Heat After Sunset

Use energy data to evaluate a solar water heater.

E.8.10 "Students will demonstrate an understanding that a decrease in natural resources is directly related to the increase in human population on Earth and must be conserved..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline two links between people's demand and fuel use or pollution, circle one benefit and one limit of solar heating, and number the steps that move and store solar heat.

Hot Water at Harbor School

1 At Harbor School, more students mean more warm water for handwashing and kitchen cleanup. If many schools grow, demand for natural gas can rise. Natural gas formed over millions of years, but people use it much faster than it forms. Burning it releases carbon dioxide, which contributes to rising average temperatures. Conserving energy helps limit fuel use.

2 The school tests a roof-mounted solar water heater. Sunlight warms fluid in a dark collector; a pump moves the heat to an insulated water tank. The tank stores heat for evening use. On each test day, the school needed 24 kilowatt-hours (kWh) of heat for hot water. The table shows how that demand was met.

SAMPLE DAILY HOT-WATER MEASUREMENTS AT HARBOR SCHOOL

Day	Heat needed (kWh)	Solar heat used (kWh)	Gas heat needed (kWh)
Clear	24	18	6
Partly cloudy	24	12	12
Cloudy	24	8	16

3 Solar heat lowers gas use, but it does not provide the same amount every day. A gas heater supplies the rest when sunlight is weak. Installing collectors and a tank costs money, and making equipment uses materials. Still, lower fuel use can reduce pollution over time. Engineers can test insulation to keep stored heat from escaping.

2 ANSWER WITH EVIDENCE

Use the passage

1. Compare the gas heat needed on the clear and cloudy days. What explains the difference?

2. How can this system reduce demand for a nonrenewable resource as the school grows? Use one number from the table.

3. A student says the school can remove its gas heater now. Evaluate this claim using the passage and table.

4. Which part of the system makes solar heat available after sunset? What could engineers test to conserve more of that heat?

3 YOUR TURN

Your own words

Propose one change to the school's water-heating system that could further reduce natural gas use. In 4 to 5 sentences, explain how it would work, use one number from the table to support your proposal, and describe one cost or limitation.

ANSWER KEY

Heat After Sunset

GRADE 8 · E.8.10

PART 1 · READ AND MARK

Underline two links between people's demand and fuel use or pollution, circle one benefit and one limit of solar heating, and number the steps that move and store solar heat. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Compare the gas heat needed on the clear and cloudy days. What explains the difference?	**The school needed 6 kWh of gas heat on the clear day and 16 kWh on the cloudy day. Less solar heat was available on the cloudy day, so gas supplied more of the same 24 kWh demand.**
2	How can this system reduce demand for a nonrenewable resource as the school grows? Use one number from the table.	**Solar heat replaces some heat from natural gas. For example, it supplied 18 kWh of the school's 24 kWh demand on the clear day.**
3	A student says the school can remove its gas heater now. Evaluate this claim using the passage and table.	**The data do not support removing it. Sunlight varies, and the gas heater supplied 16 kWh of heat on the cloudy day.**
4	Which part of the system makes solar heat available after sunset? What could engineers test to conserve more of that heat?	**The insulated water tank stores heat for evening use. Engineers could test better tank insulation to reduce heat loss.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would add more insulation around the storage tank so less captured heat escapes before evening. On the cloudy test day, the school still needed 16 kWh of gas heat, so keeping more stored heat could help reduce that amount. Engineers could compare gas use before and after the change on days with similar weather. Extra insulation costs money and cannot replace sunlight on a very dark day.

Accept other workable changes if the student explains how they could reduce gas use, cites a table value accurately, and identifies a realistic cost or limitation. Do not assume the table shows how much heat was lost from the tank.