Wind, Transportation

Schwartz Problem Set #7

Due Monday, March 11

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? Ok, this is an old question… I bought a BEV (Nissan LEAF) last July.
   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. Own a small wind farm and notice that when the wind blows at 3 m/s, you generate 20 MW.
   a) About what will be your power generation when the wind blows at 6 m/s? Explain how you know this.
   b) It seems as though they are always making wind turbines bigger and taller. "Go BIG, or go home." Please explain why we would want to do it rather than making many small, modular wind turbines like we do with roof top solar panels.

4. 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

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?