**TIM 155: Problem Set 3**

Due Thursday, April 27, in class

1. How many nuclear power plants would be needed to supply all of the US’s electricity demands? How many rooftop solar systems? Assume that the average nuclear facility generates one Gigawatt (GW) of power, and a rooftop generates 4 kilowatts (kW). *Hint: You can find US electricity consumption toward the bottom of p. 25 in the USEIA Annual Energy Outlook for 2015.* (1 point)

2. We find that the US has a mix of electricity-generation technologies and fuels, from small scale to large scale – a *portfolio* of power generation technologies. What were the largest primary energy sources for electricity production in the US in 2013? List the top five sources as a percentage of the total. *Hint: you will find the answer in the USEIA publication nearby the information needed in question 1.* (1 point)

3. Why do we have a portfolio of power sources? Why hasn’t the nation identified what the best primary energy source is for electricity generation and generated all its power from that one source? Give two or three reasons why the US has an energy *portfolio* rather than a single energy source. (1 point)

4.a On our class website, right below the icon for this problem set, is an Excel spreadsheet you will need. It is the table Professor Haddad presented in class on Tuesday April 18. It has the five forms of capital presented in class. The energy pathway (recall this is some combination and order of **extraction**, **conversion**, **storage**, **delivery**, and **use**) has not been inserted. Where you see yellow cells, insert an energy pathway of your choice. It should be a fairly-to-very large contributor to overall US energy production and consumption. Begin each cell with one of the terms in bold above and then explain what is happening in this particular pathway (e.g.: Extraction: mining of coal). You will not need all of the yellow cells provided. Use phrases that explain in more detail what is happening at each step, but recall that each step should be a form of extraction, storage, conversion, etc. Some steps can appear more than once. Use Ch. 15 of the *Global Energy Assessment* (GEA). (1 point)

4.b Now select **two** cells in the matrix that are at intersections between a step in your energy system and the forms of capital. Highlight them with a color and number them 1 and 2. For **each** of them, provide the following information:

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|  |
|  | **1. Detailed, quantified need or purpose:**  |
|  | **(What? How much? When?)** |
|  | **2. What is the role of the private sector?** |
|  | **3. What is the role of the public sector?** |
|  | **4. What other actors are involved? (e.g., private, non-profits?)** |

You can provide the information here in the homework set instead of entering it all into one cell. *Hint – choose the two cells based on having sufficient data available in the reading and other available class resources, and on having sufficient information to answer 4.c below. That means that most of your matrix will be empty.* (2 points)

4.c For each of the cells you provided in 4.b, think about regulatory changes or technical innovations that could improve this combination of a step in an energy supply system and a needed form of capital. What would the next generation of this step look like? Justify your answer based on GEA and other class research. List all your sources. (1 point)

4.d Based on your answer to 4.b above, if you were to fill out the entire matrix, how many pages of text would you generate? Now estimate how many major energy systems there are in the U.S. How many pages would it take describe all of them using this matrix approach? (1 point)