

Power Your School Worksheet **Example Answers**

Answers will vary, depending on the location of your school.
The EXAMPLE answers below are based on a middle school in Boulder, CO.

LEARNING OBJECTIVE:

Students use energy data from the Renewable Energy Living Lab to calculate the potential energy for solar and wind energy at their school. They use this data to write a recommendation as to what type of energy generation the school should pursue.

ENGAGE:

Your school has received a grant from the Department of Energy to help offset power costs by funding the placement of either solar panels on your school roof or wind turbines on school grounds. Working as an engineer, your task is to analyze data about the potential amount of solar and wind energy available at your school location. Then, you will write a recommendation for which option (solar panels or wind turbines) your school should build, using your data analysis for support.

EXPLORE:

1. Go to the Renewable Energy Living Lab at <http://www.teachengineering.org/livinglabs/index.php>.
2. Enter the Renewable Energy Living Lab and choose age group K -12.
3. Zoom in on your state. Find your school!
4. Check the boxes under the Resources folder (located on the left under the Data Layers tab) to switch between the maps depicting the potential for the five different forms of renewable hydropower, biomass, geothermal, wind and solar. Use the icons in the lower left corner to read more information about each form of energy.

EXPLAIN:

Part 1: Data Analysis

In order to make a decision, first analyze the potential for solar and wind energy at your school. Use the Renewable Energy Living Lab to figure out how much solar potential and wind potential exists at your school location. Follow the steps below to get started!

1. Describe the amount of solar energy that is received by your school. (Be detailed. Include the numerical data [that is, 5.0 kWh/m²/day]).
Based on the Renewable Energy Living Lab map, my school receives a potential for approximately 5.5 kWh/m²/day of photovoltaic solar power. Based on the legend scale and the entire U.S. map, this is a relatively high potential for generating photovoltaic solar power.
2. Describe the amount of wind energy received by your school. (Be detailed. Include both relative descriptions [that is, class type] and the numerical data [that is, 5.0 m/s]).
Based on the Renewable Energy Living Lab map, my school can be classified as a Class 2 potential for wind power. This corresponds to a potential range of 5.0 - 6.5 m/s (~200-300 W/m²) in electrical output from wind power. Please note this is a very broad estimate (legend shows range of 0.5 -7.0

m/s. I chose a range in between that range that would be easy to determine the wind power density from). This is relatively low, based on the legend scale, although relatively typical for the country as a whole.

ELABORATE:

- Using the numerical data from questions 1 and 2, calculate the amount of solar and wind energy the school could possibly generate in one year, based on the following conditions:
 - Your school roof has a surface area of approximately 4,300 square meters; 50% of that space is useable space.
 - Your school football field can hold approximately four wind turbines safely. Each wind turbine has an area of approximately 1,000 m².
 - Your units should be in kilowatt hours/year. (Remember, 1000 W = 1 kW)

Calculations:

Solar:

Solar energy per year: 5.5 kWh/m²/day x 365 days/year = 2000 kWh/m²/year

Useable space: 4300 m² x 0.5 = 2150 m²

Potential solar energy generated in a year: 2000 kWh/m²/year x 2150 m² = **4,300,000 kWh/year**

Wind:

Note: After looking at the Table 1-1, the wind power density chosen was 250 W/m². Again this is only an estimate (finding wind data is harder to determine than solar, thus expect a wider range of values)

Wind energy per year: 250 W/m² x 24 hours/day x 365 days/year = 2,190,000 Wh/m²/year =
2200 kWh/m²/year

Useable space: 4 x 1,000 m² = 4,000 m²

Potential wind energy generated in a year: 2200 kWh/m²/year x 4,000 m² = **8,800,000 kWh/year**

My school would generate 4,300,000 kWh/year of solar energy.

My school would generate 8,800,000 kWh/year of wind energy.

EVALUATE:

Part 2: Writing a Recommendation

Now that you have analyzed the data, write your recommendation to explain whether your school should place solar panels on its roof or wind turbines on its grounds. Include the following in your recommendation:

- Option selected (solar panels or wind turbines).
- Explanation for your renewable energy source selection, based on data.
- Recommendation for where the option should be located.

I would recommend that my school place wind turbines on its grounds. We have room for four wind turbines, and together, they can potentially produce approximately double the amount of energy compared to solar panels, based on the amount of useable space available at our school. Since all four

wind turbines are necessary to produce this much energy, they could be placed on the school football field, where there is enough room for all four.