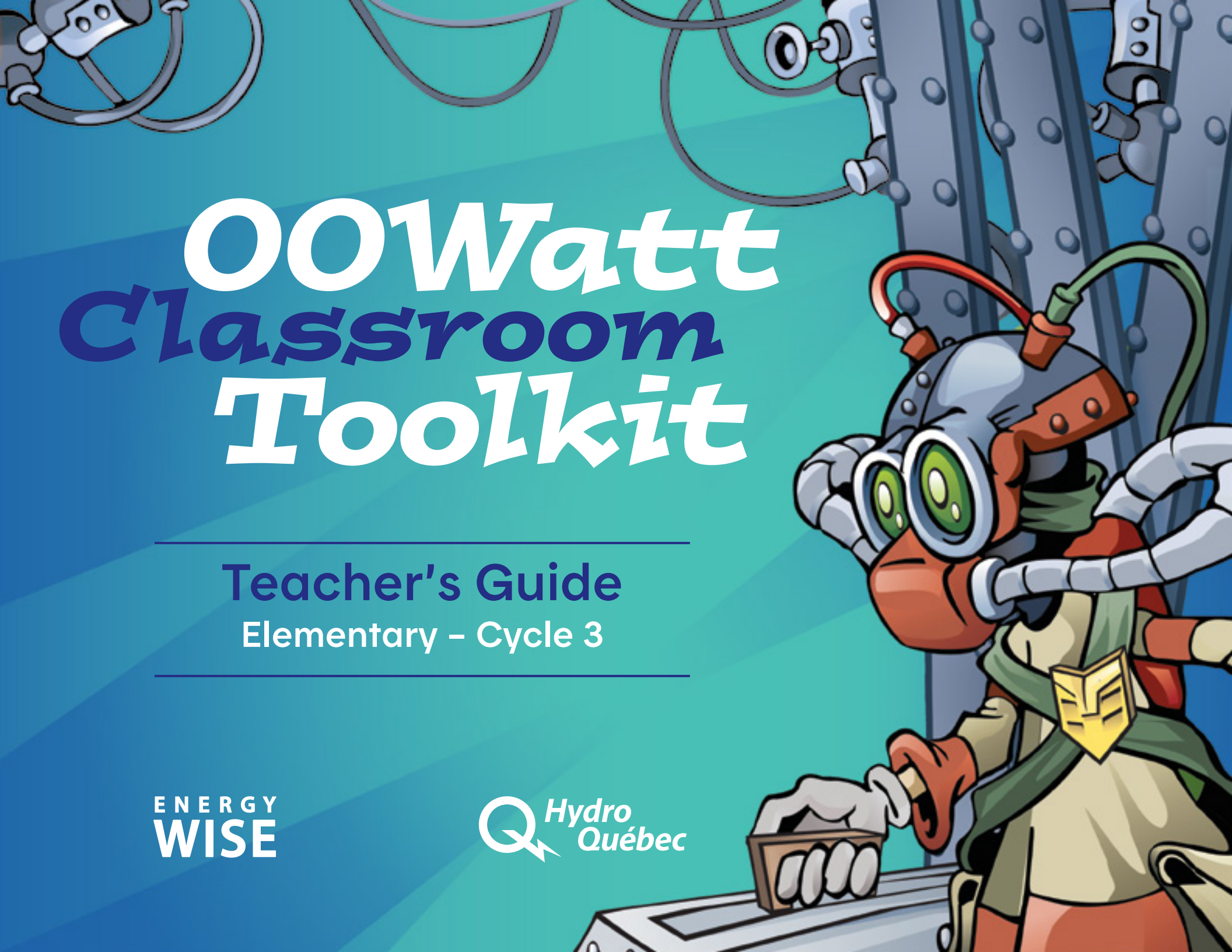
00Watt Classroom Toolkit

Teacher's Guide

Elementary – Cycle 3

ENERGY WISE

Hydro Québec



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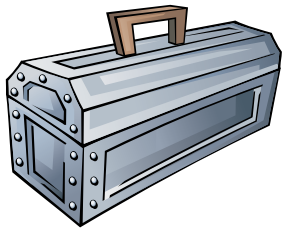

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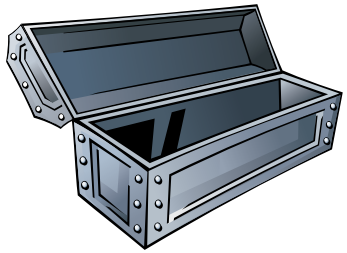
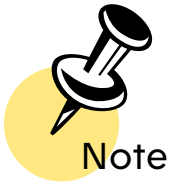


Introduction to the 00Watt Classroom Toolkit



Note

The name Inspector **00Watt** is pronounced *double-oh watt*.

A Classroom Toolkit for elementary cycle 3 students

The **00Watt Classroom Toolkit**, the result of a partnership between Hydro-Québec and the Montréal Science Centre, is specially designed for elementary cycle 3 (grades 5-6) students. The activities will help them understand how science and technology contribute to our society and how they can be used to make a better future while protecting the environment. More specifically, the Toolkit helps young people become more aware of the need to save electricity, find solutions by themselves and discover the many ways in which they can save energy. It also encourages them to promote energy-wise habits. All this is accomplished through various scientific activities, experiments and hands-on exercises.

Saving energy is everybody's business!

With the current emphasis on sustainable development, protecting the environment, saving energy and promoting environmental awareness are issues that affect everyone, and we all have to do our part.

Regardless of what type of energy we consume (electricity, oil, natural gas or other) and how we consume it (heating, lighting, getting around or producing goods), we know that it is a valuable resource we must use wisely.

In Québec, hydroelectricity and wind energy are the two main sources for generating electricity. They are *renewable* sources of energy, meaning the wind and rivers are constantly renewed. But there are only a limited number of places where we can transform water and wind into electricity. The more energy we consume, the closer we get to the maximum production capacity of our hydroelectric generating stations and wind turbines. What's more, since the least costly sites have already been developed, electricity rates will inevitably rise as we develop new sites.

Through real-life situations, elementary cycle 3 students will come to understand that electricity must be purchased, that it has a cost like anything else and that they have a role in saving energy if they don't want to drive up their families' electricity bills unnecessarily.

Students will see that by saving energy, they can avoid waste and help protect the environment and the future of our planet.

The 00Watt Classroom Toolkit: Concept

Main message

It's not hard to conserve energy; there are all sorts of products and services available for this purpose. In addition, changing some everyday habits can help save substantial amounts of energy. Young people can do their share and become ambassadors for the cause at home.

Theme

By saving energy, we can avoid waste and help preserve our environment without sacrificing our comfort.

Learning approach

The learning approach is based on discoveries, interactivity and challenges. The project approach is key because it is a fun way to cover different subject areas and understand how they are interrelated. Because it takes several days (about 15 hours) to carry out all the activities in the Toolkit, students will also have time to better understand the material and change their behaviours in the short, medium and long terms. Teachers will find that the very flexible project approach makes it easy to incorporate activities from the Toolkit into their lessons.

Storyline and characters

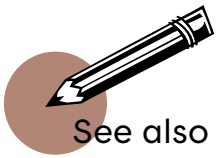
To make the Toolkit even more fun and motivate students, the educational content is structured around a story featuring two characters. Energy Inspector **OOWatt** and **Terawattus Energivorus**, an energy-gobbling virus that may have already "infected" students' homes, keep students company throughout the challenges and missions.

Structure of the Toolkit and guides

On loan for five weeks, the Toolkit was designed to make young people aware of the need to save energy. It takes a gradual approach, building on the message step by step. We therefore recommend that the activities be carried out in the order in which they are presented.

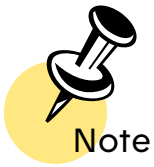
Two documents come with the **OOWatt Classroom Toolkit**: the *Teacher's Guide* and the *Student Activity Book*.

Length



See also
Student
Activity Book

Link with
the QEP



Note

The ***Teacher's Guide*** explains the objectives and methods suggested in the Toolkit and describes each of the activities. They are grouped into five parts, corresponding to five themes related to energy conservation.

1. Introduction to energy conservation
2. Hydroelectricity
3. Electric appliances and devices
4. Energy consumption
5. Ways to save energy

The five parts are carried out using materials in the Toolkit. Note that the materials for each part are clearly identified with a different colour.

Icon

This icon means you may need to review the **vocabulary** used during the activity with your students before getting started.

Four other icons in the left margin draw attention to useful information.

For each activity, the Guide explains:

- its **goal**;
- its **length**;
- the **materials** provided and those to be to be obtained (or prepared);
- links with the Québec Education Program (**QEP**);
- the suggested **steps and**, in some cases, the **suggested discussion approach**.

The Guide contains a complete list of the materials in the Toolkit. It also provides:

- a **lexicon** entitled *Speaking of Electricity*;
- a **list of programs** related to energy conservation and **related organizations**.

The *Student Activity Book* contains cartoons, quizzes and other exercises for students. At the end, every student receives a certificate and is invited to formally commit to taking steps to save energy and promote energy conservation in their families. The *Student Activity Book* will serve as a wonderful souvenir of their adventures with **OOWatt**!

Link with the QEP

Depending on the activity

Objectives of the 00Watt Classroom Toolkit

General objectives

- Learn about the technology used to produce, transmit and distribute electricity.
- Understand how energy can be wasted in the home.
- Discover various products and everyday habits to save energy.
- Make students aware of how they can be energy-saving ambassadors at home.

Links with the Québec Education Program (QEP)

The **00Watt Classroom Toolkit** meets the requirements of the *Ministère de l'Éducation et de l'Enseignement supérieur* education program, while developing cross-curricular competencies.

Areas of learning and competencies

Science and technology

- Propose explanations or solutions to scientific or technological problems
- Make effective use of scientific and technological tools, objects and procedures
- Use modes of communication appropriate to science and technology

Mathematics

- Reason using mathematical concepts and processes

Geography, history and citizenship education

- Interpret the organization of a society and its territory
- Construct social awareness in order to act as a responsible, informed citizen (general objective)

English

- Write a variety of texts
- Communicate verbally

Visual arts

- Produce personal visual arts creations

Progression of learning

Science and technology: the material world

Energy

- Identify energy sources in the student's environment
- Identify and describe the function of the components of a simple electrical circuit
- Describe situations where people consume energy
- Name steps that people take to limit their energy consumption

Systems and interaction

- Identify the primary function of a few complex machines
- Recognize the influence and impact of electric devices on individuals' lifestyle and environment

Techniques and instrumentation

- Use simple measuring instruments properly

Appropriate language

- Use terms associated with the material world properly

Science and technology: the living world

- Describe the impact of human activity on the environment

Mathematics: arithmetic

- Approximate a result
- Assimilate written computation processes

Mathematics: measurement

- Understand relationships between units of measure

Geography, history and citizenship education

Knowledge pertaining to the organization of a society in its territory

- Understand hydrographic assets

Research process and information processing

- Become aware of a problem
- Formulate questions
- Gather and process information
- Organize information
- Communicate the results of the student's research

List of Materials Provided

Note

We have supplied this list of materials to help you understand the contents of the 00Watt Classroom Toolkit. You can also use it to make sure your Toolkit is complete when receiving it and sending it back.

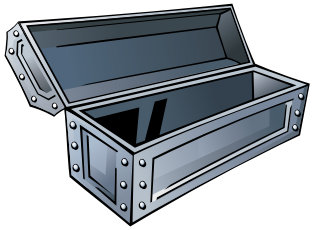
Contents

USB key

The Toolkit includes a USB key. You can use the key to project the content on an interactive whiteboard.

Documents

- *Teacher's Guide*
- Letter to parents
- *Waste Not, Want Not!* comic strip (Activity 3.1)
- *Stop the Virus!* comic strip (Activity 5.1)



Slideshow and videos

- *Electricity Timeline* slideshow (Activity 1.3)
- *Energy is neither created nor destroyed* film (Activity 2.2)
- Hydro-Québec Video, *Doing something for the planet doesn't require too much…energy!*

Digital games

- *An Adventure Right down the Line!* (Activity 2.4)
- *The Energy-Wise Squad* (Activity 5.3)
- *Mystery Objects* (Activity 5.4)
- *Let's Get Started!*, *Unplugged!* (Activity 5.5)

Important

- The *Teacher's Guide*, slideshow, videos and digital games are also available online, at **hydroquebec.com/teachers**.
- The comic strips are also in the *Teacher's Guide* and *Student Activity Book*.
- The USB key **must be returned with** the Toolkit.
- Activities 5.6 and 5.7 (week 5, according to the timetable) may be **carried out after** the Toolkit is returned because only the *Student Activity Book* is required.

Documents

Suggested timetable

A sheet measuring approximately 28 cm X 43 cm provides a quick overview of the proposed schedule.

Teacher's Guide

The printed copy of the *Teacher's Guide* is for **consultation** only. You must return it with the Toolkit. If you would like your own copy, you may request one from Réseau technoscience.

Letter to parents

This letter should be sent to parents at the start of Part 1 to inform them about the educational experience on which their children are about to embark.

Student Activity Book

Students should be given their own copies of the *Student Activity Book* during Part 1. Students may keep them as a souvenir when finished.

Evaluation questionnaire

Please fill out the evaluation form to help us improve the contents of the **OOWatt** Classroom Toolkit.

Learning outcome evaluation tool

Once you have completed the **OOWatt** experience, visit **hydroquebec.com/teachers** and use the tool to evaluate how much your students learned.

Costumes

The Inspector **OOWatt** costume consists of a top, two armbands, a pair of goggles and an LED flashlight with a crank.

The **Terawattus Energivorus** costume consists of a top, two armbands and a pair of goggles.

Envelope for damaged items

If any items are damaged, please place them in the envelope provided.

Toolkit inventory checklist

Use the checklist to confirm the Toolkit's contents before and after using it.

Colour codes

The teaching materials are colour coded to make them easier to organize and put away. Each colour goes with a particular part of the 00Watt experience.

Part 1

Materials identified in red

- 1 wanted poster for **Terawattus Energivorus**
- 2 copies of the instruction sheet for role-playing exercise 1.1, *The Meeting*
- *Electricity Timeline* slideshow (USB key)

Part 2

Materials identified in yellow

- 4 copies of the instruction sheet for Role-playing exercise 2.1, *Turn Me On!*
- 1 plastic jug
- 1 turbine
- 1 stick
- 1 timer
- 1 roll of adhesive tape
- 15 nine-volt batteries (in a transparent plastic box)
- 30 mini-bulbs (in a transparent plastic box)
- 49 electric wires with alligator clips
- 1 copy of *Quiz and Answer Sheet A*
- 1 copy of *Quiz and Answer Sheet B*
- *Energy is neither created nor destroyed* – Hydro-Québec video (USB key)
- *An Adventure Right down the Line!* digital game (USB key)

Part 3

Materials identified in orange

- 1 wattmeter
- Round red, green and yellow stickers
- *Waste Not, Want Not!* comic strip (USB key)

Part 4

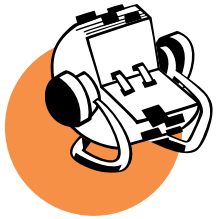
Materials identified in blue

- 4 copies of the instruction sheet for Role-playing exercise 4.1, *Taking a Shower*
- 30 thermometers (in a pouch)
- Video by Hydro-Québec, *Doing something for the planet doesn't require too much…energy!* (USB key)

Part 5

Materials identified in green

- 13 mystery object description sheets (in a transparent envelope)
- 1 set of LED holiday lights
- 1 reduced-flow faucet aerator (5.7 litres/min)
- Safety caps for electrical outlets
- 1 piece of hot water pipe insulation
- 1 dimmer switch
- 1 WaterSense® labeled reduced-flow shower head (5.7 litres/min)
- 1 shower timer
- 1 LED bulb
- 1 electronic thermostat
- 1 sheet of plastic window film
- 1 timer for indoor lights
- 1 piece of a solar pool cover
- ENERGY STAR® and WaterSense® logos
- *Stop the Virus!* comic strip (USB key)
- *ENERGY-WISE Squad* digital game (USB key)
- *Mystery Objects* digital game (USB key)
- *Unplugged!* digital game (**hydroquebec.com/teachers**)



Speaking of Electricity

Conductor

Part of a power line specifically designed to carry current.

Electric circuit

A system of conductors that carries electric current.

Electric current

Electrons in constant movement in the same direction inside a conductor (e.g., a copper wire). The current is a source of energy. It can power different devices, generate heat or light or perform work.

Electric energy

Electric energy is used to perform work: moving a load, providing heat or light, running a computer, etc. It is measured in watt-hours (Wh), which is an amount of power (in watts) over a period of time (in hours).

Electric energy makes it possible to do all sorts of things, like bake a cake, freeze ice cream or drive an electric car, for instance.

Electricity

Electricity is a form of energy associated with electric charges, at rest or in motion. It is produced by the movement of elementary particles of matter (electrons) and manifests itself as different phenomena, for instance as heat, movement, light, etc.

Electrons

Electrons are part of atoms, the building blocks of all matter. Water, oxygen, metals and the human body are all made of atoms. Electrons very often move between atoms. When a large number of electrons move constantly in the same direction, in a metal wire, for instance, an electric current is created. Because electrons have a negative charge, they are attracted by the positive pole of a magnet.

Energy

Energy is the ability to perform work or transform something. The main forms of energy are mechanical, electrical, chemical, thermal and radiant.

Energy efficiency

Energy efficiency is a an approach to energy consumption that calls for its wise use to reduce consumption, safeguard energy resources and help protect the environment. We can become more energy efficient by changing our wasteful habits and using more efficient products, technologies and processes.

Flow

The amount of water that moves through a river or pipe over a specific period.

Generator

A generator plays an essential role in a generating station, since it produces electric current.
A generator basically consists of two main parts: the stator and the rotor. Electromagnets are attached to the outside of the rotor, which spins inside the stator. The stator is the stationary part of a generator and is made of a winding of copper bars. It is the movement of the electromagnets next to the copper windings that forces electrons to start moving in the wires to produce an electric current.

Greenhouse gases

These gases are naturally present in Earth's atmosphere and help trap the heat from the Sun. Without them, our planet would be one big ice cube! The best-known greenhouse gases are carbon dioxide (CO_2) and methane (CH_4).

Over the past 100 years, human activities have caused these gases to build up in the atmosphere. One of the main culprits is the burning of coal or oil, and thermal generating stations and cars are the main sources of CO_2. Garbage decomposing in landfills releases tonnes of CH_4.

As a result, the temperature on Earth has risen slightly in recent years, upsetting the balance of our ecosystems. This is what's known as global warming.

Hydroelectric generating station

This refers to any kind of generating station that uses the force created by moving water (a waterfall or a flowing river, for instance) to turn its turbines. That is how the station transforms the mechanical energy of the water into electrical energy. There are two main types of hydroelectric generating stations: reservoir-type generating stations and run-of-river generating stations.

Mechanical energy

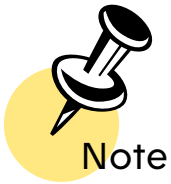
A physical body (water, for instance) that has weight and moves with a certain speed possesses mechanical energy. This type of energy can be transformed into electric energy by using the moving body to turn a turbine. This is the basic principle behind hydroelectricity.

Nuclear (thermal) generating station

This type of generating station uses a nuclear reactor to heat water and turn it into steam, which then drives a turbine connected to a generator.

Penstock

A pipe that carries water from the reservoir (behind the dam) to the turbines in a hydroelectric generating station.



Note

Boost your students' brainpower.

Power line

The combination of conductors, insulators and other equipment used to transport or distribute electric energy.

Power use

A value representing the combined effect of the voltage and amperage of an electric current. It shows how much power it takes to operate a machine, for instance, or for a household appliance, machine or system to work.

A microwave oven, for example, has a power use rating of about 1 kilowatt (kW) or 1,000 watts (W).

Recycling

To reduce the amount of waste that ends up in landfills, we must focus on recycling. That means transforming waste into new goods similar to those that would have been thrown out (transforming scrap paper into newsprint, for example) or different goods (using old tires to make rubber matting, for instance).

Source reduction

Source reduction means reducing the amount of waste we throw out. The principle is simple: buy less and choose goods without too much unnecessary packaging.

Reservoir

An artificial lake upstream of (behind) a dam, where water is retained until it is used to drive the turbines in a hydroelectric generating station.

Reservoir-type generating station

This type of generating station is driven by the water stored in an artificial lake, or reservoir, created by placing a dam across a river. The generating station operator can easily control the flow of water to the turbines by deciding how much water to take from the reservoir.

Rotor

The moving part in a generator, equipped with electromagnets. The rotor turns inside the stator.

Run-of-river generating station

This type of generating station is driven directly by a flowing river and has almost no water reservoir. As a result, the amount of energy it produces depends on the flow of the water. The more it rains, the more water flows in the river and the more electricity the station can generate.

Stator

The stator is the stationary part of a generator and is made up of copper bar windings.

Sustainable development

Development that meets the needs of the present generation without compromising the ability of future generations to meet their own.

Thermal generating station

There are two types of thermal generating stations:

(1) those that produce energy by burning a fuel like coal, diesel or natural gas to boil water, transforming it into pressurized steam that is then released to drive a turbine;

(2) those that produce energy by burning diesel using an engine that drives a generator to produce electricity. Most Hydro-Québec thermal generating stations have a diesel engine.

Thermostat

An automatic device used to measure the temperature indoors and keep it relatively constant.

Turbine

A machine in which water, steam, compressed gas, etc. pushes the paddles, vanes or blades on a wheel and causes it to turn, transforming the energy from the fluid or gas into mechanical energy.

Wind energy

Moving air has energy known as wind power. This energy can be captured and converted into electric energy by means of huge propellers. When the wind sets them spinning, they drive a generator. Machines that use wind power to produce energy are called wind turbines.

For More Information

Various programs and guides

Energy-efficient appliances

- nrcan.gc.ca/energy/products/energystar/12519
- nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/energystar/v6_eng.pdf
- solutionsecofitt.ca/en/

Hydro-Québec Distribution

- hydroquebec.com/residential/energy-wise/
- hydroquebec.com/residential/customer-space/account-and-billing/understanding-bill/
- hydroquebec.com/safety/
- hydroquebec.com/teachers
- hydroquebec.com/transportation-electrification/

Energy-saving tips

- ecohome.net
- economie-d-energie.ooreka.fr/ (French only)

Sustainable tourism

- aeq.aventure-ecotourisme.qc.ca/home

Stratégie québécoise d'économie d'eau potable (Québec strategy for drinking water conservation) (French only)

- mamh.gouv.qc.ca/fileadmin/publications/grands_dossiers/strategie_eau/strategie_eau_potable.pdf

Electric vehicles in Québec

- vehiculeselectriques.gouv.qc.ca/english

Organizations

Transition énergétique Québec (TEQ)

- transitionenergetique.gouv.qc.ca/en

Équiterre

- equiterre.org/en

Natural Resources Canada

- nrcan.gc.ca/energy/efficiency

RECYC-QUÉBEC (French only)

- recyc-quebec.gouv.qc.ca

WaterSense®

epa.gov/watersense

Knowledge Is Power

Note

Spark your students' curiosity during the activities!

- In 1908, Montréal was one of the first cities in North America to adopt a **policy calling for power lines to be buried**. There were far too many overhead power lines crisscrossing each other, and it made the city look unattractive. The new measure was also intended to protect the power system from harsh winter weather.
- Québec has one of the highest per-capita **electricity consumption rates** in the world. This is mostly attributable to home heating and the presence of large industrial enterprises that use a lot of electricity.

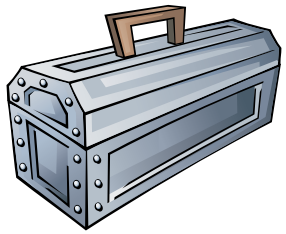
And more!

- Transportation accounts for more of Québec's **greenhouse gas (GHG) emissions** than any other sector. Replacing one million gasoline-powered cars in Québec with electric cars would reduce greenhouse gas emissions by 3.4 million tonnes a year.
- The **wholesale electrification** of transportation can help fight climate change, along with making greater use of mass transit and redesigning our cities.

- In addition to its **63 hydroelectric generating** stations, Hydro-Québec operates 24 thermal generating stations and purchases power from 36 wind farms.
- If all of Hydro-Québec's transmission and distribution lines were laid end to end, they would stretch 152 491 km, more than enough to go **three and a half times around Earth!**
- The world's largest underground generating station is Robert-Bourassa generating station in the Eeyou Istchee Baie-James region. It is 483 m long by 137 m wide, making it as big as **four soccer fields laid end to end!**
- Fully **95%** of all power produced in Québec is **hydroelectric**. The other 5% is mainly produced by thermal generating stations and wind turbines.
- By 2022, Québec is expected to have 3,933 MW of wind energy, which is equivalent to the electricity needs of approximately 1 million homes.
  Source: https://mern.gouv.qc.ca/en/energy/wind-energy/
- Hydro-Québec serves over 4 million industrial, business and residential customers.
- To produce electricity, maintain its power system and serve its customers, Hydro-Québec employed nearly **20,000 people in 2020**.

Part 1

Introduction to Energy Conservation



OOWatt's Mission

Activity 1.1

Introduction to the Characters

The Meeting Role-Playing Exercise

Length

10 minutes, not counting students' preparation time

Goal of the Activity

Two students play the parts of the characters featured in this educational exercise: Inspector **OOWatt** and the dastardly **Terawattus Energivorus**.

Materials Required

Materials provided

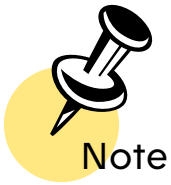
- **OOWatt** costume
- **Terawattus Energivorus** costume
- The **OOWatt** flashlight (the instructions are shown on the flashlight)
- A wanted poster describing **Terawattus Energivorus** to show the students
- 2 copies of the instruction sheet for Role-playing exercise 1.1

Steps

- On the day before the exercise, take two students aside and ask them if they would like to play the roles of the ingenious Inspector **OOWatt** and the dastardly **Terawattus Energivorus** and give them the instruction sheet for Role-playing exercise 1.1.
- The two actors don't need to learn the script by heart; they can hold it during their performance. They must follow the instructions.
- Using the instruction sheet for Role-playing exercise 1.1, they should practise ahead of time, but in secret, to better surprise their classmates. To add to the surprise, turn out the lights off right before the performance begins.

Links with the QEP

Drama



Note

OOWatt and **Terawattus** can be played by a boy or a girl.

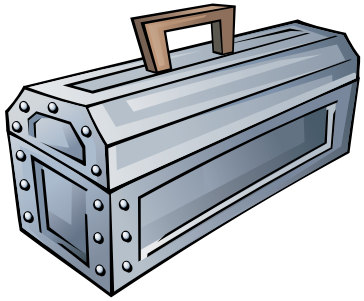
Getting into Character

If you are playing OOWatt:

- Think of yourself as a police inspector.
- Speak slowly and with authority.
- Stand up straight.
- Be suspicious of everything, keep looking around as though you're expecting to see the evildoer everywhere.

If you are playing Terawattus Energivorus:

- Think of yourself as evil.
- Hunch over.
- Walk with a limp.
- Speak with a deep, growly voice.



Script

- The classroom lights are off.
- **OOWatt** enters, holding a flashlight, and prowls around the classroom. He seems to be looking for something or someone.

OOWatt

Hello, my name is Inspector Watt. Double-oh Watt. I am looking for the abominable Terawattus Energivorus. Do you know him? This is what he looks like.

- **OOWatt** shows the class the wanted poster for **Terawattus Energivorus** and places it on the blackboard chalk tray.

OOWatt

If you see him, let me know!

- **Terawattus Energivorus** turns on the lights.
- **OOWatt** jumps.

Terawattus Energivorus

Ha, ha! Do you really think you can catch me, you Double-0-nothing?

Note

After their performance, the actors can take a bow.

- **OOWatt** is cross. That's not his name!

OOWatt

*My name is **OOWatt**!*

- **Terawattus Energivorus** speaks in a triumphant tone.

Terawattus Energivorus

Ha! Be quiet! You'll never catch me. There are millions of people on my side. They all love using tons of energy!

- **OOWatt** speaks like a superhero.

OOWatt

Not so fast, you energy-gobbling heap of scrap metal! I am here to stop you from taking over the world.

- With a sweeping gesture, **OOWatt** indicates the students.

OOWatt

And I have plenty of assistants to help me. Together we'll get rid of you, and people will stop wasting energy.

- **Terawattus Energivorus** is sure of himself, mocking.

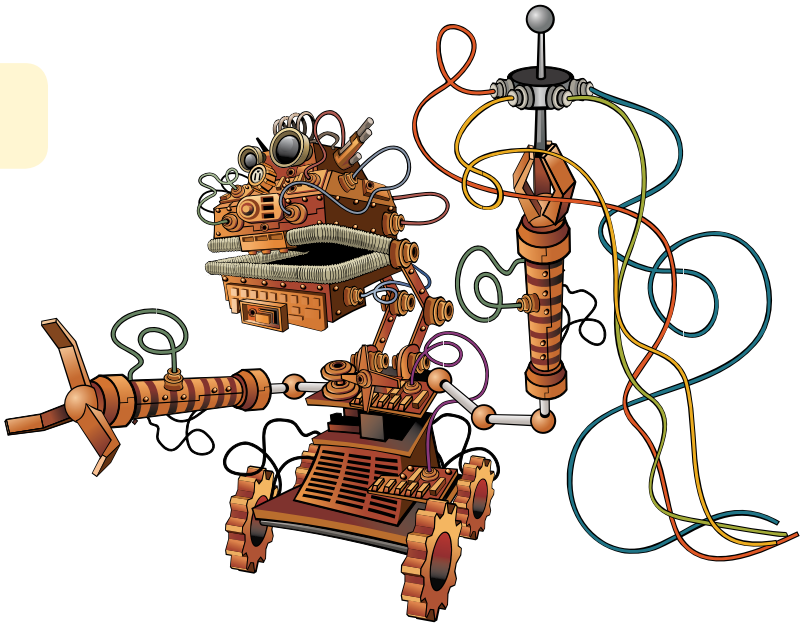
Terawattus Energivorus

Good luck, my friend. I am invincible! I'm going to continue to infect people all over the world and devour all the energy I can. Gnahahaha!

- **Terawattus Energivorus** leaves the room with a menacing laugh.
- **OOWatt** talks to the class in a confidential tone.

OOWatt

I have to go after him, but I'm going to need your help. You'll find everything we need to carry out our mission in the Toolkit. Good luck!



Activity 1.2

The Toolkit

OOWatt in search of the dastardly Terawattus Energivorus

Length
20 minutes

Goal of the Activity

Show the class the Classroom Toolkit, its activity book and interactive materials and launch a discussion to help students understand that they will be asked to look at their own behaviours and take action.

Materials Required

Materials provided

- The Classroom Toolkit and its contents
- Activity books to be handed out to students
- Copies of the letter to parents

Steps

- Show the students the Classroom Toolkit and a few of the things it contains. Use a mysterious and confidential tone to pique their curiosity and interest in the proposed activities (without giving it all away!).
- Before the class ends, distribute the letters and ask students to give them to their parents that evening.

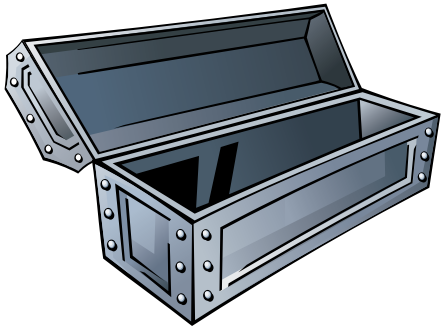
Links with the QEP

Social Sciences

Suggested Approach

Here are some suggestions for launching a discussion about energy conservation. **The idea is not to answer the questions raised at this point**, but simply to ask the *right* questions:

- *I'm going to show you this Toolkit from Hydro-Québec and what's inside. It's full of activities and experiments to help us get cured of the infection by that nasty* **Terawattus Energivorus***!*
- *Have you ever heard anyone say that it's wrong to waste electricity?* **Why** *is that, do you think?*
- *First of all, where does electricity come from? How does it get all the way to our homes?*
- *What are the benefits of saving energy for our society and our families?*
- *Do you think we can use less energy and still be just as comfortable?*
- *Suppose we say it's a good idea to save energy.* **But how***? What can we do?*
- *Let's find the answers to all these questions by joining forces with that clever* **OOWatt** *and helping him track down the dastardly* **Terawattus Energivorus***!*
- *With* **OOWatt***, we'll learn about the history of electricity in Québec, how it is produced, good and bad things about energy consumption, ways of saving energy and lots more.*
- *We'll make discoveries, play games and do scientific experiments, at school and at home, too. Just like scientists, we'll make hypotheses, do calculations and make observations and draw our conclusions.*
- *By the time we've finished the program, we'll be real* **energy-saving ambassadors** *– just like Inspector* **OOWatt***!*



Good to know

Why should we use less electricity when Québec generates its own hydroelectricity?

First of all, because rising consumption means Hydro-Québec has to find new sources of energy or build new dams. Second, because the energy we don't use can be sold to neighbouring states or provinces where coal is the main source of energy. Lastly, because it's never a good idea to waste anything!

Source: *La Presse*, Montréal, Saturday, April 21, 2007, special environment section

And besides:

"Published in December 2018, the recent report of the International Energy Agency (IEA) indicates that global coal consumption is on the rise again (+1% compared to 2017).

This is an alarming trend, because despite increasing international awareness of the risks of global warming due to greenhouse gas emissions, some major economies are unable to substitute their coal-based electricity with less carbon-intensive energies. Indeed, coal is mainly used for electricity production, with two-thirds of world consumption intended for this purpose."

https://theconversation.com/explaining-the-increase-in-coal-consumption-worldwide-111045

Activity 1.3

History of Electricity in Québec
Electricity Timeline Slideshow

Length

- 5 minutes for the slideshow
- 10 minutes for the discussion

Goal of the Activity

The slideshow outlines the main phases in the development of electricity production and consumption in Québec, from its beginnings to the present day. Students will come away with a better understanding of the scale and complexity of the sites and equipment and of their environmental impact.

For more information on the history of electricity: **hydroquebec.com/learning**

Materials Required

Materials provided

- *Electricity Timeline* slideshow available at **hydroquebec.com/teachers** or on the provided USB key

Materials to be obtained for the slideshow

- Interactive whiteboard or computer with speakers, multimedia projector and screen

Steps

- Play the slideshow on the history of electricity in Québec for your class.
- To start the slideshow, go to **hydroquebec.com/teachers** or insert the USB key in the computer and click on the Electricity Timeline file.
- After the slideshow is over, talk with the students about what they learned and go over the various themes.

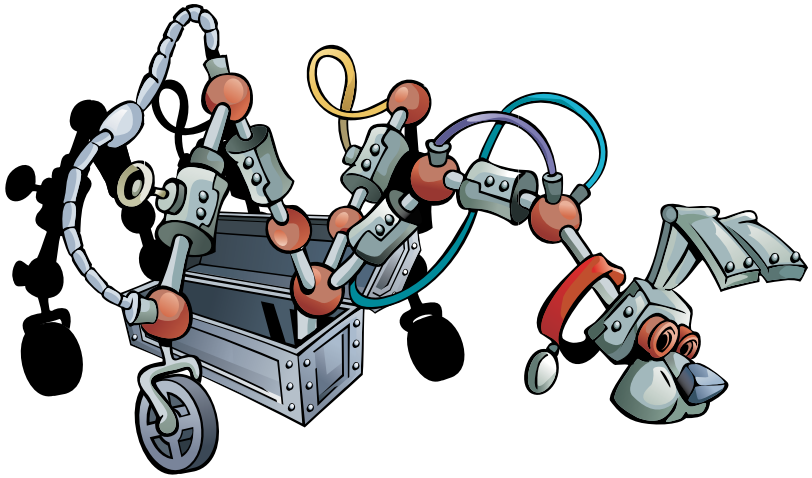
Discussion

Themes

- Life before electricity
- The first uses of electricity
- The impact of electricity on home life
- The construction of hydroelectric generating stations in Québec
- Growing energy needs: how far can we and should we go?

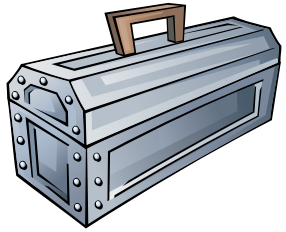
Links with the QEP

Social Sciences



Part 2

Hydroelectricity



An Adventure Right down the Line!

Activity 2.1

Hydroelectricity

Turn Me On! Role-Playing Exercise

Length

10 minutes

Note

Boys or girls may play the roles of **OOWatt** and **Terawattus**.

Goal of the Activity

Through this role-playing exercise, some students present a humorous look at the theme of this part, i.e., **how hydroelectricity is produced in Québec**.

Materials Required

Materials provided

- **OOWatt** costume
- **Terawattus Energivorus** costume
- 4 copies of the instruction sheet for Role-playing exercise 2.1

Materials to be obtained

- Any props useful for the role-playing exercise

Steps

- Call on students or ask for four volunteers to play the characters. Give them the instruction sheet for Role-playing exercise 2.1.
- The actors read the instruction sheet for Role-playing exercise 2.1 and get ready. They don't need to learn the script by heart; they can hold it during their performance. They must follow the instructions.

Roles

- **OOWatt**
- **Terawattus Energivorus**
- A six-year-old boy or girl
- A teenager

Links with the QEP

Drama

Getting into Character

If you are playing OOWatt:

- Think of yourself as a police inspector.
- Speak slowly and with authority.
- Stand up straight.
- Be suspicious of everything, keep looking around as though you're expecting to see the evildoer everywhere.

If you are playing Terawattus Energivorus:

- Think of yourself as evil.
- Hunch over.
- Walk with a limp.
- Speak with a deep, growly voice.

If you are playing the six-year-old:

- Speak rather quickly, in a childlike voice.
- Bounce around a bit when you move.
- Make big, excited movements.

If you are playing the teenager:

- Look as though you are concentrating on your homework.
- Speak with a lazy but impatient voice.

Script

- The teenager is seated at a desk, doing homework.
- Terawattus Energivorus is hiding under a table.
- OOWatt stands off to the side a bit, watching, with arms crossed.
- The child is turning the classroom lights on and off, on and off ...

Child

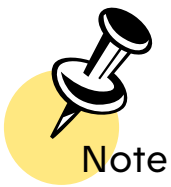
On and off, on and off, on and off.
Electricity is magic!

- The teenager is trying to work and is getting irritated with this game.

Teenager

You think it's magic? You know, a lot of people have to work really hard just so you can flick the lights on and off so easily!

- The child continues playing with the light switch.
- The teenager gets up.



Note

The furniture and props can be imaginary or simulated.

Teenager
Knock it off with the lights!

- The child stops playing with the light switch and joins the teenager next to the desk.

Child
Where does electricity come from, anyway?

Teenager
How should I know? I'm not your teacher! I just know it travels a long way before it gets to our house.

Child
It must be tired when it gets here, then!

- **OOWatt** turns off the lights.
- The child and the teenager look at him, eyes wide in surprise.
- **OOWatt** winks at the child.

OOWatt
If the electricity is tired, let's give it a rest!

- **OOWatt** turns the lights back on and joins the child and the teenager.

OOWatt laughs gently.
No, I was just kidding. But sometimes electricity must find that we use it up pretty quickly!

- **Terawattus Energivorus** bursts out from under the table, waving his arms excitedly.

Terawattus Energivorus
Oh come on, now! Don't worry about electricity. The whole idea is to use it up.

Child
Really?

Terawattus Energivorus
Of course! You're lucky to have it. Your great-grandparents didn't.

The child and teenager answer at the same time.
That's true.

Terawattus Energivorus
You have electricity to make your lives easier, so take advantage of it! In some countries, electricity is a luxury even now. But not here, in Québec.

Teenager
Lucky us!

Note
After their performance, the actors can take a bow.

Terawattus Energivorus
*We're **very** lucky! In Québec, with all the water we have, we can produce lots and lots and lots of electricity. So go ahead, turn on your TVs, lights, computers and game consoles!*

- **OOWatt** jumps forward and stands nose to nose with **Terawattus Energivorus**.

OOWatt
Hold it right there, my friend the energy hog! Electricity doesn't grow on trees. We have to build dams and create huge reservoirs in order to produce electricity. It takes a lot of water!

- The child moves between them to push them apart.

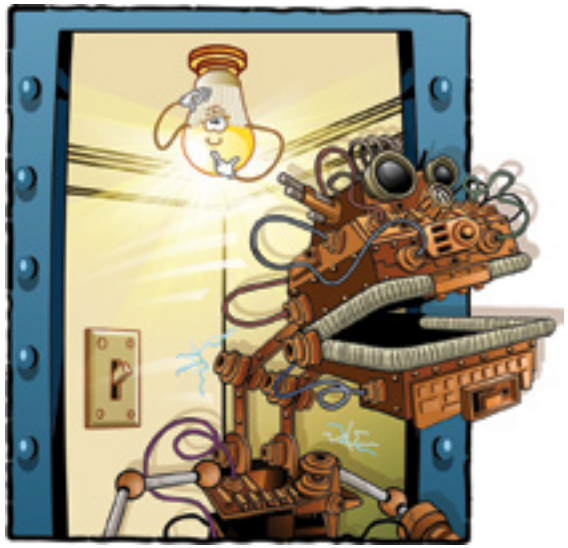
Child
But we have lots of water, don't we?

OOWatt
That's true. We have plenty of water in Québec, but that's no reason to waste energy!

Child
Why? Does it cost a lot?

OOWatt
It sure does! Just think, we also have to build a whole power system to carry the electricity from where it is generated. All that costs a lot of money and has an impact on the environment.

Teenager
*Really? I'd like to know more. **Enlighten me**!*



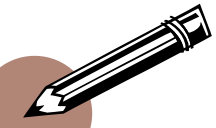
Activity 2.2

How Hydroelectricity Is Generated

Energy is neither created nor destroyed – Hydro-Québec video

Length

- 2 times 5 minutes for the video
- 20 minutes for the quiz



See also

Student Activity Book, page 3

Vocabulary

Goal of the Activity

Have your class watch the Hydro-Québec video explaining how hydroelectricity is produced, transmitted and distributed. Then have them answer the quiz on the video in their activity books.

Materials Required

Materials provided

- Hydro-Québec video on the production of hydroelectricity, *Energy is neither created nor destroyed* at **hydroquebec.com/teachers** or on the provided USB key
- *Student Activity Book*
- Answer sheet (next page)

Materials to be obtained for the projection

- Interactive whiteboard or computer with speakers, multimedia projector and screen

Steps

- The students watch the video once.
- They read the questions in the activity book.
- Explain the vocabulary in the video, if necessary.
- The students watch the video again.
- They answer the questions in the activity book (they can work in teams of two).
- Working from the answer sheet, help the students correct their answers, if necessary.

Links with the QEP

- Science and Technology
- English
- Mathematics

Answer Sheet

Only questions 1 to 9 relate to the video.

Q1. What do you call the movement of **electrons** in an electric wire?

A1. Electric current

Q2. What machine generates **electric energy**?

A2. A generator

Q3. The stator is the stationary part of a generator. What do you call the **moving part**?

A3. The rotor

Q4. What changes the **power of moving water**?

A4. The difference in elevation and the flow

Q5. Which of these statements apply to a **reservoir-type generating station**?

A5. It has a water reservoir. More power can be generated when needed.

Q6. Which of these statements apply to a **run-of-river generating station**?

A6. It is fed directly by flowing water. It has only a small water reservoir. The power it generates varies with the flow of water.

Q7. What turns a **turbine**?

A7. The power of the moving water

Q8. What drives a **generator**?

A8. A turbine

Q9. Complete the following sentence with these words: **powerful / transformed / force**

A9. The surging force of our water is transformed into a form of energy just as powerful: electricity.

Supplementary questions

Q10. About how many **incandescent light bulbs** do you use **in your home**?

A10. _____ incandescent light bulbs

Q11. How much **energy** do ten 100-watt incandescent light bulbs use in one hour?

A11. 10 x 100 W x 1 h = 1,000 Wh = 1 kWh

Q12. Can you imagine how many **incandescent light bulbs** are used **every day** in Québec and all of Canada?

A12. Estimated number of incandescent light bulbs in each student's home X number of households in Québec (approximately 4,000,000 in 2015).

Estimated number of incandescent light bulbs in each student's home X number of households in Canada (approximately 15,500,000 in 2015).

Suggested Approach

What is the difference between an incandescent and an LED light bulb?

LED bulbs are much more efficient and environmentally friendly than incandescent bulbs. They also last much longer.

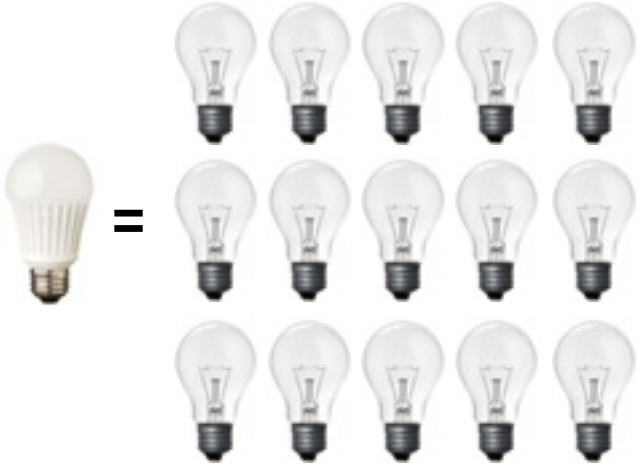
Note

Spark your students' curiosity by drawing their attention to the pictures of incandescent and LED light bulbs in their activity books.

Incandescent bulb

Light-emitting diode (LED) bulb

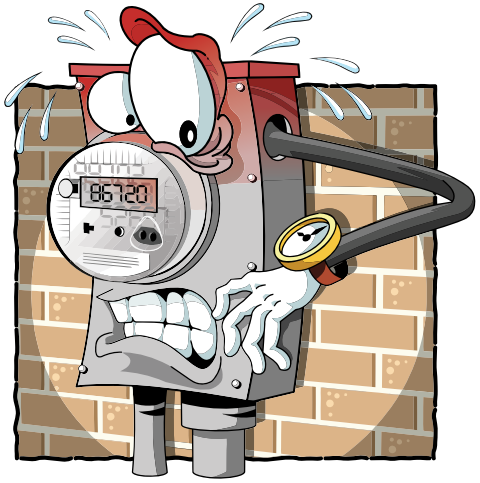
An **LED bulb** lasts 15 times longer than an incandescent bulb and uses 70% to 90% less energy.



Are incandescent bulbs on their way out? Have people made the switch to less energy-hungry bulbs?

In 2018, 47% of lights bulbs used in the home were efficient models, like LED bulbs. However, a lot of homes still rely on incandescent bulbs.

Help your students think about our provincial and national energy consumption by pointing out that these figures relate only to light bulbs in people's homes!



Ask them to imagine how many light bulbs are used every day if we add those in schools, offices, restaurants, stores, factories and so on.

And can they imagine the enormous quantity of electricity consumed if they also factor in household appliances, audiovisual equipment, machinery, etc.?

Knowledge is power

Over 90% of the materials in LED bulbs are recyclable.

Because of their electronic components, they should be dropped off at a municipal ecocentre or other designated facility.

Activity 2.3

How a Hydroelectric Generating Station Works

An Experiment to Demonstrate the Power of Water

Length

30 minutes

Vocabulary

Goal of the Activity

A number of student volunteers use a container and turbine (provided) to conduct a demonstration in front of the class showing the effects of different levels of water (head) on a turbine. The demonstration illustrates the phenomenon of the **power of water**.

By making observations and recording them in their activity books, the students come to understand that it is the power of water that drives the turbines in a generating station and produces electricity. They also learn that this force depends on the **head**, which is the difference in elevation between the water behind the dam (upstream) and below the dam (downstream).

For the in-class experiment, the difference in elevation is the difference between the level of water in the container and the hole at the bottom of the container out of which the water flows to drive the turbine.

Then, using the diagram of a hydroelectric generating facility, remind students that the **energy** of the movement of water (mechanical energy) is transformed into electric energy by the **generator**, consisting of the stator and the rotor.

At the very end of the activity, you can invite all the students to repeat the experiment at home (optional: the steps are explained in the *Student Activity Book*).

Links with the QEP

Science and Technology

Materials required

Materials provided

- 1 jug of water
- 1 turbine
- 1 stick
- 1 timer
- Adhesive tape
- *Student Activity Book*

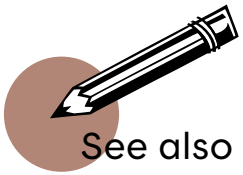
Materials to be prepared

- 1 dish pan
- 1 towel

Steps

An experiment to demonstrate the power of water

- Explain to the class that they are going to conduct an experiment to study the phenomenon of the **power of water** using a turbine and container to provide the flow of water. They will have to count the number of times the turbine turns at three different levels of water to find the one that makes the turbine turn fastest.
- Choose three students to conduct the demonstration in front of the class and give each one a job: one will be responsible for the **water**, one for the **turbine** and one for the **timer**.



See also

Student Activity Book, page 7

Preparation

- The student in charge of the water places a piece of adhesive tape over the hole near the bottom of the container.
- He or she then holds the container over the dishpan and fills it up to the lower level (B).
- The student in charge of the turbine places the stick in the turbine and points out to the class that one blade is colored, making it easier to count the number of times it turns.
- The student in charge of the timer makes sure he or she knows how it works.
- Meanwhile, the other students read the questions in their activity books. Explain any terms they are not sure of.

Assumption

Before starting the experiment, ask your students which level of water they think will make the turbine turn fastest and vote on it by raising their hands and explaining their reasoning. They can also estimate the number of times the turbine will turn in 10 seconds.

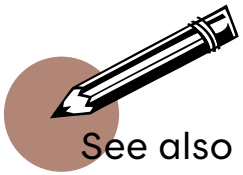
On the blackboard, write down only the number of students who voted for the bottom (B), middle (M) and top (T) levels, without their reasons.

Knowledge is power

- **The turbines at Brisay generating station, on the Rivière Caniapiscau, weigh 300 tonnes each. That's as much as 50 African elephants!**
- **You can visit a hydroelectric generating station for free. To find out how, go to hydroquebec.com/visit/visites-scolaires.html**

Experiment

1. The class comes to the front to see the demonstration properly.
2. The student in charge of the turbine holds it level in front of the hole, using the stick. He or she may have to move the turbine after the water starts flowing to keep it in the stream of water.
3. At the same time, the student in charge of:
   - the water removes the tape from the hole,
   - the timer starts the timer (and counts 10 seconds),
   - the turbine starts counting the number of times it turns. The other students in the class may count along.



See also

There is a diagram of a generating station on the next page of this *Teacher's Guide* and the activity book, on page 9.

4. After 10 seconds, the student in charge of:
   - the timer says "Stop!",
   - the turbine says how many times it turned and writes that number on the board.
5. The student in charge of the water tapes up the hole again and fills the container again, this time up to the middle (M) level.
6. Repeat steps 2 to 5 for levels M and T.
   - After the experiment, have the students answer the questions in the activity book, on their own or in teams of two.
   - Using the answer sheet on page 44, check the answers in class and compare the results with the initial assumptions.

Diagram of a hydroelectric generating station

- Using the diagram in their activity books, the students try to explain how a generating station works.
- Help them, using the explanation on the right side of this page and the generating station poster.

Explanation

How hydroelectricity is produced

1. The water in the reservoir gains speed and power when it moves through the penstock, making the turbine turn quickly.
2. The turbine is connected to the rotor, the moving part of the generator. When it turns, the rotor turns as well.
3. When the rotor turns in the stator (the stationary part of the generator), it creates electric energy.
4. The electricity produced is then transported and distributed to users.

Remember that:

- the generator at the generating station transforms the mechanical energy of the water into electric energy;
- the mechanical energy comes from the force of the water that turns the turbine, which in turn turns the rotor;
- the power of the water varies depending on the difference in elevation and flow of the water.

Note

The generator is connected to the turbine and transforms the energy from the flowing water into electric energy.

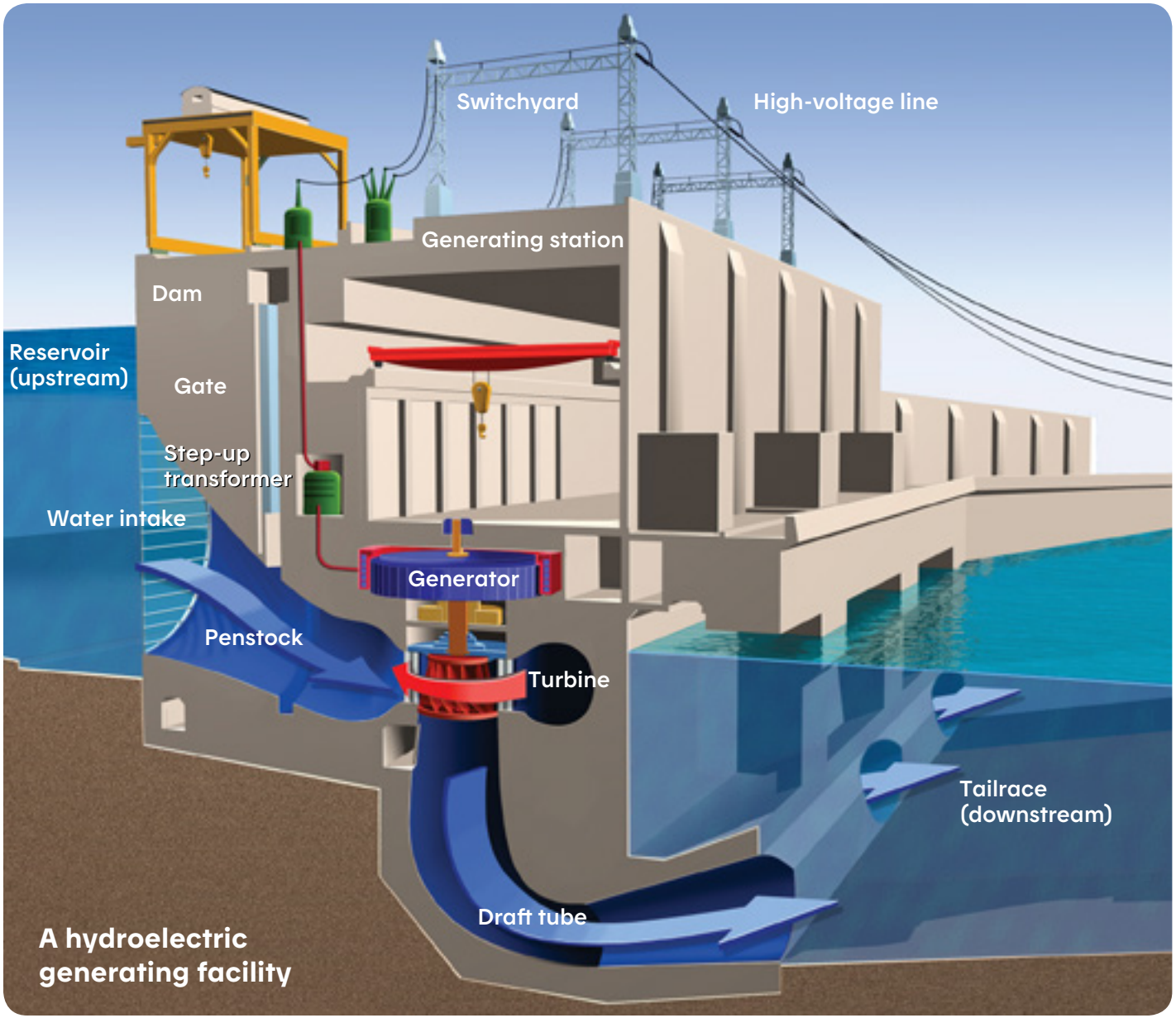


Illustration: Cité de l'énergie

Answers to the questions on the experiment to demonstrate the power of water

Q1. Which of the three water levels makes the turbine turn **the most times** in 10 seconds?

A1. The top level (T)

Q2. The power of flowing water makes the turbine turn faster or slower. **Why** is the power greatest for the top level (T)?

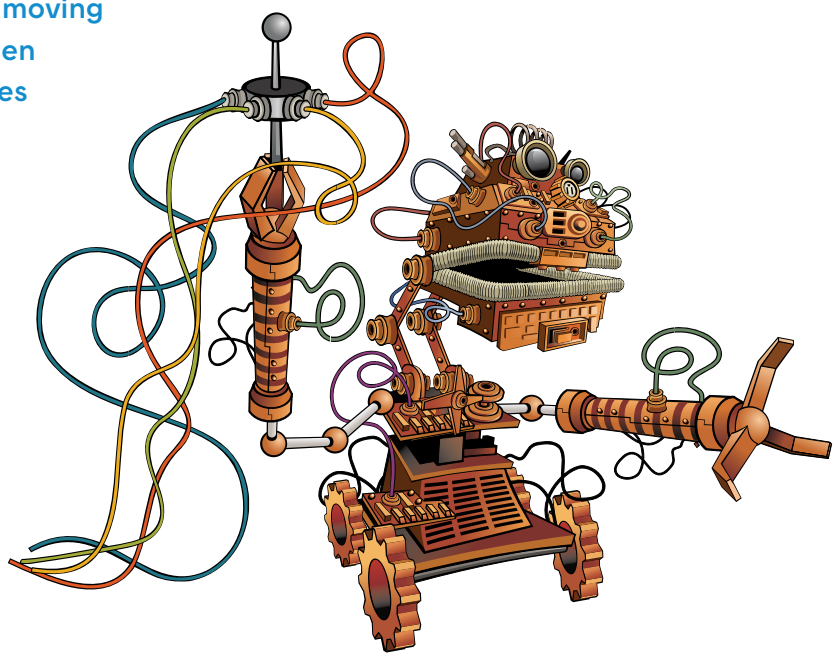
A2. The farther the water falls and the greater the flow of water, the more hydraulic energy is produced. (In our experiment, the flow of water was constant.) The power of the moving water turns the turbine, which then drives the generator and produces electrical energy.

Q3. **Why** do you think we need to build a dam to produce hydroelectric power?

A3. To create a reservoir of water and increase the distance the water falls.

Q4. **Where** do you think **the turbines are placed** in a hydroelectric generating station in relation to the water intakes, which are usually located on the wall of the dam?

A4. The turbines are installed as low as possible in relation to the water intakes to create the greatest possible difference in elevation. This makes it possible to generate more electric energy.



Source

This experiment was inspired by the book *Éveil à l'esprit scientifique chez les petits, 46 nouvelles expériences*, Cahier 2, Collection Éveil, SAMSON P., Éditions Guérin, 1990. p. 51.

Activity 2.4

The Generating, Transmission and Distribution System
An Adventure Right down the Line! Digital Game

Length
40 minutes

Note
BEFORE playing the game in the classroom, try it out a few times to make sure everything goes smoothly with your students.

Goal of the Activity

The *An Adventure Right down the Line!* game teaches students to identify the generating, transmission and distribution components of a hydropower system or grid. It also helps them understand how the components work together to produce and deliver electricity, from the generating site to the service address.

Materials Required

Materials provided

- *An Adventure Right down the Line!* game at **hydroquebec.com/teachers** or on the provided USB key

Materials to be obtained for the projection

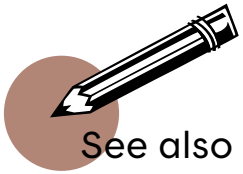
- Interactive whiteboard or computer with speakers, multimedia projector and screen

Steps

- Students can play individually on a computer or all together on the interactive whiteboard. To start, go to **hydroquebec.com/teachers** or insert the USB key in the computer and click on the *An Adventure Right down the Line!* game link or on the file *An Adventure Right down the Line!* game.

Links with the QEP

Science and Technology



See also

Student Activity Book, *Overview of Generating Facilities map* on page 13

- At the end of the game, when the students have succeeded in placing the hydropower system components in the right order and the lights have come back on, they are ready to watch the video. It provides an overview of the power grid in action, from the generating station to the home, and demonstrates the system's remarkable ingenuity.
- Finally, to help your students get a grasp of the scale of our hydropower system, take a look at the *Overview of Generating Facilities* map on page 48.
- When the game is finished, ask the students if they had any idea how extensive the infrastructure required to generate, transmit and distribute electricity was. Encourage them to think about it the next time they flip a switch or put a slice of bread in the toaster!

Suggested Approach

Here are some sample questions to recap what your students have learned:

- *Can you name the components of a hydropower system (or grid)?*
- *What do you call the immense basin that provides a reserve of water available at any time? (Answer: reservoir)*
- *What do beavers, like humans, build to create a large body of water with a higher elevation than the adjacent water? (Answer: dam)*
- *What do you call the metal support structure that is so tall it is sometimes hit by lightning? (Answer: tower)*
- *What is mounted on a pole and reduces the electricity's voltage before it gets to our homes? (Answer: transformer)*

Important

Note for teachers using the proposed activity calendar

- We **suggest** you give the instructions for carrying out the family inventory and choosing an appliance or device (Activity 3.2) on a Friday (10 min), **before** going on with Part 2 on the following Monday (Activities 2.5 and 2.6). Students can make their assumptions regarding the number of electric appliances and devices found in their homes (*Student Activity Book*, p. 28).
- The change in the schedule will enable your students to conduct their inventories and choose their appliances or devices during the **weekend** (40 min). Since Part 3 (Activities 3.1 to 3.4) will not be carried out until Tuesday, any student who has forgotten to bring in an appliance or device on Monday will have another opportunity to do so in preparation for the experiments in Part 3.

Timetable snapshot

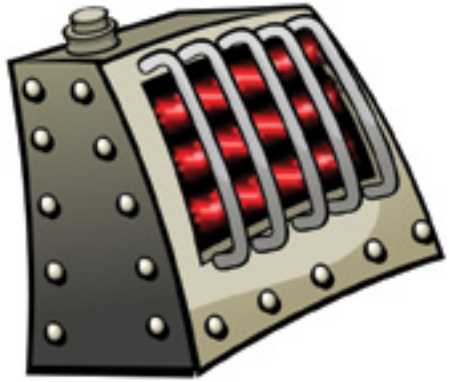
Friday

10 min

3.2 Instructions: Family inventory
10 min

Sat.-Sun.

3.2 Family inventory and choice of appliance or device
40 min

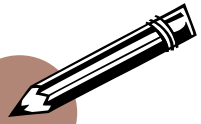


Overview of Generating Facilities

Activity 2.5

Making Energy Work for You
Electricity Quiz Experiment

Length
45 minutes



See also
Student Activity Book, page 14

Goal of the Activity

The students make a quiz game that introduces them to electric connections and teaches them about the environmental impact of using batteries.

They make the holder for the multiple-choice quiz, including the connections. They learn about the concepts of open and closed circuits, contacts, terminals, conductive and insulating materials, etc. Each game is connected to a battery, which supplies the current, and a bulb that lights up only if the players match the right questions and answers.

The students are given the multiple-choice questions and answers to use for the game, which is about using and recycling batteries.

Note

Have the students form teams of two. They share the connection materials but each student makes his or her own holder for the quiz.

Links with the QEP

- Science and Technology
- Social Sciences

Materials Required

Materials provided

- 15 nine-volt batteries
- 30 mini-bulbs
- 49 electric wires with alligator clips
- 1 copy of *Quiz and Answer Sheet A*
- 1 copy of *Quiz and Answer Sheet B*
- *Student Activity Book*

Materials to be obtained

- 30 cardboard sheets, 22 cm x 28 cm (8.5 x 11 inches)
- Paper clips (4 per student)
- 15 one-hole punches
- 1 roll of aluminum foil
- 30 pairs of scissors
- 30 rolls of adhesive tape
- Two-sided copies of *Quiz and Answer Sheet A* (15 copies)
- Two-sided copies of *Quiz and Answer Sheet B* (15 copies)

Steps

- Present the activity by explaining that in the walls of a house, for instance, there are various electric circuits ready at any time to supply the electricity produced by generating stations and transported to our homes.
- Separate the class in two and give the *Quiz and Answer Sheet A* to one group and *Quiz and Answer Sheet B* to the other.
- Distribute the materials to students and explain that they are going to use them to make an electric circuit.
- Using the suggestions below, help students identify and figure out the different parts of an electric circuit.

Suggested Approach

- *Which of the materials I gave you supplies the electricity?* (Answer: the battery)
- *How will we know if the circuit is working properly?* (Answer: the bulb will light up)
- *What carries the electric current?* (Answer: the electric wires and the aluminum foil)

See also

Student Activity Book, page 17

Note

Make sure you cover the aluminum strips carefully so that they don't touch one another. Otherwise, you'll have a short circuit!

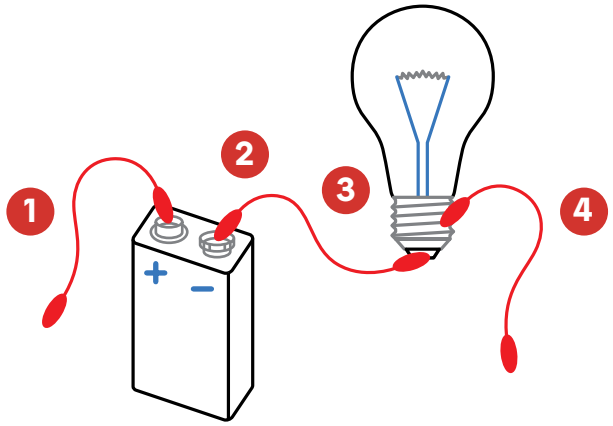
Steps (cont'd)

- **Using the information in the activity book** and by trial and error the teammates work together to make the connections and assemble the components of their circuit.

Making the circuit

1. Connect the end of one wire to the positive pole (+) on the battery.
2. Connect the end of another wire to the negative pole (-) on the battery.
3. With the other end of one of the two wires, touch the contact on the bottom of the light bulb.
4. Touch the end of a third wire to the screw base of the light bulb.

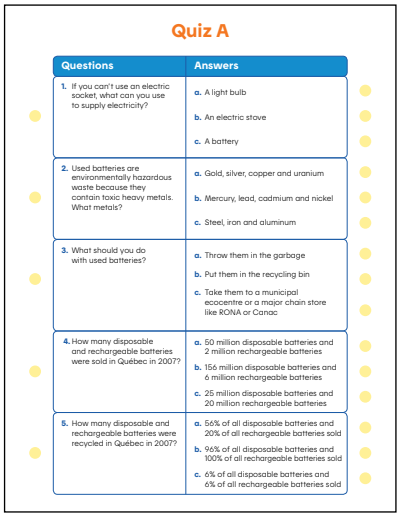
The ends of two wires should be free. The students will use this set-up once they have made their games.



Plans for the connections for quizzes A and B

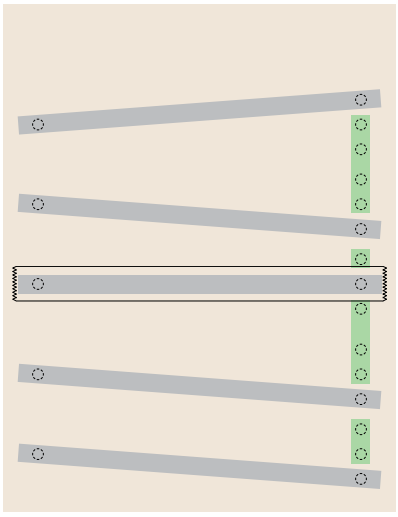
The students then finish making their games by connecting the aluminum strips to the cardboard as explained and shown in the activity book.

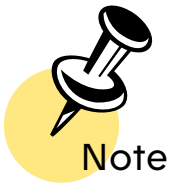
- The grey lines represent the strips of aluminum foil, which make the contact between the questions and the right answers.
- The green lines represent the pieces of aluminum foil used to cover up the holes of the wrong answers. This makes it look as though all the answers have the same kind of pole, so the game isn't too easy.



Quiz A

Questions	Answers
1. If you can't use an electric socket, what can you use to supply electricity?	a. A light bulb b. An electric stove c. A battery
2. Used batteries are environmentally hazardous waste because they contain toxic heavy metals. What metals?	a. Gold, silver, copper and uranium b. Mercury, lead, cadmium and nickel c. Steel, iron and aluminum
3. What should you do with used batteries?	a. Throw them in the garbage b. Put them in the recycling bin c. Take them to a municipal ecocentre or a major chain store like RONA or Canac
4. How many disposable and rechargeable batteries were sold in Québec in 2007?	a. 50 million disposable batteries and 2 million rechargeable batteries b. 156 million disposable batteries and 6 million rechargeable batteries c. 25 million disposable batteries and 20 million rechargeable batteries
5. How many disposable and rechargeable batteries were recycled in Québec in 2007?	a. 56% of all disposable batteries and 20% of all rechargeable batteries sold b. 96% of all disposable batteries and 100% of all rechargeable batteries sold c. 6% of all disposable batteries and 6% of all rechargeable batteries sold





Note

Encourage your students to think about the information presented and ask questions during the activity!

- In teams of two, students test their connections. One holds the wires to the bulb, while the other closes the circuit by touching the hole of a question with one clip and the right answer with the other clip. The bulb should light up. Students should also test their connections with the incorrect answers to make sure the bulb doesn't light up.

Playing the game

- Once the games are working properly, the students in group A exchange quizzes with those in group B.
- The students in both groups take turns trying to answer the questions. If they get a right answer, the bulb will light up. While one plays, the other counts the number of times the bulb lights up on the first try and keeps score.
- If the student doesn't get the answer right away, the teammate can read the question and try to help find the right answer.

Conclusion

- Ask students how many right answers they got.
- Finish up the activity by reviewing what they learned about connections, open and closed circuits and the impact of using electric batteries.
- Afterwards, all the students retrieve their games and can take them home if they wish. They can play them with their families and even make a different game with new questions. **However, they must hand in the batteries, wires and bulbs from the Toolkit**.

Think safety

Why can't you plug the wires directly into a wall socket instead of using a battery?

- Because the materials you are using (light bulb, cardboard, aluminum foil, electric wires) aren't strong enough for the powerful electric current used in our homes.
- You could get an electric shock and even injure yourself very badly.
- If students want to use their games at home, make sure they use a battery!

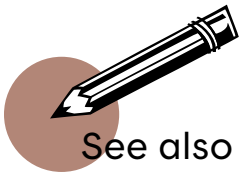
Suggested Approach

Instead of using wires, use other strips of aluminum foil, attaching them directly to the contact and base of a small light bulb. Make sure they are properly insulated.

Activity 2.6

Series and Parallel Circuits
Connection Experiment

Length
20 minutes



See also
Student Activity Book, page 22

Goal of the Activity

Students learn more about the concepts introduced in Activity 2.5 and are introduced to series and parallel circuits by creating both in teams.

Materials Required

Materials provided

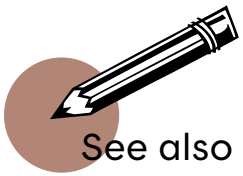
- 15 nine-volt batteries
- 30 mini-bulbs
- 49 electric wires with alligator clips
- *Student Activity Book*

Steps

- Have students form teams of four. Two teammates make a **series circuit**, and the other two, a **parallel circuit**. Each half of a team must find a way to light up the two bulbs on the circuit.
- Each team of two making a **series circuit** gets 1 battery, 2 bulbs and 3 electric wires. Each team making a **parallel circuit** gets 1 battery, 2 bulbs and 4 electric wires.
- Using the diagrams in their activity books, the students attempt to put together the wires, battery and bulbs to build the circuit assigned to them. Regardless of which kind of circuit they are making, both bulbs should light up.

Link with the QEP

- Science and Technology



See also

Student Activity Book, page 23

- Once the circuits are working, the four team members explain to each other how they made their circuits.
- Finish the activity with the help of the suggestions below.

Suggested Approach

What is the difference between the two circuits?

The bulbs in the series circuit aren't as bright as those in the parallel circuit!

Why?

In a series circuit, the energy from the source (battery) is shared and divided among all the bulbs. This means that the more bulbs are added, the less voltage reaches each one and the less light they produce.

In a parallel circuit, each of the bulbs is directly powered by all the energy from the source (the battery). This means that each bulb receives the maximum voltage and the light from each one is bright and constant.

Good to know

Are parallel and series circuits used in our homes?

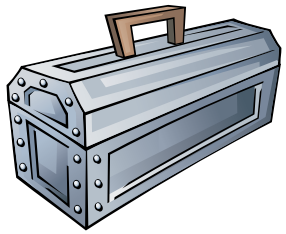
In our homes, all the equipment directly connected to electric circuits (light fixtures, baseboard heaters, bathroom fans, etc.) and the electric sockets used to plug in household appliances (kettle, television, lamp, etc.) are connected to **parallel circuits**, so that if something goes wrong with one it won't automatically knock out all the others.

Even so, it is important not to plug too many appliances into a single circuit, because the intensity of the current adds up and can overload the circuit. When this happens, a protective device on a home's distribution panel (a breaker) cuts power to the circuit to prevent the wires from overheating and possibly causing a fire.

It is mainly the internal components of equipment and appliances that are connected by **series circuits**.

Part 3

Electric Appliances and Devices

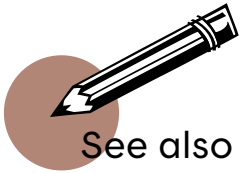


Electricity at Home

Activity 3.1

Using Electric Appliances and Devices
Waste Not, Want Not! Comic Strip

Length
10 minutes



See also
Student Activity Book, page 26

Links with the QEP
English (reading)

Goal of the Activity

Using humorous comic strips, students learn about the central theme of this part of their investigation: misusing electric appliances and devices and wasting energy.

Materials Required

Materials provided

- *Waste Not, Want Not!* comic strip. It can be found on the next page, on the USB key and in the *Student Activity Book*

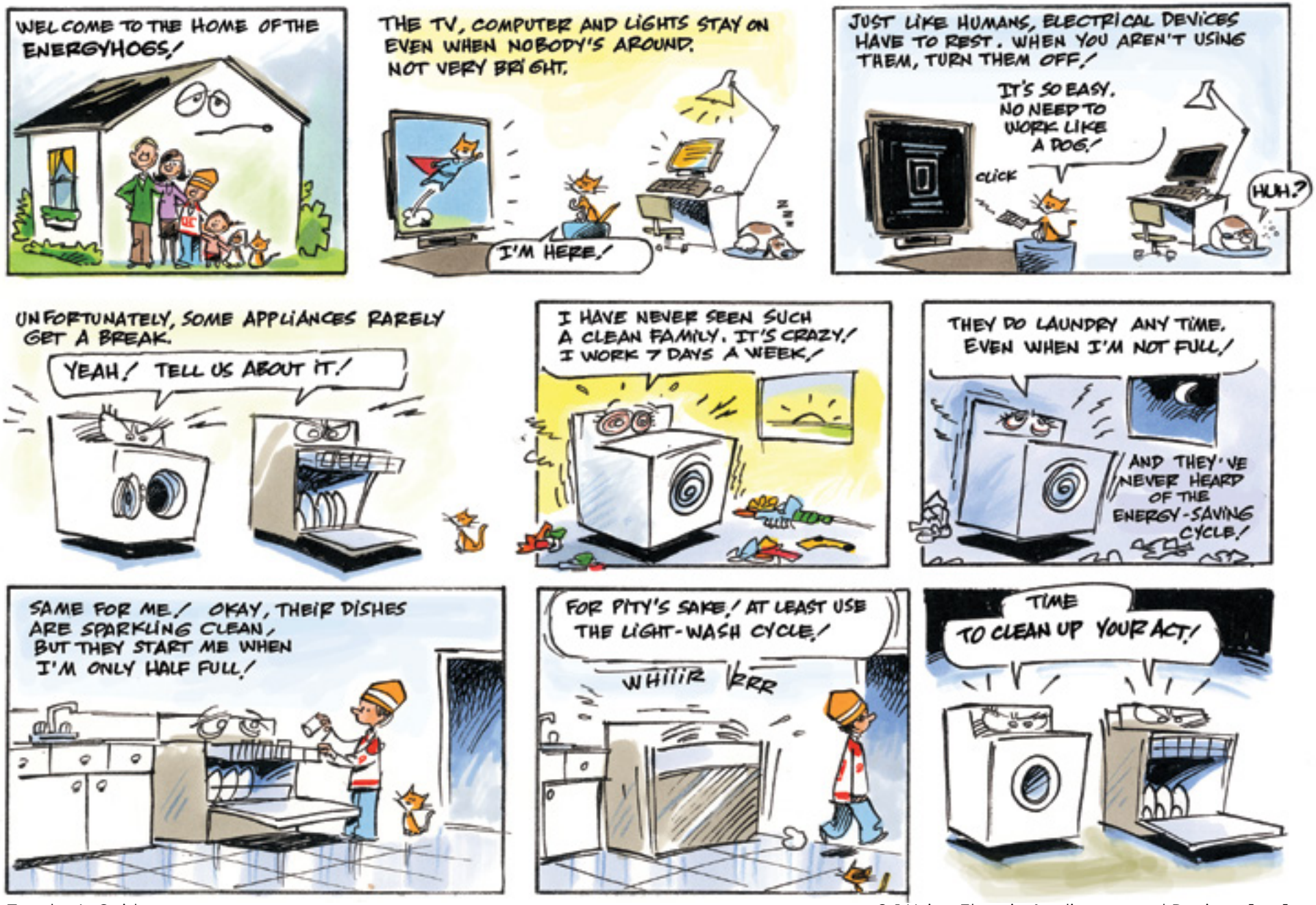
Materials to be obtained for the projection

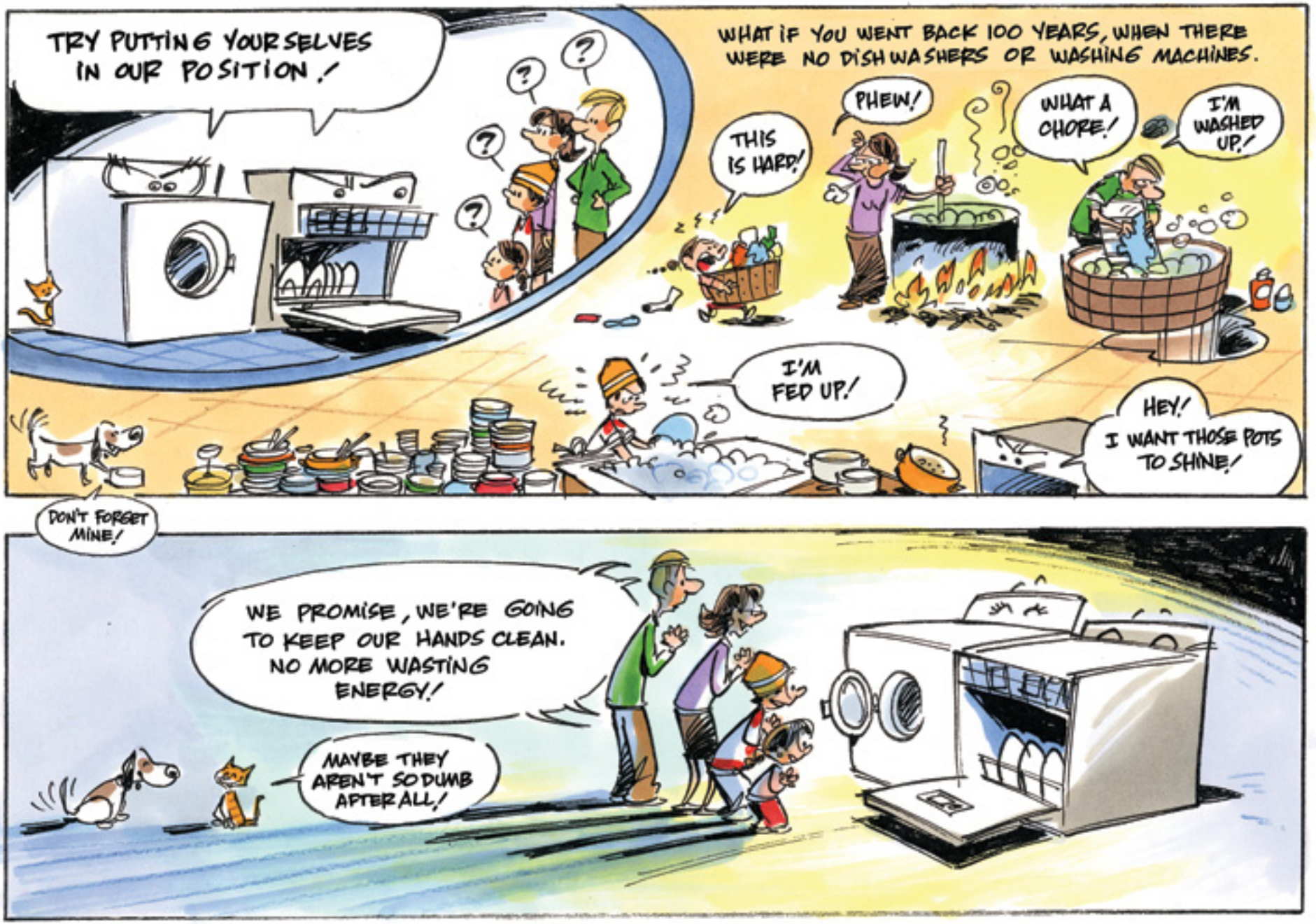
- Interactive whiteboard or computer with speakers, multimedia projector and screen

Steps

- Invite students to read the comic strip in their activity books on their own or project the comic strip on the screen and have students read it aloud.
- Next, ask students what they learned from the comic strip. Had it ever occurred to them that the way we use household appliances and devices could impact the environment? What do they think about using the washing machine or dishwasher only when they're full? ●

WASTE NOT, WANT NOT!




TRY PUTTING YOURSELVES IN OUR POSITION!
WHAT IF YOU WENT BACK 100 YEARS, WHEN THERE WERE NO DISHWASHERS OR WASHING MACHINES.
THIS IS HARD!
PHEW!
WHAT A CHORE!
I'M WASHED UP!
I'M FED UP!
HEY! I WANT THOSE POTS TO SHINE!
DON'T FORGET MINE!
WE PROMISE, WE'RE GOING TO KEEP OUR HANDS CLEAN. NO MORE WASTING ENERGY!
MAYBE THEY AREN'T SO DUMB AFTER ALL!

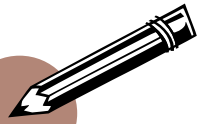
Activity 3.2

AT HOME

All Kinds of Household Appliances and Devices
Family Inventory

Length

- 10 minutes in class before the weekend
- 40 minutes at home (during the weekend) for the inventory and choosing the appliance or device to bring to class
- 15 minutes in-class review



See also

Student Activity Book, page 28

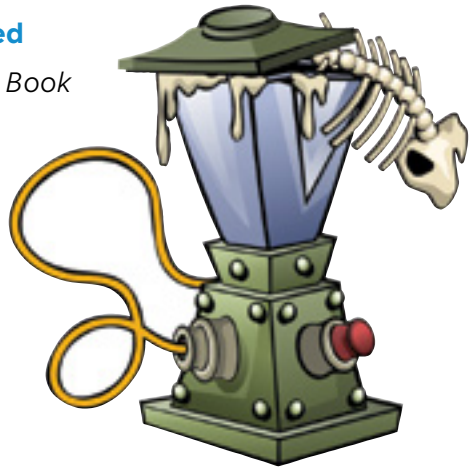
Goal of the Activity

Using their activity books, students count up all the household appliances and devices in their homes, one room at a time. They will realize **how many different** appliances and devices we use in our homes.

Materials Required

Materials provided

- *Student Activity Book*



Steps

In class

- Explain the students' mission, reviewing the questions on the inventory sheet in the activity book.
- Before carrying out the inventory, ask students to estimate how many electric appliances and devices they have in their homes.
- You can also suggest they ask their grandparents what appliances and devices didn't exist in their day, so they can see how the number and variety of goods have increased over the years.

Links with the QEP

- Mathematics (calculation)
- English (writing)

At home

- Students look in each room and make a list of all the electric appliances and devices there – **even those that are unplugged or stored in a cupboard**. They are welcome to ask their parents to join in the fun!
- They should not make any spelling mistakes in the names of the items.
- In their activity books, they add up the number of items in each room and then the grand total and answer the questions about what they found.

Back in class

- First, review the appliances and devices brought into class and make sure there is a good variety. If any students have forgotten to bring one in, give them until the next day to do so. Students identify their items, if necessary, and store them safely away in a designated location.
- Inventory review: Rather than asking each student to report on his or her inventory, take a survey by asking them to raise their hands.

  For example: Who has fewer than 15 household appliances or devices in their home? Who counted fewer than 20 household appliances or devices? Between 21 and 30? Between 31 and 40? More than 40?
- Students form teams of four and add up the total number of appliances or devices they noted in their activity books. Write each team's results on the blackboard, and then have the class add it all up.
- To help them understand the overall impact on energy consumption, ask students to think about the total for the whole school, the whole city or the whole country.
- Lastly, ask them if they think we have too many household appliances or devices in our homes? Are they all really useful?

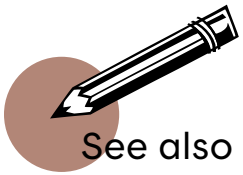
Reminder

- The students will also have to choose one electric appliance or device in their homes to bring to class, with their parents' permission, so they can carry out Activity 3.3.
- Make sure students bring in a variety of appliances and devices and that at least one brings in a **hair dryer**.

Activity 3.3

The Power of Electric Appliances and Devices
Wattmeter Experiment

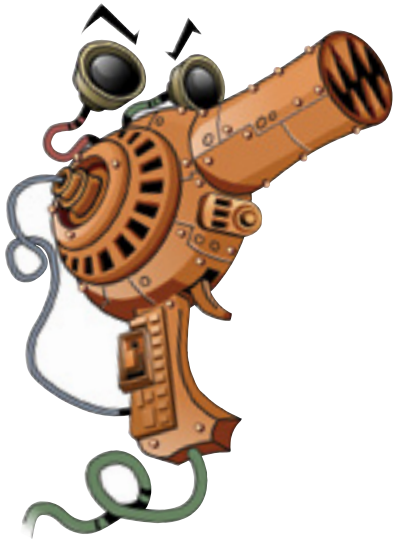
Length
- 50 minutes



See also
Student Activity Book, page 32

Goal of the Activity

The students use the wattmeter to measure and compare power use by different household appliances and devices. They learn about the concept of **energy-wise** appliances and devices and those that are **energy hogs**.



Materials Required

Materials provided
- 1 wattmeter
- Red, yellow and green round stickers
- *Student Activity Book*

Materials to be obtained
- 1 extension cord
- Small household appliances and devices, like a **hair dryer**, razor, radio, lamp, clothes iron, curling iron, etc.

Links with the QEP

Science and Technology

Steps

Preparation

- While conducting the inventory of electric appliances and devices in their home (Activity 3.2), the students were asked to select one and bring it to school.
- Inform students that their challenge is to rank the appliances and devices brought in by how *energy-hungry* they are.
- To do so, they will have to measure the appliances and devices' **power using a wattmeter** (show them the wattmeter). *Power* is the force an appliance or a device needs to perform a given work.

Important

When we talk about how energy-hungry appliances and devices are, we're talking about how much energy they use, not their power. As explained later, appliances and devices' energy consumption is calculated as their power multiplied by the amount of time they are used. Here, to rank appliances and devices' energy consumption based on their power alone, we assume that they are all used for the same amount of time.

Suggestions

- You may wish to bring in some electric applicances or devices yourself, in case some students forget or aren't allowed to bring one in.
- You can also test some appliances and devices available at the school, such as a microwave oven, television, computer, coffee maker, toaster, etc.
- It is best to carry out activities 3.3 and 3.4 on the same day.

Assumption

- However, before learning how the wattmeter works and measuring the appliances or devices' power, students start by ranking the items by how much energy they use based only on their best guesses. Holding their appliances or devices, students line up in order, from the most **energy-wise** items (those that use little energy) to the biggest **energy hogs** (those that use a lot).

Note

It is interesting to show the difference between the low and high settings, if the appliance has them.

- Explain the legend in the students' activity books. Then, ask them to make an assumption about their appliance or device's power and place a sticker corresponding to their assumption on the item.

  Is the appliance or device's power …

  - LOW? **0 to 399 watts (green)**
  - MEDIUM? **400 to 1,099 watts (yellow)**
  - HIGH? **1,100 to 1,800 watts (red)**

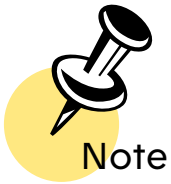
Experiment

- Now it's time for the students to check their assumptions by measuring the appliances and devices' power with the wattmeter. Explain how.
- Every student should get to plug his or her appliance or device into the wattmeter and measure its power in watts.

Instructions

Wattmeter instructions

1. Plug the extension cord into an outlet.
2. Plug the wattmeter into the extension cord.
3. Press the **Watt** button to reset the digital display to 0.
4. Plug the selected appliance or device into the wattmeter.
5. Wait for the numbers to stop changing. (For some appliances or devices, such as laptop computers, the numbers will never stabilize completely. Use an approximate measurement.)
6. Note the number shown on the screen in your activity book. This is the appliance or device's power in watts.
7. Disconnect the appliance or device. The screen will revert to 0 automatically within a few seconds.
8. Plug a new appliance or device into the wattmeter and measure it.



Note

1 kW = 1,000 watts

- Students should note the result in their answer to question 1 in the *Student Activity Book* and then answer questions 2 and 3 while you write the results for all the appliances and devices on the blackboard. Correct the colour of the stickers the students placed on the items, as necessary.
- When the experiment is over, students rank all the appliances and devices tested by increasing power use (questions 4 and 5). They can do this in teams of two. Make sure they see which items are the biggest energy hogs.

Note

Amperes, volts, watts

For more information on the three units used to measure electricity, see: hydroquebec.com/learning

Conclusion

- Explain that to really find out whether an appliance or device **uses a lot of energy**, the students have to consider not only its **power** but also **how long** it is used. Electricity consumption is calculated using this equation:

Electricity consumption (in kWh) = Power use (in kW) X Hours of use

- In other words, an appliance or device that is fairly energy wise but used for a long time will consume as much electricity as a real energy hog used for just a few minutes!

Example

- A refrigerator with a 250-litre capacity has an average power rating of only 250 W, while a portable heater is rated at roughly 1,112 W (four times as much).
- Since the refrigerator runs day and night, it uses roughly 500,000 Wh or 500 kWh a year. On the other hand, the heater's annual energy use is 271 kWh based on only two hours of use a day during the four coldest months of the year.
- Even though the fridge has a much smaller power rating than the heater's, it ends up using more energy because it is used for so much longer.

Activity 3.4

Energy Use by Electric Appliances and Devices

Calculating Energy Costs

Length
20 minutes

See also
Student Activity Book, page 36

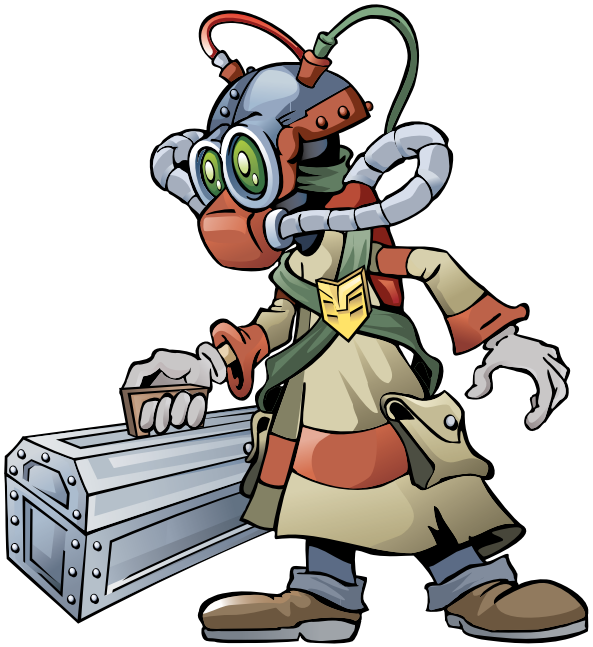
Goal of the Activity

The students calculate the annual cost of the electricity used by three appliances or devices tested using the wattmeter. The three items should have different power ratings. Their calculations will take account of the one time each appliance or device is used by each family member.

Materials Required

Materials provided

- *Student Activity Book*



Knowledge is power

The largest unit of measurement for electricity consumption is the terawatthour (1,000,000,000 Wh). That's where Terawattus Energivorus gets his name.

Links with the QEP

Mathematics

Steps

Table 1

Referring to the list of appliances and devices tested and ranked according to their power in the preceding activity, each student chooses three items and enters them in Table 1 on page 37 of their activity books. **Students must choose one item from each colour group (green, yellow and red).**

For each item, the students must:

1. Enter each appliance or device's **power** in watts (W) (step A).
2. Divide the power in watts by 1,000 to obtain the power in kilowatts (kW) (step B).

Example:

1. Power in watts (W) measured for the hair dryer: **1,300 W** (step A).
2. Power in kilowatts (kW): 1,300 W ÷ 1,000 = **1.3 kW** (step B).

Table 1

APPLIANCE OR DEVICE POWER		Item 1	Item 2	Item 3
Steps and equations		Hair dryer		
	Power in watts			
A	Power measured in Activity 3.3, Question 1	1,300 W	W	W
	Power in kilowatts			
B	Power (W) ÷ 1,000	1.3 kW	kW	kW

Table 2

In Table 2, students estimate the number of hours during which their families use each item in **one week**.

For each item, they should:

1. Estimate the number of minutes of use per day and the number of days of use per week for each member of the family and then multiply the results to obtain **the number of minutes of use per week** (min/week).
2. Add up the minutes for each family member to get the **total number of minutes for the family** (step C).
3. Divide the result by 60 to get the **total number of hours** of use (step D).

Table 2

	AMOUNT OF TIME USED	Item 1	Item 2	Item 3
	Steps and family member's first name	Hair dryer		
	Matthew (me):	10 min/week	min/week	min/week
	Isabel *(Mom)*	70 min/week	min/week	min/week
	Peter *(Dad)*	0 min/week	min/week	min/week
	Sarah *(sister)*	105 min/week	min/week	min/week
	Eric *(brother)*	10 min/week	min/week	min/week
C	**Total for the family, in minutes**	195 min/week	min/week	min/week
	Total for the family, in hours			
D	Total in minutes C ÷ 60	3.25 hrs/week	hrs/week	hrs/week

Table 3

In Table 3, students calculate the annual electricity cost of each appliance or device.

For each item, they should:

1. Multiply the family's total number of hours of use (Table 2) by 52 to determine the number of hours of use per year (step E).
2. Multiply the item's power in kW (Table 1) by the number of hours of use per year to get the item's **annual electricity consumption** in kWh for the whole family (step F).
3. Multiply the result by $0.09/kWh[1] to obtain the item's annual electricity cost (step G).

Conclusion

The annual electricity cost for each appliance or device may not seem like much, but remember that there are a lot of items in your home. Put them together and the costs add up quickly! Now think about how much electricity is used all over Québec. That's why we have to be careful not to be wasteful when using our appliances and devices!

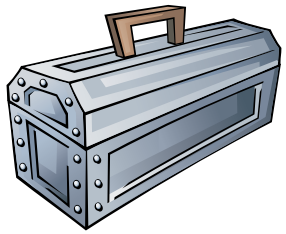
Table 3

ANNUAL ELECTRICITY COST		Item 1	Item 2	Item 3
Steps and equations		Hair dryer		
	Number of hours of use per year			
E	Total number of hours per week D x 52 weeks	169 hrs/yr	hrs/yr	hrs/yr
	Annual electricity consumption			
F	Power (in kW) B x number of hours of use per year (hrs/yr) E	219.70 kWh/yr	kWh/yr	kWh/yr
	Annual electricity cost			
G	Consumption (in kWh) F x $0.09/kWh[1]	$19.77/yr	$/yr	$/yr

1 According to the rates in effect in April 2021. This amount includes taxes.

Part 4

Energy Consumption Habits

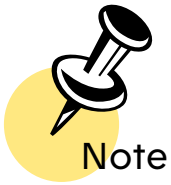


Tracking down the Virus!

Activity 4.1

Energy Consumption Habits
Taking a Shower Role-Playing Exercise

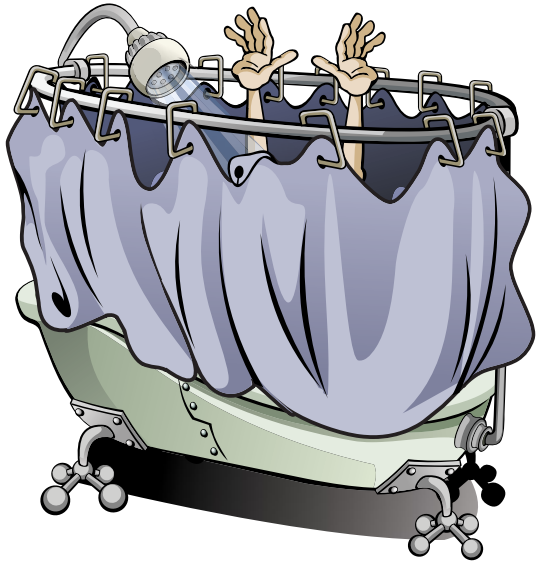
Length
10 minutes



Note
The furniture and props can be imaginary or simulated.

Goal of the Activity

Through this role-playing exercise, some students present a humorous look at the theme of this part, **energy consumption habits at home**.



Materials Required

Materials provided

- **OOWatt** costume
- **Terawattus Energivorus** costume
- 4 copies of the instruction sheet for Role-playing exercise 4.1

Materials to be obtained

- Any useful props (e.g., soap, towel, etc.)

Links with the QEP

Drama

Note

Boys or girls may play the roles of **OOWatt**, **Terawattus** and the other characters.

Steps

- Call on the students or ask for four volunteers to play the characters. Give them the instruction sheet for Role-playing exercise 4.1.
- The *actors* read the instruction sheet for Role-playing exercise 4.1 and get ready. They don't need to learn the script by heart; they can hold it during their performance. They must follow the instructions.

Roles

- **OOWatt**
- **Terawattus Energivorus**
- Teenager (boy or girl) with long hair, taking a shower
- Parent (voice)

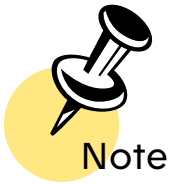
Getting into Character

If you are playing OOWatt:

- Think of yourself as a police inspector.
- Speak slowly and with authority.
- Stand up straight.
- Be suspicious of everything, keep looking around as though you're expecting to see the evildoer everywhere.

If you are playing Terawattus Energivorus:

- Think of yourself as evil.
- Hunch over.
- Walk with a limp.
- Speak with a deep, growly voice.



Note

After their performance, the actors can take a bow.

Script

- The teenager is in the shower, singing his or her favorite song.
- The parent is near the shower, as if he or she is standing outside the bathroom door.
- **OOWatt** and **Terawattus Energivorus** are just on the edge of the scene, watching with their arms crossed.

Parent (voice)

[Teenager's name], you've been in the shower for 20 minutes now. Hurry up or there won't be any hot water for the rest of the family.

Teenager

Just five more minutes! I still have to wash my hair.

Parent (voice)

No, not a minute more! You're wasting water and electricity. Get out of the shower right now!

- **Terawattus Energivorus** enters the bathroom and talks to the teenager through the shower curtain.

Terawattus Energivorus

Go ahead, take all the time you need to wash your hair. What does it matter anyway? There's plenty of water. Everyone else can just wait about five minutes and then they'll have more hot water.

Teenager

You're right.

Terawattus Energivorus

Besides, showers are a good idea. You use a lot less water when you take a shower than when you have a bath. And you've got every right to take your time. Cleanliness is important, it's no place to cut costs. So go ahead and scrub. You're not wasting anything.

- **OOWatt** enters the bathroom.

OOWatt

That's enough. It's true that a shower uses less water than a bath, but not when it lasts half an hour! I manage to take my shower in eight minutes, and that includes washing my uniform. Get it?

- **OOWatt** holds out a towel for the teenager.

OOWatt

Think about our poor planet, as well as your parents' electricity bills. Enough wasting! It's time to dry off!

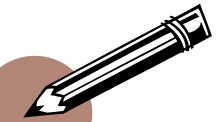
Activity 4.2

Wasting Energy

The Class under Investigation!

Length

- 10 minutes in the morning
- 20 minutes after lunch



See also

Student Activity Book, page 41

Goal of the Activity

The students learn about gathering information, giving them the opportunity to think about people's energy consumption habits and why they waste energy.

You can encourage the discussion by using the questions in the *Student Activity Book* and jogging students' memories.

Materials Required

Materials provided

- *Student Activity Book*

Steps

In the morning

- Explain the activity. Have students start by reading the questions in their activity books and asking for explanations, as necessary. Tell them not to answer the questions right away but to remember them and observe the group's energy consumption habits carefully all morning.

Note

Some observations are more applicable in the winter, when the students can check for drafts around windows with a feather or a tissue, for instance.

After lunch

- Lead a discussion on the themes raised by each question in the activity book and have the class answer the questions together.
- This is a good time to talk about their good and bad energy consumption habits and discuss things they could do to avoid wasting energy.
  For instance, why they should turn off the lights when they leave the classroom or resolutions to use the drapes and blinds to warm or cool the classroom and avoid wasting energy on heating or air conditioning.

Links with the QEP

Science and Technology

At the end of the activity

- Have them elect monitors to handle daily tasks to avoid waste. The monitors can change every week, so that everyone gets a turn.

Suggestions

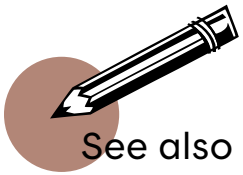
Energy-saving jobs

- Turn off the lights when everyone leaves the classroom for recess, and turn them back on after recess.
- During winter, close the drapes and blinds at the end of the day and open them in the morning.
- In warm weather, close the drapes and blinds when the sun is pouring in through the windows and heating up the classroom.
- Go around and make sure all the computers are off.

Activity 4.3

Energy Consumption at Home
Assumptions Game

Length
15 minutes



See also
Student Activity Book, page 43

Goal of the Activity

The students start thinking about their own energy consumption and that of their families by making assumptions about different day-to-day situations. They will test their assumptions later using the scientific method and decide whether they were right or wrong.

Note

The summary table will also be used in activities 4.4 (Collecting Data at Home) and 4.5 (Assumptions and Conclusions).

Materials Required

Materials provided

- *Student Activity Book*

Steps

- Students work on their own or in teams of two. Each student fills out his or her own activity book based on the situation at his or her home.
- Present the activity using the *suggested approach* on the following page.
- Students list their assumptions in the first column of the **summary table**. For each statement, they choose the assumption they feel best applies to their family's energy consumption.
- Explain any terms they do not understand.
- Conclude the activity using the *Suggested Approach* (Conclusion) on the next page.

Terms

Links with the QEP

Science and Technology

Suggested Approach

Introduction

Now we will start thinking about how much energy we and our families use.

What do you think?

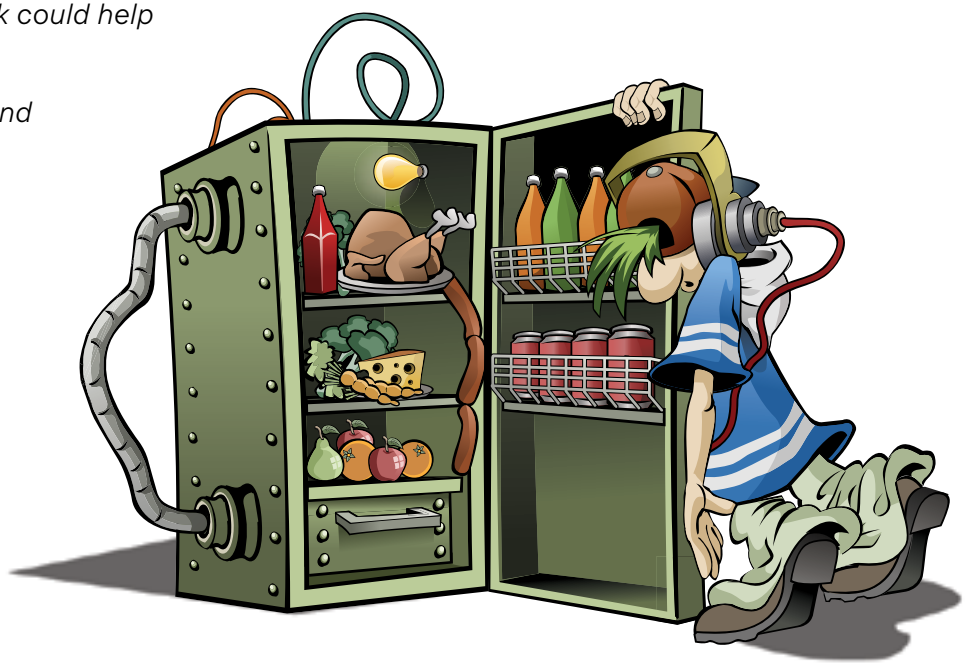
- *Are you and your family energy hogs or energy wise at home?*
- *Who in your family uses the most electricity?*
- *Who uses the least?*
- *Which appliances use the most electricity?*
- *What day-to-day habits do you think could help you avoid wasting energy?*
- *What habits in your family could stand to be improved?*

To find the answers to these questions and more, we're going to start by making assumptions about different day-to-day situations that cause us to use more or less energy.

Conclusion

Later, you'll use the scientific method to test your assumptions and find out whether you were right.

Whatever your findings, whether you were right or wrong, you'll learn more about your energy use at home.



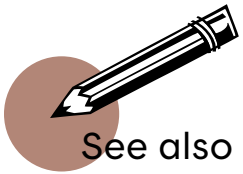
Activity 4.4

AT HOME

Energy Consumption
Collecting Data at Home

Length

- 10 minutes in class
- About 90 minutes at home, over three evenings



See also

Student Activity Book, pages 47

Links with the QEP

Science and Technology

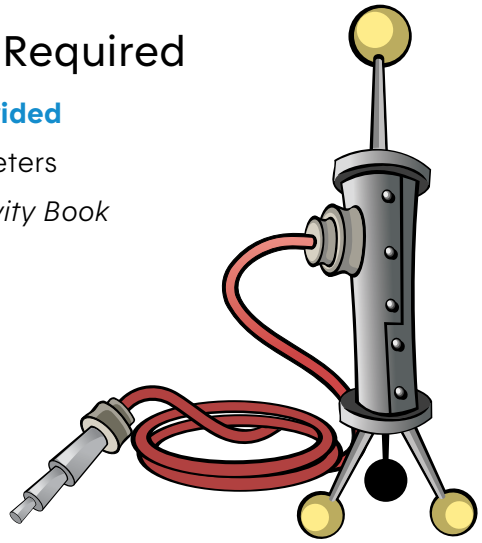
Goal of the Activity

Using the questions in the activity book, the students take measurements and make observations in their own homes. They collect data that they will use later to test their assumptions about their families' energy use.

Materials Required

Materials provided

- 30 thermometers
- *Student Activity Book*



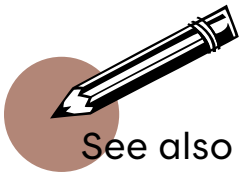
Steps

- Start by reviewing the questions in the activity book to make sure students understand the instructions and terms.
- At the end of the day, before they leave, give each student a thermometer to be brought back at the end of the activity.
- Over three evenings, students will take different measurements, make the appropriate observations and compile their data in the second column of the **summary table** in the activity book.

Activity 4.5

Energy Consumption
Assumptions and Conclusions

Length
45 minutes



See also
Student Activity Book, page 49

Goal of the Activity

In class, the students test their initial assumptions by analyzing the data they gathered at home. They draw conclusions about their families' energy consumption habits and think about how to improve them, if need be.

Good to know

Hydro-Québec recommends:

- Keeping the **refrigerator** temperature between **2°C** and **5°C** and the **freezer** at **-18°C**
- Keeping your **home**'s temperature at **17°C** at night and whenever you're away, and **20°C** the rest of the time when the heating system is on.

Materials Required

Materials provided

- *Student Activity Book*

Steps

- Introduce the activity using the *Suggested Approach* (Introduction) on the next page.
- In teams of two, students verify their starting assumptions by answering the questions in column 3 of the **summary table**. They must compare their results (in column 2) with their assumptions (in column 1). They should also refer to the *Good to know* box on page 49 of their activity books and reproduced here (left).

Links with the QEP

Science and Technology

Terms

- Each team of two then discusses their results and draws conclusions about their families' energy consumption. They answer the questions in column 4 on ways to save energy. With the students back in a group, review their discussions and the choices they made in column 4.
- Using the ideas presented in *Suggested Approach* (discussion) on the next page, explain that when talking about energy consumption, it's important to take **peak periods** into account.
- Finally, conclude the activity by explaining the multiplier effect, using the *suggested approach* (conclusion) on page 84.

Suggested Approach

Introduction

Now that you have finished collecting the data to be entered in column 3 of the summary table, it's time to test your initial assumptions. We'll find out whether they were right or wrong.

To make things easier, try to answer these questions:

- *What conclusions can you draw from your analysis?*
- *How would you describe your family's energy consumption (good, fair or bad)?*
- *At home, are your family members energy wise or energy hogs?*
- *What resolutions should you make?*
- *What actions are the top priorities?*

Discussion

When discussing energy consumption, it's important to consider the concept of **peak period** or **peak hours**.

What is a peak period? Have you ever heard this expression?

To understand the concept of peak periods, driving provides a good analogy. Rush hour is the time of day when traffic is heaviest. It's the same for electricity consumption: there are peak periods when demand is higher, especially in the winter. (Heating accounts for over 50% of total electricity consumption for homes heated by electricity.)

Why does Hydro-Québec ask people to use less energy during peak periods in the winter?

Once again, the driving analogy can be helpful in answering this question. During rush hour, the higher number of cars on the road at the same time can result in traffic jams. No matter how many cars (energy) are in use, the road stays the same, with the same width and same capacity (power).

It's the same thing with electricity in the power grid. When everyone uses their electric devices and appliances at the same time, usually in the morning and evening, the power demand can exceed the power (in watts) produced by Québec's generating stations, which is limited by the number of stations and their maximum output. That's why Hydro-Québec sometimes has to purchase electricity from neighbouring systems in the winter to meet the demand for energy.

Note

What are Québec's peak electricity demand hours?

In Québec, **peak hours** in the **winter** are from **6 to 9 a.m.** and from **4 to 8 p.m.**

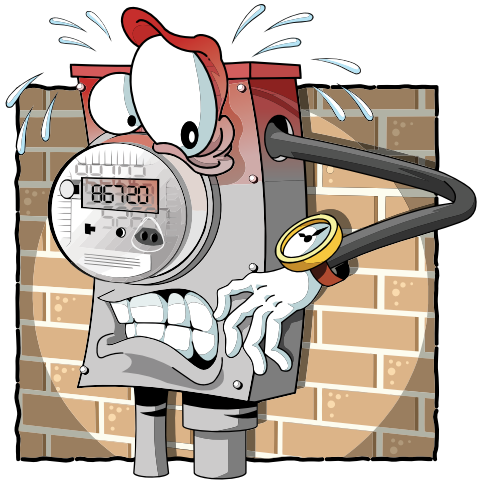
How can electricity demand during peak periods be kept to a minimum?

Reducing your electricity consumption in the morning and evening is simple. Here are a few easy tips:

- *Lower the temperature slightly in unoccupied rooms.*
- *Postpone the use of major appliances such as the dryer or dishwasher.*
- *Limit the use of hot water as much as possible.*

Other questions

- *What are peak periods like at your home?*
- *Are there any electric appliances or devices you could do without during these periods? How?*



Conclusion

Turning just one appliance like your television on or off won't make a big difference to Québec's energy needs, but imagine what would happen if everyone turned their televisions on at the same time! Generating stations would have to boost their electricity production quite a bit. And that's exactly what happens each evening, for instance, when people in homes across Québec turn on their stoves to start making supper at about 6 o'clock.

It's the same thing when it comes to saving energy. One person's actions don't have a big impact, except on a family's electricity bill. But if everyone were **energy wise***, we'd see a positive impact on the environment all over the world!*

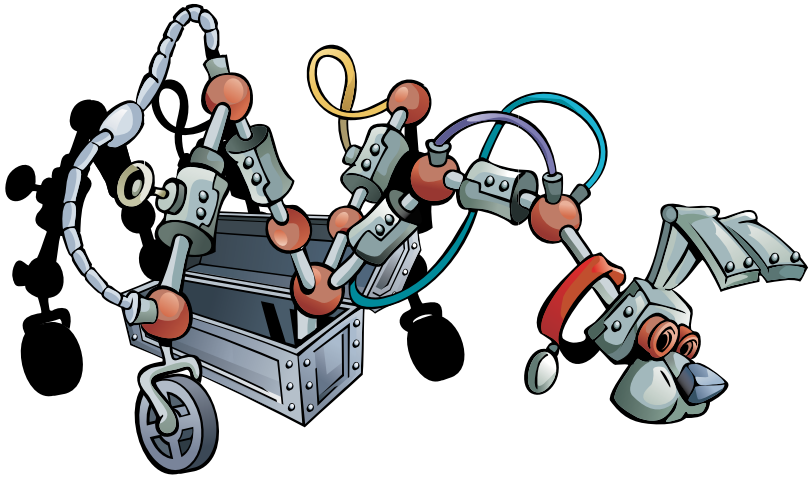
Reminder

What is the difference between POWER and ENERGY?

- **Power** is the effort made by generating stations at any given moment to meet customer demand. It is measured in watts (W).
- **Energy** is the effort deployed **over a given period of time** and is what residential electricity meters track. It is measured in watthours (Wh), which is power multiplied by time.

Note

Encourage your students to think about the information presented and ask questions during the activity!



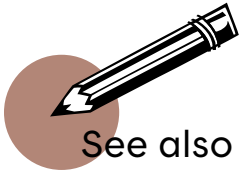
Activity 4.6

Video Hydro-Québec:

Doing something for the planet doesn't require too much...energy!

Length

20 minutes, including in-class discussion



See also

Student Activity Book, page 51

Goal of the Activity

The students watch a short video produced by Hydro-Québec to review some of the concepts they've already seen and become more aware of the importance of saving energy.

Materials Required

Materials provided

- Video by Hydro-Québec, *Doing something for the planet doesn't require too much...energy!* at **hydroquebec.com/teachers** or on the provided USB key
- *Student Activity Book*

Materials to be obtained for the projection

- Interactive whiteboard or computer with speakers, multimedia projector and screen

Steps

- Have students watch the video attentively.
- They then answer the questions in the *Student Activity Book*. The idea is above all to have them talk about the video and think about where they stand on the issue of wasting energy.
- Lead a discussion so students can voice their opinions.
- Explain any terms they do not understand.

Links with the QEP

- Social Sciences
- English

Terms

Answers

Q1. What do you think was the main message of the video?

A1. Show what we can do to reduce our energy consumption at home.

Q2. "We tend to take our energy for granted" What do you think of this statement?

A2. Students choose a feeling or an impression (funny, worrisome, sad, who cares?, disgusting, crazy) and explain why they feel that way.

When the narrator says, "Quebecers are among the world's top energy consumers."

A3 to A6. Students explain their answers.

Q3. What did she mean?

Q4. What do you think?

Q5. Are you suprised? Why?

Q6. Is it OK to waste a resource if there's lots of it? Why?

Q7. At the end of the video, the narrator says: "The future of our planet depends on all the little things we do everyday." Is she right? Why?

A7. Students explain their answers.

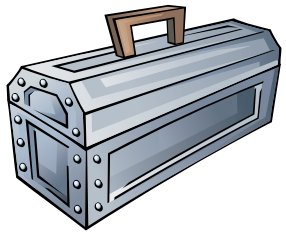
Q8. What little things can you do to save energy? Can you name two?

A8.

- **Disconnect devices you are not using.**
- **Only use the lights you really need.**
- **Turn off lights when you leave a room.**
- **Use LED bulbs instead of incandescent bulbs.**
- **In winter, draw the curtains at night and keep them open during the day.**
- **In summer, keep the curtains drawn during the day to keep the house cooler.**
- **Take a shower instead of a bath to reduce hot water consumption.**

Part 5

Ways to Save Energy



Stop the Virus!

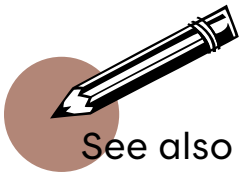
Activity 5.1

Get Energy Wise

Stop the Virus! Comic Strip

Length

10 minutes



See also

Student Activity Book, page 55

Goal of the Activity

Using a humorous comic strip, the students learn about the central theme of this part of their investigation: **ways to save energy**.

Materials Required

Materials provided

- *Stop the Virus!* comic strip on the next page, on the USB key and in the *Student Activity Book*

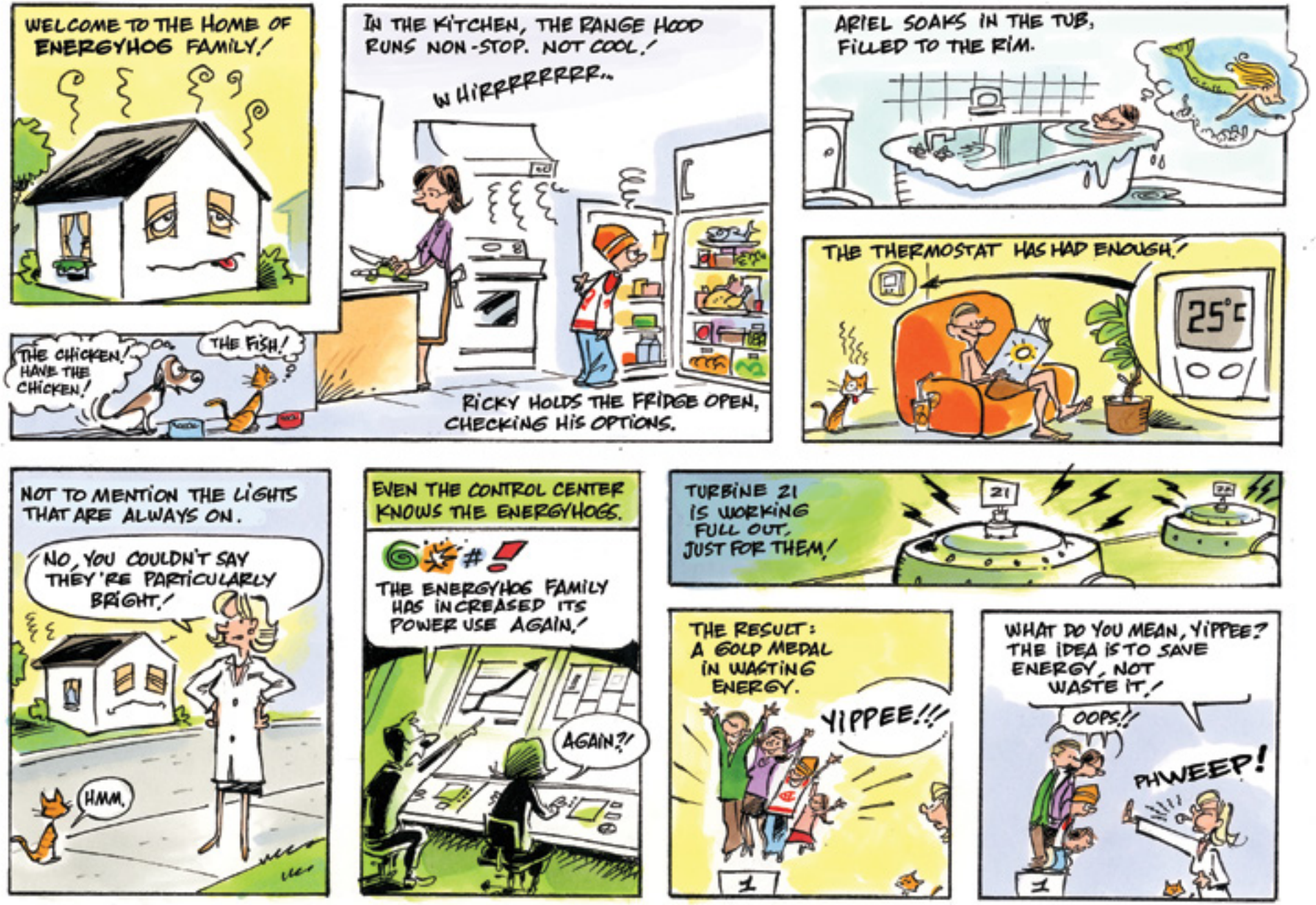
Materials to be obtained for the projection

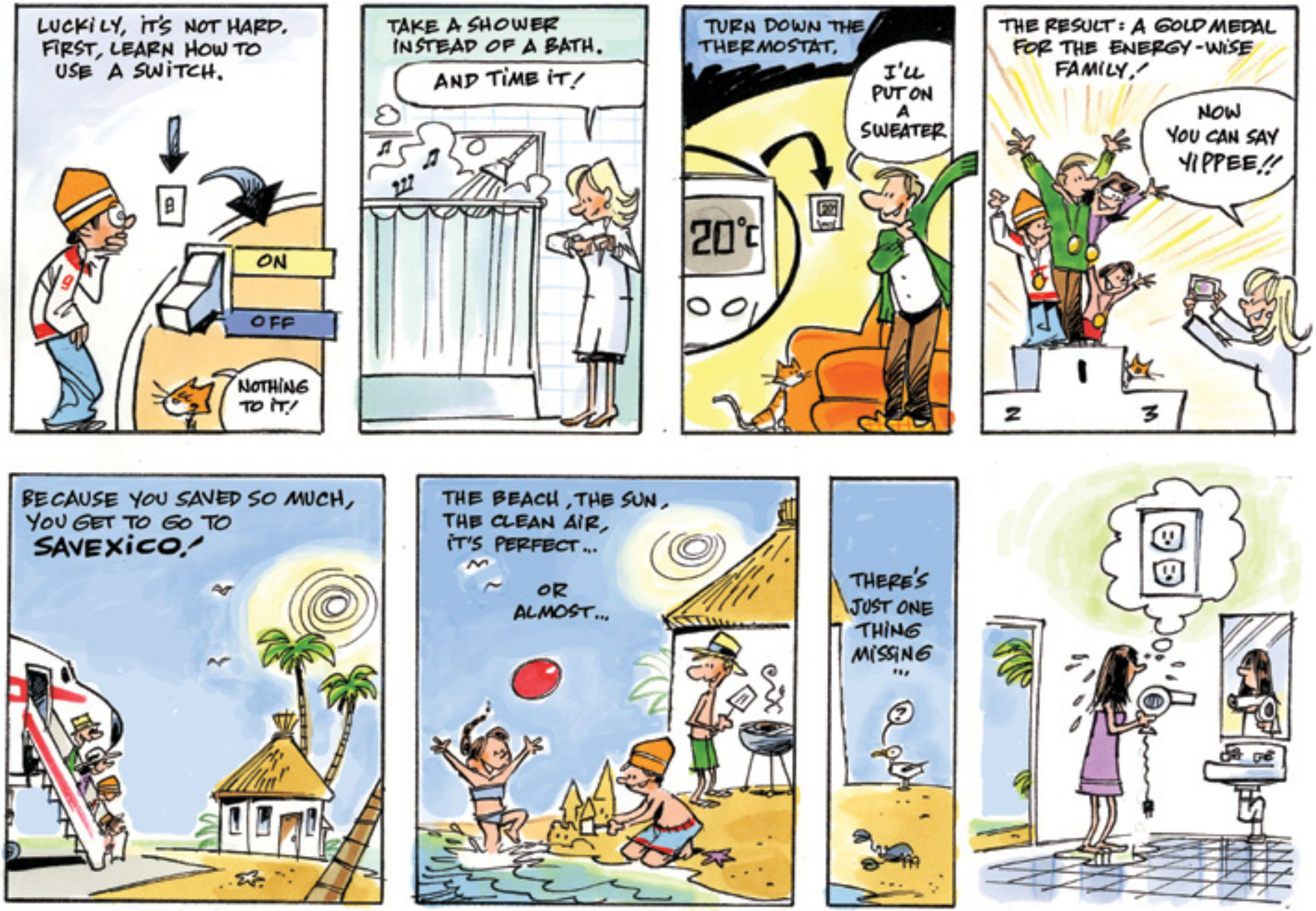
- Interactive whiteboard or computer with speakers, multimedia projector and screen

Steps

- Invite students to read the comic strip in their activity books on their own or project the comic strip on the screen and have students read it aloud.
- Next, ask students what they learned from the comic strip. Had it ever occurred to them that our lifestyles and habits impact the environment? Do they find it's easy to save energy? Can they find at least four ways to save energy in the comic strip? ●

STOP THE VIRUS!




LUCKILY, IT'S NOT HARD. FIRST, LEARN HOW TO USE A SWITCH.
ON
OFF
NOTHING TO IT!
TAKE A SHOWER INSTEAD OF A BATH.
AND TIME IT!
TURN DOWN THE THERMOSTAT.
I'LL PUT ON A SWEATER
20°C
THE RESULT: A GOLD MEDAL FOR THE ENERGY-WISE FAMILY.!
NOW YOU CAN SAY YIPPEE!!
2
1
3
BECAUSE YOU SAVED SO MUCH, YOU GET TO GO TO SAVEXICO.!
THE BEACH, THE SUN, THE CLEAN AIR, IT'S PERFECT...
OR ALMOST...
THERE'S JUST ONE THING MISSING...

Activity 5.2

Energy-Saving Ideas
Brainstorming

Length
25 minutes

See also
Student Activity Book, page 57

Goal of the Activity

The students form teams and think up simple tricks and tips to save electricity and any other form of energy at home inspired by all the activities they have done so far.

Materials Required

Materials provided

- *Student Activity Book*

Steps

- Referring to the activities already done and the information on the next page, start by briefly summarizing energy consumption habits as they apply to lighting, heating, hot water, household appliances, small appliances that use different amounts of electricity, etc.
- Students brainstorrm in teams of four, to come up with at least five ways of saving energy at home. They write their ideas in their activity books.

Links with the QEP

Social Sciences

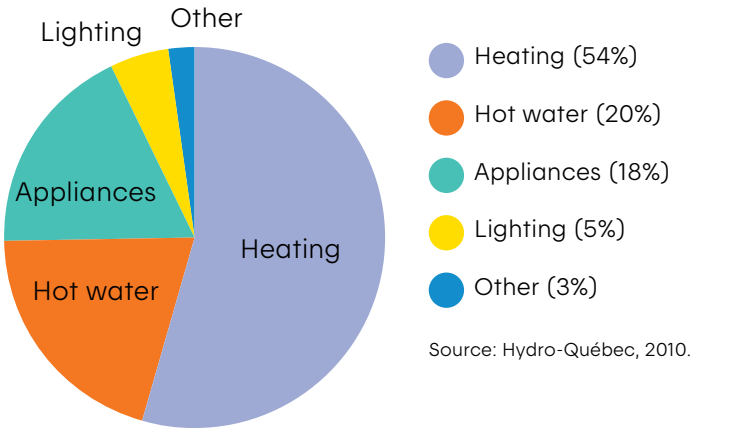
Suggested Approach

If we want to be responsible, energy-wise members of society, the idea is not to give up the benefits of electricity or other forms of energy but ***not to use too much of them or waste them!***

Knowledge is power

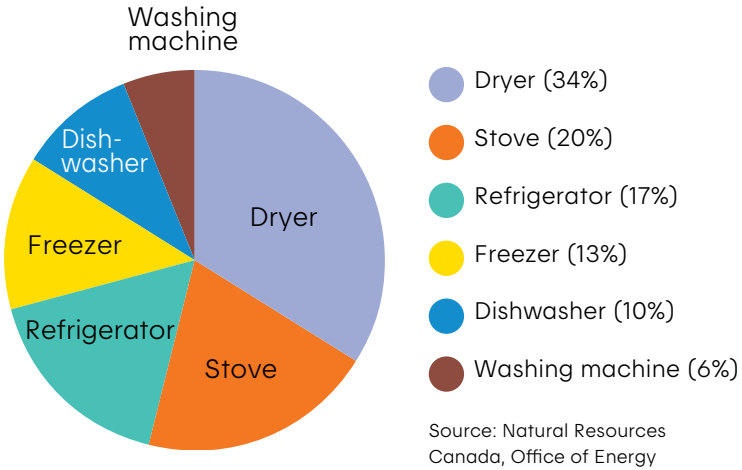
- Baths and showers account for more than one third (35%) of the drinking water we use in our homes.
- A top-loading washing machine uses about 75 litres of water for each load, while a dishwasher uses up to 60 litres.
- To save energy, run your washing machine and dishwasher only when you have a full load.
- Your laundry comes out just as clean when you wash it in cold water as when you wash it in hot or warm water.

Breakdown of Home Energy Consumption



Source: Hydro-Québec, 2010.

Energy Consumption Breakdown by Appliance



Source: Natural Resources Canada, Office of Energy Efficiency, 2012

Activity 5.3

Simple, Effective Ways to Save Energy
The ENERGY-WISE Squad Digital Game

Length
40 minutes

See also
Student Activity Book, page 60

Goal of the Activity

The purpose of the *ENERGY-WISE Squad* game is to teach students what's true and what's false about the energy efficiency of selected appliances and devices, as well as statistics and myths pertaining to energy consumption.

In addition, the game makes students more aware of the wide variety of simple ways to save energy. It's easy to adopt a more energy-wise lifestyle without sacrificing comfort just by changing a few habits.

Materials Required

Materials provided

- *ENERGY-WISE Squad* game at **hydroquebec.com/teachers** or on the provided USB key

Materials to be obtained for the projection

- Interactive whiteboard or computer with speakers, multimedia projector and screen

Links with the QEP

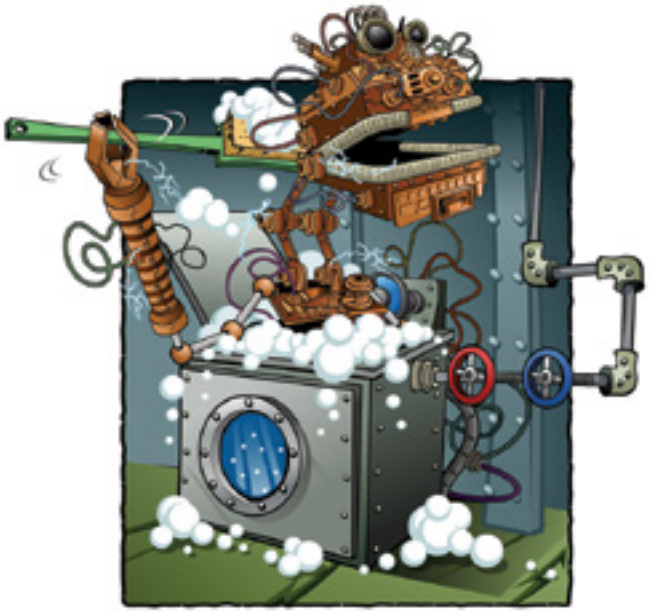
Social Sciences

Note

BEFORE playing the game in the classroom, try it out a few times to make sure everything goes smoothly with your students.

Steps

- Students can play individually on a computer or together on the interactive whiteboard. To start, go to **hydroquebec.com/teachers** or insert the USB key in the computer and click on the *ENERGY-WISE Squad* game link or file.
- Divide students into five or six teams. Each team chooses a captain. Taking turns, each captain reads two or three instructions out loud.

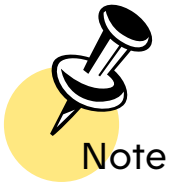


- To enter a room, a team must answer a True or False question correctly. Every right answer drops the energy consumption level, and the lights at the top of the screen go out.
- Once students are inside one of the five rooms on the screen, let one team start. Working together, members have 30 seconds to identify a situation in which energy is being wasted. Once they have a guess, the captain goes to the board and clicks on the object in question. There are three in each room.
- If the captain clicks on the right object, the team will be asked to answer a multiple-choice question. If the team does not answer correctly, another team gets a chance to choose a different answer.
- Every right answer is awarded a **OOWatt** badge (at the bottom of the screen). Now, let the fun begin!

Activity 5.4

All Kinds of Energy-Wise Products
Mystery Objects Digital Game

Length
45 minutes



Note
Not all dimmer switches control any type of light bulb. Make sure you have the right dimmer for the type of bulb you're using.

Goal of the Activity

The *Mystery Objects* game is designed to test the students' memory. The goal is to collect as many objects as possible by giving the right answers. The students will learn about the wide range of energy-saving products on the market.

Materials Required

Materials provided

- *Mystery Objects* game, which can be found at **hydroquebec.com/teachers** or on the provided USB key
- 13 mystery object description sheets
- 13 objects:
  - Set of LED holiday lights
  - Reduced-flow faucet aerator (5.7-litres/min)
  - Safety caps for electrical outlets
  - Piece of hot water pipe insulation
  - Dimmer switch
  - WaterSense® qualified reduced-flow shower head (5.7 litres/min)
  - Shower timer
  - LED bulb
  - Electronic thermostat
  - Sheet of plastic window film
  - Timer for indoor lights
  - Piece of a solar pool cover
  - ENERGY STAR® and WaterSense® logos

Materials to be obtained for the projection

- Interactive whiteboard or computer with speakers, multimedia projector and screen

Links with the QEP

Science and Technology

Steps

- In the classroom, the game should be projected on a screen and played as a group. Students can also play at home on Hydro-Québec's website.
- Before starting the game, the teacher presents objects to students and asks them two questions: what is this object and what is it used for?
- Have students form seven teams. Each team can choose a name for itself (e.g., The Sparks, The Green Team, Energy Wizards, etc.).
- To play, go to **hydroquebec.com/teachers** or insert the USB key in the computer and click on the link or on the file called *Mystery Objects* game.
- On the screen you will see 28 **numbered cards**, face down. On the other side of the cards are 14 pairs of pictures, 13 of them showing energy-saving items and the last pair a picture of the dastardly **Terawattus Energivorus**.
- Teams take turns deciding which two cards they want you to turn over. If one of the **Terawattus Energivorus** card turns up, they immediately lose their turn. The **Terawattus Energivorus** pair of cards must be the last one chosen. The teams continue until one of them chooses a matching pair of cards.
- **When a pair of objects is found**, ask a team member to read aloud the card that appears on the screen and hand the item on the card to the team. You can read the information off the descriptive sheet.
- The team that completes the game with the most items wins!
- You can play more than once to try to improve each team's score (the pairs of cards are not in the same places from one game to the next). Click *Start over* at any time to restart the game.
- When the game is finished, let students handle the items for 5 to 10 minutes. They can also read the descriptive sheets.

Suggested Approach

We can save energy by being less wasteful and by using products that reduce or optimize our energy use. They are inexpensive and easy to find. We're going to play a game to learn more about them and test your memory at the same time!

Activity 5.5

Let's Get Started!
Unplugged! Digital Game

Length
20 minutes

Goal of the Activity

In the *Unplugged!* game, Inspector **OOWatt** asks the students to free their house from the evil clutches of **Terawattus Energivorus**. In the process, they will get tips to reduce their day-to-day energy use.

Materials Required

Materials provided

- *Unplugged!* game at **hydroquebec.com/teachers**

Materials to be obtained for the projection

- Interactive whiteboard or computer with speakers, multimedia projector and screen

Steps

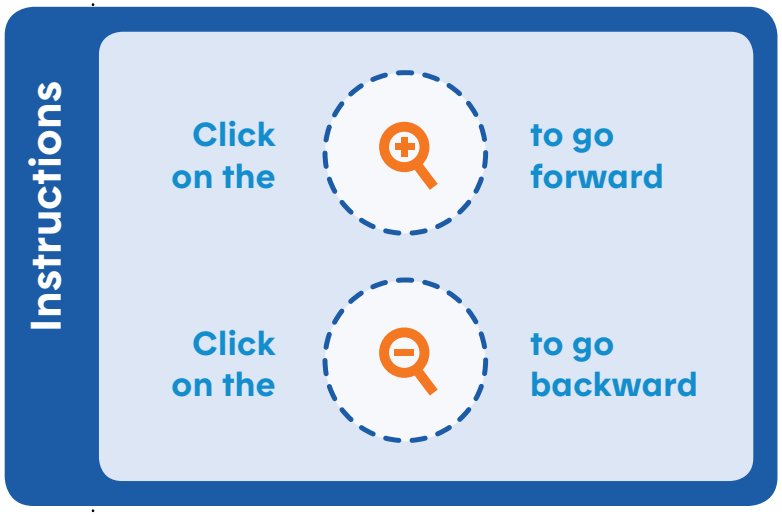
- Project the game onto the interactive whiteboard and divide the class into five teams (one for each zone in the game).
- To start, go to **hydroquebec.com/teachers** and click on the *Unplugged!* game link. Students can play again at home and even challenge their family members!

- Explain that there are thirty situations in which energy is wasted in the home's five rooms. Students must therefore find the sources of this excessive consumption and solutions to reduce their home's energy consumption.

Each of the rooms in the house has:

- two effective solutions
- two wacky solutions
- two interesting but ineffective solutions

To succeed students must find the 10 effective solutions.



- Taking turns, the teams choose the room they want to explore.
- Remind the six teams that they have to act fast: they have only twelve minutes to restore the energy consumption habits in their home and get rid of **Terawattus Energivorus**!
- Students can play again at home at **hydroquebec.com/teachers**.

Hint

Pay special attention to objects that move or that become highlighted in blue.

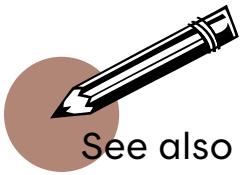
Activity 5.6

Wrap-up and Pledge Form

I Promise!

Length

30 minutes



See also

Student Activity Book, page 62

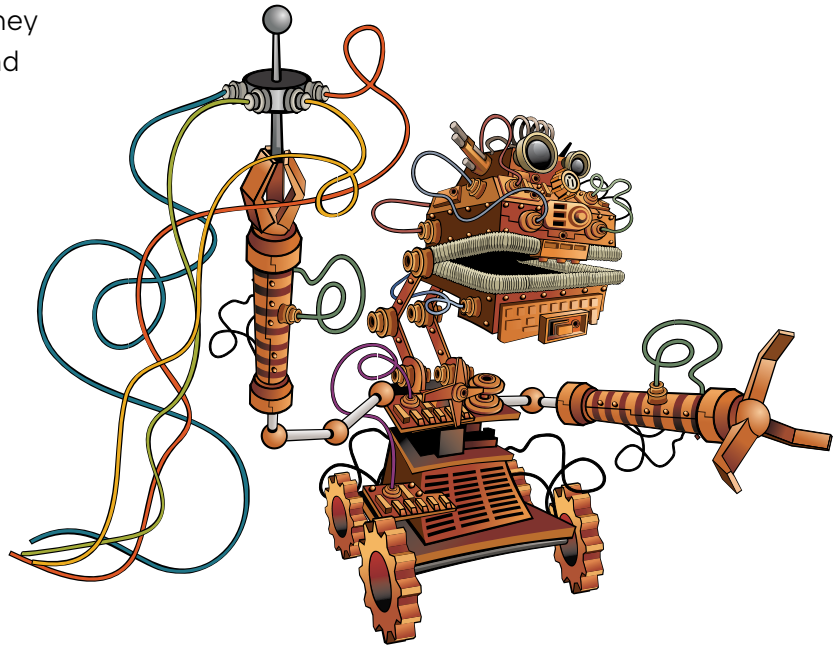
Goal of the Activity

The first goal of this activity is to wrap up the **OOWatt** experience. The second is to provide students with a diploma and pledge, designed as both official certification that they completed the Toolkit activities and a formal way to encourage them to continue their efforts to save energy.

Materials Required

Materials provided

- *Student Activity Book*



Steps

Preparation

- First, students write a summary of everything they have learned. They can do this in teams of two using the *Student Activity Book*, which will help them review what they have seen.
- Second, using their finest handwriting, students complete the diploma and pledge in their activity books. They personally commit to applying three energy-saving resolutions of their choice. They also choose three other energy-saving measures, which they promise to encourage their families to adopt.
- Encourage your students to display their diploma and pledge on their refrigerator at home!

Ceremony

- At a formal ceremony, each student solemnly reads his or her resolution to the group and is then congratulated by the whole class for becoming energy wise and an ambassador for **OOWatt**'s mission!
- Wrap up the activity with the statement in the box below or something similar.

Reminder

Being energy wise doesn't mean you have to do without energy in your life. You just have to avoid using too much and wasting it!

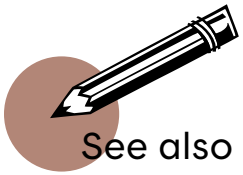
Activity 5.7

Creating Public Interest Posters

My Voice at School!

Length

- 90 minutes wrap-up and designing posters
- 30 minutes putting up the posters



See also

Student Activity Book, page 64

Goal of the Activity

To fulfill their role as ambassadors to the school's other classes, the students design a promotional **poster** to tell their peers that by saving energy, they can avoid waste and help protect the environment and our planet's future.

Materials Required

Materials provided

- *Student Activity Book*

Materials to be obtained

- Writing materials or computer
- Art supplies

Steps

Wrap-up

- In teams of two, students choose the **theme** of their posters and the **main message** they want to get across. Their message should be designed to convince their peers that saving energy is a wise move.
- Write their messages on the blackboard. Be sure to choose a variety of suggestions and work with the teams to find variations if the suggestions are too similar. Each message must promote energy conservation in a responsible society.
- To back up their messages, students should provide concise, **relevant information** (three sentences at most). Each poster should have a catchy **title**, and the message should be summarized in a compelling **slogan**.

Instructions

Each poster must include:

1. **A title**
2. **A slogan or catchy phrase**
3. **A message (useful and concise information)**
4. **At least one illustration (drawings, magazine photos, etc.)**

Links with the QEP

- Social Sciences
- English
- Art

Design

In addition to writing their copy, each team should think about their poster's **concept**. They must decide:

- What will the poster's backing be (paper, cardboard, foamcore, etc.)?
- How big will their poster be? Will it be laid out horizontally or vertically?
- What kind of art techniques will they use (comic strips, drawings, paintings, collages, photos, etc.)?
- How many illustrations will they use?
- What materials will they use (gouache, felt pens, glue, scissors, rulers, stickers, glitter, tissue paper, electric wires, etc.)?

Display

- Once they have planned their posters carefully and written their copy, teams can begin production.
- All the posters may be displayed in the classroom or, even better, in the school's common areas. The students will be proud to hold an official opening for their poster display.

Suggestions

Official opening

- Organize a small ceremony attended by the principal.
- Officially announce the event over the PA system.
- Invite other students to view the posters at lunchtime in your students' presence.
- Organize a one-week contest where visitors can vote for their three favourite posters.

Conclusion

You've completed the **OOWatt** Toolkit!
We hope it proved to be a useful teaching tool.

Thank you for teaching young people about the importance of using energy – and the resources needed to produce it – wisely.

They have a tremendous contribution to make, today and tomorrow, to tackle the energy effiicency challenge. Much of the credit for their efforts goes to you. Well done!

Suggestions

For more information on hydroelectricity and the different ways electricity is generated, check out the *Eco-Energy Squad* and *Envirovolt* (French only) educational kit produced by Hydro-Québec.

You'll find details on these kits and all the other learning resources available from Hydro-Québec at **hydroquebec.com/teachers**.

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