

## Solar, Transportation

### Schwartz Problem Set #8

Due Monday, March 12, with PS#7

1. Why do ICE (Internal Combustion Engines) suck (gasoline so much)?
  - a) Why is the efficiency so low?
  - b) For a hybrid that isn't plug in electric, all the energy still comes from gasoline or diesel. So how does the hybridization of the engine to include an electric motor increase gas mileage?
  - c) How does having plug-in capability change the efficiency, cost, etc.?
  
2. I have a 1996 Subaru Outback, that we drive to the beach about 20 times a year, maybe once to San Francisco or some other far off destination. We've talked about just getting rid of it and renting a car for long trips. However, maybe I should buy an electric car or hydrogen fuel cell vehicle?
  - a) How are electric cars and hydrogen fuel cell vehicles the same? How are they different?
  - b) What are the advantages/disadvantages of each one over the other? Which one do you recommend for me? Or should I get a hybrid electric?
  - c) I have 4 solar panels (about 1600 W total) on my roof that senior project students installed for experiments at home. How would having these solar panels change or not change the situation for me?
  - d) Where do you want to be living 5 years from now? Extrapolate into the future and consider at least 3 different transportation strategies for the place you will live. Compare them and state which you will choose.
  
3. Calculate the surface area of standard PV panels (15% efficiency) necessary for you to live your life. Please include the following consideration:
  - a) We live in SLO and can anticipate the corresponding solar incidence.
  - b) You continue to use electricity like always, and continue to drive like you always do, but in a (shared?) electric car.Please give your answer in square meters.... Does this area seem reasonable to you? Do you feel you are taking too much of the planet's surface area with this?
  - c) Indicate what kind of lifestyle changes you would need to make in order to live like this.
  
4. Concentrated Solar vs PV.
  - a) What are the differences between PV, Concentrated Solar Thermal Electric, and Concentrated PV?
  - b) What are the relative advantages/disadvantages of each in meeting the electrical demand of society?
  - c) Since making this question on CSP (concentrated solar power), there have been some changes. Large solar power towers have been built. Take a look at Ivanpah: [https://en.wikipedia.org/wiki/Ivanpah\\_Solar\\_Power\\_Facility](https://en.wikipedia.org/wiki/Ivanpah_Solar_Power_Facility) What are some advantages of this facility? Some disadvantages/concerns?

5. Taken directly from Monday's Class schedule. Please read the [NPR article about infrastructure](http://www.npr.org/2017/03/09/519500054/engineers-say-tax-increase-needed-to-save-failing-u-s-infrastructure).  
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- a) \$2 trillion... is that a lot? Of course, what this should mean is to find a way to compare it to something that makes sense. For instance, how much is this per US American? Or better yet, per US American family?
  - b) \$0.25 per gallon gasoline tax? How long would it take to bring in \$2 trillion at the rate we use petroleum? Use any method you like.
  - c) Would you consider this a market mechanism? To what degree is this *internalizing* an *external cost*? To what degree is it just raising money and not internalizing an external cost?