Energy Efficiency Engagement Plan - Grade 9

Objective: To understand where energy comes from, energy efficiency, and how can we save energy.

Method: Use hands-on experiments to measure energy consumption in various electronic items and calculate the difference between various technologies to discover the meaning of energy efficiency.

Materials: Energy meters, lamps, or electrical items listed below. If you're coordinating with a Green Schools NS Engagement Officer, they may be able to supply many materials for the engagement.

Suggested electric items: Lamp with incandescent bulb, Compact Fluorescent Light (CFL) bulb, Light Emitting Diode (LED) bulb, incandescent holiday lights (large light bulbs), Light Emitting Diode (LED) holiday lights (large light bulbs), mini incandescent holiday lights, mini Light Emitting Diode (LED) holiday lights, incandescent night light, LED night light, fan, hair dryer, battery charger, iPad charging with two different chargers, iPad charging cart, electric pencil sharpener, microwave, kettle

Set-up: The proposed engagement is a plan for a large group of students (three to five classes) to progress through different activities in three groups. The groups will have staggered start times and will spend 30 - 45 minutes in each room. The three stations will cover Introduction, Data Collection, and lastly, Calculations.

Time Options: If you have 30 minutes for each room, you may have time to do the experiment with at least three different light bulbs and follow the experiment with the Light Bulb Comparison Activity in the Calculations room. If you have 45 minutes for each room, there is probably time to do the measurement of three different light bulbs and also the holiday lights, and in the Calculations room students can complete both the Light Bulb Comparison Activity and the activity called Let's Compare Holiday Lights.

Time	Group A	Group B	Group C
Period 1	Room 1: Introduction		
Period 2	Room 2: Data Collection	Room 1: Introduction	
	RECESS	RECESS	RECESS
Period 3	Room 3: Calculations	Room 2: Data Collection	Room 1: Introduction
Period 4		Room 3: Calculations	Room 2: Data Collection
Period 5			Room 3: Calculations

- **Room 1: Introduction** - Invite an Engagement Officer from Green Schools NS to deliver this content.

You can use the Green Schools NS Grade 9 Electricity Curriculum Slideshow (on our Resources page) to introduce these main topics: What is energy? What are the sources of energy in Nova Scotia? Why is it important to waste less energy? And what is energy efficiency? The leader can give an overview of what students are expected to do in the next two rooms: Data Collection and Calculations. Students will learn about energy efficient changes we can make such as installing energy efficient products as well as changes to our habits. If there are time constraints but space allows, one presentation could be given to all the students at once.

- **Room 2: Data Collection** - Led by a classroom teacher

In this room, students will divide up into groups according to the number of energy meter stations. Each group will be given an Energy Meter Activity sheet. Students will measure and record the number of watts used by the items at each station. For more information on how to use the energy meter, check out the online instruction manual. Watts is the number on the top line of the energy meter. This line can also measure Volts (V) and amps (A). If W is not the unit shown, press the top button again until the W appears.

Each energy meter station can use questions to help guide students through what to look for during each measurement, and what to try at each station. Question sheets at the end of this document can be used at each station to help guide student exploration. Each item should be clearly labelled, for example using tape on its electrical cord. It may be important to your group to emphasize basic electrical safety before beginning.

Stations may include (but are not limited to):

Station 1:	Lamp with incandescent bulb
	Lamp with Compact Fluorescent Light (CFL) bulb
	Lamp with Light Emitting Diode (LED) bulb
Station 2:	Large Incandescent Holiday lights
	Large Light Emitting Diode (LED) Holiday lights
Station 3:	Mini Incandescent Holiday lights
	Mini Light Emitting Diode (LED) Holiday lights
Station 4:	Incandescent night light
	LED night light
Station 5:	Fan
	Hair dryer
Station 6:	Battery charger
	iPad charging with two different chargers
	iPad cart
Station 7:	Pencil sharpener
	Microwave
	Kettle

- **Room 3: Calculations and Summary** – Led by an additional classroom teacher

We measure energy use of numerous items during the Data Collection phase. Plan to practice the calculations for about three items if you have 30 minutes, or about seven items if you have 45 minutes. Use the Light Bulb Comparison Activity and the activity called Let's Compare Holiday Lights to guide the calculations and to guide discussion through the questions in each. To conclude, review the answers together, and show students what they will take home and what they can do next. The learning never stops!

- **Take-home activities for students:**

Home Energy Experiment
Lights Out At Home Challenge
Home Energy Checklist
Efficiency Nova Scotia pamphlet

- **Follow-up activities:**

Did students get the free Product Installation Service from Efficiency Nova Scotia? If so, ask them to report how many kilowatt hours Efficiency NS estimated would be saved with the new efficient products installed at their house.

Did students do the Lights Out at Home Challenge? Ask them to report their savings calculated in the activity.

Make a classroom energy savings chart to record energy savings and do a long-term projection to estimate how much energy will be saved collectively over 10 years through both energy efficient upgrades and realistic behavioural changes.

Station 1: Lamps with Incandescent, Compact Fluorescent (CFL), and LED Light Bulb

- Test each light bulb and record the number of watts.
- Start from a distance and move your hand closer to each light bulb. Is there any heat coming from the bulb?

Station 2: Large Incandescent and Large LED Holiday Lights

- Plug in each strand and record the number of watts.
- Start from a distance and move your hand closer to the light bulb. Is there any heat coming from the light bulb? Can you comfortably touch both types of lights?
- How many bulbs are on each strand? You will need to know for calculations.

Station 3: Mini Incandescent and Mini LED Holiday Lights

- Plug in each strand and record the number of watts.
- Start from a distance and move your hand closer to the light bulb. Is there any heat coming from the bulb? Can you comfortably touch both types of mini lights?
- How many bulbs are on each strand? You will need to know this for calculations.

Station 4: Incandescent and LED Night Lights

- Plug in each night light and record the number of watts used by each. If the energy used is less than two watts, the energy meter reading will be zero.
- Start from a distance and move your hand closer to the light bulb. Is there any heat coming from the bulb? Can you comfortably touch both types of night light bulbs?

Station 5:
Fan & Hair Dryer

- Plug in and record the number of watts used when each is set on high.
- Try turning the fan speed up and down to see how the number of watts changes. What is the range of energy used?
- Turn the dryer to low, high, and cool settings to see whether the number of watts will change. (Be careful because hairdryers will get hot!)

Station 6: Battery Charger, Different iPad Chargers & iPad Cart

- Record how many watts the battery charger uses when charging batteries.
- Is any measurable energy used when the charger is plugged in but there are no batteries charging?
- Test the number of watts used by the two different iPad chargers. Does this number change if the iPad is on or off?
- Try leaving the chargers plugged in but unplug the iPads, do the chargers still use measurable energy?
- For the cart, unplug a few iPads and measure if there is a change in the watts used by the cart.

Station 7: Electric Pencil Sharpener

- Does it use any measurable energy when a pencil is not being sharpened?
- How much energy is used when sharpening a pencil?
- Does the amount of energy change as the pencil goes from dull to sharp?
- How long does it take to sharpen a pencil?
- What energy would you use to sharpen your pencil if the power went out?