

Assignment #1: Due at end of class on Tuesday, 1/22/2019

Assignments:

1. Download the first two "Energy Systems" slide decks from course website.
2. Attend lectures 1 and 2 and take very good notes.
3. Download and read Module B2 from course website.
4. Download book from library (see slide 1 of "Energy Systems" slide deck) and read chapter 1.

Answer the following questions.

A. From Module B2:

1. What are the three main subsystems of the electric power system?

B. From Kirtley:

2. Identify the most common forms of fossil fuels used to produce electricity.
3. Identify the most common renewable forms of energy used to produce electricity.
4. Define "heat rate."
5. It is well-known that burning fossil fuels produce carbon dioxide. What other contaminants are produced by burning fossil fuels?
6. In 2009, how many nuclear power plants were there in the US?
7. What is the "head" of a hydroelectric power plant?
8. What are the two main operating modes of a pumped storage hydro plant?
9. Wind turbines extract energy from the kinetic energy of the wind. The power production of a wind turbine is proportional to what power of wind speed velocity?
10. What are the two principal means of producing electricity from solar energy?
11. For a power plant, what is the difference between generating capacity and generated energy?

B. From Slide deck #1 on "Energy Systems":

12. What is "economies of scale"?
13. What is an important feature of a natural monopoly?
14. What motivated the 1935 Public Utility Holdings Company Act (PUCHA)?
15. What was the growth rate of electric energy from 1938-1964?
16. What is NERC and how did it get started?

17. How many interconnected asynchronous grids are in the continental US?
18. What is FERC and what is its electricity-related responsibilities?
19. What is DOE and what is its energy-related responsibilities?
20. In 2017, in which states do the highest average electricity price per kwhr occur? What is the average electricity price in Iowa?
21. The 1996 FERC Orders 888 and 889 initiated *unbundling*. What did this mean?
22. What is "ISO"? Identify seven of them in the US? What are their responsibilities?
23. What precipitated the 2000-2001 California Energy Crisis?
24. What are the three primary ways of moving large amounts of energy that is or can become electricity throughout the nation?
25. In terms of electric energy production, the sum of what three sources of electrical energy has been almost constant since 2000? How have each individually changed?
26. What is typical voltage ranges for generation, transmission, and distribution in the US?
27. What does an energy control center do?
28. What are the three main mechanism of an ISO's balancing system?
29. What causes faults in power systems?
30. Identify three main causes of the 2003 Northeast Blackout.

B. From Slide deck #2 on “Energy Systems”:

31. Before 2005, the US gas supply was mainly from the Gulf of Mexico and Canada. Although these still remain natural gas suppliers, most US gas come from onshore facilities in several states – what states are these? And what technology has enabled this change?
32. What is a quad?
33. Approximately what percent of the US total energy supplied for any use is supplied for electricity production? Approximately what percent of the US total energy supplied for any use is supplied for transportation needs?
34. Approximately what percent of the US total energy supplied is ultimately “rejected” (lost)? What is the major cause of rejected energy?
35. Rank the following ways to supply electric energy from lowest LCOE to highest LCOE: Coal, Gas Peaking, Gas Combined Cycle, Solar PV Thin Film Utility Scale, Solar PV Rooftop C&I, Solar PV-Community, Solar PV – Rooftop residential, Onshore wind, offshore wind, nuclear. Use the minimum of the range for each technology.
36. What are the top 5 states for wind capacity added in 2017? What are the top 5 states for cumulative wind capacity at the end of 2017? What are the top 5 states for wind generation as a percentage of in-state generation? What are the top 5 states for R-factor (wind potential/annual retail sales)?
37. Answer the following questions:
 - Is all PV also DG?
 - Is most rooftop PV also DG?
 - Does all PV have the same LCOE?
 - Does all rooftop PV have same LCOE?
 - Are all dist systems having DG also microgrids?
 - Is all utility-scale PV owned by utilities?
 - Is all DG renewable?
 - Is most wind also DG?