

CSC 400 Estimation Questions

September 8, 2006

Document your sources and describe your reasoning and assumptions in answering the following questions. For uncertain quantities, it is wise to consult more than one source. Do your own calculation rather than looking up the answers.

1. How much recoverable fossil fuels (coal, oil, natural gas) is estimated to exist on the planet? How much energy would be produced by burning all of it? What fraction of the total atmospheric oxygen would be consumed in the process? If the entire population of earth used energy at the same per-capita rate as the United States, how long would this supply last?
2. How much recoverable uranium is estimated to be available on earth? If this uranium were used in a conventional reactor (which mainly consumes the U235 component), how much energy could be generated? How much energy could be generated if the uranium were used in a fast breeder system instead? How long would this supply last if the entire world population consumed energy at US per-capita rates?
3. How much solar electrical energy (e.g. per meter or hectare per year) can be practically recovered with current technology (photovoltaic or other methods) in a climate like Rochester? How about Arizona? Remember that the sun does not shine all the time, and it is not always directly overhead. How much surface area would have to be covered with solar collectors to supply the world's needs if the whole population consumed energy at US rates?
4. How much energy could be accumulated (per unit area per unit time) using photosynthesis - i.e. growing trees or other plants as fast as possible, and harvesting the (dried) biomass to burn as fuel. What percentage of the earth's surface would need to be devoted to energy agriculture to supply the world's energy needs if it's population consumed energy at US rates? How much of the earth's surface is potentially arable land?