Unit 6 Sustaining Natural Resources

Content Area: **Science**
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Enduring Understandings

EIN-2 When humans use natural resources, they alter natural systems.

ENG-3 Humans use energy from a variety of sources, resulting in positive and negative consequences.

STB-1 Humans can mitigate their impact on land and water resources through sustainable use.

Essential Questions

Why are fossil fuels the most widely used energy resources if they are nonrenewable?

Learning Objectives

Non-Renewable Energy Learning Objectives: (Forests, Mining, Fossil Fuels)

EIN-2.B Describe the effect of clearcutting on forests.

STB-1.G Describe methods for mitigating human impact on forests.

EIN-2.K Describe natural resource extraction through mining.

EIN-2.L Describe ecological and economic impacts of natural resource extraction through mining.

ENG-3.A Identify differences between nonrenewable and renewable energy sources.

ENG-3.B Describe trends in energy consumption.

ENG-3.C Identify types of fuels and their uses.

ENG-3.D Identify where natural energy resources occur.

ENG-3.E Describe the use and methods of fossil fuels in power generation.

ENG-3.F Describe the effects of fossil fuels on the environment.

ENG-3.G Describe the use of nuclear energy in power generation.

ENG-3.H Describe the effects of the use of nuclear energy on the environment.

Renewable Energy Learning Objectives:

ENG-3.I Describe the effects of the use of biomass in power generation on the environment.

ENG-3.J Describe the use of solar energy in power generation.

ENG-3.K Describe the effects of the use of solar energy in power generation on the environment.

ENG-3.L Describe the use of hydroelectricity in power generation.

ENG-3.M Describe the effects of the use of hydroelectricity in power generation on the environment.

ENG-3.N Describe the use of geothermal energy in power generation.

ENG-3.O Describe the effects of the use of geothermal energy in power generation on the environment.

ENG-3.P Describe the use of hydrogen fuel cells in power generation.

ENG-3.Q Describe the effects of the use of hydrogen fuel cells in power generation on the environment.

ENG-3.R Describe the use of wind energy in power generation.

ENG-3.S Describe the effects of the use of wind energy in power generation on the environment.

ENG-3.T Describe methods for conserving energy

EIN-2.M Describe the effects of urbanization on the environment.

Standards

Non-Renewable Standards (Forests, Mining, Fossil Fuels)

STB-1.G.1 Some of the methods for mitigating deforestation include reforestation, using and buying wood harvested by ecologically sustainable forestry techniques, and reusing wood.

STB-1.G.2 Methods to protect forests from pathogens and insects include integrated pest management (IPM) and the removal of affected trees.

STB-1.G.3 Prescribed burn is a method by which forests are set on fire under controlled conditions in order to reduce the occurrence of natural fires.

EIN-2.B.1 Clearcutting can be economically advantageous but leads to soil erosion, increased soil and stream temperatures, and flooding.

EIN-2.B.2 Forests contain trees that absorb pollutants and store carbon dioxide. The cutting and burning of

trees releases carbon dioxide and contributes to climate change.

EIN-2.K.1 As the more accessible ores are mined to depletion, mining operations are forced to access lower grade ores. Accessing these ores requires increased use of resources that can cause increased waste and pollution.

EIN-2.K.2 Surface mining is the removal of large portions of soil and rock, called overburden, in order to access the ore underneath. An example is strip mining, which removes the vegetation from an area, making the area more susceptible to erosion.

EIN-2.L.1 Mining wastes include the soil and rocks that are moved to gain access to the ore and the waste, called slag and tailings that remain when the minerals have been removed from the ore. Mining helps to provide low cost energy and material necessary to make products. The mining of coal can destroy habitats, contaminate ground water, and release dust particles and methane.

EIN-2.L.2 As coal reserves get smaller, due to a lack of easily accessible reserves, it becomes necessary to access coal through subsurface mining, which is very expensive.

ENG-3.A.1 Nonrenewable energy sources are those that exist in a fixed amount and involve energy transformation that cannot be easily replaced.

ENG-3.A.2 Renewable energy sources are those that can be replenished naturally, at or near the rate of consumption, and reused.

ENG-3.B.1 The use of energy resources is not evenly distributed between developed and developing countries.

ENG-3.B.2 The most widely used sources of energy globally are fossil fuels.

ENG-3.B.3 As developing countries become more developed, their reliance on fossil fuels for energy increases.

ENG-3.B.4 As the world becomes more industrialized, the demand for energy increases. ENG-3.B.5 Availability, price, and governmental regulations influence which energy sources people use and how they use them.

ENG-3.C.1 Wood is commonly used as fuel in the forms of firewood and charcoal. It is often used in developing countries because it is easily accessible.

ENG-3.C.2 Peat is partially decomposed organic material that can be burned for fuel.

ENG-3.C.3 Three types of coal used for fuel are lignite, bituminous, and anthracite. Heat, pressure, and depth of burial contribute to the development of various coal types and their qualities.

ENG-3.C.4 Natural gas, the cleanest of the fossil fuels, is mostly methane.

ENG-3.C.5 Crude oil can be recovered from tar sands, which are a combination of clay, sand, water, and bitumen.

ENG-3.C.6 Fossil fuels can be made into specific fuel types for specialized uses (e.g., in motor vehicles).

ENG-3.C.7 Cogeneration occurs when a fuel source is used to generate both useful heat and electricity

ENG-3.D.1 The global distribution of natural energy resources, such as ores, coal, crude oil, and gas, is not

uniform and depends on regions' geologic history

ENG-3.E.1 The combustion of fossil fuels is a chemical reaction between the fuel and oxygen that yields carbon dioxide and water and releases energy.

ENG-3.E.2 Energy from fossil fuels is produced by burning those fuels to generate heat, which then turns water into steam. That steam turns a turbine, which generates electricity.

ENG-3.E.3 Humans use a variety of methods to extract fossil fuels from the earth for energy generation.

ENG-3.F.1 Hydrologic fracturing (fracking) can cause groundwater contamination and the release of volatile organic compounds.

ENG-3.G.1 Nuclear power is generated through fission, where atoms of Uranium-235, which are stored in fuel rods, are split into smaller parts after being struck by a neutron. Nuclear fission releases a large amount of heat, which is used to generate steam, which powers a turbine and generates electricity.

ENG-3.G.2 Radioactivity occurs when the nucleus of a radioactive isotope loses energy by emitting radiation.

ENG-3.G.3 Uranium-235 remains radioactive for a long time, which leads to the problems associated with the disposal of nuclear waste.

ENG-3.G.4 Nuclear power generation is a nonrenewable energy source. Nuclear power is considered a cleaner energy source because it does not produce air pollutants, but it does release thermal pollution and hazardous solid waste.

ENG-3.H.1 Three Mile Island, Chernobyl, and Fukushima are three cases where accidents or natural disasters led to the release of radiation. These releases have had short- and long-term impacts on the environment.

ENG-3.H.2 A radioactive element's half-life can be used to calculate a variety of things, including the rate of decay and the radioactivity level at specific points in time.

Renewable Energy Standards (Biomass, Solar, Water, Geothermal, Hydrogen, Wind, Energy Conservation)

ENG-3.I.1 Burning of biomass produces heat for energy at a relatively low cost, but it also produces carbon dioxide, carbon monoxide, nitrogen oxides, particulates, and volatile organic compounds. The overharvesting of trees for fuel also causes deforestation.

ENG-3.I.2 Ethanol can be used as a substitute for gasoline. Burning ethanol does not introduce additional carbon into the atmosphere via combustion, but the energy return on energy investment for ethanol is low.

ENG-3.J.1 Photovoltaic solar cells capture light energy from the sun and transform it directly into electrical energy. Their use is limited by the availability of sunlight.

ENG-3.J.2 Active solar energy systems use solar energy to heat a liquid through mechanical and electric equipment to collect and store the energy captured from the sun.

ENG-3.J.3 Passive solar energy systems absorb heat directly from the sun without the use of mechanical and electric equipment, and energy cannot be collected or stored.

ENG-3.K.1 Solar energy systems have low environmental impact and produce clean energy, but they can be

expensive. Large solar energy farms may negatively impact desert ecosystems.

ENG-3.L.1 Hydroelectric power can be generated in several ways. Dams built across rivers collect water in reservoirs. The moving water can be used to spin a turbine. Turbines can also be placed in small rivers, where the flowing water spins the turbine.

ENG-3.L.2 Tidal energy uses the energy produced by tidal flows to turn a turbine.

ENG-3.M.1 Hydroelectric power does not generate air pollution or waste, but construction of the power plants can be expensive, and there may be a loss of or change in habitats following the construction of dams.

ENG-3.N.1 Geothermal energy is obtained by using the heat stored in the Earth's interior to heat up water, which is brought back to the surface as steam. The steam is used to drive an electric generator.

ENG-3.Q.1 Hydrogen fuel cells have low environmental impact and produce no carbon dioxide when the hydrogen is produced from water. However, the technology is expensive and energy is still needed to create the hydrogen gas used in the fuel cell.

ENG-3.P.1 Hydrogen fuel cells are an alternate to nonrenewable fuel sources. They use hydrogen as fuel, combining the hydrogen and oxygen in the air to form water and release energy (electricity) in the process. Water is the product (emission) of a fuel cell.

ENG-3.O.1 The cost of accessing geothermal energy can be prohibitively expensive, as is not easily accessible in many parts of the world. In addition, it can cause the release of hydrogen sulfide.

ENG-3.R.1 Wind turbines use the kinetic energy of moving air to spin a turbine, which in turn converts the mechanical energy of the turbine into electricity.

ENG-3.S.1 Wind energy is a renewable, clean source of energy. However, birds and bats may be killed if they fly into the spinning turbine blades.

ENG-3.T.1 Some of the methods for conserving energy around a home include adjusting the thermostat to reduce the use of heat and air conditioning, conserving water, use of energy-efficient appliances, and conservation landscaping.

ENG-3.T.2 Methods for conserving energy on a large scale include improving fuel economy for vehicles, using BEVs (battery electric vehicles) and hybrid vehicles, using public transportation, and implementing green building design features.

Urbanization Standards:

EIN-2.M.1 Urbanization can lead to depletion of resources and saltwater intrusion in the hydrologic cycle.

EIN-2.M.2 Urbanization, through the burning of fossil fuels and landfills, affects the carbon cycle by increasing the amount of carbon dioxide in the atmosphere.

EIN-2.M.3 Impervious surfaces are human-made structures—such as roads, buildings, sidewalks, and parking lots—that do not allow water to reach the soil, leading to flooding.

EIN-2.M.4 Urban sprawl is the change in population distribution from high population density areas to low density suburbs that spread into rural lands, leading to potential environmental problems.

Content

Vocabulary:

Clear Cutting

Slash and Burn

Types of Mining

Effects of Mining on Environment

Net Energy
Oil
Shale Oil
Natural Gas
Liquefied Natural Gas
Coal
Nuclear Power
Cogeneration
Passive Solar Heating System
Active Solar Heating System
Photovoltaic Cell
Hydroelectric Power
Wind Power
Biomass
Geothermal Energy

Resources

College Board AP Central : https://apcentral.collegeboard.org/courses/ap-environmental-science/course

College Board AP Environmental Science Course & Exam Description Manual https://apstudents.collegeboard.org/sites/default/files/2019-05/ap-environmental-science-course-and-exam-description.pdf

College Board AP Environmental Science "AP Classroom" https://apcentral.collegeboard.org/about-ap/news-changes/ap-2019?course=ap-environmental-science

AP Environmental Science Classroom Resources https://apcentral.collegeboard.org/courses/ap-environmental-science/classroom-resources

Khan Academy (Please look in AP Biology & Chemistry/Physics for all APES topics) https://www.khanacademy.org/science

Bozeman Science AP Environmental Science videos http://www.bozemanscience.com/ap-environmental-

science