

CSC 400 Estimation Questions

September 1, 2011

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 (which might very well be wrong), that is, work from the most basic information you can find.

1. What is the current annual world production of lithium ? How much lithium would be needed to replace the entire US vehicle fleet with Volt-type electric vehicles which use lithium-ion batteries? (Ignoring for the moment that no-one makes e.g. a Volt-type minivan or pickup) what would be the capital cost of such fleet replacement? How much did the US spend last year (2010) on imported petroleum?
2. How many watts does current US petroleum consumption represent? What would be the capital cost of building sufficient (land-based) wind turbines to replace this power? (You may ignore the usability factors for this exercise, i.e., the fact that for some applications, electrical joules may be more efficiently usable than chemical joules) Is there sufficient accessible land with sufficient wind in the US to do this? (Windfarms need to place considerable distance between turbines or they sap each other's power; determining placement for cost-effective energy extraction is actually a tricky problem. On the plus side, the land is still available for farming and other uses)
3. How many cows live in the US. How much methane do they produce annually? How does the greenhouse warming potential of this methane compare with that of the CO₂ produced by US consumption of petroleum?
4. How many raindrops did Irene deposit on the US mainland. How much energy (in Megatons) is represented by the latent heat of vaporization of this water?
5. If all the DNA molecules in a human body were stretched out and laid end to end, how long would the resulting string be? Find a comparable interval in the real world. Ignoring redundancy, how much information is encoded in the base pairs? How does this compare to the size of the internet? (also highly redundant)