

ENERGY USE AND DELIVERY – LESSON PLAN 3.6

Energy at Home

This lesson is designed for 3rd – 5th grade students in a variety of school settings (public, private, STEM schools, and home schools) in the seven states served by local power companies and the Tennessee Valley Authority. Community groups (Scouts, 4-H, after school programs, and others) are encouraged to use it as well. This is one lesson from a three-part series designed to give students an age-appropriate, informed view of energy. As their understanding of energy grows, it will enable them to make informed decisions as good citizens or civic leaders.

This lesson plan is suitable for all types of educational settings. Each lesson can be adapted to meet a variety of class sizes, student skill levels, and time requirements.

| Setting | Lesson Plan Selections Recommended for Use |
|--|---|
| Smaller class size, higher student ability, and/or longer class length | <ul style="list-style-type: none"> The “Modeling” Section contains teaching content. While in class, students can do “Guided Practice,” complete the “Recommended Item(s)” and any additional guided practice items the teacher might select from “Other Resources.” NOTE: Some lesson plans do and some do not contain “Other Resources.” At home or on their own in class, students can do “Independent Practice,” complete the “Recommended Item(s)” and any additional independent practice items the teacher selects from “Other Resources” (if provided in the plan). |
| Average class size, student ability, and class length | <ul style="list-style-type: none"> The “Modeling” Section contains teaching content. While in class, students complete “Recommended Item(s)” from “Guided Practice” section. At home or on their own in class, students complete “Recommended Item(s)” from “Independent Practice” section. |
| Larger class size, lower student ability, and/or shorter class length | <ul style="list-style-type: none"> The “Modeling” Section contains teaching content. At home or on their own in class, students complete “Recommended Item(s)” from “Independent Practice” section. |

Electrical Safety Reminder: Teachers should remind students that electricity is dangerous and that an adult should be present when any recommended activities or worksheets are being completed at home. Always obey instructions on warning labels and ensure one has dry hands when touching electronics or appliances.

Performance Objectives

By the end of this lesson, students will be able to:

- Read and answer real world questions about an electric bill.
- Plot points to create a line graph representing monthly electric charges.
- Interpret a line graph depicting monthly electric charges.

Public School System Teaching Standards Covered

Common Core Mathematics

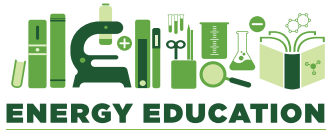
- CCSS.MATH.CONTENT.3.MD.B.3
- CCSS.MATH.CONTENT.3.OA.D.8
- CCSS.MATH.CONTENT.3.OA.A.3
- CCSS.MATH.CONTENT.4.MD.A.1
- CCSS.MATH.CONTENT.4.MD.B.4
- CCSS.MATH.CONTENT.4.OA.A.3
- CCSS.MATH.CONTENT.5.MD.A.1
- CCSS.MATH.CONTENT.5.MD.B.2
- CCSS.MATH.CONTENT.5.OA.A.2

Common Core Language Arts/Reading

- CCSS.ELA-LITERACY.RI.3.1
- CCSS.ELA-LITERACY.RI.3.3
- CCSS.ELA-LITERACY.RI.3.7
- CCSS.ELA-LITERACY.RI.3.5
- CCSS.ELA-LITERACY.RI.4.3
- CCSS.ELA-LITERACY.RI.4.5 (if students do the “book report” on the electric bill)
- CCSS.ELA-LITERACY.RI.4.7
- CCSS.ELA-LITERACY.RI.5.3
- CCSS.ELA-LITERACY.RI.5.7

State Science Standards

- GA S3CS1.1.b
- GA S3CS2.a
- GA S3CS4.b
- GA S4CS1.c
- GA S4CS2.a,b, and c
- GA S5CS1.c
- GA S5CS2.a,b, and c
- GA S5CS4.b and c
- TN Science GLE0307.Inq.3
- TN Science GLE0407.Inq.3
- TN Science GLE0507.Inq.3
- KY.3-ESS3-1
- KY.3-ESS2-1
- AL.4-PS-1
- VA Science Goal 3
- VA Science Goal 4
- VA Science Goal 6
- VA 3.1.h, j, and m
- VA 4.1.a,e,i, k, and m
- VA 5.1.g, l, and k
- MS 3.1.d and e
- MS 4.1.d and e
- MS 5.1.b, d, e, g, and h



I. Anticipatory Set (Attention Grabber)

? Essential Question

What does an electric bill tell us about the use of energy in a home?

II. Modeling (Concepts to Teach)

Electric Bills

- Here is an example of an electric bill. (Teachers, if possible show a bill from the local power company. However, if a local bill is not available, view this Nashville Electric Service (NES) bill):
<http://www.nespower.com/PayMyBill/understandmybill2.aspx> (this example includes an explanation for each part of the bill—simply click on each section and read about it).
- If using the NES bill example, teachers read and review the Usage History Graph and ask math questions related to it, such as:
 - Which month had the highest amount of kilowatt-hours (kWh) used? Why might that be?
 - Which summer months were probably the hottest?
 - What was the amount of electricity (kilowatt-hour – kWh) used in January? What is a possible reason for the family using that much in that month?
 - How much more electricity did this family use last month than this month?

(Note to educator: Weather has a lot to do with the amount of kWh required to keep your home comfortable. As a general rule, people use more air conditioning during summer months and that means more kWh. If the home has electric heat instead of gas, more kWh might be used in the winter.)

III. Checking for Understanding

Teachers can ask students these questions to determine understanding of concepts

| | |
|-------------------|---|
| REMEMBER | What is shown in an electric bill? (Class discussion) |
| UNDERSTAND | Why is the information in an electric bill important? (Class discussion) |
| APPLY | Looking at an electric bill, what unit of measurement is used to show how much electricity is used each month? (Class discussion) Answer: Electricity in the home is measured in kilowatt-hours (kWh) consumed on a monthly basis. |
| ANALYZE | Compare and contrast what months of the year may have high vs. low energy use and discuss why. (Teachers write the months of the year and seasons on the board. Together, teachers and students identify and label possible high and low energy use months and discuss why. Teacher explains that each home uses energy differently and energy use is significantly affected by weather). |
| EVALUATE | What can you and your family do with the usage history information (13 months of energy use) in the electric bill? (Class discussion) |

IV. Guided Practice Ideas

Recommended Item

- **Math Activity** (see below)

Other Resources

Practice that uses math/reading standards:

- **Math Activity:** Calculate how much electricity you, your family, and your class use in a day.
<http://teachcoal.org/energy-and-you/wp-content/uploads/2012/11/LessonPlan-HowMuchElectricity.pdf>
- Go to your utility's website and download the last twelve month usage; determine how much each kilowatt-hour used costs (total bill divided by the total number of kilowatt-hours) and explain why each month's kWh usage was different.

V. Independent Practice Ideas

Recommended Items

Personal Practice Worksheets and Answer Keys provided (see below)

Parent or Guardian Interview: Interview Guide provided. (see below)

Other Resources

Personal Practice – Worksheets and Answer Keys provided

- Read an Electric Bill Worksheet and Answer Key provided
- Graphing Monthly Electric Bills Worksheet and Answer Key provided
- Identify ways that a family can reduce energy use in each month and rank those efforts in priority of most effective in reducing the use to least effective in reducing the use. (Student writes these on a piece of paper.)

Practice That May Involve Parents or Guardians

- **At-home Scavenger Hunt:** Students find five things in their home that run on electricity and contribute to the electric bill. List them on a piece of paper. (Ex. Lamp, air conditioner, hair dryer, etc.).
- **Parent or Guardian Interview:** Teachers ask students to interview their parents/guardians on the use of electricity in their home. Interview Guide provided.
- **In-home audit:** Students go online to www.energyrightsolutions.com. Click on “Solutions for the Home” then “Energy Saving Tools” in the header bar and listen to the Online Energy Audit video. After listening, student should click on “Do it Yourself Energy Evaluation” and take the online energy audit using his / her home and his / her home’s energy usage. Student can print off results of the audit, discuss the results with his/her family or guardian, and list actions his/her family has committed to take based on audit results.

Option

- Write a “Book Report” on your family’s electric bill. Teachers instruct students to write a book report on their family’s electric bill. It can include characters, setting, main idea, author, etc.

VI. Assessment

These items provide a check for understanding so teachers can easily determine whether concepts need to be reinforced. These items can be graded, if grades are desired.

- Read an Electric Bill Worksheet and Answer Key provided
- Graphing Monthly Electric Bills Worksheet and Answer Key provided



VII. Materials Needed

The following materials are needed for the “Recommended Items” in Guided Practice & Independent Practice sections.

- Optional: calculators

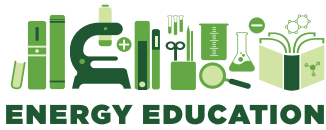
VIII. Closing the Lesson

In addition to the Essential Question shown below, teachers can reference the Performance Objectives at the top of the Lesson Plan.

Essential Question

What does an electric bill tell us about the use of energy in a home?

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WORKSHEET FOR ENERGY AT HOME LESSON 3.6

NAME: _____

Read an Electric Bill

Objective: Students will be able to read and answer real world questions about an electric bill.

ELECTRICITY USAGE

| METER NUMBER | BILLING PERIOD | | ELAPSED TIME | CURRENT METER READING | PREVIOUS METER READING | KILOWATT HOURS USED |
|--------------|----------------|--------------|--------------|-----------------------|------------------------|---------------------|
| | FROM | TO | | | | |
| 658954 | Dec. 13 2012 | Feb. 11 2013 | 2.0 months | (37322 Actual | - (36370 Actual) | = 952 |

CURRENT CHARGES AND CREDITS

ENERGY \$98.87
 CUSTOMER CHARGE 6.92

| | |
|------------------------|-----------------|
| AMOUNT DUE > | \$105.79 |
|------------------------|-----------------|

Due Date **March 5, 2013**

If Paid After Due Date Balance Due: \$110.73

Energy Management Information

| Reading Date | Elapsed Time (Days) | kWh Used | Average Daily kWh | Total kWh Cost (\$) |
|----------------|---------------------|----------|-------------------|---------------------|
| Feb 11, 2013 | 60 | 952 | 16.1 | 98.87 |
| Dec 13, 2012 | 57 | 987 | 15.7 | 94.37 |
| Oct 17, 2012 | 62 | 1165 | 18.8 | 116.30 |
| Aug 16, 2012 | 61 | 997 | 16.1 | 102.55 |
| Jun 15, 2012 | 65 | 1307 | 20.7 | 127.91 |
| April 11, 2012 | 55 | 1271 | 21.9 | 124.97 |
| Feb 15, 2012 | 67 | 1311 | 19.6 | 128.24 |
| Dec 9, 2011 | 56 | 858 | 15.3 | 91.18 |

Note to Student:
 Electricity used in your home is measured in kilowatt hours.
 Kilowatt-hour is abbreviated as kWh.

- Approximately how many months did this billing period cover? _____
- How was the number of kWh determined? _____
- What was the amount of kWh used in this billing period? _____
- What is the total amount of the bill? \$ _____
- What is the cost per kWh in Feb? (hint: Cost/kWh Used) _____
- How do you think the amount of the bill was determined?



WORKSHEET FOR ENERGY AT HOME LESSON 3.6

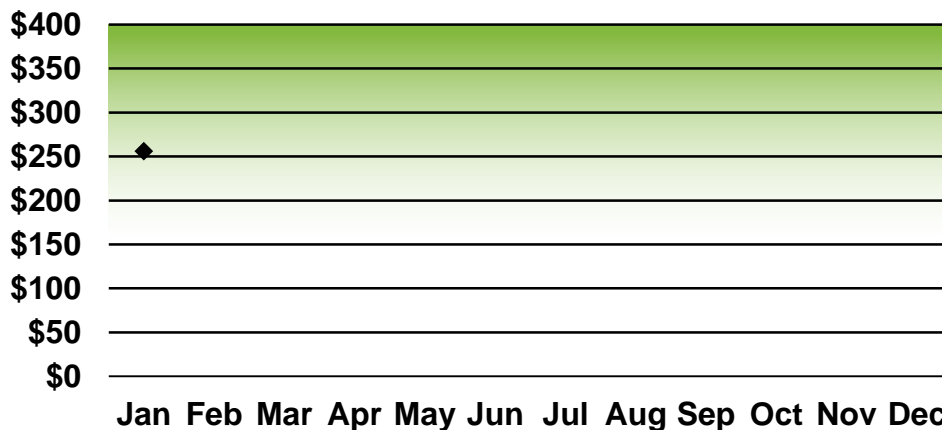
NAME: _____

Graph Monthly Electric Bills

Objective: Students will demonstrate how to plot points to create a line graph representing monthly electric charges.

Monthly Electric Bill Graph (\$)

Instructions:
Plot the monthly electric bill amount on the graph based on the chart below. Then, connect the points.



Monthly Bill

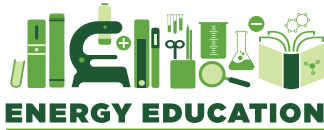
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| \$256 | \$202 | \$169 | \$154 | \$158 | \$280 | \$389 | \$354 | \$273 | \$158 | \$206 | \$272 |

1. What is the *highest* bill? In what month does it occur?

2. What is the *lowest* bill? In what month does it occur?

3. List two ways to conserve energy in the *summer* months.

4. List two ways to conserve energy in the *winter* months.



Interview Guide

Instructions: Students interview parents or guardians on their use of electricity in the home.

1. What are some things we do in our family to use electricity more efficiently?

2. Do we ever waste electricity by accident?

3. Can we improve our energy efficiency? How?

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Answer Keys

ANSWER KEY FOR WORKSHEET: READ AN ELECTRIC BILL

ELECTRICITY USAGE

| METER NUMBER | BILLING PERIOD | | ELAPSED TIME | CURRENT METER READING | PREVIOUS METER READING | KILOWATT HOURS USED |
|--------------|----------------|--------------|--------------|-----------------------|------------------------|---------------------|
| | FROM | TO | | | | |
| 658954 | Dec. 13 2012 | Feb. 11 2013 | 2.0 months | (37322 Actual | - (36370 Actual) | = 952 |

CURRENT CHARGES AND CREDITS

ENERGY \$98.87
 CUSTOMER CHARGE 6.92

| | |
|---------------------|-----------------|
| AMOUNT DUE ▶ | \$105.79 |
|---------------------|-----------------|

Due Date March 5, 2013

If Paid After Due Date Balance Due: \$110.73

Energy Management Information

| Reading Date | Elapsed Time (Days) | kWh Used | Average Daily kWh | Total kWh Cost (\$) |
|----------------|---------------------|----------|-------------------|---------------------|
| Feb 11, 2013 | 60 | 952 | 16.1 | 98.87 |
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| Jun 15, 2012 | 65 | 1307 | 20.7 | 127.91 |
| April 11, 2012 | 55 | 1271 | 21.9 | 124.97 |
| Feb 15, 2012 | 67 | 1311 | 19.6 | 128.24 |
| Dec 9, 2011 | 56 | 858 | 15.3 | 91.18 |

1. Approximately how many months did this billing period cover? 2 months
2. How was the number of kWh determined? Current meter reading minus previous meter reading
3. What was the amount of kWh used in this billing period? 952
4. What is the total amount of the bill? \$ 105.79
5. What is the cost per kWh in Feb? (hint: Cost/kWh Used) (98.87 / 952 = 0.103)
6. How do you think the amount of the bill was determined? Energy cost + Customer Charge

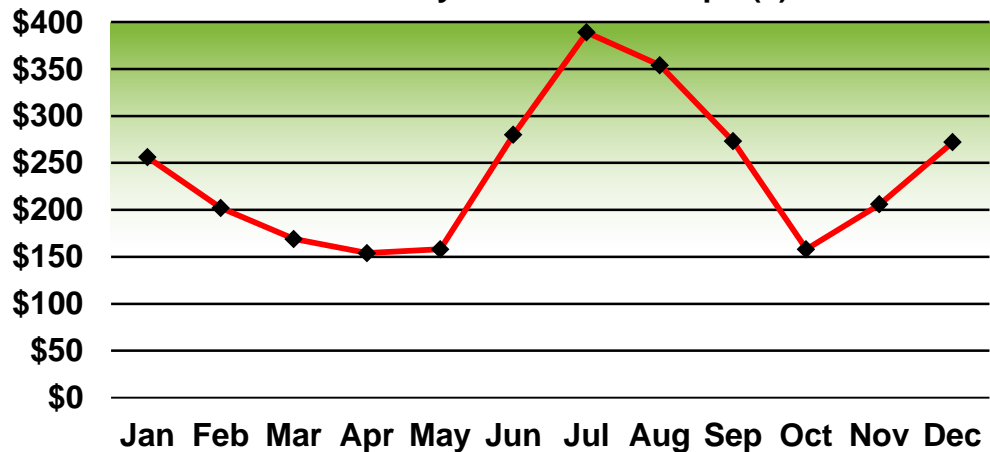
ANSWER KEY FOR GRAPHING MONTHLY ELECTRIC BILLS

Graph Monthly Electric Bills

Objective: Students will demonstrate how to plot points to create a line graph representing monthly electric charges.

Monthly Electric Bill Graph (\$)

Instructions:
Plot the monthly electric bill amount on the graph based on the chart below. Then, connect the points.



Monthly Bill

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| \$256 | \$202 | \$169 | \$154 | \$158 | \$280 | \$389 | \$354 | \$273 | \$158 | \$206 | \$272 |

1. What is the *highest* bill? In what month does it occur?

\$389, July

2. What is the *lowest* bill? In what month does it occur?

\$154, April

3. List two ways to conserve energy in the *summer* months.

Ex. Turn down A/C during the day when no one is home, plant a tree! Shade trees can help keep a home cooler in the summer

4. List two ways to conserve energy in the *winter* months.

Ex. Turn down heat during the day when no one is home, use area rugs on hardwood floors to keep feet warm