

Energy resource (grade 6)

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RENEWABLE

Renewable resources can be replenished at a comparable rate to the rate of consumption. Energy sources like hydroelectric power, solar energy, and wind power are considered "perpetual resources" because they run no risk of depletion.

NONRENEWABLE

Nonrenewable resources are energy sources like petroleum, propane, natural gas, coal, and nuclear energy that take millions of years to form and cannot be regenerated in a short time period.

PETROLEUM



PETROLEUM is formed from animals and plants that lived millions of years ago when heat and pressure turned decayed matter into crude oil. It is a part of the fossil fuels family, found underground or under seabed floor by drilling. It is then transported to refineries and distilled into fuel or base chemical products.

PROS

- Transportation fuel for the world
- Basis of many products, from prescription drugs to plastics
- Economical to produce, easy to transport

CONS

- High CO₂ emissions
- Found in limited areas
- Supply may be exhausted before natural gas and coal resources
- Possible environmental impact from drilling and transporting

NATURAL GAS



NATURAL GAS consists primarily of methane but includes significant quantities of ethane, butane, propane, carbon dioxide, nitrogen, helium, and hydrogen sulfide. It is a part of the fossil fuels family and found underground by drilling. It is then transported by tankers or pipelines as liquefied natural gas.

PROS

- Widely available
- Burns more cleanly than coal or oil
- Often used in combination with other fuels to decrease pollution in electricity generation

CONS

- Transportation costs are high; lack of infrastructure makes gas resources unavailable from some areas
- Burns cleanly, but still has emissions
- Pipelines impact ecosystems



COAL is formed from trees and plants in vast primeval forests, when heat and pressure turned decayed matter into coal. Coal is a part of the fossil fuels family.



COAL

nonrenewable

PROS

- Abundant supply
- Currently inexpensive to extract
- Reliable and capable of generating large amounts of power

CONS

- Emits major greenhouse gases/acid rain
- High environmental impact from mining and burning, although cleaner coal-burning technology is being developed
- Mining can be dangerous for miners

NUCLEAR ENERGY



nonrenewable



NUCLEAR ENERGY is generated in reactors, when nuclear fuel fission (using uranium) heats water, and the steam turns turbines to run the generators that convert energy into electricity.

PROS

- No greenhouse gases or CO₂ emissions
- Very efficient at transforming energy into electricity compared to coal plants
- Uranium reserves are abundant (but costly to mine)
- Refueled yearly unlike coal plants that need trainloads of coal every day

CONS

- Higher capital costs due to safety, emergency, containment, radioactive waste, and storage systems
- Problem of long-term storage of radioactive waste
- Heated waste water from nuclear plants harms aquatic life
- Potential nuclear proliferation issue



SOLAR ENERGY is generated when photovoltaic (PV) cells convert heat from the sun directly into electricity.

PROS

- Nonpolluting
- Most abundant energy source available
- Systems last 15–30 years

CONS

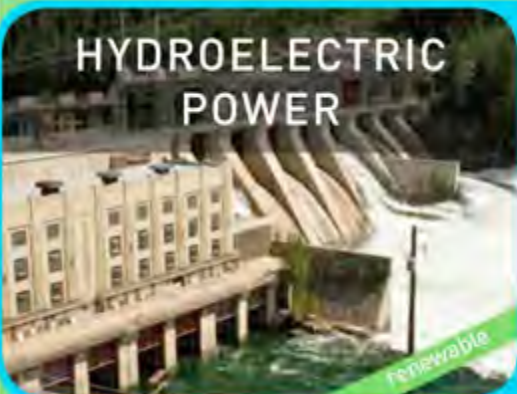
- High initial investment
- Dependent on sunny weather
- Supplemental energy may be needed in low sunlight areas
- Requires large physical space for PV cell panels
- Limited availability of polysilicon for panels



SOLAR ENERGY

renewable

HYDROELECTRIC POWER



renewable



HYDROELECTRIC POWER is generated when flowing water turns turbines to run generators that convert energy into electricity.

PROS

- No emissions
- Reliable
- Capable of generating large amounts of power
- Output can be regulated to meet demand

CONS

- Environmental impacts by changing the environment
- Hydroelectric dams are expensive to build
- Dams may be affected by drought
- Potential for floods



WIND POWER is generated when wind turns turbines to run the generators that convert energy into electricity, which is then stored in batteries.

PROS

- No emissions
- Affordable
- Little disruption of ecosystems
- Relatively high output

CONS

- Output is proportional to wind speed
- Not feasible for all geographical locations
- High initial investment and ongoing maintenance costs
- Extensive land use
- Can be unsightly and noisy
- Can pose a threat to birds

WIND POWER



renewable



GEO THERMAL ENERGY is generated by heat in the earth's core. It is found underground by drilling steam wells (like oil drilling). There is a global debate as to whether geothermal energy is renewable or nonrenewable.

PROS

- Produces about 1/5 the CO₂ that a power plant using natural gas emits
- Efficient
- Minimal environmental impact

CONS

- Geothermal fields found in few areas around the world
- Wells could eventually be depleted
- Expensive start-up costs

GEO THERMAL ENERGY



renewable
nonrenewable

BIOMASS



BIOMASS is produced from vegetable oils, animal fats, recycled restaurant greases, and other byproducts of plant, agricultural, and forestry processing or industrial/human waste products. It is converted to electricity in a process similar to converting fossil fuels to heat or electricity.

PROS

- Abundant supply
- Fewer emissions than fossil fuel sources
- Can be used in diesel engines
- Auto engines easily converted to run on biomass fuel

CONS

- Source must be near usage to cut transportation costs
- Emits some pollution as gas/liquid waste
- Increases nitrogen oxides, an air pollutant emissions
- Uses some fossil fuels in conversion



ETHANOL is a subset of biomass that is manufactured from alcohols, ethers, esters, and other chemicals extracted from plant and tree residue. It can be made from corn, sugar, wheat, and barley.

PROS

- Easily manufactured
- Fewer emissions than fossil fuel sources
- Carbon-neutral (CO₂ emissions offset by photosynthesis in plants)

CONS

- Source must be near usage to cut transportation costs
- Extensive use of cropland
- Less energy in a gallon of ethanol than in a gallon of gasoline and diesel fuel
- Costs more than gasoline to produce
- Currently requires government subsidy to be affordable to consumers
- Requires engine conversion to be used as fuel

ETHANOL



renewable

Choose the best answer

1. **What is the main source of energy for homes and factories in the United States?**

- A. solar collectors
B. wood
C. peat
D. electrical power plants

2. **What forms fossil fuels?**

- A. a chemical reaction between water and the soil
B. acid rain
C. the compression of ash from a volcanic eruption
D. the decayed remains of ancient plants and other organisms

3. **Before vegetation is converted to coal, a dark, organic material called is formed.**

- A. Oil
B. lignite
C. anthracite
D. peat

Peat is a dark, organic substance formed as microorganisms decay sediments

4. **How are oil and natural gas formed?**

- A. Microscopic ocean animals and algae die and fall to the seafloor where they are buried and decay. Over time, chemical reactions form oil and natural gas.
B. Coal is melted into oil by magma under Earth's surface. Once it reaches the surface, it becomes natural gas.
C. water to form oil. Natural gas is formed when oil is burned.
D. Oil and natural gas are not formed, they are manufactured.

5. **Why do oil and natural gas move upward toward the surface of Earth?**

- A. Geothermal activity forces oil and natural gas toward the surface
B. Oil and natural gas do not move toward the surface
C. They are less dense than the surrounding rock and pore water contained within small spaces in the rock.
D. Oil and natural gas are more dense than the surrounding rock and therefore rise to the surface

6. **Harmful waste produce by burning fossil fuels is called**

- A. Pollution
B. radioactive waste
C. smudge
D. mud

7. **What is formed when gases released by burning oil and coal mix with water in the air?**

- A. acid rain
B. dew
C. smog
D. dirty snow

8. **Today's car has that reduce the amount of pollutants released in car exhaust.**

- A. Mufflers
B. catalytic converters
C. exhaust converters
D. filters

9. Fossil fuels cannot be replaced by natural processes in less than 100 years. They are classified as

- A. Precious B. **nonrenewable** C. renewable D. expensive

10. Sun, wind, and water are all examples of _____ because they can be replaced by natural processes in less than 100 years.

- A. **renewable resources** C. alternative energy resources
B. inexpensive resources D. clean energy sources

11. Solar energy is obtain from

- A. Wind B. **the Sun** C. rivers D. stars

12. What is one drawback of using solar cells to make electric?

- A. They are hard to use. C. They cause pollution.
B. They are not reliable D. **They are expensive**

13. What element is used a solar cell?

- A. Carbon B. calcium C. **silicon** D. iron

14. _____ uses water to produce electricity.

- A. solar power C. wind power
B. **hydroelectric power** D. hydrothermal power

15. Water that soaks into the ground and collects in small spaces between bits of soil and rock is called

- A. **Groundwater** B. freshwater C. surface water D. drinking water

16. Water pollution that cannot be traced to an exact location is called a

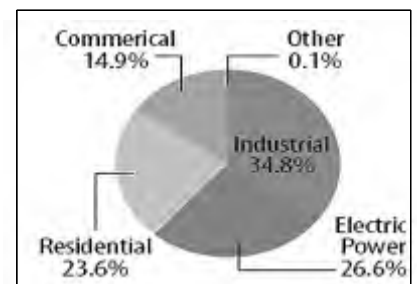
- A. Spill B. runoff C. **nonpoint source** D. wetland

17. What is the process where large quantities of soil and rock are moved to get to a material called?

- A. Panning B. **mining** C. clearing D. erosion

18. According to the graph, which is the second highest area of natural gas consumption?

- A. Industry
B. **electric power**
C. commercial
D. residential



19. What is a fossil fuel?

- A. fossils capable of burning
B. **a fuel originating from the remains of ancient life**
C. a renewable resource
D. fossilized remnants of a fire

