

Awareness of Electrical Energy Consumption

Mod.3.5

TIME

180 (3 x 60) minutes

OVERVIEW

Students describe factors that affect the consumption of electrical energy, thereby raising their awareness of energy use. They outline an action plan to reduce energy consumption and promote their plan. They describe ways in which electricity has an impact on their daily life.

LEARNING OUTCOMES

Through this learning experience (LE), students will achieve specific learning outcomes (SLOs) in various subject areas. Consider the intent of this LE and your choice of instructional and assessment strategies to determine which SLOs students may achieve, in addition to those identified.

English Language Arts

Consider the intent of this LE and your choice of instructional and assessment strategies to determine which SLOs students may achieve, in addition to those identified below:

- 2.1.1 *Prior Knowledge* — Seek connections between previous experiences, prior knowledge, and a variety of texts.
- 2.3.5 *Create Original Texts* — Create original texts [such as letters, short stories, media broadcasts, plays, poems, video presentations, Readers Theatre...] to communicate and demonstrate understanding of forms and techniques.
- 4.4.1 *Share Ideas and Information* — Share information on a topic with class members in a planned and focused group session using a variety of strategies [such as interactive dialogues, demonstrations, dramatizations, audiovisual and artistic representations...].

Science

Consider the intent of this LE and your choice of instructional and assessment strategies to determine which SLOs students may achieve, in addition to those identified below:

- SLOs related to Scientific Inquiry or the Design Process in Cluster 0: Overall Skills and Attitudes.
- 6-3-01 Use appropriate vocabulary related to their investigations of electricity.
Include: positive charge, negative charge, current electricity, static electricity, electrical circuit, insulator, conductor, switch, series circuit, parallel circuit, electromagnet, magnetic field, motor, generator, transformation, electrical energy, renewable, non-renewable, energy consumption.
- 6-3-05 List electrical devices used at home, at school, and in the community, and identify the human needs that they fulfill.
Examples: heat, light, communication, movement...
- 6-3-14 Identify forms of energy that may result from the transformation of electrical energy, and recognize that energy can only be changed from one form into another, not created or destroyed.
Include: light, heat, sound, motion.
- 6-3-17 Evaluate an electrical device using the design process.
Examples: light bulbs, kitchen appliances...
- 6-3-18 Describe factors that affect the consumption of electrical energy, and outline an action plan to reduce electrical energy consumption at home, at school, or in the community.
- 6-3-19 Describe ways in which electricity has had an impact on daily life.

ICT LITERACY SKILLS AND COMPETENCIES

Consider the intent of this LE and your choice of instructional and assessment strategies to determine which skills and competencies students may achieve, in addition to those identified below:

- basic operating skills
- electronic publishing
- spreadsheet analysis
- word processing

SUGGESTED LEARNING RESOURCES**Software**

- word processor
- spreadsheet
- web page authoring

Internet

- IMYM Links Database: <<http://www.edu.gov.mb.ca/ks4/tech/imym/resources/links.html>>

Videos

- Manitoba Hydro. *Simple Things You Can Do to Save Energy*. Videocassette. Winnipeg, MB: Manitoba Hydro, 1993. (VHS, 15 min.)
- ---. *Simple Things You Can Do to Save Energy in Your School*. Videocassette. Winnipeg, MB: Manitoba Hydro, 1993. (VHS, 15 min.)

Print

- Appendix C: Index of Teaching and Learning Strategies and Tools
- Manitoba Hydro. *Middle and Senior Years Power Smart Poster*. Winnipeg, MB: Manitoba Hydro, n.d.

BLMs

- BLM OLE.4#6: Reading Circle Response Log (see OLE.4: Reading Circles)
- BLM Mod.3.5#1: Changing One Form of Energy to Another
- BLM Mod.3.5#2: The Effect of Closing Doors on Home Heating
- BLM Mod.3.5#3: The Effect of Using a Fireplace on Home Heating
- BLM Mod.3.5#4: Comparing Window and Wall Heat Loss
- BLM Mod.3.5#5: Boiling Water with or without a Lid
- BLM Mod.3.5#6: Bath Versus Shower

TBLMs

- TBLM Mod.2.4#2: Examples of Advertising Strategies
- TBLM Mod.3.5#1: Cooperative Group Learning: Teacher Assessment
- TBLM Mod.3.5#2: Brief Facts on Energy Consumption
- TBLM Mod.3.5#3: What Can You Do to Save Energy?

Materials

- survey generated in Mod.2.5: Tally-Ho
- hydro-consumption bills
- Signal or Transitional Words wall chart created in Mod.2.3: Rube Goldberg

SUGGESTIONS FOR INSTRUCTION

Preparation and Set-up

- Assemble a list of library resources containing information on energy consumption.
- Inform students that they will be asked to keep track of their electricity consumption in the coming days.
- Have available the survey generated in Mod.2.5: Tally-Ho.
- Bring to class one year's worth of hydro bills. Ask students to do the same, if possible. Photocopy one set of records for each collaborative group, removing the consumer information to protect the privacy of the owner, but recording the size of home and number and age of the occupants.
- Have available the Signal or Transitional Words wall chart created in Mod.2.3: Rube Goldberg.

Activating Strategies

- Students list all the electrical appliances they used before coming to school that morning (e.g., lamp, stove, microwave oven, toaster, hair dryer, kettle). They imagine how their life would differ without electricity. Students write a paragraph about a morning without electricity.
- If the survey (generated in Mod.2.5: Tally-Ho) is being used, review the contents with students.
- Students brainstorm how electricity is used in the classroom. To guide discussion, refer to TBLM Mod.3.5#3: What Can You Do to Save Energy?

Acquiring Strategies

- Examine the hydro bills available. Select one set of records and, using a spreadsheet, chart electrical consumption for each month. Review the skills acquired in ICT.12: Chart This.
- In collaborative groups, students examine the resources assembled and identify brief facts about energy consumption. They create a group poster highlighting five facts, which they illustrate or add to a class list posted on the wall (see TBLM Mod.3.5#2: Brief Facts on Energy Consumption).
- Brainstorm for factors that might have the most significant impact on consumption (e.g., size of home, number of people in household, age of people in household, seasonal temperature, special events).
- In collaborative groups, students conduct tests to identify simple factors that might affect energy consumption.

Examples:

- Closing doors (use BLM Mod.3.5#2: The Effect of Closing Doors on Home Heating)
- Using a fireplace (use BLM Mod.3.5#3: The Effect of Using a Fireplace on Home Heating)
- Comparing heat loss through windows versus walls (use BLM Mod.3.5#4: Comparing Window and Wall Heat Loss)
- Boiling with or without covering the pan (use BLM Mod.3.5#5: Boiling Water with or without a Lid)
- Taking baths versus taking showers (use BLM Mod.3.5#6: Bath Versus Shower)

Students may wish to design a test of their own to test energy efficiency.

- In collaborative groups, students select three households, two of which have one characteristic in common, such as
 - two are the same households but have a different number of occupants
 - two have the same number of occupants but are of different sizes

- two have the same number of occupants but of different ages
- two are the same size but use a different heating system and/or have air conditioning
- Students use a spreadsheet to chart the monthly electrical consumption of the three households for a full year.

Applying Strategies

- Based on previous discussion, students describe factors that affect the consumption of electricity in general (e.g., hosting guests, using air conditioner on hot days, using hot water for washing and cleaning, using entertainment devices on rainy days).
OR
Students examine the charts of electrical consumption and identify patterns of use (e.g., according to seasons).
- Students record daily electrical consumption of their household for one week by using the reading of their hydro meter. In collaborative groups, students compare their readings and the survey of each group member's home (using the surveys generated in Mod.2.5: Tally-Ho and BLMs Mod.3.5#2 to BLM Mod.3.5#6), to see whether a pattern of use can be discovered. They select three electrical appliances or circumstances from the survey.
- Students select an electrical appliance for which there is a non-electrical equivalent (e.g., stove, toothbrush, clothes dryer). Using a word processor (or using BLM OLE.4#6: Reading Circle Response Log), students write a paragraph about the impact that owning the electrical version of the invention can have on their daily life.
- In a class forum, students discuss the value of electricity as a time-saving factor when creating an invention.

Variations/Extensions

- Referring to the list of electrical household appliances generated in Mod.2.5: Tally-Ho, or any other list they brainstorm, students identify the form of energy that results from the transformation of electrical energy in the appliances (e.g., heat, sound, light, motion). Introduce the task with questions such as the following:
 - What happens when you touch a light bulb that has been on for a while? (It feels hot.)
 - What happens when you turn on the electrical switch on the radio? (It makes sounds.)
 - What happens when you turn on the switch on the blender? (It whirls.)
- Students record their findings on BLM Mod.3.5#1: Changing One Form of Energy to Another.
- Each collaborative group evaluates an electrical device from their Tally-Ho survey using the Design Process outlined in Cluster 0: Overall Skills and Attitudes of the Grade 6 Science curriculum.
- Students prepare an Energy Awareness presentation based on the questions on TBLM Mod.3.5#3: What Can You Do to Save Energy? and share it with students in other classrooms in the school or at a school assembly.
- Review TBLM Mod.2.4#2: Examples of Advertising Strategies. In collaborative groups, students develop action plans to reduce consumption of electricity. They make posters entitled You Can Be Energy Efficient, offering simple suggestions for energy saving, and display the posters around the school. They add a page to the class website with their plans.

SUGGESTIONS FOR ASSESSMENT

- Read the paragraph students wrote on the impact of owning the electrical version (innovation) of an invention. Look for references to ease of use, improved access, faster use, or better results. Consider whether signal or transitional words have been used appropriately and effectively.

- Read students' work recorded on BLM Mod.3.5#1: Changing One Form of Energy to Another and look for gaps in understanding.
- Use TBLM Mod.3.5#1: Cooperative Group Learning: Teacher Assessment to observe and assess students' work within their collaborative groups.
- Create a peer-assessment tool with students (based on TBLM Mod.3.5#1: Cooperative Group Learning: Teacher Assessment), and have them assess the work of their peers in their collaborative group.

CONNECTION TO INVENTION CONVENTION

- In becoming aware of ways in which electricity affects their lives, students can plan for an invention that would benefit them the most.
- In preparing presentations or posters on energy efficiency, students prepare for marketing their own invention.

BLM Mod.3.5#2: The Effect of Closing Doors on Home Heating

Question

- Is energy saved by closing doors to unoccupied rooms?

Materials

- thermometer
- Data-Recording Chart

Method

- Set the home heating system at a constant temperature for several hours.
- Set the heating system at the same constant temperature for each day data is being recorded.
- Record the data for two days (e.g., Saturday and Sunday).
Note: The weather and/or sun conditions should be fairly constant so as not to invalidate the data being recorded.
- Record data at the same time each day.
- Record data for several rooms of different sizes (e.g., bedrooms, bathroom).
- Record the first temperature data when the doors to the rooms are opened. Then close them, and take a second reading after the doors have been closed for at least four hours. The reverse will also work.

Room Temperature: Data-Recording Chart

The thermostat for the home is set at _____

Room	Date	Temperature Door(s) Open	Temperature Door(s) Closed

What do you conclude about closing doors to unoccupied rooms for energy conservation?

If you have air-intake vents, do you think opening or closing them would make a difference?

BLM Mod.3.5#3: The Effect of Using a Fireplace on Home Heating

Questions

- Can energy be saved by using a fireplace while a forced-air central heating system is operating?
- Is there a difference in energy saving between using a wood fireplace and using a gas fireplace?

Materials

- wood fireplace and gas fireplace (the test should be done using both kinds)
- watch
- Data-Recording Chart

Method

- Leave the thermostat for the home heating system set at a constant temperature.
- Be prepared to record data for at least one hour. Data recorded over a longer period of time will provide more information.
- Ask an adult to verify that the damper in the fireplace is closed at the start of the test.
- With no fire in the fireplace, record the time on your watch each time the heating system turns on and off (in minutes and seconds).
- Ask an adult to open the damper and supervise as you build a fire in the fireplace.
- When the fire is established, record the time on your watch each time the heating system turns on and off (in minutes and seconds).
- Keep a record over the same amount of time in each instance. (If you keep records for 1.5 hours without fire, then you must keep records for 1.5 hours with fire.)

Effect of a Fireplace on Home Heating: Data-Recording Chart

Kind of fireplace _____

Damper Closed—No Fire in Fireplace		Damper Open—Fire in Fireplace	
Start Time	Stop Time	Start Time	Stop Time
Number of times heating system started _____		Number of times heating system started _____	
Total time heating system worked _____		Total time heating system worked _____	

What do you conclude? Is the furnace cycle affected by having a fire in the fireplace?
 For a (kind of fireplace), _____

Why do you think this?

BLM Mod.3.5#4: Comparing Window and Wall Heat Loss

Question

- How does glass compare to wall material in conserving energy?

Materials

- thermometer
- Data-Recording Chart
- access to a window on the north, south, east, and west sides of a home

Method

- Put the thermometer in the centre of the pane of glass for each window (north, south, east, and west) and record the reading on the Data-Recording Chart.
- Identify a spot on the outside wall adjoining each window, at least three feet away from the window or any door. Put the thermometer on that spot and record the reading on the Data-Recording Chart.
- Go outside and record the temperature near each window (north, south, east, and west).
- In the Temperature (T) Difference column, calculate the difference between the inside temperature and the outside temperature, for each window and wall.

Window Versus Wall: Data-Recording Chart

How many window panes are there? _____ What is the thickness of the wall? (cm) _____

Outside	T (C)	Inside Window	T (C)	T Difference	Inside Wall	T (C)	T Difference
North		North			North		
South		South			South		
East		East			East		
West		West			West		

Which material (wall or window) has the greatest variation in temperature from outside to inside?
Does compass direction make any difference? Why or why not?
If you were designing an energy-efficient home, how would you apply this data?

BLM Mod.3.5#5: Boiling Water with or without a Lid

Question

- Does water boil sooner when there is a lid on the pot?

Materials

- pot with a see-through lid
- measuring cup
- stove
- watch (it needs to be able to measure seconds)
- Data-Recording Chart

Method

- Add a cup of water to the pot until it is about half full. Record how many cups of water were needed.
- Put the pot, without a lid, on a stove element that is about the same size as the bottom of the pot.
- Turn up the heat to high and immediately record the time, in minutes and seconds, on the Data-Recording Chart.
- As soon as the water comes to a rolling boil, record the time, in minutes and seconds, on the Data-Recording Chart.
- Empty the water in the sink and let the pot cool completely.
- Allow the element on the stove to cool completely.
- Using the same pot, add the same amount of water as in the first part of the test.
- Put the lid on the pot, place the pot on the same element as before, turn the heat to high, and immediately record the time, in minutes and seconds, on the Data-Recording Chart.
- As soon as the water comes to a rolling boil, record the time, in minutes and seconds, on the Data-Recording Chart.
- Repeat the test with a much larger pot.

Water Boiling: Data-Recording Chart

Diameter of pot used (cm) _____

	Time Element Turned On	Time Element Turned Off	Time Difference
Small Pot without Lid			
Small Pot with Lid			
Large Pot without Lid			
Large Pot with Lid			

Is the boiling time the same with and without the lid? Explain.
Is there a change in the boiling time difference for the small pot and the large pot? Explain.
What is your suggestion to people who cook?

BLM Mod.3.5#6: Bath Versus Shower

Question

- Which uses less water, a bath or a shower?

Materials

- waterproof adhesive tape
- two-litre plastic container
- bathtub with shower

Method

- Calibrate the tub by pouring exactly 20 litres of water into it.
- Mark the top of the water level.
- Add another 20 litres and again mark the top of the water level.
- Repeat this process until the tub is nearly full.
- Empty the tub to the level where a person would normally fill it with water for a bath. Record the number of litres this represents. Empty the tub.
- For the next few days, plug the tub when you take showers. Ask other family members to do the same.
- After a normal shower time, record the amount of water that accumulated in the tub (once the person is out of it) next to the family member’s name.

Bath Versus Shower: Data-Recording Chart

Amount of water used for bath (litres) _____

Date	Amount of Water Used for Shower (Litres)			
	Me	Person A	Person B	Person C

What can you conclude about the amount of water you and your family use in bathing and showering?

TBLM Mod.3.5#1: Cooperative Group Learning: Teacher Assessment

Task _____ Date _____

Criteria	Names of Group Members							
The student								
• negotiates roles and responsibilities of each group member								
• contributes ideas and suggestions								
• encourages involvement of all group members								
• is receptive to questions of all group members								
• listens to others' suggestions								
• modifies thinking to incorporate new information or others' ideas								
• respects and accepts contributions of each group member								
• completes individual commitment to the group								
Additional Comments								

Cooperative Group Learning: Teacher Assessment: Adapted, by permission, from *English Language Arts: A Curriculum Guide for the Elementary Level*. Copyright © 1992 by Saskatchewan Education.

Reference:
 Manitoba Education and Training. *Grades 5 to 8 English Language Arts: A Foundation for Implementation*. Winnipeg, MB: Manitoba Education and Training, 1998. BLM-89.

TBLM Mod.3.5#2: Brief Facts on Energy Consumption

Have students identify facts related to energy consumption in their examination of resources. Consider posting facts such as the following on the classroom wall and invite students to add to the list. The list can be divided into home use and school use.

Did You Know?

- Schools spend more on energy than on computers and textbooks combined.
- Compact fluorescent bulbs use $\frac{1}{4}$ of the energy of incandescent bulbs, last 10 times longer, are just as bright, and are more cost efficient.
- Only 10% of the energy used by the basic incandescent bulb results in light. The remaining 90% forms heat energy.
- Most of the time a computer is on, it is not in use. It just sits there and uses up energy.
- Using a water-saving showerhead can save up to 15% of your home's hot water use.
- The standard recommended temperature for heating a room is 20°C.
- People in Canada use more energy per capita than anyone else in the world. If we were to use energy-efficient buildings, cars, appliances, and machines, we would greatly reduce our energy consumption.

TBLM Mod.3.5#3: What Can You Do to Save Energy?

Questions such as the following can initiate discussion to help students become more aware of energy-efficient behaviours at school. Use the questions to generate a checklist that can be used to save energy in the classroom. Students may also use them to prepare a presentation to encourage other classes or the whole school to be involved in energy conservation.

Lighting

- Do the classroom (library, gymnasium) lights need to be on?
- Do all the lights need to be on at all times?
- Do we turn off the lights if the space is to be unoccupied for more than 10 minutes?
- What kind of lighting do we use? Do we use energy-efficient fluorescent or incandescent light?
- Do we turn off lights during recess?
- Can we turn off some lights while others stay on?
- Do we turn off the classroom lights when leaving for the day?

Computers

- Does the computer monitor need to be left on?
- Is the computer set to go to sleep automatically after a period of inactivity?

Heating and Cooling

- Is there a stand-alone space heater in the classroom? Is it needed?
- Is air circulating freely through heating ducts or air-intake grills? Is air circulation being blocked by materials such as posters, books, or articles of clothing?
- Are there window coverings to reduce the sun's heat when the air conditioning is on?
- Do we use window coverings to reduce heat loss at night?