

Homework #2 NPRE 201

Please show work for all calculations.

1. Which form of renewable energy is produced and consumed the most in the US?

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|------------------|---------|
| A. Hydroelectric | B. Wood |
| C. Solar | D. Wind |

2. What is the largest hydroelectric dam in the world?

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|---------------------------|-----------------------------|
| A. Niagara Falls (US) | B. Three Gorges Dam (China) |
| C. Itaipu Dam (Venezuela) | D. Hoover Dam (US) |

3. Which US state has the most installed wind power capacity?

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|---------------|-------------|
| A. Alaska | B. Texas |
| C. Washington | D. Illinois |

4. If you increase the height of a water source by a factor of 4, how much more power can you create by hydroelectric methods?

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| A. 2 | B. 4 |
| C. 6 | D. 8 |

5. Which US region has the greatest potential for geothermal power?

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| A. Northeast | B. Midwest |
| C. Southwest | D. Southeast |

6. What is the name of the largest dry steam field in the world, at which 22 geothermal plants are built that produce a total power of about 1500 MW?

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|-------------------------------------|--------------------------------------|
| A. Leyte Geothermal (Philippines) | B. Darajat Power Station (Indonesia) |
| C. Serrazzano Power Station (Italy) | D. The Geysers (California, US) |

7. Assuming that the efficiency of existing dams remains the same, is it possible to increase the US's hydropower capacity? Explain.

Yes, build the hydropower generators along the coast and exploit that resource or install them in areas with higher reservoirs of water.

8 through 10. Match the following description to the correct term:

- Choices:
- A. First-generation biofuels
 - B. Second-generation biofuels
 - C. Third-generation biofuels

Matches:

8. **C.** Biofuels that are produced from non-food crops, such as waste biomass, wheat stalks, wood, and special biomass crops (such as Miscanthus or switchgrass).

9. **A.** Biofuels made from sugar, starch, vegetable oil, or animal fats using conventional technology. The basic feedstocks for the production of this type of biofuel are often seeds or grains (which yield starch that is fermented into bioethanol) or sunflower seeds (which are pressed to yield vegetable oil that can be used in biodiesel).

10. **B.** Biofuels derived from algae. Algae require low maintenance and produce 30 times more energy per acre than land crops such as soybeans.

11. The amount of carbon stored in dry wood is approximately what percentage by weight?

- A. 20%
- B. 30%
- C. 40%
- D. 50%**

12. Which of the following is not a concern in using hydrogen power?

- A. Molecular hydrogen slowly leaks from most containment vessels, and if significant amounts of hydrogen gas escape, the gas may act as free radicals that would catalyze for ozone depletion.
- B. At certain concentrations of hydrogen, there is a high risk of explosion.**
- C. The byproducts of hydrogen-nitrogen reactions in internal combustion engines may be dangerous.
- D. Running out of hydrogen

13. At a hypothetical Ocean Thermal Energy plant, water is being drawn from deep within the ocean at 5°C. The surface temperature of the water is 25°C. What is the maximum possible efficiency of this energy plant?

$$\eta = 1 - \frac{5 + 273}{25 + 273} = 6.71\%$$

14. Choose one renewable energy source (i.e. Solar, Wind, Geothermal, Hydropower, Hydrogen, **Biofuels**, other) and list 2 pros and 2 cons associated with that energy source.

Pro #1: **Reduce need for external oil sources**

Pro #2: **Can be grown from crops**

Con #1: **Energy intensive**

Con #2: **Burns like an oil, so still releases carbon**

15. Because the sun moves during the day, stationary solar panels cannot always directly face the sun. What is the name for the computer-controlled system of mirrors that moves and rotates throughout the day in order to focus sunlight onto a receiver to produce maximum power?

A. Heliostat

B. Anothode

C. Fuel cell

D. Magnifying glass

16. The “capacity factor” of an energy generating station refers to the ratio of how much power an energy station actually produces to the amount of power that station would produce at full power over the same time period. Which of the following currently has, in general, the lowest capacity factor?

A. Nuclear power plant

B. Hydroelectric power plant

C. Fossil-fueled power plant

D. Wind turbines

Explain your answer: **Nuclear and fossil fuel plants are usually running all the time because there is no external factor limiting their operation. Hydroelectric power plants run almost all the time because, if there is water, gravity will carry it downhill. Wind turbines cannot generate any power without wind, which is not always there or as strong as it should be for maximum capacity.**

17. “Corn to ethanol” is the least energy efficient of all of the biofuels considering all of the energy that goes into producing corn-based ethanol versus the amount of energy it contains. Explain why the US is still pursuing this option.

The USA wants to have a lower reliance on foreign oil and not be subject to global price fluctuations. By making biofuels, they can replace ~10% of the oil for something produced domestically.

18. Which division of end-use sectors uses the most energy produced by solar photovoltaic energy cells?

- A. Commercial
- B. Transportation
- C. Residential
- D. Industrial

19. Geothermal energy originates from all of the following methods/sources except:

- A. Radioactive decay of minerals within the crust and core
- B. Heat leaking out of the earth's core
- C. Releases of pressure from within the earth's core

20. Which of the following refers to a vegetable oil or animal fat based diesel fuel?

- A. Biodiesel
- B. Ethanol
- C. Methanol
- D. Fertilizer

21. The public often believes that Wind and Solar are the best solution to the end of the use of Fossil Fuels (coal, oil and natural gas).

(a) Is this really possible? No, unless there is some way to compensate for the fact that wind and solar are incapable of being non-baseload power sources. There would have to be an excess in these sources and then something like hydrogen is generated and used for power instead of them directly.

(b) What do you think is the best way to reduce the dependence on Fossil Fuels?
I believe nuclear is the best way as it generates more energy per area than wind or solar and is also a base load energy system. Also, advanced biofuels are worth pursuing more because they are types of fuel that do not rely on any limited fuel resource, such as: nuclear depending on uranium, solar depending on rare metals, and fossil fuels relying on fossil fuels. These material concerns could be solved with the mining of asteroids or the moon. However, this is a long way away.