**TIM 155: Problem Set 7**

Due **Thursday, May 25**, in Class.

1. According to GEA, Ch. 11, after several years of decline, the cost of windpower increased between 2002 and 2009. Focusing on onshore systems, how much did it go up in cents per kWh? What reasons were suggested for the rise? Based on this recent behavior in the cost of wind power, do you think costs will go up or down over the next 10 years? Base your answer on the factors you listed above for the recent rise in costs – are they temporary or long-term trends in your opinion? Will other factors outweigh them? (1 point)

1. Review the Interview Notes in this week’s Homework Folder. Part way down is a section on how to determine how many panels a solar system needs. The first half includes what Prof. Haddad could quickly jot down during his conversation with the solar installation expert. He then added an extra step to the calculation to include the TOF, or tilt-orientation factor. Use that equation for this question. The SAM model also calculates the number of panels needed for a solar installation. Use the “by hand” approach presented in the SAM-help document. Your job is to compare the SAM approach to the Installer/Prof. Haddad approach. Are they identical? Does one approach have additional factors? Explain in detail any methodological or input differences. (*Hint: there is some useful explanation and links to more details starting at page 125 of the SAM-help document.*) (1 point)
2. Deborah, who kindly agreed to be interviewed, has five years professional experience in the residential solar industry. She had not heard of the SAM system. Based on your analysis of question 2, do you think Deborah or her competitors would improve their service if they used the SAM model for residential PV? Explain. (1 point)
3. Elsewhere in the interview notes is Deborah’s reference to PG&E’s “110% rule.” Prof. Haddad noted that he does not believe this is an actual regulatory standard but rather an incentive built into PG&E’s net metering rate structure. First explain what net metering is. Then present in your own words what the “110% rule” is. (1 point)
4. Now open the SAM system and point out whether/where evidence of the “110% rule” is found. (*Hint: For residential-solar, select PG&E’s Territory T Rate E-7. When it loads, examine the rate structure. Explain what buy rates and sell rates are, and point out any evidence of the “110% rule.”)* (1 point)
5. Take a look at this UCSC web site: http://sustainability.ucsc.edu/get-involved/student-projects/green-labs/Energy%20Efficiency/index.html . You will find a total campus electricity consumption figure for one year in kWh, as well as annual load for some specific buildings. Choose one of the buildings and design a solar system that would make that building roughly energy neutral. Use both the SAM system and, if you wish, the calculation in Question 2. Use the following parameters:

* Put a microconverter on each panel. P. 154 in the SAM help manual provides guidance.
* Even though these buildings are all likely to encounter shade-related reductions in power availability, we will ignore them at this point.
* Select a PG&E commercial power rate in area T.
* Assume that UCSC will pay 100% of the system costs and will have no insurance costs for the system (UC is in fact “self-insured” and never pays insurance premiums). Also, since UC is a non-profit organization it doesn’t pay income taxes, so it doesn’t qualify for income tax credits.

Scoring for this question is as follows:

Identifying a solid system design: one that generates roughly the average daily power used by the building you chose and that closely approximates the DC-AC ratio you selected. (You can either use the SAM system exclusively or use the interview notes as you did in question 2 above and plug your results into the SAM system if you wish.) (1 point)

Selecting a PG&E commercial power schedule that is applicable in our area and for specifying other financial parameters consistent with the third and fourth bullet points. (1 point)

Generating a standard report provided by SAM and also writing an additional summary of how you programmed SAM, including how you chose your panel type, and other steps and decisions. Also note how long it would take for your installation to pay off for UCSC, where you might locate the panels on campus, and whether you believe UCSC should proceed with the investment. With respect to location, discuss the issue of shading and make an estimate of how important location and shading are to the overall cost of the project. (1 point)