



ENERGY AUDIT

Home Electricity Audit

Background

Whenever we use electricity, there are two main costs. One is that the electricity costs us money, and the other is that carbon dioxide (CO_{2e}) emissions are created during the production of electricity. (Remember that over 75% of Saskatchewan's electricity is produced by burning fossil fuels.)

Procedure

Choose the method that works best for you.

Method 1: Published Information

Use published information to estimate the power and energy of individual appliances.

Use the attached **Appliance Table** to calculate the power and approximate cost per month to operate electrical devices/appliances in your home.

- The amount of **electrical power** an item uses is measured in watts.
- One kilowatt equals 1000 watts.
- **Electrical energy** is measured in kilowatt hours (kWh).
- **Energy = Power x Time.**
- To calculate monthly electrical energy consumption of electrical devices/appliances:
 - Determine the wattage of the device or appliance (this may be marked on the device, or you can use estimates you find online).
 - Divide by 1000 to determine kilowatts (kW).
 - Multiply by the daily usage in hours of the device or appliance.
 - Multiply by 30 days to calculate monthly usage

Energy = Power x Time

Energy = Watts x (kW/1000W) x hours/day x 30 days/month = kWh/month

Note that wattage will vary with most appliances. For example, your refrigerator runs for a while, and then shuts off. The wattages in this table should be average wattages.



Method 2: Watt Meter

Use a watt meter to measure the actual power and energy consumption of individual appliances. Also known as a Power meter, Circuit Monitor or an Energy Use Monitor.

The following description is based on the *Belkin Conserve Insight Energy Use Monitor*. There are several other watt meters on the market. The functions of the meters vary. Use the User's Manual for your watt meter to modify this activity.

Be sure you have permission to unplug something before testing it. If you unplug a printer while someone is sending it a print job, or unplug a computer while someone is working, you may not be very popular!

- Plug the watt meter into the wall, and plug an appliance into the watt meter.
 - Push the  button. The unit will read how many watts your appliance is consuming.
 - Push the  button to show CO_{2e} emissions. (Note that the monitor will calculate this assuming that the appliance runs 24 hours/day, 7 days/week)
 - Push the  button to show electricity cost. (Note that the monitor will calculate this assuming that the appliance runs 24 hours/day, 7 days/week)
- See the User's Guide for how to enter Saskatchewan's electricity cost (\$0.17/kWh) and CO_{2e} emissions (0.5 kg/kWh).

The power drawn by appliances like lights, toasters, kettles etc. should be consistent as long as they are on.

Measuring variable power: The power used by many appliances will vary over time. After a unit has been plugged in for 45 minutes, the meter will show an average cost and CO_{2e} over time. It will continue to show instantaneous wattage. For appliances where energy consumption will vary, do an ordinary task with the appliance. For example, plug in your video game console (or the TV plus console) to the watt meter, and then play a game.

Read the cost and CO_{2e} emissions.

Measuring phantom load: Turn the appliance off. Wait a minute for the numbers on the watt meter to stop changing. How many watts does it consume when off? The power a device continues to use even when it is turned off is called the **phantom load**. Note that if the power is less than 0.5 W, the unit will read 0-0.5 W. The meter is unable to read power smaller than 0.5 W.

Measure the power from several appliances in your home or classroom, including things like cell phone chargers, entertainment, kitchen and office appliances – anything that can plug in. Write your readings in the Appliance Table.



Method 3: In-Home Display

Use an in-home display to measure the power and energy of the whole house.

The following description is based on the AzTech In-Home Display. There are several other in-home displays on the market. The functions of the units vary. Use the User's Manual for your display to modify this activity.

Project #1 – Phantom Load:

1. In “cost” mode, scroll through the screens until you see the “current” display. Record the Power (kW) reading on the display. It should look something like this:

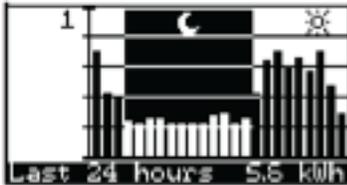


2. Turn off everything that is running in the house. **Be sure you have permission to turn things off.** If you turn something off while someone is using it, you may not be very popular. Turn off things like lights, computers, TV, or anything that is plugged in. Record what you turned off, and record the Power reading on the display.
3. Turn down the thermostat 2°C so the furnace won't come on. **With permission**, set the furnace fan to run on “auto”, and turn off the Heat Recovery Ventilator (if there is one). **(Remember to reset these when you are finished)**. Listen for the fridge (and freezer) to stop running. Record the Power reading on the display.
4. Go around the house and unplug things you think have a phantom load (things that draw power when turned off). **Be sure you have permission to unplug things.** Look for things that have a light, a clock, are programmable, are Wi-Fi connected, or are instant on (computer and peripherals, TV and peripherals, microwave, programmable coffee maker, etc.). Wait for the fridge (and freezer) to stop running. Record the Power reading on the display.
5. What is the lowest number you read on the display? What might still be running in the house?



Project #2 – Whole House Consumption:

1. In “usage” mode, scroll through the screens until you see the “last 24 hours” display. It should look like this: Write down the number from the bottom right corner of the screen. In this example it says 5.6 kWh.



2. Run your campaign to reduce home electricity consumption. Then repeat step 1. Compare the daily energy consumption of the house before and after your campaign.

Note: You could do step 1 for a few days in a row (before your campaign), and do step 2 for a few days in a row after your campaign. Home electricity consumption won't be the same every day, so measuring it for a few days will allow you to calculate an average, and to see how much it varies day to day.



APPLIANCE TABLE

Appliances	Wattage	kW (divide by 1000)	Use per day (hours)	kWh per month (kW x use per day x 30)	Cost per month (kWh per month x \$.17)	GHG per month (kWh per month x 0.5 kgCO _{2e} / kWh)	Phantom Power (Watts)
	A	B =A/1000	C	D =BxCx30	E =Dx0.17	F =Dx0.5	G
Dishwasher							
- Standard	1420	1.42	1				
- Energy star	700	.7	1				
Refrigerator							
- Standard	87	.087	24				
- Energy star	47	.047	24				
TV							
- Standard LCD 26"	140	.14					
- Energy star LCD 26"	70	.07					
Hair Dryer	1000	1	0.1				
Computer							
CPU/Monitor							
- Standard	119	.119					
- Energy star	51	.051					
Lap Top							
- Standard	19	.019					
- Energy star	9	.009					
Video Game System							
- PS4 Pro	130	.130					
- Xbox One X	140	.140					
Lights							
- Incandescent	60	.06					
- Compact Fluorescent	13	.013					
- LED	9	.009					

Information in this table comes from various web sources.



Questions: Audited Home

1. Which appliances use the most energy? Which use the least?
2. Re-do the energy and CO_{2e} emission calculations assuming the appliance runs twice as many hours, then half as many hours. How big of an impact did that make?
3. Looking at your watt meter readings, how big a difference does it make to turn off appliances?
4. Are any of the appliances/devices ENERGY STAR® rated? Which ones? Look up ENERGY STAR® at Natural Resources Canada, Energy Efficiency. How do ENERGY STAR® rated products help us save energy?
5. In the home where you did your audit, are appliances turned off or unplugged when not in use?
6. Add up the phantom load power from the appliances you tested.
 - What is the phantom load from these appliances?
 - How much energy does that consume in a year?
 - How much would that cost in a year?
 - What would be the CO_{2e} emissions each year from it?
7. What could this family do to use less electricity?



Questions: Your Home

8. List the types of lighting in *your* home. Note: To find the watts used by each, look on the side of the bulb, near the base. You will see a number, followed by a “W”.

Type of lighting	Number of Bulbs	Watts
LED (light emitting diode)		
CFL (compact fluorescent)		
Halogen		
Incandescent		
Other:		

9. What was the most common type of lighting found in your home? How many watts does the most common type of lighting use?

10. Does your family turn off lights and appliances when not in use?

11. Does your family unplug appliances that draw a phantom load? (Appliances and devices that have a remote control, show lights when turned off, have a clock, are Wi-Fi connected, etc.)

12. Are any of the appliances/devices ENERGY STAR® rated? Which ones? Look for the logo, or go to Energy Star's website and search the product finder.



13. List three things your family could do to use less electricity.



Curriculum Connections

Grade 4 Mathematics: Outcomes N4.1 Demonstrate an understanding of whole numbers to 10 000 (pictorially, physically, orally, in writing, and symbolically). **N4.2** Demonstrate an understanding of addition of whole numbers with answers to 10 000 and their corresponding subtractions (limited to 3 and 4-digit numerals). **N4.3** Demonstrate an understanding of multiplication of whole numbers (limited to numbers less than or equal to 10). **N4.4** Demonstrate an understanding of multiplication (2- or 3-digit by 1-digit). **N4.5** Demonstrate an understanding of division (1-digit divisor and up to 2-digit dividend) to solve problems. **N4.7** Demonstrate an understanding of decimal numbers in tenths and hundredths (pictorially, orally, in writing, and symbolically). **P4.1** Demonstrate an understanding of patterns and relations. **SS4.1** Demonstrate an understanding of time. **SP4.1** Demonstrate an understanding of many-to-one correspondence.

Grade 5 Social Studies: Outcome RW5.1 Explain the importance of sustainable management of the environment to Canada's future.

English Language Arts: Outcomes CC5.1 Compose and create a range of visual, multimedia, oral, and written texts that explore and express personal thoughts shaped through inquiry. **CC5.4** Use a writing process to experiment with and produce multi-paragraph narrative and persuasive compositions that clearly develop topic and provide transitions for the reader. **AR5.1** Identify strengths in viewing, listening, reading, speaking, writing, and other forms of representing. **AR5.2** Set goals to enhance the development and improvement of the skills and strategies in viewing, listening, reading, speaking, writing, and other forms of representing and take steps to achieve goals.

Mathematics: Outcome N5.2 Analyze models of, develop strategies for, and carry out multiplication of whole numbers. **N5.3** Demonstrate, with and without concrete materials, an understanding of division (3-digit by 1-digit) and interpret remainders to solve problems. **N5.6** Demonstrate understanding of decimals to thousandths. **P5.2** Write, solve, and verify solutions of single-variable, one-step equations with whole number coefficients and whole number solutions. **SP5.1** Differentiate between first-hand and second-hand data.

SP5.2 Construct and interpret double bar graphs to draw conclusions.

Grade 6 Science: Outcome: EL6.1 Assess personal, societal, economic, and environmental impacts of electricity use in Saskatchewan and propose action to reduce those impacts.

Mathematics: Outcome: N6.3 Demonstrate understanding of the order of operations on whole numbers (excluding exponents) with and without technology. **N6.4** Extend understanding of multiplication and division to decimals (1-digit whole number multipliers and 1-digit natural number divisors). **P6.1** Extend understanding of patterns and relationships in tables of values and graphs.

SP6.1 Extend understanding of data analysis to include: line graphs; graphs of discrete data; data collection through questionnaires, experiments, databases, and electronic media; interpolation and extrapolation.

Grade 7 Science: Outcome: HT7.1 Assess the impact of past and current heating and cooling technologies related to food, clothing, and shelter on self, society, and the environment.

Mathematics: Outcome: N7.2 Expand and demonstrate understanding of the addition, subtraction, multiplication, and division of decimals to greater numbers of decimal places, and the order of operations.



SP7.1 Demonstrate an understanding of the measures of central tendency and range for sets of data.

Grade 8 Health Education: Outcome: USC8.6 Examine and assess the concept of sustainability from many perspectives, and develop an understanding of its implications for the well-being of self, others, and the environment.

Mathematics: Outcome: N8.5 Demonstrate understanding of multiplication and division of integers concretely, pictorially, and symbolically.

SP8.1 Analyze the modes of displaying data and the reasonableness of conclusions.

Grade 10 Science: Outcome: SCI10-CD1 Assess the implications of human actions on the local and global climate and the sustainability of ecosystems. **SCI10-CD2** Investigate factors that influence Earth's climate system, including the role of the natural greenhouse effect.

Grade 12 Physics: Electricity 5 Explain how the power rating on electrical appliances can assist a person in making wise decisions as a consumer.

Design-Housing 30: Module10 Students examine their own home, school or classroom to determine ways to make them more energy efficient. **Construct/Fabricate Module 19** To be aware of the economic and environmental advantages of a well-insulated structure.