**TIM 155: Problem Set 2**

Due Thursday, April 20, in class

1. In week 2 we have been discussing energy systems. In the beginning of our Tuesday, January 19, discussion, we looked at a definition of the term “system.” Please repeat it here. (1 point)
2. The definition is actually 2 definitions. Do both definitions mean the same thing, just stated differently, or is there an essential difference? Explain. If you think that the two parts are different, which do you think is the more essential or central meaning of the terms “system” or are they both essential? Explain. (1 point)
3. One of our lecture slides reads:

**Storage** –   
  
decouples energy supply and energy demand, thereby giving greater system flexibility, essential for both technical and economic reasons.

3.a Provide an example of a natural and/or engineered energy storage system for **natural gas** and explain how it gives **energy** **suppliers** flexibility by decoupling energy supply and demand. (1 point)

3.b Provide an example of a engineered energy storage system for electricity and explain how it gives **energy** **consumers** flexibility by decoupling energy supply and demand. (1 point)

4. Review Figure 1.13 (pdf p. 135) in GEA. There are seven red arrows leaving the blue flow of energy. The quantitative “unit” in the figure is the percentage of the initial amount of primary energy required to produce the outcome of someone utilizing illumination for a beneficial purpose. If you wish to reduce the total amount of primary energy consumed and could only intervene to reduce or eliminate one of the red arrows, which one would you focus on? What would you do and why would you intervene in that aspect of the power supply chain? Why is that way better than the next best way (say which way you think is second best). (1 point)

5.a The top of p. 880 (pdf) of GEA offers a definition of a microgrid. What is that definition? (1 point)

5.b Section 15.8.3 goes into more detail on the benefits of microgrids and the challenges facing their implementation. Summarize in your own words the benefits and challenges presented in Section 15.8.3. (1 point).

6. Review Figure 16.3 in GEA (p. 1,204 of the PDF). It presents a 3-dimensional graph. First explain what the graph is presenting. Then explain when the system experience peak load. Why does a utility try to avoid periods of peak load? Give one strategy a utility might use to shave peaks. (1 point).