


What is the best renewable energy source for your community?

Short Performance Assessment: HS-ESS3-2

Grade Level: **High School**

Adapted from [SNAP](#)¹

Title	What is the most beneficial energy source for your community?		
Designed by	Sean Ellison and Heidi Lux	Course(s)	NY Earth Science
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Performance Expectation	<p>HS-ESS3-2: Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.</p> <p>Clarification Statement: 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.</p> <p>Assessment Boundary: none</p>
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Science and Engineering Practice	<p>Engaging in Argument from Evidence</p> <ul style="list-style-type: none">Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g., economic, societal, environmental, ethical considerations).
Disciplinary Core Ideas	<p>ESS3.A: Natural Resources</p> <ul style="list-style-type: none">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. <p>ETS1.B: Developing Possible Solutions</p> <ul style="list-style-type: none">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. (secondary)
Crosscutting Concept	

Student Performance	<ol style="list-style-type: none">Supporting claimsIdentifying scientific evidenceEvaluation and critiqueReasoning/synthesis
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¹ The Short Performance Assessment (SPA) and the Assessment Rubric adapted from the Stanford NGSS Assessment Project <http://snapgse.stanford.edu/>



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Name _____

Your task:

As CO₂ emissions continue to rise, many communities have made it a goal to reduce the amount of carbon dioxide released by burning fossil fuels for energy production. If your community were to build a renewable power source to reduce the emission of CO₂ which method would be the most beneficial for the overall cost? You need to evaluate the costs and benefits of using a renewable method of power generation exclusively, and then pitch it to your town board for approval. To make these claims, you will need to choose a method of energy generation from the many that we have talked about (natural gas, nuclear, coal, wind, solar, geothermal, etc.), collect information, analyze the costs and benefits, and then make your proposal.

	
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Energy and your community

The cost of powering your home and community is not always measured in the total dollars it takes to run an energy source. Other costs such as land usage, environmental impacts, and potential hazards to nearby communities also need to be considered when providing power for our modern civilization. With that in mind, is there one renewable source of power that would be a better choice for our community than another? What would be the cost if your community were to switch to one exclusive power source? Examine the information below to help you reach a conclusion about the benefit of one energy source versus continuing with the sources currently in use.

What does energy use look like in your community now?

Visit <https://www.epa.gov/energy/power-profiler#/NYUP> and take a look at the source of current energy for your region, and the US as a whole. Summarize the data in the table below.

Energy Source in Upstate New York	
Energy type	Percentage



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This table is from UK's Parliamentary Office of Science and Technology illustrates GHG emissions from electricity production.

Wind Power

A single commercial wind turbine can generate 500,000 kWh per month and costs about 3.5 million US dollars. These large structures are 300 feet tall and require about 50 acres of clearance for each turbine produced. Unfortunately they can be responsible for harming migratory birds due to impact with the blades.

Solar or Photovoltaic (PV) Power

Many communities are now developing solar farms that can provide energy for the entire town rather than individual home owners building panels on their homes. A typical solar farm will generate about 300,000 to 450,000 kWh per month at a cost of 1 million US dollars and take up 2.5 acres of land. Annual cleaning of the panels will run about 30,000 US dollars per year.

Biomass

In biomass power plants, wood waste or other biological material is burned to produce steam that runs a turbine to make electricity, or that provides heat to industries and homes. The cost of a biomass plant depends on the amount of energy needed by your community.

1. How much energy do you need for your community? Use this link and your zip code to figure out how many housing units are in your community. Multiply this by 1000 (kw*h) to come up with your monthly energy generation needs. https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml



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2. Our societies have significant energy needs to function, and a widening variety of ways to generate that energy. Using the information above and this link (<https://energyeducation.ca/encyclopedia/Fuel>) contrast 2 different methods of energy production. Use the table below to organize your results.

method	Cost Operation	Feasibility of Reuse	Environmental impact	Carbon Footprint

3. Using the table you created for each of the power generation solutions,
- Describe the trade-offs specific to each method
 - Identify the solution that has the overall most favorable cost-benefit ratio
4. Compare your two chosen design solutions, based on
- direct(\$) and indirect(environmental) and geopolitical (?) costs as well as risks and benefits.
 - how solid the evidence is on these costs and benefits
 - constraints- how feasible will these methods be? Consider cost, safety, reliability, aesthetics, cultural and environmental effects



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5. Reflect on your comparison from #3, and make an argument for one method of energy generation for your community. Make a logical argument to support your choice, acknowledging that as scientists and engineers continue to advance design the benefits of certain methods of energy generation will increase while costs and risks should decrease.



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Assessment Rubric* - Question 1

	Emerging	Developing	Approaching Proficiency	Excelling
Description of performance				
Sample student responses				

Assessment Rubric* - Question 2

	Emerging	Developing	Approaching Proficiency	Excelling
Description of performance				
Sample student responses				

Insert additional Assessment Rubrics (if needed) here.



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