



LESSON 1

Electric Rates

In this lesson, students convert measurement units to find the number of solar panels needed to generate enough energy for a home.

INSTRUCTIONAL FOCUS

- Solve multi-step word problems involving all four operations.
- Use ratio and rate reasoning to solve real-world and mathematical problems.
- Use ratio reasoning to convert measurement units.
- Use proportional relationships to solve multi-step ratio and percent problems.

LANGUAGE SUPPORT

MATH TERMS

kilowatt

unit of electrical power that is equal to 1000 watts

kilowatt-hour

unit of energy that is equal to 1 kilowatt used per hour

ACADEMIC LANGUAGE

sustainable housing

environmentally responsible homes that use resources efficiently

SET UP

Introduce Chapter 2 from *Math Meets Homebuilding*.

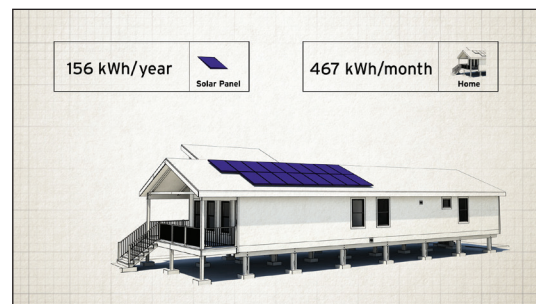
Ask questions to review the video with students.

For example: **What types of careers are there in construction?** (architect, urban planner, plumber, bricklayer, electrician) **How do people working in careers in homebuilding use math?** (Architects use geometry to design blueprints; Builders measure construction materials to ensure they fit the dimensions of the homes.)

Review the definition of *sustainable housing*.

Today, we'll find the number of solar panels needed to make enough energy for a sustainable home.

▶ Play Chapter 2: Electric Rates.



[Pause at 01:49.]

PLAN

Create a plan to solve the problem.

The projected amount of energy the home will use is 467 kilowatt-hours (kWh) per month. The projected amount of energy that each solar panel will produce is 156 kWh per year. How many solar panels does the home need to generate all its energy from sunlight?

Read the problem aloud to students.

Guide students to analyze the quantities and look for entry points to solve the problem.

For example: **What is the problem asking us to find?** (the number of solar panels needed to generate all the home's energy)

What information are we given? (the monthly energy needs of the home and the annual solar panel energy production)

Point out to students that they can convert the rates into the same unit.

Can we simply divide 467 by 156 to get our answer? (No, because the numbers have different units of time.)



LESSON

1

Electric Rates, *continued*

MATHEMATICAL THINKING

Make Use of Structure

Students apply the structure of rates to convert the quantities into measurements of the same unit.

Use Repeated Reasoning

Students reason about ratios to convert between rates per month and rates per year.

SOLVE

Have student pairs solve the problem as you circulate.

Encourage students to come up with multiple strategies and represent the problem situation in different ways. Guide students to work backwards to check their work.

SUPPORT

Ask questions based on common errors to support student understanding.

- *How can we convert a rate per month to a rate per year?*
- *How can we convert a rate per year to a rate per month?*
- *How do you know whether to multiply or divide when converting between units?*

EXTEND

Ask questions to encourage students to extend their thinking.

- *What are some of the drawbacks of a home only using solar energy to be sustainable?*
- *Why might homes in California benefit more from solar panels than homes in New York?*

SHARE

Have students present their solutions.

Ask students from each pair to explain their solutions to the class. Show at least two different approaches to solving the problem and one incorrect solution. To extend classroom discussion, call on students to explain the reasoning of the student who is presenting.

Possible student work:

Home: $467 \text{ kWh/mo} \times 12 = 5604 \text{ kWh/yr}$

Panels: $5604 \text{ kWh/yr} \div 156 \text{ kWh/yr} \approx 35.9$

So, the home needs 36 solar panels.



Play the Chapter 2 Solution from Math Meets Homebuilding.

Have students complete the Practice and Reflect sections on Student Page 2.

HOMEWORK IDEAS

Have students explore solar energy!

Students determine if a solar panel can power an appliance.

- *Name an appliance (e.g., a TV) you use frequently. How many hours do you use it per day? Per week?*
- *How much energy does it use?*
- *Is one solar panel enough to power it for one year?*

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1

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MATH TERMS

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The projected amount of energy the home will use is 467 kilowatt-hours (kWh) per month. The projected amount of energy that each solar panel will produce is 156 kWh per year. How many solar panels does the home need to generate all its energy from sunlight?

PLAN

Create a plan to solve the problem with your partner.

SOLVE

Use your plan to solve the problem.

LESSON

1

Electric Rates, *continued*

PRACTICE

Apply your skills to solve another problem.

Maria wants to invest in a solar panel system that costs \$15,000. She pays \$0.11 per kWh to her electric company. The solar panels will help Maria reduce her energy consumption by 620 kWh per month. How long will it take Maria to break even on her purchase?

REFLECT

Explain how you made sense of the math.

How did you begin solving the problem?

I began solving the problem by _____

Why is it important to convert the units?

It is important to convert units because _____

SCORE 0 1 2 3