FSC 401
Exam 1

Be sure to work individually and take maximum advantage of information already available on the class web site or with the help of google.com, www.eia.gov, etc.). Document all your work: attach computer files, state clearly and justify your assumptions, and provide references (e.g., complete URLs) where needed. Read the problem statements very carefully and be sure to address explicitly EACH ONE of the questions in them.

1. Science/engineering of fossil fuel technologies (35%)

(a) Estimate the SO_2 concentration in the exhaust gas from a 500 MW(el) power plant that consumes a subbituminous coal.

(b) Determine the temperature dependence of the equilibrium constant for the conversion of SO_2 to SO_3, construct the corresponding van't Hoff plot, and determine the SO_2/SO_3 ratio at 300 and 2000 K.

(c) Does the result in (a) agree with the result in (b)? Any difficult-to-make assumptions needed for a meaningful comparison?

2. Statistical analysis of fossil fuel technologies (35%)

Prepare a graph that compares the trends in the production and consumption of petroleum and natural gas in the United States over the past half century (until today). Briefly discuss the implications of these trends for (i) global climate change and (ii) future of fossil fuel utilization (relative to that of renewable energy technologies).

3. Analysis of media reports on fossil fuel technologies (30%)

Using the article "Should fracking stop" (*Nature*, September 15, 2011) as your starting point, provide as many quantitative arguments as possible, either in favor or against continued exploitation of shale gas in the U.S. (e.g., growth rates relative to expected economic growth, proven reserves *vs.* annual consumption, …). In particular, discuss the message(s) contained in the graph on page 275, as well as its reliability. Be sure to also compare this information (and the related arguments) with at least one subsequent (and reputable!) media report.

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