OREGON ENVIROTHON 2024 TEAM #_____

CURRENT ISSUE: RENEWABLE ENERGY FOR A SUSTAINABLE FUTURE Test Total: _____/ 50 points

Part I: Energy and Traditional Energy Infrastructure

1. What is energy? Circle the best definition. [1 point]

   a. The ability to radiate light or heat
   b. The ability to travel in the form of a wave
   c. The ability to make matter change or move
   d. An object in motion

2. Energy comes in six basic forms:

Chemical	Mechanical	Radiant
Electrical	Nuclear	Thermal

   From where you are located right now, look for examples of three of these forms of energy and describe them in a couple words. For full credit, you must provide correct examples for three different forms of energy. [3 points]

Energy Form	Example Seen at This Site

Possible answers:

- Chemical:
  - Battery
  - Food
  - Gas burning in a car
  - Wood burning
- Electrical:
  - Battery
  - Plugs
  - Lighting
  - Appliances
  - Devices
  - Wind turbine
  - Solar panel
- Mechanical:
  - Writing
  - Breathing
  - Walking
  - Vehicle moving
  - Bicycle moving
- Nuclear: (not likely to observe)
- Radiant:
  - Sunlight
  - Light
  - Radio waves
  - Microwave
- Thermal:
  - Engine heat
  - Body heat
  - Heat from a stove
  - Ice or frost melting
  - Warmth from sun

3. In the United States, which one of these sectors uses the largest portion of energy resources? [1 point]

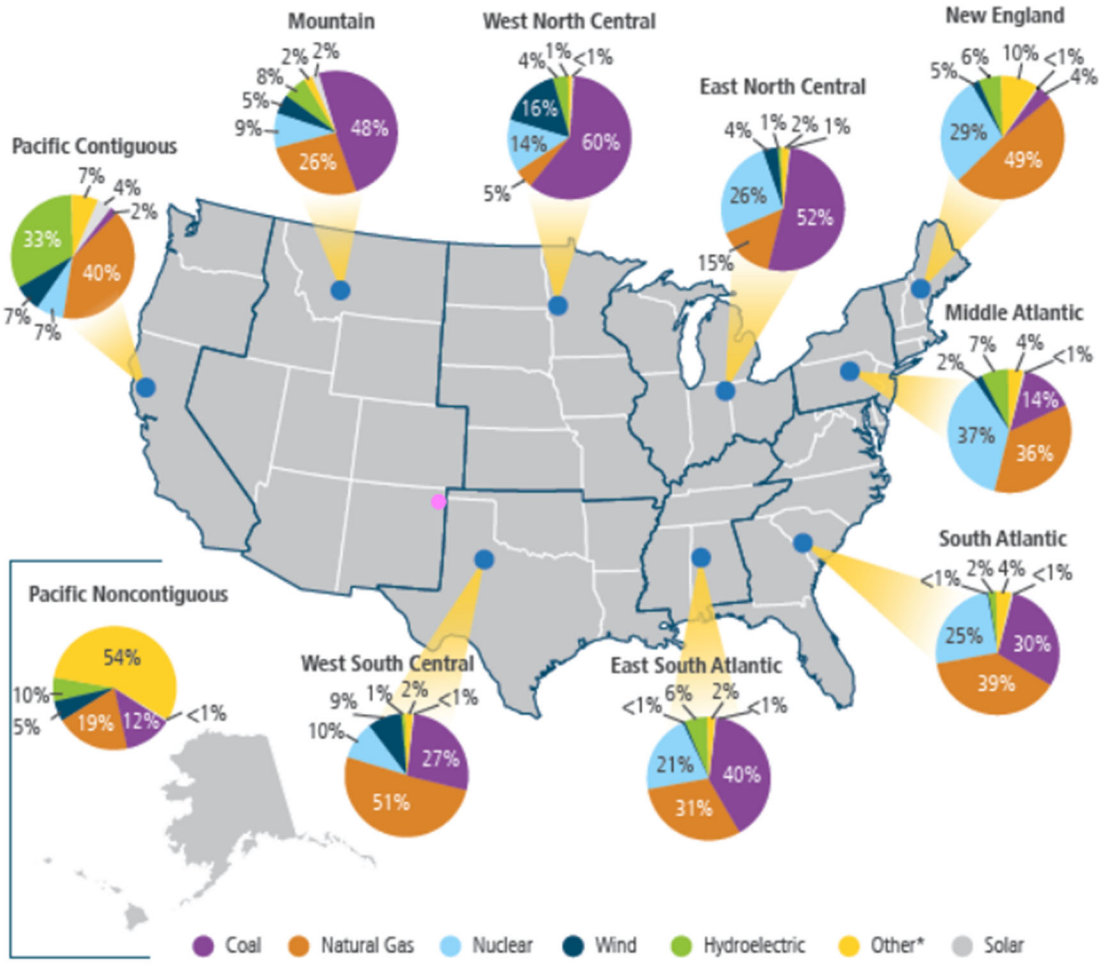
   a. Agriculture
   b. Electricity generation
   c. Industry
   d. Residential and commercial
   e. Transportation

____/ 5 points

4. Oregon is located in the Pacific Contiguous Region shown in the infographic below. Looking at the following diagram, what is one way this region is unique among all the U.S. regions, in terms of how it gets its power? [1 point]

Possible answers:

- ~~The Pacific region gets 1/3 of its power from hydro – way more than any other region.~~
- The Pacific region gets only 2% of its power from coal, significantly less than any other region.



Electric Power Regional Fuel Mixes. 2015

5. The U.S. electric power system (the "grid") is a complex system-of-systems comprising generation, transmission and distribution subsystems, and many institutions involved in its planning, operation and oversight. Which one of these statements is TRUE about the reliability of the U.S. grid? [1 point]

   a. The U.S. grid is not very reliable.
   b. Almost all power outages in the U.S. are due to long-distance transmission issues.
   c. If one part of the U.S. grid fails, it can cause an outage of the whole system.
   d. Regulations at the state, regional, and federal levels require individual utilities or grid operators to maintain grid reliability.

____/ 2 points

6. Match the following elements of the grid (on the left) with its function (from the list on the right). [2 points. ½ point for each correct answer]

__e_ Transformer	a. Converts motion- or fuel-based power to electric power
__a_ Generator	b. Carries electricity to consumers
__b_ Distribution line	c. Connects an electrical device to an electric supply
__d_ Transmission line	d. Carries high-voltage electricity over long distances
	e. Increases and decreases voltage

____/ 2 points

Part II. Renewable Energy and Infrastructure

7. What is renewable energy? Circle the best definition. [1 point]

An energy source that:

a. is clean and free to use
b. can be converted directly into heat and electricity
c. can be replenished by nature faster than it is used
d. does not produce air pollution

9. What are two advantages of renewable energy sources? [2 points]

a. Possible answers:
- Won't run out.
- Cleaner water/air
- Less waste.
- Lower maintenance requirements.
- Less reliance on foreign energy sources.

b.

10. What are two disadvantages of renewable energy resources? [2 points]

a. Possible answers:
- High upfront costs
- May be intermittent
- Are limited to certain geographic areas
- Aren't always 100% carbon-free

b.

11. Using the contents in the plastic bag at your station—and solar energy—make the propeller spin in two different directions. Draw a diagram of the circuit you created and describe what you did to change the direction. [3 points, 2 for diagram and one for description]

Diagram:

Diagram includes:
- Propellor inserted on motor
- Each connector on solar panel wires connected to a terminal on the motor.
- Panel placed in sun.

Description of how changed propellor direction:
To reverse direction, switch which motor termina the connectors are connected to.

____/ 8 points

12. Is hydrogen fuel renewable or nonrenewable? Explain your answer. [2 points, 1 for correct answer, and 1 for explanation]

Correct answer: It depends.
Explanation:
(Must at least have): Whether hydrogen fuel is renewable depends how the fuel is made.
(May include): It depends on the feedstock and process used to make the fuel:

- "Green" hydrogen fuel made from water and electricity from renewable sources (like wind or solar) is renewable.
- "Black," "brown," "gray," "blue," and "turquoise" hydrogen fuels are produced from breaking down coal or natural gas using heat – and are not renewable.

13. Describe one way that transitioning to more renewable energy resources can increase the resilience of the U.S. power grid? [2 points]

Possible answers:

- Distributed (on-site or de-centralized) renewable energy resources provide more ways to keep the power on or bring it back after an outage.
- Extreme heat and winter events cause fossil-fueled power plants to shut down or underperform.
- Reducing greenhouse gas emissions will help to tackle climate change and improve the reliability and resiliency of the grid.
- Renewable energy resources reduce the need for foreign energy sources.

____/ 4 points

Part III: Renewable Energy and Natural Resources

14. Transforming the U.S. electric grid to renewable sources is challenging because renewable sources generate variable amounts of electricity depending on the amount of wind or sunlight available, and the best places to generate renewable energy are often far away from the areas that use the electricity. Which of the following is NOT a means to help meet these challenges? Circle the best response. [1 point]

a. Tax renewables at a higher rate than fossil fuels
b. Develop energy storage
c. Provide backup generation
d. Increase transmission lines to connect to long-distance power generation

15. Renewable power requires more land per unit of power produced than fossil fuels. One way to address this is through dual-use projects (sometimes called agrivoltaics) that generate renewable energy and agricultural products at the same time on the same land.

A Lane County vegetable farmer is considering solar development on their farmland. What are two benefits and two challenges of dual use projects they should consider? [4 points, one for each correct response]

Benefits

a. Possible answers:
- Both uses have similar land requirements: open spaces, well-draining soils, southern exposure.

b.
- Farmer gest income from the power generated.
- Supports energy transition to renewable energy
- Reduces energy needed from power grid.

Challenges

c. Possible answers:
- The initial expense may be prohibitive.

- Placement of panels could reduce farm yield.

d.
- In order to allow farming, may need elevate panels and allow more space between row of panels, thus increasing materials and expense, and decreasing the amount of power generated.

- It is difficult to move farm equipment around solar panels.

- Dust from farm activities soil solar panels, reducing their effectiveness.

16. Describe one thing Oregon could do to encourage more solar development in farm regions, while not reducing the amount of farmland? [2 points]

Possible answers:
- Tax credits as incentives to build solar projects on landfills, sandpits, and brownfields, rather than farmland.
- Tax credits for dual use development to reduce the cost.
- Mandate streamlined permitting for rooftop solar.
- Maintain or increase incentives for rooftop solar.
- Pre-approve solar development on nonfarmed private land (e.g., range land)

____/ 7 points

17. The U.S. Bureau of Ocean Energy Management (BOEM) has designated two potential offshore wind energy areas (WEAs) off the Oregon coast. The Coos Bay WEA is 61,204 acres and located approximately 32 miles from shore. The Brookings WEA is 133,808 acres and approximately 18 mi off the coast. If fully developed, the Final WEAs could support 2.4 gigawatts of energy production.

    You have been asked to write an opinion article about these projects for a blog that focuses on Oregon coast issues. What potential pros and cons for Oregonians of these projects would you include in your article? Identify two pros and two cons. [4 points, 1 for each]

    Pros

    a. Possible answers:
    - Offshore wind speeds tend to be faster than on land so much more energy can be generated.
    - Offshore wind speeds tend to be steadier than on land, so more reliable source of energy.

    b.
    - Provide renewable energy that doesn't run out.
    - Provide domestic energy source
    - Create jobs.
    - Do not emit environmental pollutants or greenhouse gases.
    - Promote economic development

    Cons

    c. Possible answers:
    - Expensive to build as turbines have to withstand harsh conditions.
    - Wave and wind action, especially during heavy storms, can damage turbines.

    d.
    - Production and installation of power cables to land can be very expensive
    - Difficult to maneuver around them for fishing and cargo boats.
    - Unknown effects on marine life (fish and other animals) and birds.
    - On west coast, offshore wind would require floating turbines, which are still in development phase.

____/ 4 points

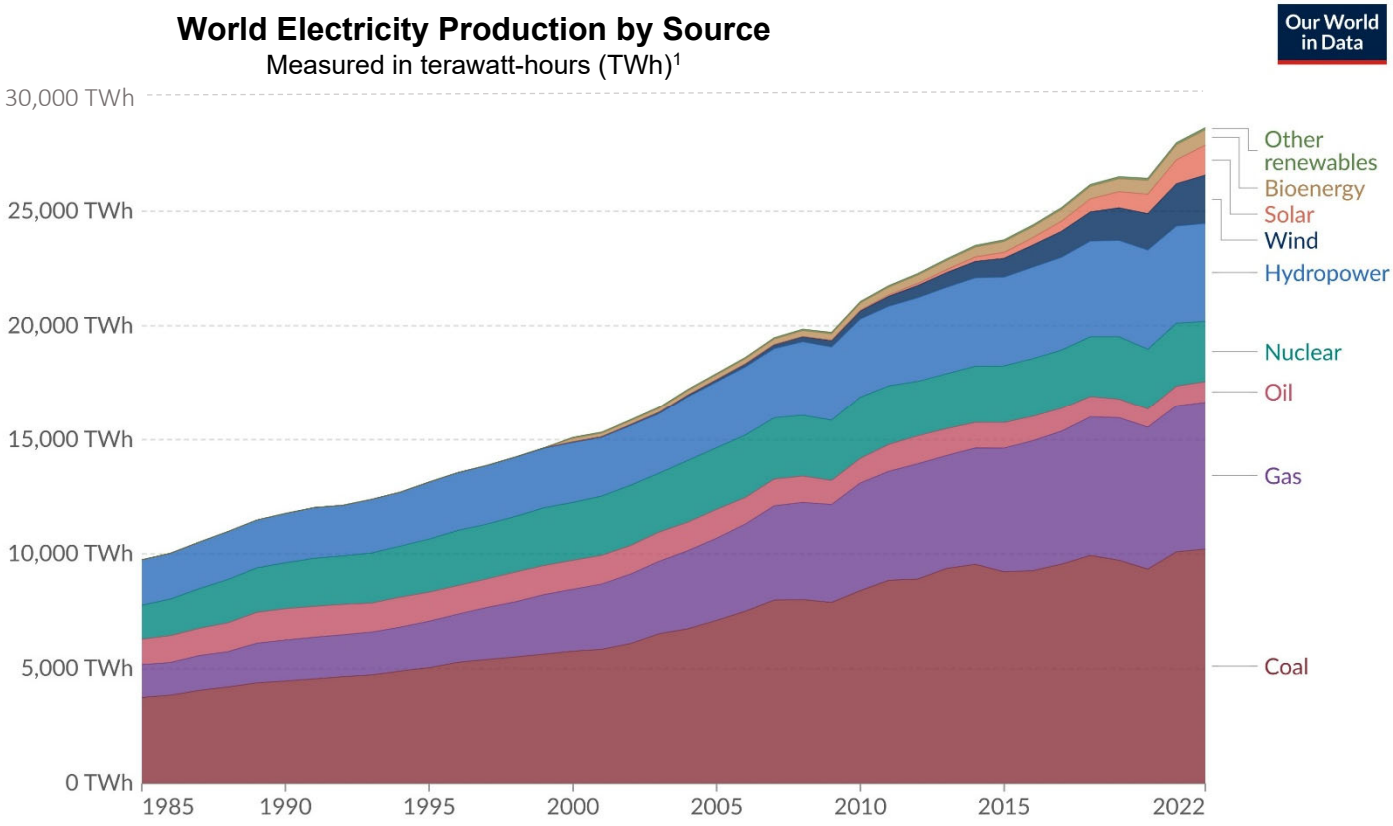
Part IV: Renewable Energy and Global Perspectives

18. The graph below shows the world's electricity production from 1985-2022, by energy source.

Looking at the graph, fill in the blanks in the following statements using the word bank below. (Use each term no more than once.) [3 points]

a. The total amount of electricity produced worldwide has __tripled_____ in 37 years.
b. While the percentage of renewable energy used to produce electricity has __doubled_____, so has the amount of coal used.
c. Oil has ___decreased_ in use.

Word bank: decreased, doubled, halved, tripled



[1]A watt-hour is the amount of energy delivered by one watt of energy for one hour. A terawatt-hour is 1 trillion watt-hours. Other renewables include waste, geothermal, wave and tidal.

____/ 3 points

19. United Nations Secretary-General Antonio Guterres identified five actions the world needs to take to speed up the shift to renewable energy. Which of the following is NOT one of the five actions necessary to transform the world's energy systems. [1 point]

a. Improve global access to components and raw materials
b. Level the playing field for renewable energy technologies versus fossil fuels
c. Make renewable energy technology a global public good
d. Minimize investments in renewables
e. Shift energy subsidies from fossil fuels to renewable energy

20. Currently only a small percentage of electricity is generated from renewable energy, especially in developing countries. Numerous barriers prevent renewable energy from effectively competing with traditional energy.

For each of the following common barriers, indicate whether it is a social barrier (S), economic barrier (E), technical barrier (T), or regulatory barrier (R). [4 points, ½ point for each correct answer]

_R_a. Bureaucratic and administrative hurdles

_T_b. Complexities of energy storage

_S_c. Concerns about disruption of lifestyle

_E_d. High initial capital

_S_e. Lack of communication with local communities

_E_f. Lack of financial institutions

S or E g. Lack of information about the benefits

_E_h. Lack of investors

____/ 5 points

Part IV: Local Action and Energy Equity

21. According to climate activist Eleanor Stein, an "energy just" world involves equitable sharing of benefits and burdens involved in the production and consumption of energy services. Which of the following is an example of energy justice in practice? Circle the best answer. [1 point]

    a. A tax credit is made available to homeowners for installing rooftop solar panels.
    b. A community owns and controls its sources of energy production and involves community members in decision-making about it.
    c. The extraction of coal causes physical harm to miners and degrades the environment around the coal mine.
    d. Low-income households in the US pay nearly 9% of their income in energy costs, three times the percentage that middle- and high-income households pay.

22. Indigenous communities have often been harmed by—rather than benefitting from—energy development projects. For example, in the U.S., over 1.1 million acres of tribal land have been flooded under the reservoirs of dams, and tribal land has often been targeted for high-impact fossil fuel extraction (like oil, natural gas, and coal mining).

    In recent years, many tribes have planned and developed small-scale renewable energy projects such as solar and wind on their land. For example, the Coquille Indian Tribe has installed rooftop solar on its Community Center building.

    What are environmental, economic and social benefits of Indigenous renewable energy projects like these? Name two benefits for each type.

    Environmental benefits [2 points]

    a.__ Possible answers:
    - Reduce carbon emissions
    - Help to alleviate climate change.
    - Reduce impact on land from fossil fuel extraction.

    b._____

    _____

    Economic benefits [2 points]

    c.____ Possible answers:
    - Save money on electricity bills.
    - Create jobs for building and maintaining project.
    - Provide revenue for the tribe.

    d._____

    _____

____/ 5 points

Social benefits [2 points]

e.__ Possible answers:
- Local control of energy source
- Providing electricity for community services
- More independence, local control
- Honoring cultural connections to land

___ -

f. __

_____

23. There are many different things a person should consider before installing a home renewable energy system. Which one of the following is the LEAST important factor? [1 point]

a. Cost of different options
b. Present electricity use
c. How long it would take to recoup the investment
d. Local codes and requirements
e. Behavioral changes to reduce electricity use
f. Equipment color
g. Whether to operate the system on or off the grid

24. Home renewable energy systems are expensive, and not everyone owns their home or can afford the investment. Describe two low- or no-cost actions individuals can take to help transition their personal energy use to renewable energy, or to support more renewable energy development in their community? [2 points, 1 for each action]

a._ Possible answers:
- Participate in a 100% renewable portfolio option with local electric utility.
- Purchase renewable energy through a retail electricity supplier.
- Receive renewable energy through a community solar project or community choice aggregation.
- Directly purchase renewable energy certificates (RECs)
- Write letters to editor

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b._
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____/ 5 points