LESSON MAKER PRO

Alabama Energy Choices

Use quantities to weigh energy benefits and risks.

HIGH SCHOOL · ES.6.b

ES.6.b "Construct an argument based on data about the risks and benefits of using renewable and nonrenewable energy sources in Alabama."

NAME _____ DATE _____

COMPARE EQUAL AMOUNTS

Compare energy sources using the same amount of electricity. Subtract to find a difference, or divide to find how many times greater one quantity is. Use the result to support a claim, and include a trade-off when the data show one. All data on this page are simplified Alabama planning estimates, not measured statewide totals.

WORKED EXAMPLE

For the same 200 kWh of electricity, which source has lower emissions, by how much, and what trade-off do the available hours show?

PLANNING ESTIMATES FOR ONE DAY

Source	Emissions for 200 kWh	Hours available
Natural gas	86 kg CO2e	19
Solar	9 kg CO2e	7

1. 86 - 9 = 77 kg CO2e.
2. 19 - 7 = 12 hours.
3. Solar has lower emissions, but natural gas is available for more hours in this estimate.

Answer: Solar produces 77 kg less CO2e for 200 kWh; natural gas is available for 12 more hours.

PRACTICE 6 problems

1 For the same amount of electricity, which source has lower emissions, and by how much?

EMISSIONS ESTIMATES

Source	kg CO2e per 1,000 kWh
Natural gas	360
Hydropower	30

ANSWER _____

2 How many times as much CO2e does coal produce as solar for the same electricity?

EMISSIONS ESTIMATES

Source	kg CO2e per 1,000 kWh
Coal	900
Solar	45

ANSWER _____

3 A school estimates the daily electricity each source could supply. Over 4 days at these rates, which source supplies more electricity, and by how much?

DAILY SUPPLY ESTIMATES

Source	kWh per day
Solar	90
Gas generator	150

ANSWER _____

4 Which source has the lower estimated operating cost for 1,000 kWh, and what is the difference?

OPERATING COST ESTIMATES

Source	Cost per 1,000 kWh
Coal	$72
Solar	$48

ANSWER _____

5 On this estimated day, how many times as many hours is natural gas available as wind? State one benefit the data suggest.

AVAILABLE HOURS ON ONE DAY

Source	Hours available
Natural gas	18
Wind	9

ANSWER _____

6 If a building needs 3,000 kWh, how much less CO2e would solar produce than natural gas?

EMISSIONS ESTIMATES

Source	kg CO2e per 1,000 kWh
Solar	40
Natural gas	440

ANSWER _____

APPLY IT Show your work

1 An Alabama high school plans to supply 4,000 kWh for electric-vehicle charging. Compare the estimated emissions if it uses all solar electricity instead of all natural gas electricity. How much CO2e would it avoid? State one reason the school might still plan for gas power on the day shown.

CHARGING PLAN ESTIMATES

Source	kg CO2e per 1,000 kWh	Hours available that day
Solar	50	6
Natural gas	450	18

ANSWER _____

2 An Alabama school's football game needs 2,000 kWh. Compare the estimated operating cost of all solar electricity with all natural gas electricity. How much would the lower-cost choice save? Name one availability trade-off.

GAME-DAY ESTIMATES

Source	Cost per 1,000 kWh	Hours available that day
Solar	$70	5
Natural gas	$110	20

ANSWER _____

CHALLENGE One step up

An Alabama community center needs 4,000 kWh. Plan A uses 4,000 kWh of natural gas. Plan B uses 2,000 kWh of natural gas and 2,000 kWh of solar. Calculate each plan's total emissions and operating cost. Which plan would you recommend? Support your choice with the emissions and cost differences.

COMMUNITY CENTER PLANNING ESTIMATES

Source	kg CO2e per 1,000 kWh	Cost per 1,000 kWh
Natural gas	500	$100
Solar	25	$150

WORK SPACE AND ANSWER

Alabama Energy Choices

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For the same amount of electricity, which source has lower emissions, and by how much?	**Hydropower has lower emissions by 330 kg CO2e per 1,000 kWh.**
2	How many times as much CO2e does coal produce as solar for the same electricity?	**Coal produces 20 times as much CO2e as solar.**
3	A school estimates the daily electricity each source could supply. Over 4 days at these rates, which source supplies more electricity, and by how much?	**The gas generator supplies 240 kWh more over 4 days.**
4	Which source has the lower estimated operating cost for 1,000 kWh, and what is the difference?	**Solar costs $24 less per 1,000 kWh to operate.**
5	On this estimated day, how many times as many hours is natural gas available as wind? State one benefit the data suggest.	**Natural gas is available for 2 times as many hours; it could supply electricity during more hours that day.**
6	If a building needs 3,000 kWh, how much less CO2e would solar produce than natural gas?	**Solar would produce 1,200 kg less CO2e.**

PART 2 · APPLY IT

1. **Using solar would avoid 1,600 kg CO2e. Gas could provide power during more hours on the estimated day.** The emissions difference is 450 - 50 = 400 kg per 1,000 kWh, so 4 × 400 = 1,600 kg. Gas is available for 18 hours compared with 6 hours for solar.
2. **Solar would save $80 in operating costs, but natural gas is available for 15 more hours that day.** The cost difference is $110 - $70 = $40 per 1,000 kWh, so the savings for 2,000 kWh are 2 × $40 = $80. The availability difference is 20 - 5 = 15 hours.

CHALLENGE

Plan A produces 2,000 kg CO2e and costs $400. Plan B produces 1,050 kg CO2e and costs $500. A student could recommend Plan B because it produces 950 kg less CO2e for an additional $100, or recommend Plan A because it costs $100 less while acknowledging its 950 kg higher emissions.

Accept equivalent wording and any challenge recommendation that accurately uses both differences. Emissions comparisons apply to the electricity quantities stated, not to Alabama's total energy use.