Summary: Students examine a school electric bill and interpret a story to identify energy users and analyze peak demand.

Demanding School Electric Bills

Grade Level: 9-12 (5-8)

Subject Areas:
English (Research and Inquiry), Family and Consumer Science, Mathematics, Science, Social Studies (Geography)

Setting: Classroom

Time:
Preparation: 2 hours
Activity: two 50-minute periods

Vocabulary:
Customer charge, Degree days, Demand (customer maximum 15-minute), Demand (maximum monthly 15-minute), Demand (maximum on-peak 15-minute), Electricity service, Energy charge, Kilowatt, Kilowatt-hour, Meter multiplier, Non-taxable fixed charge, Off-peak energy, On-peak energy, Rate, Rate (seasonal)

Major Concept Areas:
- Consumption of energy resources
- Quality of life
- Management of energy resource use

Academic Standards:
English: F.12.1
FCS: C.3
Math: A.12.2, E.12.1
Science: A.12.5, C.12.2
SS: A.12.9

Objectives

By the end of this activity, students will be able to
- identify key parts of a school's electric bill;
- list energy users in their school, categorizing them as small, medium, or large energy users; and
- explain the concept of demand and how it affects a school's electricity bill.

Rationale

Recognizing and interpreting electricity use patterns by reading school electric bills makes students aware of how people use energy at school and can lead students to develop sound strategies for managing energy use in the school building.

Materials

- Residential utility bill
- Copies of the following:
  - ***Example School Electric Bill***
  - ***Example School Electric Bill Questions***
  - ***Energy Users Cards (laminated - complete set found on accompanying CD)***
  - ***Energy Users Cards Overview***
  - ***Back to School Story Chart (blank)***
  - ***Back to School Story***
- Tape (optional)

Background

See ***A Guide to Reading the Example School Electric Bill*** for definitions of electricity energy units and for a detailed description of billing information.

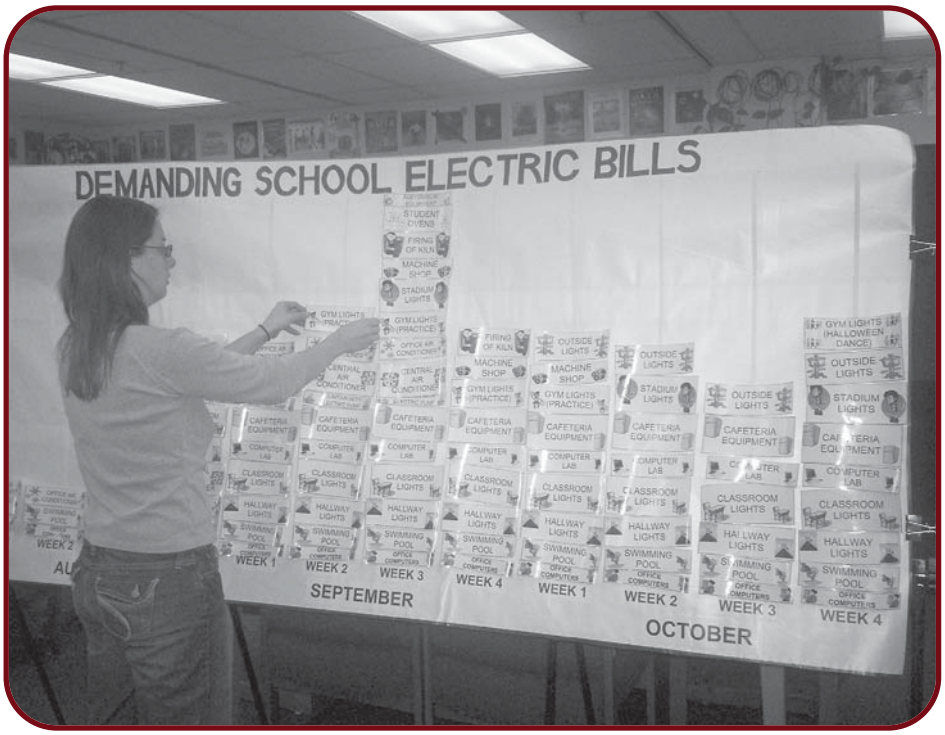
Each month, your school receives utility bills. Students, teachers, and most of the school staff may not know how much the monthly electric bill for the school is, but the budget officer, principal, and the facilities manager are most likely very aware of the amount spent on utilities. Utility bills are often the largest part of a schools budget next to payroll and benefits for employees.

Billing information may be reported differently by different utilities; there is no standard format. There are a few differences between school electric bills and residential electric bills. For one, schools and other businesses have added demand charges that residences do not have. This means that they are charged for the amount of electricity they may use, based on past consumption, in addition to their actual electricity consumption. The utility companies charge the demand so that they can be ready to supply the maximum power requested if needed.

There are three general types of charges on a school electric bill: demand charges, energy charges, and fixed charges. The rate is the cost of electricity per unit of energy (dollars or cents per kilowatt-hour).
- There are two types of demand charges on school electric bills:
  - Customer, sometimes also called Rachet, demand charges reflect the highest 15 minute usage period from the previous calendar year. The kilowatts (kWs) used in those 15 minutes is multiplied by a set rate and added to each monthly bill.
  - The on-peak demand charges reflect the highest 15 minute usage period from the current month being billed. The date and time of peak consumption should appear on your school's electric bill. If it is not stated, contact the utility company to find out when the peak times occurred. The kWs used in that peak 15 minutes is multiplied by a much higher rate and added to your bill. Therefore, if your highest 15 minute usage period from this month was really high, you may pay more in demand charges for electricity you didn't use than actual energy charges for electricity that you did use.
- Energy charges are charges for electricity that your school actually used. There are on-peak and off-peak charges. Generally

Tips for Hanging Cards

- Cut 12 pieces of tape 36 inches long. Stick ends to the wall 8 inches apart so sticky side is facing out. Have students stick laminated ***Energy Users Cards*** to the strips of tape when it is their turn.
- For a durable activity 'board' that can be reused, prepare a piece of fabric or large laminated piece of paper (44" X 92") with the title, months, and weeks clearly labeled, see photo below. Cut 12 pieces of sticky-back Velcro 36 inches long. (Cost $aver Tip: cut strips of Velcro in half the long way before cutting three foot sections). Peel and stick the soft side of the pieces in strips 8 inches apart to the prepared surface and cut the rough side into smaller pieces. Attach the rough sided pieces to the center of the back of laminated ***Energy Users Cards***. Students can simply attach the ***Energy Users Cards*** to the appropriate strip of Velcro when it is their turn.



Getting Ready:

Cut out the ***Energy Users Cards (including months and weeks)***, complete set found on the accompanying CD, and laminate them if you plan to re-use them in the future. Group like energy users together; there should be seventeen energy user groups in all.

Prepare a space on the wall or chalkboard to post ***Energy Users Cards*** for the activity, see ***Tips for Hanging Cards***. The three months (August, September, and October) and the four weeks for each month should be written/posted below the vertical strips of tape or Velcro before the activity begins, see photo below.

NOTE: The ***Example School Electric Bill*** is also located on the KEEP Web site on the *NR 734: School Building Energy Efficiency Education support page*. Other useful information can be found on the support page that may be used as a reference in preparing for this activity.

speaking, on-peak charges are incurred Monday through Friday, 9 AM to 9 PM which reflect the period of high demand from the utility company. Off-peak charges are usually incurred Monday through Friday, 9 PM to 9 AM, holidays, and weekends, which reflect the period of low demand from the utility company. There is also a change of rates depending on the season. Utilities use significantly higher rates during the summer months, usually from June 1st to September 30th, to determine a customers demand and on-peak energy charges. Off-peak energy rates usually remain the same year-round.

- Fixed charges include a variety of charges that vary from one utility company to the next. Some examples of fixed charges include: a facilities or customer charge which covers a portion of the costs for gas and electric meters, lines or pipes that connect you to the delivery system, meter reading, billing, and record keeping. In Wisconsin, there is a non-taxable fixed charge that is a fee paid to the State of Wisconsin and used to promote efficient electricity use and provide assistance to low-income customers. Fuel cost adjustment charges and transmission surcharges are sometimes itemized on the utility bill, but may also be included in the facilities or customer charge. See Glossary for complete definitions.

Other important information you may find on a school electric bill includes:

- on-peak and off-peak rates
- meter reading dates
- bill payment due dates
- the customer's account number
- heating degree days
- dates and times of peak consumption
- messages from the utility company

While both homes and schools are charged based on their electricity consumption, schools and other businesses get charged for demand as well. Understanding the concept of demand can help schools manage their energy usage.

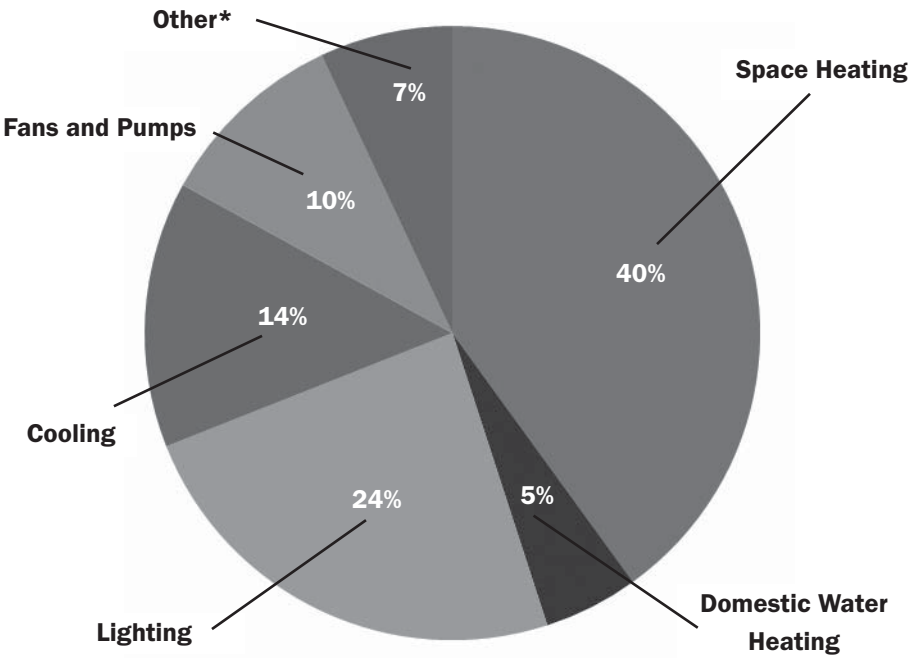
Procedure

Orientation

Show students a residential utility bill and ask if they have seen their parents or guardian receive these. Discuss what the bill is for, making sure they understand it is based on how much energy is used and a rate charged for the amount. If students are unfamiliar with the concepts of rates, provide examples of prices per unit of measure that students may be familiar with (e.g., price per pound for produce or the price per gallon of gasoline). Have students suggest other costs or prices that are expressed as rates. Tell students the electric rate their utility charges home owners.

Do students think their school receives an energy bill? Inform them that the school does indeed receive a bill. Ask students how much they think their school pays for electricity each month. Do they think schools pay a lot for this energy resource? What are typical energy users found in a school?

Energy Use in School Buildings in Western Wisconsin



*Other includes computers, copy machines, water fountains, kitchen equipment, etc.
Source: Focus on Energy Schools and Local Government Program, 2008 Disaggregated School Building Energy Consumption Study in the CESA 10 and CESA 11 areas of western Wisconsin.

Steps

1. Hand out the ***Example School Electric Bill*** and ***Example School Electric Bill Questions***. Discuss the different parts of a school electric bill and ask students to answer the questions. The concept of demand may be abstract to some students. For further explanation, see ***Examples of Demand***.

2. Review the different energy users commonly found in a school building listed on the ***Energy Users Cards Overview.***

3. Pass out ***Energy Users Cards***. Each student should get one set of energy users; some sets have more cards than others. If there are less than seventeen students in your class, some students may receive more than one set of energy users cards. If there are more than seventeen students, you can divide some of the larger energy users sets (like the ***Pool, Office Computers, Classroom Lighting,*** and ***Hallway Lighting***) among them.

4. Hand out copies of the ***Back to School Story Chart (blank)*** for students who would like to fill in their own chart as you read the story. NOTE: The first row (office computers) has been filled in. You may also pass out copies of the ***Back to School Story*** to students who would like to read along.

5. Read the ***Back to School Story***, which is an example of 12 weeks of energy use at a school. Instruct students to listen for their energy user noted on their cards and come to the front of the room and tape up their energy user when the story indicates that it is being used. See ***Tips for Hanging Cards*** in the **Getting Ready** section for ideas on how to adhere the cards to the wall or chalkboard. There should be several different energy users listed for each week and some energy users will be listed for several weeks. Use the ***Back to School Story Chart (complete)*** to make sure students are putting up the correct energy users.

6. After the story is complete, ask students to share general observations about the "chart" made by the ***Energy Users Cards***. Use ***Interpreting the Back to School Story (Questions & Suggested Answers)*** to evaluate the chart further.

Examples of Demand

Examples of "demand" can be found all around us. Stores are stocked with extra supplies so they can be ready if more than one customer is in need of the same item. If the store didn't have extra supplies on hand, some customers would not be satisfied and the "demand" would not be met. Automotive insurance is another example of "demand." Although you may not ever file a claim, you still pay an insurance premium each month. The insurance company needs resources (e.g., money) to pay for claims they do receive. If you are a good driver, you can lower your monthly premium, like lowering the "demand" because the insurance company doesn't think you will file an expensive claim. In other words, something is ready to be supplied in anticipation of the demand (be it a box of cereal or money to buy a new car if you're in an accident). Being prepared to meet a demand requires money and resources. Utilities charge a fee based on monthly peak demand to be prepared to meet their customers electricity needs (whether or not the customer needs that much electricity at any other time during the month).

Closure

Review the different charges found on a school electric bill. Discuss the importance of analyzing a bill and what to look for during analysis.

Have students identify times of the year when a school might use more energy than other times. Remind students these times are called peak demands. Challenge students to explain why decreasing energy consumption during the school's peak demand times helps reduce the amount they are charged each month on their electric bill. Have students identify ways they think their school could use less energy. Notice if they mention reductions during times of peak demand and remind them of these times if needed. Review the benefits of reducing energy consumption, especially for saving the school money!

Assessment

Formative

- Can students accurately answer ***Example School Electric Bill Questions****?*
- Can students identify common energy users found in a school building, categorize them as small, medium, or large, and explain how they can be used most efficiently?
- Can students accurately answer ***Interpreting the Back to School Story*** *Questions?*

Summative

- Ask students why it is important for schools to keep their electric bills over the

months and years instead of throwing them away.

- Discuss with students ways they can use the information from a set of electric bills to manage future electricity use.
- Are there other areas in student's lives where reducing demand would have a wider benefit?

Extensions

Explore the NR 734: School Building Energy Efficiency Education supplement page on the KEEP Web site.

Develop an energy action plan to conserve energy and save money on your school's electric bill.

Rewrite the ***Back to School Story*** to reflect your own school's energy users.

Create a play using the ***Back to School Story*** provided, or your own, to perform for other students, teachers, and staff in your school.

Example School Electric Bill

KEEP
Power Company for Tomorrow!!!

Efficient High School
123 Savings Way
Electricville, WI, 33333

Account #	Date Due	Amount Due
1234-567-8910	**10/20/2007**	**$5,650.97**

Billing Summary

Previous Balance 9/07	$4,954.39
Payment Received 9/20	$4,954.39CR
Balance As Of 10/01	**$0.00**
Current Energy Charges	$5,650.97
Total	**$5,650.97**

Monthly Energy Usage	This Year	Last Year
Average Temp (F)	65	63
Average kWh/day	2354	2488
Average cost/day	$201.82	$234.23

Current Charges for 9/02/07 to 9/30/07 (28 Days) – 247 Heating Degree Days

Meter #	**On-peak**	
00034902	Actual Reading on 9/30/07	4580
	Actual Reading on 9/02/07	4129
	Difference	**451 kWh**
	Meter Multiplier	X 80
	Total	**36,080 kWh**
Meter #	**Total**	
00034902	Actual Reading on 9/30/07	16852
	Actual Reading on 9/02/07	16028
	Difference	**824 kWh**
	Meter Multiplier	X 80
	Total	**65,920 kWh**
	Actual on-peak demand (9/12/07 @ 11:00 AM)	279.000 kW
	Billed on-peak demand	**279.000 kW**
	Customer demand (set 8/30/07 @ 10:45 AM)	**311.000 kW**

Customer charge		$100.00
Customer demand charge	311.0 kW @ $1.00000/kW	$311.00
On-peak demand charge	279.0 kW @ $7.00445/kW	$1,954.24
On-peak energy charge	36,080 kWh @ $0.05531/kWh	$1,995.58
Off-peak energy charge	29,840 kWh @ $0.03772/kWh	$1,125.56
Subtotal		**$5,486.38**
Non-taxable customer charge		$164.59
Total amount		$5,650.97

Messages

Your account is in good standing. We appreciate your efforts to conserve energy in your school and should you need any assistance in further lowering your electric bills, feel free to contact us.

Contact us:

Monday thru Friday 8:00 AM – 5:00 PM
Customer service: 1.800.111.2222, ext. 5555
In an emergency call: 1.800.111.1111

Example School Electric Bill Questions

Instructions: Answer the following questions using the ***Example School Electric Bill***

1. On what date was the on-peak electric meter most recently read?

2. What was the present reading of the on-peak electric meter for the date in Question 1?

3. On what date was the on-peak electric meter previously read?

4. What was the previous reading of the on-peak electric meter for the date in Question 3?

5. What is the meter multiplier for the on-peak electric meter?

6. How many kilowatt-hours (kWh) of electricity were used on-peak?

7. How many kilowatt-hours (kWh) of electricity were used in total?

8. How many kilowatt-hours (kWh) of electricity were used off-peak? (total kWh – on-peak kWh)

9. When was the on-peak demand set for this billing cycle (date and time)?

10. Why do you think the on-peak demand was set at this time?

11. What is the billed on-peak demand for this billing cycle?

12. Is the billed on-peak demand equal to the actual on-peak demand for this billing cycle?

13. When was the customer demand set (date and time)?

14. What is the customer demand for this billing cycle?

15. What is the customer charge for this billing cycle?

16. What is the customer demand rate?

17. What is the customer demand charge for this billing cycle?

18. What is the on-peak demand rate?

19. What is the on-peak demand charge for this billing cycle?

20. What is the on-peak energy rate?

21. What is the on-peak energy charge for this billing cycle?

22. What is the off-peak energy rate?

23. What is the off-peak energy charge for this billing cycle?

24. What is the non-taxable customer charge for this billing cycle?

25. What percent of the subtotal is the non-taxable customer charge? ((non-taxable customer charge x 100) / (subtotal))

26. What is the total amount for current energy charges?

27. By what date must the bill be paid?

28. What was Efficient High School's average energy use (kWh/day) for the same billing cycle last year?

Example School Electric Bill Key

1 KEEP
Power Company for Tomorrow!!!

Efficient High School
123 Savings Way
Electricville, WI, 33333
2

Account #	Date Due	Amount Due
1234-567-8910	**10/20/2007**	**$5,650.97**
3	4	5

Billing Summary

6 Previous Balance 9/07	$4,954.39
7 Payment Received 9/20	$4,954.39CR
Balance As Of 10/01	**$0.00**
8 Current Energy Charges	$5,650.97
Total	**$5,650.97**

Monthly Energy Usage	This Year	Last Year
Average Temp (F)	65	63 (9)
Average kWh/day	2354	2488 (10)
Average cost/day	$201.82	$234.23 (11)

Current Charges for 9/02/07 to 9/30/07 (28 Days) – 247 Heating Degree Days 12

Meter # 00034902 — **On-peak** 13

Actual Reading on 9/30/07	4580
Actual Reading on 9/02/07	4129
Difference	**451 kWh**
Meter Multiplier	X 80 (14)
Total	**36,080 kWh**

16 Meter # 00034902 — **Total** 15

Actual Reading on 9/30/07	16852
Actual Reading on 9/02/07	16028
Difference	**824 kWh**
Meter Multiplier	X 80
Total	**65,920 kWh** (17)
Actual on-peak demand (9/12/07 @ 11:00 AM)	279.000 kW (18)
Billed on-peak demand	**279.000 kW**
Customer demand (set 8/30/07 @ 10:45 PM)	**311.000 kW** (19)

Customer charge			$100.00 (20)
Customer demand charge	311.0 kW @ $1.00000/kW		$311.00 (21)
On-peak demand charge	279.0 kW @ $7.00445/kW	23	$1,954.24
On-peak energy charge	36,080 kWh @ $0.05531/kW		$1,995.58 (22)
Off-peak energy charge	29,840 kWh @ $0.03772/kW	24	$1,125.56
Subtotal			**$5,486.38**
Non-taxable customer charge			$164.59 (25)
Total amount			$5,650.97

26 **Messages**

Your account is in good standing. We appreciate your efforts to conserve energy in your school and should you need any assistance in further lowering your electric bills, feel free to contact us.

Contact us:
Monday thru Friday 8:00 AM – 5:00 PM
Customer Service: 1.800.111.2222, ext. 5555
In an Emergency call: 1.800.111.1111

A Guide to Reading the Example School Electric Bill

Introduction
Electric bills may show information and use terms and abbreviations that may be unfamiliar. The purpose of this guide is to make this information more clear.

The first part of this guide includes definitions of units of measure commonly found on electric bills. The second part describes information found on typical bills from a Wisconsin utility, like the ***Example School Electric Bill***. Be aware that bills from other utilities may look different, may report some of the information differently, or may include extra information that applies to a particular customer. If you have questions about information found on a particular bill, contact the utility that generated the bill.

Electricity Units
Kilowatt-hour (kWh)
Electrical energy is measured in kilowatt-hours. One kilowatt-hour is equal to the amount of energy produced by ten 100-watt incandescent light bulbs turned on for one hour.
Kilowatts (kW)
A kilowatt is a unit of power. Power is the rate at which energy is produced or used per unit of time (or more accurately, the rate at which energy is converted from one form to another per unit of time). For example, ten 100-watt incandescent light bulbs (one kilowatt) produce light and heat at a rate ten times faster than one 100-watt incandescent light bulb. One kilowatt also equals about one and one-third horsepower.

Reading a School Electric Bill
The numbers next to each description below correspond to the numbers shown on the ***Example School Electric Bill Key***.

Abbreviations that appear on the ***Example School Electric Bill*** are
- kW = kilowatt
- kWh = kilowatt-hour
- CR = credit
- F = Fahrenheit

1. The utility company logo.
2. The name of the customer is Efficient High School. Their address is 123 Savings Way in Electricville, WI. The utility will send their monthly bills to this address. Efficient High School is responsible for the charges found on this electric bill.
3. The customer's account number is 1234-56-78910. This is the number the utility uses to keep track of this customer. If the customer has a question about their bill, it is likely they will need to use this number when talking with the utility.
4. October 20, 2007 (10/20/07) is the date when the bill is due and must be paid.
5. The total cost of electric service is equal to $5,650.97.
6. The utility charged the customer $4,954.39 for electric service on September 7, 2007 (9/07).
7. The utility received payment of $4,954.39 on September 20, 2007 (9/20) so there is no outstanding balance on the customer's account.
8. The total cost of electric service is equal to $5,650.97.
9. The Monthly Energy Usage chart compares this month's energy use to the same month in the previous year. The customer can use this chart to see if they are consuming more or less electricity, on average, than they did at the same time last year. It is important to take into consideration the average outside air temperature when making comparisons. Your heating/cooling needs will depend on the temperature outside. This year, the average temperature was 65 degrees Fahrenheit. The previous year's average temperature was 63 degrees Fahrenheit.
10. This month, the average amount of electricity used was 2,354 kilowatt-hours per day. During the same month last year, the average amount of electricity used was 2,488 kilowatt-hours per day.
11. This month, the average cost per day for electricity was $201.82. During the same month last year, the average cost per day for electricity was $234.23. It is important to take into consideration that rates may fluctuate from year to year so a more accurate indicator of energy consumption is the average kilowatt-hours per day.
12. The customer is only charged for electricity actually used between September 2, 2007 and September 30, 2007. The number of days in that time period is 28. There were 247 heating degree days over the 28 day billing period. A heating degree day is calculated by finding the day's average temperature. To do this, add the day's high and low temperatures and divide by two. If the number is above 65, there are no heating degree days that day. If the number is less than 65, subtract it from 65 to find the number of heating degree days. For example, if the day's high temperature is 60 and the low

A Guide to Reading the Example School Electric Bill (Continued)

is 40, the average temperature is 50 degrees. Subtract the average temperature of 50 degrees from 65 to come up with a total of 15 "heating degree days" for that particular day. The heating degree days were calculated for each of the 29 days in this billing cycle, totaled, and listed on the bill.

13. The on-peak meter tracks energy use during periods of relatively high energy demand (9:00 AM – 9:00 PM Monday through Friday, excluding holidays). The on-peak electricity rates are usually higher than the off-peak rates because the utility has to be running full tilt to provide electricity to all their customers and typically has excess capacity during the off-peak hours. The on-peak meter was most recently read on September 30, 2007. Prior to that, it was read on September 2, 2007. The readings were 4,580 kWh and 4,129 kWh, respectively.
14. The meter multiplier is the number that meter readings are multiplied by to convert the readings to kilowatt-hours (kWh). The meter multiplier is set by the utility based on the electricity that the customer is expected to use. A customer that uses a lot of electricity may have a meter with a larger meter multiplier so the meter does not spin at such a fast speed to wear out the meter prematurely. A residential meter may have a meter multiplier of 1.0, therefore, the meter reading is the actual kWh consumed. In this case, the difference between the meter readings for Efficient High School was 451 kWh and is multiplied by the meter multiplier (80) to calculate the on-peak kilowatt-hours used by the customer (36,080 kWh).
15. The Total meter tracks all of the electricity used by the customer. In this case, the Total meter was most recently read on September 30, 2007. Prior to that, it was read on September 2, 2007. The readings were 16,852 kWh and 16,028 kWh respectively. The difference of 824 kWh is multiplied by the meter multiplier (80) to calculate the total kilowatt-hours used by the customer (65,920 kWh).
16. The meter number is 0003492. The same meter is used to read the on-peak and total electricity used.
17. On-peak demand is determined by evaluating the customer's energy use during on-peak times of the current billing cycle. The highest average kilowatt-hour consumption over any 15 minute interval during the on-peak times will set the on-peak demand. In this case, the actual on-peak demand of 279.0 kW was set on September 12, 2007 (9/12/07) at 11:00 AM.
18. In some instances, the billed on-peak demand differs from the actual on-peak demand. For more information, research power factors. If your power factor is lower than 80%, you should contact your utility company.
19. Like the on-peak demand, the customer demand is determined by evaluating the customer's energy use. However, the customer's energy use is evaluated for the previous calendar year. The highest average kilowatt-hour consumption over any 15 minute interval throughout the year will set the customer demand. In this case, the customer demand of 311.0 kW was set on August 30, 2007 (8/30/07) at 10:45 AM.
20. The customer charge for electric service for schools is often determined by the size of service, or demand, required by the school. Many utilities have a breakpoint of 200 kW where a customer requiring less than that will have a significantly lower customer charge.
21. The customer demand charge is what the customer pays to ensure that the utility company will be able to provide electricity during their highest demand throughout the year. In this case, 311.0 kW at a rate of $1.00000 per kW equals $311.00.
22. The on-peak demand charge is what the customer pays to ensure that the utility company will be able to provide electricity during their highest demand during peak times through out the month. In this case, 279.0 kW at a rate of $7.00445 per kW equals $1,954.24.
23. The on-peak energy charge is what the customer pays for actual energy consumed during peak times throughout the month. In this case, 36,080 kWh at a rate of $0.05531 per kWh equals $1,995.58.
24. The off-peak energy rate ($0.03772 per kWh) is usually less than the on-peak energy rate ($0.05531 per kWh) because the demand of electricity from the utility is not as high during off-peak hours. The off-peak energy used is determined by subtracting the on-peak energy use from the total energy use (65,920 kWh – 36,080 kWh = 29,840 kWh). To determine the off-peak energy

A Guide to Reading the Example School Electric Bill (Continued)

charge, 29,840 kWh at a rate of $0.03772 per kWh equals $1,125.56.

25. The non-taxable customer charge is a fee that all utilities in Wisconsin collect to help fund the Public Benefits Program, Focus on Energy (focusonenergy.com). Focus on Energy works with eligible Wisconsin residents and businesses to install cost effective energy efficiency and renewable energy projects. In this case, the fee is three percent of the subtotal ($5,486.38 X 0.03 equals $164.59).

26. Any messages that the utility wants to convey to its customers will be found in this area.

Answers to Example School Electric Bill Questions

1. The on-peak electric meter was most recently read on September 30, 2007 (9/30/07).
2. The present reading of the on-peak electric meter for the date in Question 1 was 4580 kW.
3. The on-peak electric meter was previously read on September 2, 2007 (9/02/07).
4. The previous reading of the on-peak electric meter for the date in Question 3 was 4129 kW.
5. The meter multiplier for the on-peak electric meter is 80.
6. 36,080 kilowatt-hours (kWh) of electricity were used on-peak.
7. 65,920 kilowatt-hours (kWh) of electricity were used in total.
8. 29,840 kilowatt-hours (kWh) of electricity were used off-peak. (65,920 total kWh – 36,080 on-peak kWh)
9. The on-peak demand was set at 11:00 AM on September 12, 2007 (9/12/07) for this billing cycle.
10. It is likely that the on-peak demand was set at 11:00 AM because the kitchen appliances were being used to prepare hot lunches. Often times using the ovens, heated food storage units, and electric hot water boosters for the dish–washers will set the on-peak demand for a school. Teachers and students were probably using computers at 11:00 AM and classroom and hallway lights were on as well. Note: the customer demand is often set when the air conditioning is running because it requires a lot of energy to cool a school building. In this case, August 30, 2007, must have been a warm day, requiring air conditioning, since that is when the customer demand was set.
11. The billed on-peak demand for this billing cycle is 279.000 kW.
12. Yes, the billed on-peak demand is equal to the actual on-peak demand for this billing cycle.
13. The customer demand was set at 10:45 AM on August 30, 2007 (8/30/07).
14. The customer demand for this billing cycle is 311.000 kW.
15. The customer charge for this billing cycle is $100.00.
16. The customer demand rate is $1.00000/ kilowatt (kW).
17. The customer demand charge for this billing cycle is $311.00.
18. The on-peak demand rate is $7.00445/ kilowatt (kW).
19. The on-peak demand charge for this billing cycle is $1,954.24.
20. The on-peak energy rate is $0.05531/ kilowatt-hour (kWh).
21. The on-peak energy charge for this billing cycle is $1,995.58.
22. The off-peak energy rate is $0.03772/kilowatt-hour (kWh).
23. The off-peak energy charge for this billing cycle is $1,125.56.
24. The non-taxable customer charge for this billing cycle is $164.59.
25. The non-taxable customer charge is three percent of the subtotal (($164.59 x 100) / ($5,486.38) = 3 %).
26. The total amount for current energy charges is $5,650.97.
27. The bill must be paid by October 20, 2007 (10/20/07).
28. Efficient High School's average energy use (kWh/day) for the same billing cycle last year was 2,488 kWh/day.

Energy Users Cards Overview

Energy User – Number of cards
Audio/Visual Equipment – 1
Cafeteria Equipment – 9
Central Air Conditioner – 5
Classroom Lights – 10
Computer Lab – 9
Firing of Kiln – 2
Fountain with Electric Pump – 4
Gym Lights (Cheerleader) – 4
Gym Lights (Halloween Dance) – 1
Hallway Lights – 10
Machine Shop – 3
Office Air Conditioner – 9
Office Computers – 12
Outside Lights – 4
Stadium Lights – 3
Student Ovens – 1
Swimming Pool – 12

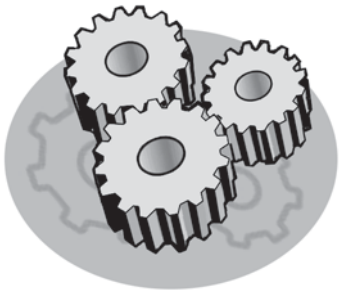
Small Energy Users (< 1500 W)
- Audio/Visual Equipment
- Fountain with Electric Pump
- Office Computers
- Gym Lights (Halloween Dance)

Medium Energy Users (1501 W – 9000 W)
- Computer Lab
- Machine Shop
- Office Air Conditioner
- Swimming Pool

Large Energy Users (9001 W – 25,000 W)
- Firing of Kiln
- Gym Lights (Cheerleader)
- Hallway Lights
- Outside Lights
- Student Ovens

Extra Large Energy Users (> 25,001 W)
- Cafeteria Equipment
- Central Air Conditioner
- Classroom Lights
- Stadium Lights

KILN



MACHINE SHOP

OFFICE COMPUTERS

FOUNTAIN W/ELECTRIC PUMP

A/V EQUIPMENT

GYM LIGHTS HALLOWEEN DANCE

HALLWAY LIGHTS

OUTSIDE LIGHTS

OFFICE AIR CONDITIONER

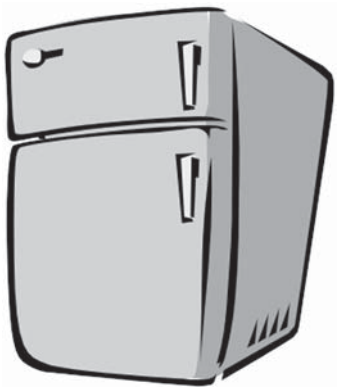
COMPUTER LAB

STADIUM LIGHTS

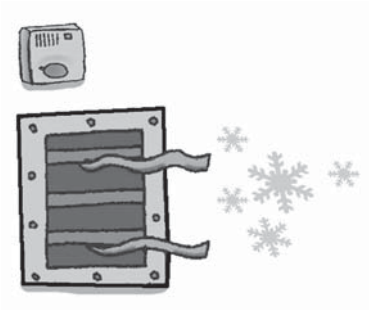
SWIMMING POOL

GYM LIGHTS

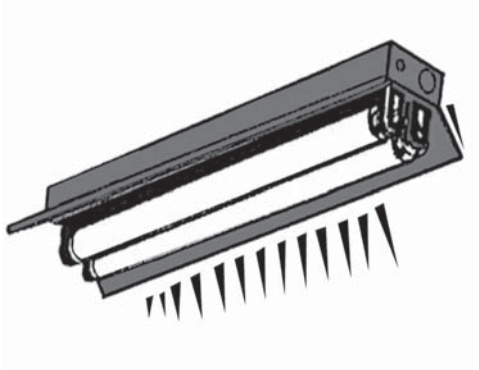
STUDENT OVENS



CAFETERIA EQUIPMENT



CENTRAL AIR CONDITIONING



CLASSROOM LIGHTS

Back to School Story Chart (blank)

office computers	office computers	office computers	office computers	office computers	office computers	office computers	office computers	office computers	office computers	office computers	office computers
WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 1	WEEK 2	WEEK 3	WEEK 4
AUGUST				SEPTEMBER				OCTOBER			

Back to School Story Chart (complete)

						Audio/Visual Equipment					
						Student Ovens					
						Firing of Kiln					
						Machine Shop					
						Stadium Lights					
					Gym Lights (practice)	Gym Lights (practice)					
			Cafeteria Equipment	Office Air Conditioner	Office Air Conditioner	Office Air Conditioner	Firing of Kiln	Outside Lights			Gym Lights (dance)
			Computer Lab	Central Air Conditioner	Central Air Conditioner	Central Air Conditioner	Machine Shop	Machine Shop	Outside Lights		Outside Lights
			Fountain w/ Elec. Pump	Fountain w/ Elec. Pump	Fountain w/ Elec. Pump	Fountain w/ Elec. Pump	Gym Lights (practice)	Gym Lights (practice)	Stadium Lights	Outside Lights	Stadium Lights
		Classroom Lights	Classroom Lights	Cafeteria Equipment	Cafeteria Equipment	Cafeteria Equipment	Cafeteria Equipment	Cafeteria Equipment	Cafeteria Equipment	Cafeteria Equipment	Cafeteria Equipment
		Hallway Lights	Hallway Lights	Computer Lab	Computer Lab	Computer Lab	Computer Lab	Computer Lab	Computer Lab	Computer Lab	Computer Lab
		Central Air Conditioner	Central Air Conditioner	Classroom Lights	Classroom Lights	Classroom Lights	Classroom Lights	Classroom Lights	Classroom Lights	Classroom Lights	Classroom Lights
Office Air Conditioner	Office Air Conditioner	Office Air Conditioner	Office Air Conditioner	Hallway Lights	Hallway Lights	Hallway Lights	Hallway Lights	Hallway Lights	Hallway Lights	Hallway Lights	Hallway Lights
Swimming Pool	Swimming Pool	Swimming Pool	Swimming Pool	Swimming Pool	Swimming Pool	Swimming Pool	Swimming Pool	Swimming Pool	Swimming Pool	Swimming Pool	Swimming Pool
Office Computers	Office Computers	Office Computers	Office Computers	Office Computers	Office Computers	Office Computers	Office Computers	Office Computers	Office Computers	Office Computers	Office Computers
WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 1	WEEK 2	WEEK 3	WEEK 4
AUGUST				SEPTEMBER				OCTOBER			

Back to School Story

Imagine... you are at the beach on a warm August day; you have three weeks before school starts and you are enjoying your summer vacation. At your school, the office staff, facilities manager, and custodians are busily preparing for your first day back.

Over the next three months, the office staff will be using their ten, old-school, TV-like computers on a daily basis making sure all of the incoming freshmen will have the toughest teachers and the most inconvenient schedule. *(Place **Office Computers** signs above all three months)*

The custodians are busy keeping the pool running properly, like they do all year round. It's amazing how much electricity it takes to run the pump and ventilate the pool area, even when no one is using it. *(Place **Pool** signs above all three months)*

Since it is quite warm outside in August, the office air conditioners are running at full capacity day and night to keep the staff cool. *(Place **Office Air Conditioner** signs above the whole month of August)*

Even though the custodians are working to clean all the classrooms during the first two weeks of August, the school's central air conditioning is not turned on until the teachers arrive during the third week, then it will run the rest of August. *(Place **Central Air Conditioner** signs above the last two weeks in August)*

When the teachers arrive, the hallway lights and classroom lights are turned on and basically left on for the entire school year. *(Place **Hallway Lights** and **Classroom Lights** signs above the last two weeks of August, all of September, and all of October)*

It is now the last week of August and you must shake the sand out of your sandals and put on your new sneakers as you head back to school. When you arrive at school, you'll notice there is a new fountain in the courtyard that runs on an electric pump. You think to yourself, "That's pretty cool but when the first cold spell arrives, that fountain will be a monument until next spring." For now, it's working wonderfully. *(Place **Fountain with Electric Pump** sign above the last week of August)*

You get your schedule and find that your homeroom is actually the computer lab. The computers are up and running and will remain that way for the rest of the school year. *(Place **Computer Lab** signs above the last week of August, all of September, and all of October)*

It's now lunchtime and you head to the cafeteria. You see the lunch ladies hard at work, serving fresh salads, tacos, and straight-from-the-oven chocolate chip cookies. They will be using the kitchen refrigerators, freezers, ovens, and dishwashers throughout the school year. *(Place **Kitchen Equipment** signs above the last week of August, all of September, and all of October)*

The first week of September is pretty much the same as the last week of August. You are settling into your routine, the fountain in the courtyard is still running and the air conditioners are still cooling all the warm bodies. The fountain and air conditioners will run through the third week of September, and then the weather will change and force the facilities manager to turn the heat on. *(Place the **Office Air Conditioner, Central Air Conditioner,** and **Fountain with Electric Pump** signs above the first three weeks of September)*

As September rolls on, the dance team needs to practice for a national competition. They have four weeks to practice, so they meet in the gym in the evenings from the second week of September through the first week of October. *(Place **Gym Lights (Cheerleader)** signs above the last three weeks of September and the first week of October)*

As the dance team practices, the football teams are gearing up for their first home games. The freshman, JV, and Varsity home games are scheduled for the third week of September, second and fourth weeks of October, and the rest are in November. The stadium lights are on three nights during each of those weeks so fans can see their football players crush the opposing team. *(Place **Stadium Lights** signs above the third week of September and the second and fourth weeks of October)*

The students in the machine shop class begin constructing tool boxes during the third week of September. This project will take three weeks and requires a lot of electricity to power all the machines that are used. *(Place **Machine Shop** signs above the last two weeks of September and the first week of October)*

The art students have been learning about pottery over the last month and they will finally get to fire their clay pots in the kiln during the third and fourth weeks of September. *(Place **Firing of Kiln** signs over the last two weeks of September)*

Also happening the third week of September is the school bake sale. Each day after school, students bake pies, cookies, and other treats to raise money for their field trips. *(Place **Student Ovens** sign over the third week of September)*

On the opposite side of the building during the same week, the American Red Cross is conducting first aid training for 50 teachers in five classrooms. The training requires the use of five televisions and DVD players for four evenings. *(Place **Audio/Visual Equipment** sign over the third week of September)*

Now that it's October, the facilities manager has to turn on the outside lights much earlier, which uses more electricity, but he wants to keep the students and staff safe as the days get shorter and it gets darker earlier. *(Place **Outside Lights** signs above all of October)*

The students and teachers will celebrate Halloween during the last week of October. They have events planned each evening of the week in the gym, with the big Halloween dance on Friday after the football game. There is supposed to be a costume contest and the students heard the principal is going to dress up in the school mascot outfit; that'll be interesting to see him dress up as a [insert your school mascot here]... *(Place **Gym Lights (Halloween Dance)** sign over the last week of October)*

Now let's evaluate the "graph" we have made with the ***Energy Users Cards.*** (Use ***Interpreting the Back to School Story (Questions & Suggested Answers)***)

Interpreting the Back to School Story

(Questions & Suggested Answers)

1. What month and week were the most energy users identified?
   - September, week 3
2. What month and week were the fewest energy users identified?
   - August, weeks 1 & 2
3. What are some small energy users? Medium energy users? Large energy users? Extra large energy users?
   - Small Energy Users: Audio/Visual Equipment, Fountain with Electric Pump, and Office Computers
   - Medium Energy Users: Computer Lab, Machine Shop, Office Air Conditioner, and Swimming Pool
   - Large Energy Users: Firing of Kiln, Gym Lights (with dancer and Halloween Dance), Hallway Lights, Outside Lights, and Student Ovens
   - Extra Large Energy Users: Cafeteria Equipment, Central Air Conditioner, Classroom Lights, and Stadium Lights
4. When does the peak demand occur for each month?
   - August, week 4; September, week 3; October, week 4
5. If the ***Back to School Story*** incorporates the highest number of energy users throughout the year, when would the school's customer demand be set?
   - September, week 3
6. Which energy users are used throughout the entire story?
   - Office Computers & Pool
7. What are other energy users found in your school that were not mentioned in this story?
   - Auditorium lights, vending machines, bathroom lights, exit signs, heating and ventilation systems (often use natural gas, not electricity), coffee pots, microwaves, refrigerators, fish tanks, automotive shop equipment, and many more...
8. How could you reduce the amount of energy used in this story, yet keep the students, teachers, and school staff happy?
   - Make sure classroom and hallway lights are turned off when not needed
   - Shut down computers (in office and lab) when not in use
   - Turn the air conditioners off at night, have them programmed to turn on before staff and/or students arrive to cool the building to a comfortable temperature
9. Which of these energy users requires the most amount of electricity to operate (has the highest wattage)?
   - Central air conditioning
10. Which of these energy users requires the least amount of electricity to operate (has the lowest wattage)?
    - Fountain with Electric Pump
11. If you were to conserve energy in this school, when would be the best time to have the most impact on your electric bill?
    - During peak times (this would lower your monthly demand charge and possibly your customer demand charge for the year)
12. Do you think it makes a difference if an energy user is used during the day versus the evening?
    - Yes, on-peak rates are generally higher and are usually Monday – Friday from 9 AM – 9 PM, excluding holidays
13. Are there any energy users in this story that could be used during off-peak times to save the school money?
    - The kiln could be fired during the evening instead of during the day or during the next month when the peak is not so high
14. Do you think it makes a difference if an energy user is used during the summer months versus any other time of year?
    - Yes, summer rates are generally higher than rates other times of the year