

Midterm #2.

1. The grid.
  - a) Some economists argue that each consumer should be charged the marginal cost of electricity at the time of use plus externalities. Please make an argument supporting or contradicting this statement. You'll be judged not by your judgement, but your expressed understanding the concepts.
  - b) As part of AB 32 (Assembly Bill 32, the 2006 Greenhouse Gas Reduction Bill), California is committed to reduce California's GHG emissions to 1990 levels by 2020. Part of the effort is introducing more renewable energy into the electricity grid. Please describe **the challenges** we may experience as we try to do this. I expect to see a drawing the California Load Curve and some numbers if you have them in order to put things in perspective.
  - c) Also **describe some strategies** to answer the challenges from b) above.

## 2. Nuclear Energy

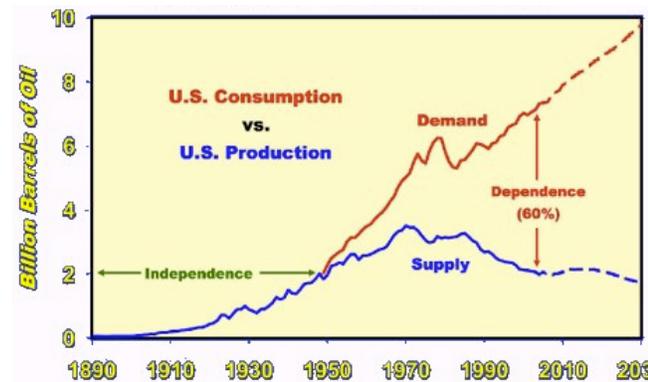
- a) What is “mass defect” or “mass deficit” and why do we care?
- b) How does one make a self-sustained nuclear chain reaction? Don't just tell me a word or sentence. Please fully describe what we need to do and how it works on the microscopic level
- c) How do we control a nuclear chain reaction so a nuclear reactor isn't just a nuclear bomb?
- d) What caused the Fukushima disaster in 2011? Don't just say “a tidal wave”. What happened inside the reactors and why?
- e) Maybe you mentioned “delay neutrons” in the above answers. If not, please do that now. What do “delay neutrons” have to do with any of this?
- f) What are your thoughts about nuclear safety? Please don't just give me your concerns or your feelings. Please back up what you have to say with numbers and/or put in the context of costs and benefits of alternative energy sources.

3. You drive to San Francisco and back.
  - a) How much gas did you use?
  - b) How many kg of CO<sub>2</sub> did your trip contribute to the environment?
  - c) What is the rate of heat dissipation into the environment if your trip was just an immediate “there and back”.  
Please put your answer in Watts.
  - d) Where did your gasoline come from? Could you please describe a narrative with possible drawings describing the full process from the primary source of energy to the earth’s surface until you burn it in your car.

4. Climate Change Green House Gas emissions
- What causes anthropogenic climate change?
  - The climate has always been changing, so why are people concerned about *this* climate change?

5. Please look at the graph at right, likely made around 2006 in US oil consumption and oil production.

- Please extend the graph to 2016.
- Please describe the cause behind the recent trends that you just updated



- What do you expect to happen in the coming 10 years? Extend the graph above into the future and explain why you think this will happen below.

What's your name? \_\_\_\_\_