

Problem Set 1

Intro to Sustainable Energy 2.650/10.291/22.081

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Sustainable Energy 1.818/2.65/10.391/11.371/22.811/ESD.166

These problems are not written to be mathematically challenging. Instead, the main challenge is to find reliable data and use sound reasoning. For each of the problems you work out, provide a list of sources for any data you used. Be sure to mark which course number you are registered for on your solution. You can turn in the homework online (via Stellar) or in class.

Intro to SE Students: Pick any 2 of the 4 problems to solve.

SE Students: Pick 3 of the 4 problems to solve.

Problems:

1. Supporters of the Cape Wind offshore wind project state that “in average winds, Cape Wind will provide for $\frac{3}{4}$ of Cape and Islands electricity needs.” How much power (in MW) is consumed by the Cape and Islands? What capacity factor is expected by the project? If the remainder of the Cape and Islands’ energy needs are met by burning coal, how many tons of coal would be needed per day? How many railcars would this daily coal supply fill?
2. California’s Renewable Portfolio Standard is among the most aggressive in the nation, requiring in-state electric corporations to procure 33% of their portfolio from renewable energy sources by 2020. How much energy is this annually? What land area would be taken up by solar farms if 33% of California’s annual energy needs came from solar? What percentage of California’s land area would this represent? How many “small hydro” plants would it take to displace the energy produced by the existing “large hydro” fleet, which is not considered renewable?
3. What is the power rating of your computer? How much coal is required per year to allow for your computing habits? How much does your computer’s electricity cost you per year?
4. SASOL, a South African Coal-to-Liquids (CTL) and Gas-to-Liquids (GTL) company, operates what is considered to be the largest point source of carbon dioxide in the world, the Secunda plant. How much carbon dioxide does SASOL emit annually from the Secunda plant? SASOL’s primary product is automotive fuel (primarily diesel), how much carbon dioxide does SASOL emit per gallon of diesel fuel it produces at Secunda? How does this compare to the amount of carbon dioxide emitted when a gallon of diesel fuel is burned?

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