Phoenixville Area School District Understanding by Design (UbD) Science Template

Grade Level &/or HS Subject: Environmental Science Unit Name: Earth's Systems and Resources

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr><td rowspan="6">Overarching NGSS & PA Standards:

<u>HS-ESS3-1</u>
Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and change in climate have influenced human activity.

<u>HS-ESS3-2</u>
Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to independently use their learning to…

Ask questions and/or define problems
Develop and/or use models
Plan and/or carry out investigations
Analyze and interpret data using computational thinking
Obtain, evaluate, and communicate information (supported by evidence)
Construct explanations and design solutions</td></tr>
<tr><td colspan="2">Meaning-Making</td></tr>
<tr><td>Students will understand that…

Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting, and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.

Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems – not what should happen.</td><td>ESSENTIAL QUESTIONS
Students will keep considering...

How do the Earth's surface process and human activities affect each other?

How do humans depend on Earth's resources?

How do natural hazards affect individuals and societies?</td></tr>
<tr><td colspan="2">Knowledge and Skills Acquisition</td></tr>
<tr><td>UNDERSTANDINGS
Students will know…

ESS3.A: Natural Resources
-Resource availability has guided the development of human society.</td><td>Students will be skilled at…

• Cite specific textual evidence to support analysis of science and</td></tr>
</table>

based on cost-benefit rations. **Which branch(es) of science apply:** **LS PS** **E&SS**	-All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. ESS3.B: Natural Hazards -Natural hazards and other geologic events have shaped the course of human history; they have significantly altered the sizes of human populations and have driven human migrations. ETS1.B: Developing Possible Solutions When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (Consider: What facts and basic concepts should students know and be able to recall?) KEY VOCABULARY oil sands, tar sands, fossil fuels, net energy, coal, crude oil, natural gas, petroleum, refining, mountain top removal, fracking, energy efficiency, energy conservation, cogeneration	technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. • Evaluate the hypothesis, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. • Reason abstractly and quantitatively. • Interpret the scale and the origin in graphs and data displays. • Define appropriate quantities for the purpose of descriptive modeling. • Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (What skills and processes will students use?)

Stage 2 – Evidence		
Evaluative Criteria	***Assessment Evidence***	

Project Rubrics
Labs
Quizzes
Tests
	PERFORMANCE TASK(S):
	
	HS-ESS3-1
	• Students construct an explanation that includes:
	  o Specific cause and effect relationships between environmental factors (natural hazards, changes in climate, and the availability of natural resources) and features of human societies including population size and migration patterns.
	  o That technology in modern civilizations has mitigated some of the effects of natural hazards, climate, and the availability of natural resources on human activity.
	• Students identify and describe the evidence to construct their explanation, including:
	  o Natural hazard occurrences that can affect human activity and have significantly altered the sizes and distributions of human populations in particular regions
	  o Changes in climate that affect human activity (e.g., agriculture) and human populations, and that can drive mass migrations
	  o Features of human societies that have been affected by the availability of natural resources
	  o Evidence of the dependence of human populations on technological systems to acquire natural resources and to modify physical settings
	• Students us a variety of valid and reliable sources for the evidence, potentially including theories, simulations, peer review, or students' own investigations
	• Students use reasoning that connects the evidence, along with the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future, to describe:
	  o The effect of natural hazards, changes in climate, and the availability of natural resources on features of human societies, including population size and migration patterns
	  o How technology has changed the cause-and-effect relationship between the development of human society and natural hazards, climate, and natural resources
		Differentiation Considerations:

	• Students describe reasoning for how the evidence allows for the distinction between casual and correlational relationships between environmental factors and human activity
	
	HS-ESS3-2
	• Students describe the nature of the problem each design solution addresses
	• Students identify the solution that has the most preferred cost-benefit rations
	• Students identify evidence for the design solutions, including:
	  o Societal needs for that energy or mineral resource
	  o The cost of extracting or developing the energy reserve or mineral resource
	  o The cost and benefits of the given design solutions
	  o The feasibility, costs, and benefits of recycling or reusing the mineral resource, if applicable
	• Students evaluate the given design solutions, including:
	  o The relative strengths of the given design solutions, based on associated economic, environmental, and geopolitical costs, risks, and benefits
	  o The reliability and validity of the evidence used to evaluate the design solutions
	  o Constraints, including cost, safety, reliability, aesthetics, cultural effects, and environmental effects
	• Students use logical arguments based on their evaluation of the design solutions, costs and benefits, empirical evidence, and scientific ideas to support one design over the other(s) in their evaluation
	• Students describe that a decision on the “best” solution may change over time as engineers and scientist work to increase the benefits of design solutions while decreasing costs and risks	

Question Accuracy
Project Rubrics
	OTHER EVIDENCE:
	
	Optional
	• Project
	  ○ Energy Speed Dating
	  ○ Solar House Project
	• Labs
	  ○ Energy Conversions Lab
	  ○ Household Energy Usage Lab
	  ○ Cookie Mining Lab
	  ○ Virtual Mining Lab
	• Unit Test
	  ○ Mineral Resources and Energy Test
		Differentiation Considerations: