Physics for future Presidents

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Homework 9, due in recitation on Thursday, October 10th

Power consumption

1. When it comes to very large amounts of energy, you will quite frequently encounter the unit "quad". What is a quad? How many joules is a quad? And how many kilowatt hours is a quad?

2. According to the international energy agency (IEA), the United States of America consumed about 14.14 quads of electricity in 2012. How much is this in kilowatt hours?

3. The population of the US in 2012 was about 310 million people. What was the average electric energy consumed per person in 2012?
   Note: This is not just the energy that you personally consumed. It's your average share of the total US electricity consumption. This makes sense because you're being part of the US economy, and so you in many ways also consume energy which other people provided, for instance whenever you use elevators, buy products that have been manufactured in the US, or use infrastructure that took energy to supply (such as streets, buildings, or public transportation). This of course gets messy once you buy products that were manufactured abroad, because the associated energy is really consumed by you, but is charged to the other country, and the reverse is true if the US exports goods. The IEA data are actually corrected for imports, exports, and losses, but it is not immediately obvious what this means. We will ignore these ramifications here, but you should keep in mind that the energy market is really a global one.

4. Based on the above data, what is the average electric power consumption per US citizen?

5. The IEA also has data for many other countries. Complete the last column in the following table, which looks at the average electric power consumption for people in four other countries: Germany (another industrial nation); China and India (the two big emerging economies); and Ethiopia (a nation comparable in population with Germany; it has one of the lowest GDPs in the world, but is also one of the fastest growing economies in the world).

Country	electricity (in quads)	population (in million)	average electric power per person
USA	14.14	310	
Germany	2.01	81.76	
China	13.44	1338	
India	2.57	1171	
Ethiopia	0.0154	83	