School Energy Audit - Detailed

Lights Out

The purpose of this audit is to determine which lights are on when not needed, and to help you calculate greenhouse gas emission reductions from your campaign.

Decide which parts of your school and which time periods you are going to audit. The worksheets are set up to cover any rooms and all time periods. But you may decide, for example, to do classrooms only, and mornings only. As long as you are consistent between your pre and post audits, that is OK.

This audit has a lot of detail and a lot of math! If you want a simpler version, try the Lights Out - Home Energy Audit, or the Lighting and Lights Out - School Energy Audit. For younger students the teacher, or SES can do the calculations for your audits.

Pre Campaign Audit

1. Using the "About Your School" sheet, calculate how long each of the time periods in your school day are. Also note school policies that will affect turning off lights.
2. Using the "About the Rooms" sheet, record the information for each room you plan to include in your audit.
    a. Switch #1 is the switch closest to the door. Switch #2 is the next switch over, etc.
    b. Ask your caretaker how many watts each light uses. If they are fluorescent lights, and your caretaker doesn't know how many watts, use 30 Watts per tube. (Older fluorescent lights will likely be 40 or 46 watts per tube).
    c. Count the number of lights each switch controls.
    d. The grey area is for you to calculate the Watts of lighting on each switch.
3. Make a copy of the "How Are We Doing?" sheet for each room you are auditing, for each day you audit. For each time period you audit, go to each room and fill out the form.
    a. In the "minutes" row, note the minutes from the "About Your School" sheet.
    b. In the "Lights on" section, note whether each switch is on or off. For younger students, put a checkmark in the boxes where lights are on. For older students put the number of minutes from the first row.
    c. Under "Time: Total Minutes" add up the time periods where lights were on.
    d. "Power: Watts per Switch" comes from the information you calculated on the "About the Rooms" sheet.

   e. Multiply Total Minutes by Watts per Switch to get Energy: Watts x Minutes.
   f. Add up the Watts x Minutes for each switch to get a total for the room.
4. On the "Calculations" sheet, transfer the "Watts x Minutes" for each room into the "Pre-Audit" column.
   a. Add up the Watts x Minutes for each room to get a Total Watts x Minutes. Then use the calculations at the bottom of the page to get kiloWatt Hours and the greenhouse gas emissions.

Mid Campaign Audit (optional, helps to see how things are going)
Repeat the How are We Doing sheet, and add the information to your Calculations sheet.

Post Campaign Audit

1. Repeat the How are We Doing sheet, and add the information to your Calculations sheet.
2. Subtract the Post-Audit Watts x Minutes from the Pre-Audit Watts x Minutes. You can do this for each room, or just for the total at the bottom of the page. Do the rest of the calculations at the bottom of the page. This is your total savings for each day that your school maintains this behavior.

Discussion and Campaign Possibilities

Energy = Power x Time. Knowing this, what are the two ways you can save energy with lighting?

Do some light switches have more Watts of lighting than others? How could you use that information to help reduce energy use?

Do all classrooms have windows? Are most classrooms keeping the blinds open during the day? Why or why not? How could natural lighting be used to reduce energy use? In your classroom, do you like working with the blinds open and lights off? Why or why not, and how can you use that in your campaign?

How often did you find lights on in unoccupied rooms? Is it happening more in some rooms than in others?

If your school still had the old T12 fluorescent lighting (approx. 40Watts/tube) how would that affect your energy use, and your campaign energy savings?

How can you apply what you've learned in this audit and campaign at home? If you switch from incandescent lighting to Compact Fluorescent (CFL) or LED lighting at home, how will that affect your energy use?

Your school saves about 6.24¢ for every kWh you save on this campaign. If you could choose, what would you do with the savings? At home, you pay about 13.78¢ for every kWh. How much money do you think you could save at home if your family got really good at turning off unnecessary lights at home?

Curriculum Connections

Grade 4 Physical Science: Outcome LI4.1 Investigate the characteristics and physical properties of natural and artificial sources of light in the environment.
LI4.2 Analyze how light interacts with different objects and materials to create phenomena such as shadows, reflection, refraction, and dispersion.
LI4.3 Assess personal, societal, and environmental impacts of light-related technological innovations including optical devices.
Social Studies: Outcome RW4.1 Analyze the strategies Saskatchewan people have developed to meet the challenges presented by the natural environment.
Mathematics: Outcome 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
P4.1 Demonstrate an understanding of patterns and relations

Grade 5 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 Physical Science: Outcome EL6.1 Assess personal, societal, economic and environmental impacts of electricity use in Saskatchewan and propose actions to reduce those impacts. **EL6.2** Investigate the characteristics and application of static electric charges, conductors, an insulators, switches and electromagnetism. **EL6.3** Explain and model the properties of simple series and parallel circuits. **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 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. **SP7.2** Demonstrate an understanding of circle graphs.
Grade 8 Life Science: Outcome OP8.1 Identify and describe, through experimentation, sources and properties of visible light including: rectilinear propagation, reflection, refraction. **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.

About Your School

How long is: (minutes)

Before School	_____	time from when school opens until 1st class starts
1st class	_____	
morning recess	_____	
2nd class	_____	
lunch	_____	
3rd class	_____	
afternoon recess	_____	
4th class	_____	
after school	_____	time from when 4th class ends until school closes
other	_____	

School rules affecting lights:

examples - library lights are slow to turn on, so they stay on all the time
- school lights out policy

_____

_____

_____

_____

_____

_____

About the Rooms:

Room name or number	Power: Watts per Light[1]	How many lights on each switch			Power: Watts per switch (Watts per light x lights per switch)			Are there windows? (Yes/No)
		Switch #1	Switch #2	Switch #3	Switch #1	Switch #2	Switch #3	
	30				0	0	0	
	30				0	0	0	
	30				0	0	0	
	30				0	0	0	
	30				0	0	0	
	30				0	0	0	
	30				0	0	0	
	30				0	0	0	
	30				0	0	0	
	30				0	0	0	
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	30				0	0	0	
	30				0	0	0	
	30				0	0	0	
	30				0	0	0	
	30				0	0	0	
	30				0	0	0	
	30				0	0	0	
	30				0	0	0	

1. Ask your caretaker. If your school has fluorescent lights, you can use 30Watts per tube.

Student Action for a Sustainable Future

How Are We Doing?

Room: _____

Date: _____

	Before School	1st class	morning recess	2nd class	lunch	3rd class	afternoon recess	4th class	after school	other			
minutes	0	0	0	0	0	0	0	0	0				
Occupied (yes/no)	0												
Sunny (yes/no)													
Blinds open (yes/no)													
Lights on:											**Time: Total Minutes**	**Power: Watts per Switch**	**Energy: Watts x Minutes**
Switch #1											0		0
Switch #2											0		0
Switch #3											0		0
											Total	**Total**	0
# lights on in empty rooms	0	0	0	0	0	0	0	0	0	0	0		
# blinds closed on sunny day	0	0	0	0	0	0	0	0	0	0	0		

Calculations

Room	Pre-Audit Date Watts x Minutes	Mid-Campaign Date Watts x Minutes	Post-Audit Date Watts x Minutes	Pre minus Post Watts x Minutes
0				0
0				0
0				0
0				0
0				0
0				0
0				0
0				0
0				0
0				0
0				0
0				0
0				0
0				0
0				0
0				0
0				0
Energy: Total Watts x Minutes	0	0	0	
÷60 (to convert minutes to hours)	0	0	0	
÷1000 (to convert Watts to KiloWatts) **= kiloWatt Hours** (kWh)	0	0	0	0
x 0.763 Kg CO_2 per kWh **= greenhouse gas emissions**	0	0	0	**0**

How Are We Doing? **Date:** _____ Name: _____

Lights on?		WEEKDAY Before School	During School	After School	After Supper	WEEKEND Morning	Afternoon	Evening
Kitchen	Occupied (y/n)→							
	blinds open (y/n)→							
Switch #1	# of bulbs							
Switch #2	# of bulbs							
Living Room	Occupied (y/n)→							
	blinds open (y/n)→							
Switch #1	# of bulbs							
Switch #2	# of bulbs							
Switch #3	# of bulbs							
Bedroom #1	Occupied (y/n)→							
	blinds open (y/n)→							
Switch #1	# of bulbs							
Switch #2	# of bulbs							
Bedroom #2	Occupied (y/n)→							
	blinds open (y/n)→							
Switch #1	# of bulbs							
Switch #2	# of bulbs							
Bathroom	Occupied (y/n)→							
	blinds open (y/n)→							
Switch #1	# of bulbs							
Switch #2	# of bulbs							
Total lights on in empty rooms								