

Providing energy education to students in the communities we serve.
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Consumers Energy's *Cost of Electricity* Lesson Supports the Michigan Grade Level Content Expectations and Common Core State Standards

Sixth

SCIENCE

Inquiry Analysis and Communication

- S.IA.06.12 Evaluate data, claims, and personal knowledge through collaborative science discourse.
- S.IA.06.13 Communicate and defend findings of observations and investigations using evidence.

Inquiry Process

- S.IP.06.15 Construct charts and graphs from data and observations

Reflection and Social Implications

- S.RS.06.11 Evaluate the strengths and weaknesses of claims, arguments, and data

MATHEMATICS

Number Sense

- 6.NS.2 Fluently divide multi-digit numbers using the standard algorithm
- 6.NS.3 Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation

ENGLISH LANGUAGE ARTS

Speaking and Listening

Presentation of Knowledge and Ideas

- SL.6.4 Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.
- SL.6.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See grade 6 Language standards 1 and 3 for specific expectations.)

Language

Conventions of Standard English

- L.6.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

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Seventh

SCIENCE

Inquiry Analysis and Communication

- S.IA.07.13 Communicate and defend findings of observations and investigations using evidence.

Reflection and Social Implications

- S.RS.07.11 Evaluate the strengths and weaknesses of claims, arguments, and data
- S.RS.07.13 Identify the need for making scientific decisions

MATHEMATICS

Number Sense

- 7.NS.2 Apply and extend previous understanding of multiplication and division and of fractions to multiply and divide rational numbers.
- 7.NS.2C Apply properties of operations as strategies to multiply and divide rational numbers

ENGLISH LANGUAGE ARTS

Speaking and Listening

Presentation of Knowledge and Ideas

- SL.7.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.
- SL.7.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See grade 7 Language standards 1 and 3 here for specific expectations.)

Language

Conventions of Standard English

- L.7.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

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Eighth

SCIENCE

Scientific Reflection & Social Implications

- E2.2B Identify differences in the origin and use of renewable (e.g., solar, wind, water, biomass) and nonrenewable (e.g., fossil fuels, nuclear) sources of energy.
- E2.4A Describe renewable and nonrenewable sources of energy for human consumption (electricity fuels), compare their effects on the environment, and include overall cost and benefits.

MATH

Number System

- 8.NS.1 Understand informally that every number has a decimal expansion

ENGLISH LANGUAGE ARTS

Speaking and Listening

Presentation of Knowledge and Ideas

- SL.8.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.
- SL.8.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See grade 8 Language standards 1 and 3 here for specific expectations.)

Language

Conventions of Standard English

- L.8.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

Grades 6-12 Literacy in History/Social Studies, Science, & Technical Subjects

Grade Bands 6th–8th, 9th–10th, & 11th–12th

English Language Arts Standards Science & Technical Subjects

Key Ideas and Details

- RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Integration of Knowledge and Ideas

- RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
- RST.9-10.9 Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.
- RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Research to Build and Present Knowledge

- WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
- WHST.9-10.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
- WHST.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

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Lesson Outcome

The student will calculate the energy costs of common household appliances and examine ways to promote energy efficiency.

Rationale / Purpose for Lesson

Energy plays an important role in our everyday life. However, we often use electronics or appliances without considering the electric costs of running such devices. After understanding how much energy particular appliances require to operate, students can compare the energy use to that of more energy efficient appliances. Using energy wisely not only helps reduce energy bills but also helps conserve the limited supply of resources used to make energy.

Resources / Materials Required

- A small electrical appliance such as a microwave, toaster, or hair dryer (if desired)
- “Home Energy Use Practice Sheet” worksheet (below)
- Copies of “My Home’s Energy Use” handout (below)

Anticipatory Set

- Prepare to use an electrical appliance to complete a task. Examples include microwaving a bag of popcorn, toasting a piece of bread, or using a hair dryer to blow-dry a wet spot on a cotton shirt. (The teacher would have these available in class to use)
- Describe what appliance you will be using to the class. Ask the students to generate a list of all of the materials needed to complete the task; make sure that “energy” is included in the list.
- Have students consider how much the energy to complete the task needed will cost.

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Procedures

- Ask the students what information would be needed in order to determine the cost of energy used. (Answer: the amount of time the appliance is used, wattage of appliance, and the cost per Kilowatt-hour used)
- Explain that electrical consumption is stated in Kilowatt-hours. Most electrical devices list power consumption in watts. Kilowatt (kW), Kilowatt-hour (kWh), Ampere & Volt.
 - Kilowatt (kW) - One thousand watts, where a watt is a unit of electrical power calculated as the rate of energy transfer equivalent to one ampere flowing under a pressure of one volt.
 - Kilowatt-hour (kWh) - The standard measure of electricity usage measured as one kilowatt of power supplied to, or taken from, an electric circuit steadily for one hour.
 - Ampere – The basic unit of electric current adapted under the Systeme International Unit (SI)
 - Volt – The unit of electromotive force, the volt measures how much pressure there is in an electric current. The higher the voltage, the more electrical current will flow in the circuit.
- Have a student examine the appliance and locate its power consumption information in watts.
- As a class, use the “Home Energy Use Practice Sheet” to determine the costs of some common household appliances.
- Check results with the students and discuss the comparisons among the energy costs for each activity.

Closure

Ask students to generate ideas of how to reduce the cost of energy. Introduce the idea of energy efficient appliances. Review the [More than 100 Ways to Save On Your Energy](#) online brochure and discuss ways to save on energy bills. Also have the students share their calculations with their parent/guardian and have them sign the homework page.

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Homework

Have students complete the “My Home’s Energy Use” worksheet below, using the formula from the “Home Energy Use Practice Sheet.” (NOTE: Some students may have trouble locating the wattage information on the appliances in their home. It may help to suggest they visit the [U.S. Department of Energy’s website](#) to find a list of common home appliances and the wattage range for each.)

Extensions

- Have students research and present their findings on energy efficient appliances, using resources such as the [Energy Star website](#).
- Compare the energy use and cost between incandescent light bulbs and compact fluorescent light bulbs.
- Have students conduct a home energy audit with their parents using the Consumers Energy Home Analyzer tool on our [kids energy website](#).

Home Energy Use Practice Sheet

Appliance	Power (Watts)	Time Used (hours)	Electricity Consumed (kWh)	Energy Price (\$ per kWh)	Daily Cost (\$)	Weekly Cost (\$)	Annual Cost (\$)	Notes
Example: Television	130	4	$=(130)(4)/1000=0.52$	\$0.10	$0.52 \times 0.10 = \$0.052$	$0.052 \times 7 \text{ days} = \0.364	$0.364 \times 52 \text{ wks} = \18.93	Plasma screen televisions cost 4 times more.
Computer (not asleep)	220	24		\$0.10				Even having your computer in sleep mode costs money. Try turning it off altogether.
Computer (asleep)	6	24		\$0.10				
Lamp (incandescent)	60	2		\$0.10				Compare this to the cost of switching to a compact fluorescent bulb (avg. 13 watts).
Clock Radio	5	24		\$0.10				
Cell phone Charger	3	8		\$0.10				Only 5% of power drawn from a cellphone charger is actually used to charge the phone. The rest is wasted by leaving it plugged in.
MP3 Player Charger	4	8		\$0.10				
Electric Blanket	200	8		\$0.10				
Curling Iron	150	0.5		\$0.10				
Hair Dryer	1200	0.083		\$0.10				
Aquarium	700	24		\$0.10				
DVD Player	20	2		\$0.10				

Name: _____

Date: _____

My Home's Energy Use

This activity will have you locate as many electrical appliances in your home or school as you can find and ask you to consider how much it costs to run all of these in the course of a year.

1. Locate all appliances used in your home, identify the watts used by each appliance and use the following calculation to estimate how much it costs to run all of these annually. The wattage of most appliances stamped on the bottom or back of the appliance, or on its nameplate. Fill in the table below with this information. Then, add up the annual cost for each item to get a total annual cost. If you have trouble finding the wattage for any of your appliances, visit www.eere.energy.gov to see a list of average wattages for a host of appliances.

Calculation:

$$\left(\frac{\text{Watts}}{\text{Avg daily use (hrs)}} \times \text{use (hrs)} \right) / \frac{1,000}{\text{kWh}} = \text{_____ kW (Electricity used to run this appliance)}$$

Then,

$$\frac{\text{_____ kW}}{\text{Cost of electricity per kW}} \times \frac{.10}{\text{Cost of electricity per kW}} = \$ \text{_____ Daily cost}$$

Then,

$$\frac{\text{_____ Daily Cost}}{\text{Days in a year}} \times \frac{365}{\text{Days in a year}} = \$ \text{_____ Annual cost}$$

2. After you calculate the energy costs for your appliances, *list at least two ways* for each appliance that you could reduce your energy bill.

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Appliance	Watts	Annual Cost	Ways to Reduce Cost
			1. 2.

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Appliance	Watts	Annual Cost	Ways to Reduce Cost
			1. 2.

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