost electricity from nuclear power? How feasible might that be?
  - a. Renewable resources account for  $2.53+1.59+0.157+0.0849 = 4.3619$  TWh of electricity
  - b. To replace 8.27 TWh from nuclear energy renewable resources need to be increased to  $4.3619+8.27 = 12.6319$  Twh
  - c. This is an increase of  $12.6319/4.3619 = 2.9$  times.
3. Suppose that (as some suggest) that we completely phase out coal from the production of electricity, since it is the ‘dirtiest’ method of doing so. By what factor would we need to increase that amount of electricity from non-coal resources to make up for the lost electricity from coal? How feasible might that be?
  - a. Non-coal sources account for  $38.2-16.5 = 21.7$  TWh of electricity
  - b. Without coal the non-coal sources would have to be increased to the full 38.2 TWh.
  - c. This is an increase of  $38.2/21.7 = 1.76$  times (a 76% increase)
4. The data table below shows the total world population in 1993 and 2011, and the amount of electricity generated by nuclear power and in total for the same years. What are
  - a. The fractional increase between those two years in the per capita total amount of electricity used?
    - i. In 1993 the per capita total electricity was  $12607/5.5 = 2292$  TWh per billion people.
    - ii. In 2011 the per capita total electricity was  $22202/7.0 = 3172$  TWh per billion people.
    - iii. This is a ratio of  $3172/2292 = 1.38$  times (a 38% increase)
  - b. The fractional increase between those two years in the per capita amount of electricity from nuclear power used?
    - i. In 1993 the per capita nuclear portion was  $2106/5.5 = 383$  TWh per billion people.
    - ii. In 2011 the per capita nuclear portion was  $2386/7.0 = 341$  TWh per billion people.
    - iii. This is a ratio of  $341/383 = 0.89$  times (an 11% decrease)

Population, billion	5.5	7
Nuclear, TWh	2,106	2,386
Total, TWh	12,607	22 202