

- 1) Please repeat any question from the midterm that needs improvement, with excellent insight and consideration.
- 2) Dan Kammen at Berkeley says, “we’re not running out of petroleum, we’re running on of atmosphere. Please investigate this statement.
 - a) In the global stocks and flow energy diagram (this is provided for April 3 class on the class website), please estimate how many years our oil will last if we continue using it at the present rate. Assume that we can use every last drop (impossible – most of it is presently considered not accessible). But our rate of use is increasing.
 - b) Estimate the mass of CO₂ emitted into the atmosphere for every gallon of gas you burn, then
 - c) estimate the mass of CO₂ in the atmosphere if (when) we did use every last drop of petroleum.
 - d) Calculate the total mass of the atmosphere knowing that atmospheric pressure times the surface area of the earth is the force of gravity acting on the entire atmosphere (right?)
 - e) Knowing that the molecular mass of the atmosphere is about 29 g/mole, estimate the PPM increase in CO₂ in the atmosphere from burning all the petroleum.
 - f) Estimate the increase in the Radiative Forcing from this increase in CO₂.
 - g) Estimate the increase in global temperature from this increase in CO₂. You may find it helpful to consider the layer model that DH and I published a few years back:
<http://www.aps.org/units/fps/newsletters/200807/hafemeister.cfm>
- 3) Look up the rate of petroleum use in gallons or barrels and see if the global use constitutes about 1/3 of humanity’s primary energy use.
- 4) I’ve heard that the thermal solar energy falling on a square meter of surface area is roughly equivalent to a barrel of oil per year. Please check that.
- 5) If I have a Prius that gets about 55 mpg and I drive 10,000 miles per year, but my partner has a hummer averaging 9.5 mpg, and drives 15,000 miles per year, what is our CAFE (Corporate Average Fuel Economy?). And if you think you average these two numbers together, think again – which number more strongly influences the answer – the higher mileage or lower mileage? The average fuel efficiency is total miles / total gallons. Please prove to yourself that weighted averages don’t work... consider if you had a car that got infinite mileage and another that got zero and you drove them both 10 miles, what would be the average mileage of your household transportation?
- 6) In my video, I quote the full cost of a gallon of gas to be \$15.
 - a) have you ever heard this before? What costs do you come up with when you research the full cost of a gallon of gas.
 - b) Where do you see yourself paying the external costs so that others to use petroleum cheaply?
 - c) Where do you see yourself benefiting from others paying your petroleum external costs?

- d) In your opinion, is it OK the way it is, or it should be changed? If your answer is “no it’s OK as it is” then please state why it’s OK. If your answer is “yes”, then what would you propose?

Interesting related readings could include below... but you could look up some yourself if you like:

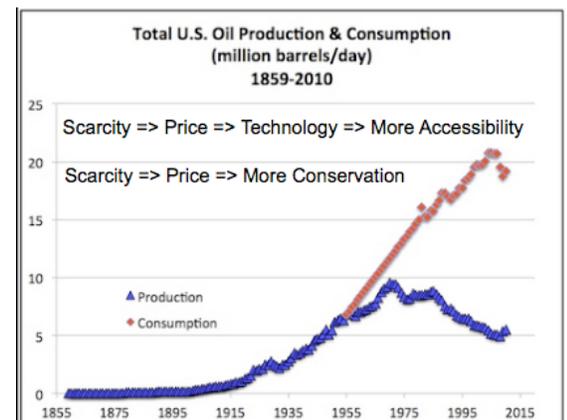
[http://www.washingtonpost.com/wp-](http://www.washingtonpost.com/wp-dyn/content/article/2010/06/12/AR2010061200167.html)

[dyn/content/article/2010/06/12/AR2010061200167.html](http://www.washingtonpost.com/wp-dyn/content/article/2010/06/12/AR2010061200167.html)

<http://www.spur.org/publications/library/article/estimatingtheexternalcostsofdrivinginsf09012005>

<http://www.hybridcars.com/news/real-cost-gallon-gas-835.html>

- 7) You’re at a party and someone screams, “we’re running out of oil and when we empty the wells, ***BAM***, no more oil!” The economists despair, the environmentalists rejoice. Please nicely explain that it’s a little more complicated than what the person screamed, and describe what it means to “run out of oil”, and describe what it will be like. Please include all following considerations:
- technological
 - Upstream energy use, and emissions
 - environmental,
 - economic
 - political, and
 - Environmental Justice. Are any groups disproportionately harmed?
- 8) Please look up a graph of US oil production and consumption ... here’s a pretty good website: <http://islandbreath.blogspot.com/2017/02/cheap-profitable-and-abundent.html> Look up the price of crude oil over the years: https://en.wikipedia.org/wiki/Price_of_oil Please estimate the total debt US might expect to have because of our... “oil problem”. If you include consideration of interest paid on debt* – more power to you. What portion of our present debt might this constitute?
* http://3.bp.blogspot.com/-Scat_VEIW9I/URrH6UrACXI/AAAAAAAAABqs/I6shP2ednNo/s1600/U.S.+Treasury+Bond+Interest+Rate+History.jpg
- 9) Please look at the graph from the video. Comment on a few things:
- Starting around 1955, what started to happen and what effect did it have on USA security?
 - Note very recently, there has been an abrupt shift in the consumption and the production of petroleum in the USA. What caused that?
 - Has the trend (in b above) continued, increased, decreased? Please do some internet research (careful about which websites you believe).



d) What do you expect to see happen under the new federal administration?

10) 10.25 in DH's book