# Power Choices

Use evidence to weigh electricity sources.

**PS.3.f** "Analyze and interpret data concerning the advantages and disadvantages of the energy sources used to produce electricity."

NAME _____ DATE _____

## 1 READ AND MARK

Read it twice

**YOUR JOB** Underline two advantages and circle two disadvantages in the passage. Number two values in the table that support a trade-off you notice.

### Choosing Power for a Town

1 A town plans to add one megawatt (MW) of generating capacity. The table compares four possible sources. Annual output estimates assume typical local sunlight and wind, a gas plant that runs part of the time, and a nuclear plant that runs nearly all year. Life-cycle emissions include building equipment and obtaining fuel, not just what leaves a power plant.

**ESTIMATED RESULTS FOR ONE MW OF GENERATING CAPACITY**

| Source | Annual output (MWh) | Life-cycle emissions (g $CO_2$e/kWh) |
|---|---|---|
| Natural gas | 5,000 | 490 |
| Solar | 1,800 | 45 |
| Wind | 3,000 | 11 |
| Nuclear | 8,500 | 12 |

2 Electricity demand rises on hot evenings, when air conditioners run. Gas plants can adjust output to meet changing demand, but burning gas releases carbon dioxide. Solar panels need daylight, and wind turbines need moving air; neither burns fuel while generating electricity. Batteries can shift some electricity to later hours, but building storage adds costs and uses materials.

3 A nuclear plant usually provides steady electricity, but it cannot be built quickly. Its spent fuel must be isolated and managed for a long time. No source is free of environmental impacts: construction uses materials, and fuel extraction or land use can affect places. The table gives estimates, not guarantees; weather, plant schedules, and local conditions may change the numbers.

## 2 ANSWER WITH EVIDENCE

Use the passage

1. How much more electricity does wind produce than solar in a year, according to the table? How do their life-cycle emissions compare?

2. A hospital needs electricity at night. What is one advantage and one disadvantage of natural gas compared with solar for this need?

3. Which has both greater estimated annual output and lower life-cycle emissions, nuclear or natural gas? Give one disadvantage of that source.

4. Which source has the lowest life-cycle emissions in the table? Why could it not meet every rise in demand by itself?

## 3 YOUR TURN

Your own words

Design a two-source electricity mix for a town seeking dependable nighttime power and low life-cycle emissions. Use at least two numerical comparisons from the table to justify your choices, then explain one limitation of your mix.

# Power Choices



## PART 1 · READ AND MARK

Underline two advantages and circle two disadvantages in the passage. Number two values in the table that support a trade-off you notice. Accept any marking that follows this job and points at the right text.

## PART 2 · ANSWERS

| # | QUESTION | ANSWER |
|---|---|---|
| 1 | How much more electricity does wind produce than solar in a year, according to the table? How do their life-cycle emissions compare? | **Wind produces 1,200 MWh more per year. Its life-cycle emissions are lower, 11 versus 45 g $CO_2$e/kWh.** |
| 2 | A hospital needs electricity at night. What is one advantage and one disadvantage of natural gas compared with solar for this need? | **A gas plant can adjust its output at night, while solar panels need daylight. Gas has higher life-cycle emissions than solar, 490 versus 45 g $CO_2$e/kWh.** |
| 3 | Which has both greater estimated annual output and lower life-cycle emissions, nuclear or natural gas? Give one disadvantage of that source. | **Nuclear has greater output, 8,500 versus 5,000 MWh, and lower emissions, 12 versus 490 g $CO_2$e/kWh. It takes years to build, and its spent fuel requires long-term management.** |
| 4 | Which source has the lowest life-cycle emissions in the table? Why could it not meet every rise in demand by itself? | **Wind has the lowest emissions at 11 g $CO_2$e/kWh. Its output depends on moving air, so it cannot always increase when demand rises.** |

## PART 3 · YOUR TURN (SAMPLE ANSWER)

I would combine nuclear and wind power. Nuclear produces about 8,500 MWh per year for each MW of capacity, compared with wind's 3,000 MWh, so it can provide steady electricity at night. Wind has life-cycle emissions of 11 g $CO_2$e/kWh, slightly below nuclear's 12 g $CO_2$e/kWh. Wind output varies, and nuclear construction takes years, so this mix would require careful planning.

Accept any two-source mix that addresses nighttime supply and emissions with two accurate numerical comparisons. The limitation must apply to a source the student selected.