PSc-320 Midterm Name_____

1) What portion of the world's people live in US? _____%

2) What portion of US population live in California? _____%

3) The United States consumes about what portion of the world's energy? _____%

4) What is the power output of your body working hard for 10 seconds? _____W

* renewables means wind, solar, geothermal, small hydro…. *ALSO* because we don't list all possible generation forms below, they don't need to add to 100%

5) What portion of *US* electricity is generated by: Coal:____, NG____, Renewables*_____

6) What portion of *Cal* electricity is generated by: Coal:____, NG____, Renewables*_____

7) State total amount annual energy production/consumption for all USA _____J

Please put any relevant calculations for this on last sheet.

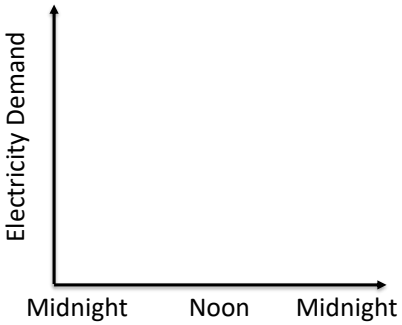
Some Longer Endeavors

1) Please *explain and show* how a combined cycle electrical facility works with a drawing – not just a flow chart – please include images so we know how the machines actually work.

2) Your friend is curious about AC… "why would we want to have alternating current?" You explain to them that we need alternating current to have inexpensive, reliable electricity.
   a) Please explain why AC is necessary for us to have inexpensive, reliable electricity. Please include in your discussion economies of scale, transmission efficiency and transformers. Again, why do we need to have AC? Certainly, draw pictures to help explain anything you like.
   b) Now that you've convinced them that we *do need* AC, explain why we *actually* don't need AC anymore.

3) Peaker plants:
   a) Why are they dirty and expensive?
   b) Why do we have them at all?

4) Explain how “the duck has landed”.
   a) At right, please draw the present load curve as well as one from a decade ago. Label each curve.
   b) Presently, when (season and time of day) do we have peak load?
   c) Why has the curve changed in the past decade, and what kind of problems do we foresee in the near future?
   d) Explain what might happen to make this work… to make the “problems” mentioned above actually opportunities?



5) You hear someone complain that we now have a “smart grid” and that we have to pay different prices for electricity at different times – very confusing.
   a) Please explain to them what a smart grid is.
   b) Please explain why it’s better to have many different time-dependent prices for electricity.

6) I left my lights on during a long weekend. I was gone 4 days and 4 hours and left all the lights on. They were the old incandescent kind because we find those new LED lights weird: 5 bulbs at 100 W each.
   a) How much electrical energy was consumed by my mistake?

   a) About how much money did this oversight cost me if it happened in California?

   b) How much heat was rejected into the environment during the generation of this electricity?
      - If it happened in California:

      - If it happened in West Virginia, the heart of coal country:

   c) How much CO_2 is this student's mistake responsible for emitting into the atmosphere?
      - If it happened in California

      - If it happened in West Virginia

   d) What else was emitted into the atmosphere that we should be concerned about?
      - If it happened in California

      - If it happened in West Virginia

7) Hopefully in the above problem you held me accountable for the *marginal electricity* in California and West Virginia. What is marginal electricity, and why should I be accountable for it?

8) The economist says, "In order for the market to work, the decision maker must bare the full cost."
   a) In electricity use, who is the "decision maker"?

   b) In our use of electricity, please give 2 examples of "external cost".
      1

      2

   c) How is electricity use subsidized?

   d) How do these external costs and subsidies prevent the electrical "market from working"?

9) I have an idea that we can cool the environment by just turning heat in the air into electrical energy, thus "producing cold" as a by-product! How do you think this would work? Explain.

10) We are closing Diablo Canyon!
    a) How much power is this taking off the grid? What portion of Cal's electricity is that?

    b) Someone says, "That doesn't matter, we have all kinds of power sources on the grid. We'll do fine." Please explain how this may affect our state:
        - What affect will this have for the other facilities over the course of the year? What effect (if any) will this have on our state's emissions?
        - What affect could this have for peak electricity use?

Please use this sheet for extra calculations and/or room to explain. ***PLEASE*** *put a note by each related question so I know to look here for the extra work!*