The Eco-Energy Squad

Teacher's Guide

Learning about energy
and the environment!

Hydro Québec

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Introduction to the Kit

With the planet's future continuing to make headlines, the E^2 Educational Kit has been designed to help students in Cycle 3 (Grades 5 and 6) understand the environmental issues associated with using energy.

Students are invited to become cub reporters specialized in energy and the environment. On the program are a host of exciting activities, including watching video reports, taking notes like a real reporter, playing a board game, presenting oral reports, reading articles and taking part in discussions, and challenging themselves and their friends with quizzes and mimes.

Under the guidance of Elliott Evans and his cartoon friends, students conduct investigations that give them an opportunity to:

→ learn about the importance of energy in their lives

→ discover that using energy has a significant impact on the environment

→ develop their critical thinking

Once they have completed all the exercises in the kit, students prepare a special report summing up everything they have learned. Their aim is to answer the following question: ***How can we use energy without jeopardizing the planet?***

Goal and Objectives

The goal of the Educational Kit is to develop Grade 5 and 6 students' critical thinking regarding the energy challenges facing Québec and the rest of the world.

Its five general objectives are to help students:

→ learn about the importance of energy in our lives

→ learn how power is generated in Québec and around the world

→ understand personal, regional and international issues associated with the production and consumption of energy

→ discover how Québec is helping meet international energy challenges through sustainable energy development (energy efficiency, hydroelectricity and other renewable energies)

→ understand the importance of using energy responsibly as part of sustainable energy development practices

Tie-ins with the Québec Education Program

The E^2 Educational Kit promotes the following knowledges and competencies targeted by the Québec Education Program.

Cross-curricular competencies
→ Using information and information technologies, cooperating and communicating appropriately

Subject-specific competencies
→ Developing competencies in English, geography, drama and mathematics

Environmental awareness and Consumer rights and responsibilities
→ Preserving a viable environment based on sustainable development

Awareness of one's environment
→ Recognize how human activity and the environment are interconnected

Effects
→ Recognize how science and technology affect our lifestyle (heating, transportation, etc.)

Essential knowledges
→ Sources of energy and how renewable and non-renewable energy is generated

Elliott Evans

Emma Erwin

Ethan Everett

Means Used

Characters in a cartoon world

Every module begins with a short video introducing the investigation. The videos feature the following characters:

Elliott Evans: A disorganized, sometimes confused anchorman who rules the newsroom.

Emma Erwin: A young, energetic and idealistic investigative reporter who's always ready to uncover the real story.

Ethan Everett: A seasoned reporter currently in the Tundra to investigate the effects of global warming.

These three characters live in the Gustville region (a microcosm of Québec), where Enercorp International, the company that supplies the area's electricity, is about to announce a generating project to meet the region's anticipated power demands in 10 years' time.

It's a great opportunity to conduct a special report on energy and the environment. Unfortunately, with Ethan stuck in the Tundra, Emma Erwin is afraid she might not be able to do it on her own.

Your students to the rescue!

Luckily, Elliott Evans has an idea: What if he invited your students to join his team of reporters and give Emma Erwin a helping hand? As they work through each investigation, your students will gather information and develop a better grasp of the environmental issues associated with power consumption.

Introduction to the Kit

Structure and Contents

The E² Educational Kit includes:
→ Presentation materials
→ Five investigations to be carried out by students
→ A special report to be produced by students
→ A variety of maps, posters and information sheets
→ Games and answer sheets

Every investigation is optional and independent from the others. In addition, each one can be completed in part or in its entirety.

Warning!

Whether or not you intend to work through every investigation, you must start with the first module. In addition, before carrying out Investigation 4 (on various energy scenarios), students must complete Investigation 3 (The Great E² Challenge) properly. Finally, we strongly advise that the Special Report not be tackled until every other investigation has been completed.

A wide variety of activities

The kit includes a variety of activities to appeal to students' diverse talents and interests.

Investigation 1: Matching game and miming
Investigation 2: Article analysis using a questionnaire
Investigation 3: Board game and association game
Investigation 4: Readings, analysis and oral report
Investigation 5: Quiz
Special Report: Preparatory readings and creating a report based on a model

The duration shown for each activity is approximate.

Detailed Description of All Seven Modules

Presentation: Wanted: Intrepid Reporters!	• Introduction to the cartoon world and presentation of the reporter's role
Investigation 1: We All Use Energy!	• Definition of the word "energy" • Everyday activities that require energy • The main sources of energy we use: electricity and fossil fuels • Our energy dependence
Investigation 2: The Planet's in Trouble!	• The greenhouse effect • Global warming • The main causes and effects of global warming and ground, air and water pollution; concerns about nuclear power
Investigation 3: Generating Electricity: The Choice Is Ours!	• Definition of "power source" • Five power sources that produce electricity: hydroelectric, wind, fossil fuels, nuclear and solar • The strengths and weaknesses of each power source according to four criteria: availability, cost, environmental impact and renewability
Investigation 4: Gustville: Looking for the Perfect Solution!	• Energy efficiency • The role of hydroelectricity, wind power and energy efficiency in sustainable energy development
Investigation 5: Everyone Gets a Say!	• Introduction to public consultations • Description of participants and topics of discussion • Examples of mitigation measures
The E^2 Special Report	• Written or video reporting plan • Production • Assimilation of knowledge acquired over all five investigations

Kit Contents

Teacher's Guide
For each module, the Teacher's Guide includes:
→ The objectives
→ The list of required materials
→ The necessary preparation
→ The context
→ The outline of the activity
→ Objectivation (optional)
→ Skill checks (optional)
→ Enrichment (optional)

Appendices
The appendices include fact sheets on each power source (in student and teacher versions), a table of power sources used to produce electricity in various countries in 2002, the Video Reporting Guide, skill checks and answer sheets, as well as games with their solutions and a list of the kit's contents.

E^2 Reporter's Notebook
Students receive one copy each. Over the course of each investigation, students make a note of what they learn; later on, they will use that information to produce their special report. As their diary of daily events, the E^2 Reporter's Notebook is a treasure-trove of information to which students can refer at any time.

Videos
The DVD contains seven videos (one for each module) averaging two minutes in length. The videos are excellent motivators, capturing students' interest while providing a context for each module and getting information across in an accessible way.

> **If a DVD player or TV set is not available,** you can still use the DVD content. We recommend that the teacher simply tell the story of the video, drawing inspiration from the video summary included in the Context step at the beginning of each module.

Power source definition sheets, skill check sheets and game sheets
These sheets, which you can find in the appendix, can be photocopied and handed out to students.

Materials
The materials you need are described in detail in each module.

Introduction:

Wanted: Intrepid Reporters!

Objectives

→ Develop a general overview of the kit's contents and how it can be used
→ Meet the cartoon characters featured in the E^2 kit
→ Identify tie-ins between energy consumption and environmental issues

Materials

→ Introductory video (on the DVD)
→ E^2 Reporter's Notebooks (one for each student)
→ "Job Offer" poster

Preparation

→ Put up the "Job Offer" poster on your classroom wall

Approximate duration: 30 minutes

Introduction: Wanted: Intrepid Reporters!

Step A – Context

1. View the introductory video starring Elliott Evans and Emma Erwin

Video summary

→ Presentation of the municipality of Gustville, whose residents use a great deal of energy.

→ Elliott Evans is a TV anchorman, working out of his television studio.

→ Emma Erwin is a reporter. She has just learned that Enercorp International is about to announce a generating project to supply power to Gustville residents.

→ Like Elliott Evans, she believes that the time is right to finally produce a special report on energy and the environment.

→ Unfortunately, the other reporters in Ethan Everett's team are stuck in the Tundra. After setting off to report on the effects of global warming, they ran out of gas.

→ Elliott Evans has to find another team to produce the report on energy consumption and the environment, quickly!

2. Ask students to give Elliott and Emma a helping hand by becoming reporters

Step B – Activity Outline

1. Present the kit

a) Elliott Evans has asked us to give him a hand with a special report on energy and the environment.

b) To help him out, we'll have to start by carrying out a few investigations. They'll help us learn about:
   → the importance of energy in our lives
   → the impact of using energy on the environment
   → the steps we can take to satisfy our need for energy without harming the environment

c) Each investigation involves a wide range of activities: watching videos, playing a board game, searching for information, discussing, writing articles, drawing and taking quizzes.

2. Hand out and present the E^2 Reporter's Notebook

a) You each have your own E^2 Reporter's Notebook.
b) It is divided into several sections, one for each investigation.
c) Take notes on everything you learn in each investigation.
d) Your notes will come in handy when it's time to produce your special report.

3. Check what students have learned about the impact of energy consumption on the environment.

Elliott Evans and Emma Erwin suggested that using energy has an impact on the environment. Have you ever heard that? What can you tell me about it? Can you give any examples?

Investigation 1

We All Use Energy!

Objectives

→ Define the word "energy"
→ Identify some of the ways we use energy in our day-to-day lives
→ Match daily activities with the two main sources of energy: electricity and fossil fuels
→ Understand our dependence on energy

Materials

→ Investigation 1 video (on the DVD)
→ E^2 Reporter's Notebooks
→ Five *Miming* cards

Approximate duration: 75 minutes

We All Use Energy!

Step A – Context

1. **Ask students the following open-ended questions**

   a) What is energy?

   b) Can you name any activities that require energy?

   c) Where does the energy we use come from?

2. **View the Investigation 1 video starring Elliott Evans and Emma Erwin**

Video summary

→ Elliott Evans welcomes his new team of reporters.

→ He points out how important energy is in our lives. He defines energy as something that enables us to run, to think, to drive a car, to fly a plane and to heat our homes.

→ Emma Erwin notes that Gustville residents use a lot of energy: at home, at school, in hospitals, and so on.

→ Elliott Evans wonders how people lived before electricity was discovered. He invites students to think about it.

3. **Ask questions about the video**

   a) **How does Elliott Evans define "energy"?**

      It's something that enables us to run, to think, to drive a car, to fly a plane and to heat our homes.

   b) **Elliott Evans says we consume so much energy worldwide that it is as if every person on Earth left something on all the time. What did he mention, and how many of them?**

      22 lightbulbs.

   c) **Emma Erwin says that the residents of Gustville are energy gobblers. What do they do with it?**

      They heat their homes and run electrical devices at home, in schools and in hospitals. They also use it to run communications equipment.

Step B – Activity Outline

1. **Present Investigation 1**
   a) Elliott Evans has assigned us our first investigation: to find out how people lived before electricity.
   b) We will see that most of the energy we use comes from one of two sources: electricity and fossil fuels.

2. **Define "fossil fuels"**

   Read the definition of "fossil fuels" on p. 4 of the E^2 Reporter's Notebook.

   a) They are called "fuels" because they can burn.
   b) They are called "fossil" because they form deep in the ground over tens of millions of years through the decomposition of organic matter from plants or animals.
   c) Oil (also called "petroleum,") coal and natural gas are examples of fossil fuels. Gasoline and fuel oil (heating oil) are oil by-products.

3. **Play the matching game**

   Emma Erwin notices that Gustville residents use a great deal of energy in their daily lives. Turn to the matching game on p. 5 of the E^2 Reporter's Notebook, and ask students to write the correct letter under each illustration.

   Check their results against the following answers.

   Matching game answers
   - Things that use electricity (E):
     The lamp, the microwave oven, the telephone, the radiator, the computer, the television set, the flashlight, the MP3 player and the stove.
   - Things that use fossil fuels (F):
     The gas barbecue, the oil lamp, the car, the hydraulic shovel, the ambulance, the radiator, the stove, the lawnmower and the scooter.
   - Things that use neither of these power sources (N):
     The campfire, the bicycle, the clothesline and the sailboard.

4. **Introduce the miming game**
   a) The purpose of the activity is to learn how people lived before electricity.
   b) The game is designed to be played in groups of five or six students. Each group is divided into two teams of two to three students.
   c) One team in the first group draws a card describing an everyday activity from another era. After taking a minute to get ready, the team members mime the activity while the second team tries to guess what it is.
   d) The members of the second team then mime the same activity, but this time they mime it as it is done today, with modern equipment.
   e) The game continues until each group in the class has had a turn.
   f) In their groups, students identify the activity on p. 6 of their E^2 Reporter's Notebook and describe the main differences between how things were done in the past compared to today.

Step C – Objectivation (optional)

1. **Ask students what their lives would be like without fossil fuels or electricity**

   Suggest the following answers, if necessary:

   - No cars or buses: getting to school would take longer
   - No television, radio, computers or airplane travel: limited recreational activities
   - No electric light at night: candlelight
   - No electric heat: woodstoves or fires
   - No electric stoves or microwave ovens: cooking over a fire

2. **Wrap up the investigation**

   - We use energy every day, in everything we do.
   - Electricity and fossil fuels make our lives easier and more pleasant.
   - Without them, we wouldn't have the same quality of life.

Step D – Skill Check (optional)

Hand out a copy of Investigation 1 Skill Check (See Appendix 4, p. 75) to each student

Ask students to fill out the skill check sheet, with or without the help of their E^2 Reporter's Notebook.

Step E – Enrichment (optional)

Suggestions for complementary activities

Activity 1
Hand out an Investigation 1 Game Sheet to every student (See Appendix 5, p. 93).

Activity 2
Visit the Hydro-Québec Web site at **www.hydroquebec.com** or an exhibition on how we use energy with your students.

Activity 3
As a tie-in with the discussion about what the world would be like without fossil fuels or electricity, carry out one of the following activities:

→ Meet with a senior citizen to find out what a typical day was like when he or she was a child.
→ Watch a movie or TV program that takes place in the early 20th century.

Then have students write a one-page essay or draw a picture describing life in the past.

Activity 4
Have students choose their favorite activity that uses electricity and draw a picture of it.

Activity 5
Ask students to continue to pay attention to the various ways they use energy in their everyday lives.

To prepare for Investigation 2, photocopy this page and cut out the titles.

Puppy Pulled from the Water!

Sunshine in a Can?

Halima Leaves Her Village

Grandma Can't Breathe!

Strawberries All Year Round?

The Forest Is Moving

Whole Islands Could Disappear Under Water!

Coming Soon: Children in the Schoolyard!

Rain that Chases the Fish Away!

Investigation 2

The Planet's in Trouble!

Objectives

→ Learn how using energy affects the environment

→ Develop an understanding of the greenhouse effect

Materials

→ Investigation 2 video (on the DVD)

→ E^2 Reporter's Notebooks

→ E-mail from Ethan Everett

→ *Planet Express!* Newspaper

→ World map (not included)

→ "Illustration of the Greenhouse Effect" poster

→ "Electricity Generation in Canada and in the United States" map

Preparation

→ Put up the world map and the "Illustration of the Greenhouse Effect" poster on your classroom wall.

→ Photocopy the preceding page and then cut out the titles. Make enough photocopies for every child or team to draw one title randomly.

Approximate duration: 75 minutes

The Planet's in Trouble!

Step A – Context

1. **Ask students the following open-ended questions**

   a) Does our energy consumption have an impact on the environment?

   b) Have you ever heard of global warming?

   c) What can you tell me about the greenhouse effect?

2. **View the Investigation 2 video starring Elliott Evans and Ethan Everett**

Video summary

→ Elliott Evans explains that using energy has a direct impact on the environment. For instance, it creates air and water pollution. It also leads to global warming, which is a gradual increase in the Earth's temperature. With the help of an environmental expert and an animated video, he explains how it works.

→ Global warming is caused by the presence of certain gases in the atmosphere, which are responsible for the greenhouse effect. The greenhouse effect is similar to what happens in a greenhouse, where tomatoes can be grown even in the winter.

- The sun's rays reach the Earth, which absorbs some of the energy and reflects the rest back out to space like a mirror.
- The atmosphere naturally contains gases called "greenhouse gases." That's a good thing, because they trap some of the sun's heat. Otherwise, the Earth would be too cold for life.
- Unfortunately, the amount of greenhouse gas in the atmosphere has increased due to human activity. As a result, the atmosphere is now trapping too much heat and the Earth is warming up.

→ Elliott Evans receives an e-mail from Ethan Everett describing the effects of global warming on the Tundra.

→ Elliott Evans also mentions the newspaper *Planet Express!,* which covers the environmental impact of energy consumption.

→ He invites students to undertake a second investigation: to discover how energy consumption affects the environment.

3. Ask questions about the video

a) **How does Elliott Evans explain the meaning of "global warming"?**

The Earth's temperature is increasing.

b) **Elliott Evans mentions a positive effect of global warming. What is it?**

Emma Erwin can cycle in February!

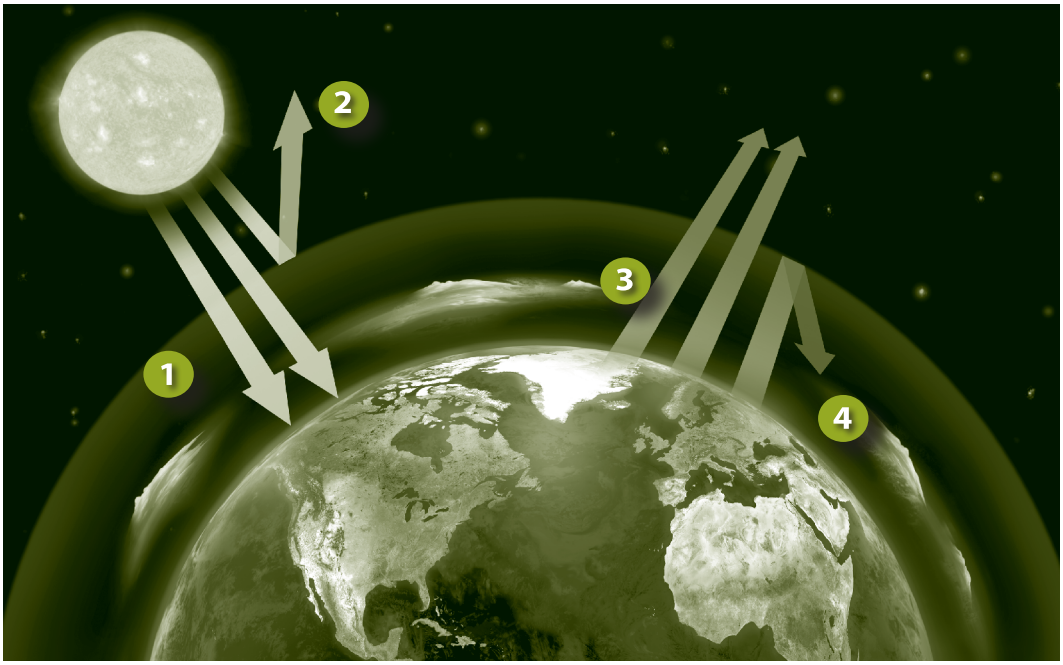
c) **Emma Erwin names two human activities that produce greenhouse gas (GHG). What are they?**

Using cars (and other motor vehicles) and generating electricity with fossil fuels.

d) **An expert explains how greenhouse gas (GHG) works. How much colder would the Earth be if there wasn't any greenhouse gas in the atmosphere?**

33 °C !

4. Look at the illustration of the greenhouse effect with your students
(poster and p. 8 of the E² Reporter's Notebook)



1. Solar energy from the sun passes through the atmosphere.
2. Some of the energy is reflected back out to space.
3. Earth's surface is heated by the rays and radiates the heat back out to space.
4. Greenhouse gases in the atmosphere trap some of the heat.

Source: www.msc.ec.gc.ca/education/scienceofclimatechange/understanding/greenhouse_gases/images/fig1_e.html

Step B – Activity Outline

1. **Present Investigation 2**

   a) Elliott Evans has invited us to learn how our energy consumption is affecting the environment by reading the e-mail from Ethan Everett and the articles in the *Planet Express!* newspaper.

   b) Have students read the e-mail that Ethan Everett sent to Elliott Evans aloud.

2. **Ask students to answer the questions on the environmental impact of human activity found on p. 9 of their E² Reporter's Notebook aloud, using Ethan Everett's e-mail to find the answers**

Here are the answers:

E-mail from Ethan Everet

Subject: Effects of global warming on the North
Characters and location: Inuit, Far North
Related to global warming? X Yes ❒ No

Affected aspects of the environment:

X Human health
X Lifestyle
X Animal life
❒ Plant life
X Ground
❒ Air
❒ Water

Summary of probable effects:

- Temperatures have increased by 4°C over the last 50 years.
- The cold weather season doesn't last as long.
- The ice cover forms later and is not as thick.
- Bears appear to be thinner and having difficulty feeding their young.
- The weather is unpredictable.
- The ground is thawing.
- Houses and roads have been damaged.
- The ice cover could disappear within 40 years.
- Global warming is drastically changing the Inuit lifestyle.

3. **Have each student or team draw the title of an article out of a box or envelope**

4. Ask each student or team to read the article and answer the questions on pp. 9 and 10 of their E² Reporter's Notebook

Planet Express! article

Puppy Pulled from the Water!

Subject: Extreme weather events
Characters and location: Children and a puppy, New Orleans, Louisiana, U.S.A.
Related to global warming? X Yes ❒ No

Environmental impact:

X Human health
X Lifestyle
X Animal life
X Plant life
X Ground
❒ Air
X Water

Summary of probable effects:

- More and more extreme weather events like hurricanes, tornadoes, heavy rainfalls and significant temperature fluctuations
- Floods
- Mass evacuations
- Deaths and injuries

Planet Express! article

Halima Leaves Her Village

Subject: Desertification
Characters and location: Halima and her family, Assaka, Niger, Africa
Related to global warming? X Yes ❒ No

Environmental impact:

X Human health
X Lifestyle
X Animal life
X Plant life
X Ground
❒ Air
X Water

Summary of probable effects:

- Drought within 75 years
- Poor harvests
- Water and food shortages
- Mass migrations
- Intensification of the greenhouse effect

Step B – Activity Outline

Planet Express!
article

Strawberries All Year Round?

Subject: Global warming
Characters and location: Anne-Sophie and Éric, Lennoxville, Québec, Canada
Related to global warming? X Yes ❒ No

Environmental impact:

❒ Human health	**X** Ground
X Lifestyle	❒ Air
❒ Animal life	❒ Water
X Plant life	

Summary of probable effects:

- Longer, hotter summers
- Shorter, milder winters
- Better harvests

Planet Express!
article

The Forest Is Moving!

Subject: Shifting climate zones
Characters and location: The forest, Val-d'Or, Québec, Canada
Related to global warming? X Yes ❒ No

Environmental impact:

❒ Human health	**X** Ground
X Lifestyle	❒ Air
X Animal life	❒ Water
X Plant life	

Summary of probable effects:

- Climate zones will shift northwards
- The forest and its inhabitants will move northwards
- Disappearance of some animal and plant species
- Job losses for forestry workers

Planet Express!
article

Whole Islands Could Disappear Under Water!

Subject: Rising sea levels
Characters and location: Philippe and Mahomed, Male, Maldives, Indian Ocean
Related to global warming? X Yes ❒ No

Environmental impact:

❒ Human health
X Lifestyle
X Animal life
X Plant life
X Ground
❒ Air
X Water

Summary of probable effects:

- Melting glaciers in Greenland and the Arctic
- Rising sea levels
- Islands swallowed by the sea
- Coastlines flooded
- Migrations

Planet Express!
article

Grandma Can't Breathe

Subject: Air pollution
Characters and location: Belinda, Mexico City, Mexico
Related to global warming? ❒ Yes **X** No

Environmental impact:

X Human health
X Lifestyle
❒ Animal life
❒ Plant life
❒ Ground
X Air
❒ Water

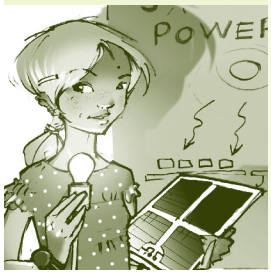
Summary of probable effects:

- Formation of smog
- Health problems
- Belinda can't go outside when smog levels are high

Step B – Activity Outline

Planet Express!
article

Sunshine in a Can?



Subject: Finding alternatives to radioactive waste
Characters and location: Nadine, Geneva, Switzerland
Related to global warming? ❒ Yes **X** No

Environmental impact in the event of an extreme accident:

X Human health
X Lifestyle
X Animal life
X Plant life
X Ground
X Air
X Water

Summary of probable effects:

- Risk of accidents that release harmful radiation

Planet Express!
article

Coming Soon: Children in the Schoolyard!

Subject: Air pollution
Characters and location: Schoolchildren in Xi'an, Shaanxi, China
Related to global warming? X Yes ❒ No

Environmental impact:

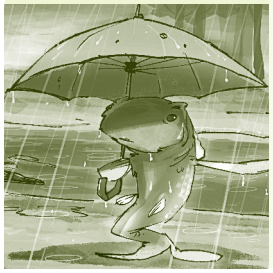
X Human health
X Lifestyle
❒ Animal life
❒ Plant life
❒ Ground
X Air
❒ Water

Summary of probable effects:

- Risk of developing respiratory illnesses
- Students not allowed to play outside as usual
- Contribution to the greenhouse effect

Planet Express!
article

Rain that Chases the Fish Away!



Subject: Air pollution
Characters and location: Anthony and his father, Nova Scotia, Canada
Related to global warming? ❒ Yes **X** No

Environmental impact:

❒ Human health
❒ Lifestyle
X Animal life
X Plant life
X Ground
X Air
X Water

Summary of probable effects:

- Disappearance of fish and amphibians
- Acidic soil
- Weakened plants
- Shortage of food for animals and humans

Step C – Objectivation (optional)

1. **Divide students into groups according to the article they read**
2. **Ask them to prepare a two-minute simulation of a TV interview for the class, with students playing the part of a TV anchor, a reporter, an interviewee or an eyewitness**

   Your students may use the report guidelines found on p. 11 of the E^2 Reporter's Notebook if they wish.
3. **Have students make their presentations**
4. **Wrap up the investigation**
   - Our energy consumption, particularly in the case of energy generated from fossil fuels, has an impact on the environment.
   - It contributes to global warming as well as air and water pollution, and can produce dangerous waste products.
   - Although some repercussions can be positive (like longer, warmer summers in Québec), the overall impact is negative for Earth's various forms of life.
   - We have to take the situation seriously and act now to preserve our future.

Step D – Skill Check (optional)

Hand out a copy of Investigation 2 Skill Check (See Appendix 4, p. 77) to each student

Ask students to fill out the skill check sheet, with or without the help of their E^2 Reporter's Notebook.

Step E – Enrichment (optional)

Suggestions for complementary activities

Activity 1
Hand out an Investigation 2 Game Sheet to every student (See Appendix 5, p. 95).

Activity 2
Have students watch or read reports on energy and environmental issues, write an essay or draw a picture, and present it to their classmates.

Activity 3
Visit the following Web sites:

→ Hydro-Québec's Web site:
www.hydroquebec.com/sustainable-development/index.html

→ The Canadian government's "Science of Climate Change" Web site:
www.msc-smc.ec.gc.ca/education/scienceofclimatechange

→ The NFB site on the Sedna IV's Arctic Mission, "A journey of discovery across the top of the world":
www.nfb.ca/aventures/sedna/arcticmission/index.html

Activity 4
Have students examine the "Electricity Generation in Canada and in the United States" map and prepare an oral report on where much of Québec's air pollution comes from.

Investigation 3

Generating Electricity: The Choice Is Ours!

Objective

→ Learn about different power sources and their strengths and weaknesses

Materials

→ Investigation 3 video (on the DVD)
→ E^2 Reporter's Notebooks
→ Ten *Who Uses What?* cards
→ World map (not included)
→ The Great E^2 Challenge (eight copies). Every game includes one game board, twenty-five *Challenge* cards, twenty-six *Question* cards, twenty Smiley markers (four green (happy) ones, six red (sad) ones, and ten orange (neutral) ones), four game pieces, one die and one rule sheet
→ "The Five Main Power Sources" poster

Preparation

→ Put up the world map and "The Five Main Power Sources" poster on your classroom wall. On the world map, mark the following regions with a lump of adhesive putty:

- Germany, Europe
- Saudi Arabia, Asia
- Argentina, South America
- Australia, Oceania
- China, Asia
- Denmark, Europe
- United States, North America
- France, Europe
- Québec, North America
- Democratic Republic of the Congo, Africa

Approximate duration: 90 minutes

Generating Electricity: The Choice Is Ours!

Step A – Context

1. Ask your students the following open-ended questions

a) Are there different ways to generate electricity? If so, what are they?

b) What can you tell me about the impact of using energy on the environment?

c) Why do we use some methods of producing energy rather than others?

2. View the Investigation 3 video starring Emma Erwin and Elliott Evans

Video summary

→ Emma Erwin is covering the World Conference of Young Energy Scientists, which is being held in Gustville. Conference delegates will be holding a big debate to evaluate power sources used around the world and choose the best one for our energy future.
→ In its broadest sense, a power source refers to the various sources of a specific form of energy and the means used to generate, transmit and use that energy.
→ The power sources being evaluated are hydroelectricity, wind power, fossil fuels, nuclear power and solar power.
→ They are being evaluated on the basis of their availability, cost, environmental impact and renewability.
→ Availability: The power source's ability to provide the required energy when the need arises.
→ Cost: The price of generating electricity using the power source in question.
→ Environmental impact: The way in which generating electricity from the power source affects the environment, and the degree to which it does so.
→ Renewability: The ability to generate electricity without exhausting the resource.
→ Elliott Evans invites students to conduct their own investigation and look into the strengths and weaknesses of each power source with the help of the surprise package from Emma Erwin.

3. Ask questions about the video

a) **What does the term "power source" mean?**

A power source refers to the various sources of a specific form of energy and the means used to generate, transmit and use that energy.

Important note

Refer to p. 13 of the E^2 Reporter's Notebook.

b) **What are the main "power sources" that the World Conference of Young Energy Scientists is looking into?**

→ Hydroelectricity
→ Wind power
→ Nuclear power
→ Fossil fuels
→ Solar power

Important note

These five power sources are described in detail in Appendix 1. A simplified definition is provided in table form in the E^2 Reporter's Notebook (p. 14) as well as on the "The Five Main Power Sources" poster.

c) **Elliott Evans asks Emma Erwin why this big debate on the strengths and weaknesses of each power source is being held. What does Emma answer?**

Our energy choices have consequences for the environment.

d) **Emma Erwin explains that each power source is evaluated on the basis of four criteria. What are they?**

→ Availability, or the power source's ability to provide the required energy when the need arises.
→ Cost, or the price of generating electricity using the power source in question.
→ Environmental impact, or the way in which generating electricity from the power source affects the environment, and the degree to which it does so.
→ Renewability, or the ability to generate electricity without exhausting the resource.

Important note

Refer to p. 15 of the E^2 Reporter's Notebook for the definition of each criterion.

e) **Emma Erwin says that one criterion was most important for the young scientists at the Conference. Which one was it?**

Environmental impact

Step B – Activity Outline

1. **Present Investigation 3**
   a) Elliott Evans asks us to conduct our own investigation into the strengths and weaknesses of power sources around the world to find out which are most promising for the future.
   b) The surprise package that Emma Erwin sent will help us. It contains The Great E^2 Challenge.

2. **Play The Great E^2 Challenge**

   Approximate duration: Minimum of 35 minutes, or as long as the teacher wishes.

   a) Divide your students into teams of two players and assign two teams to each table.
   b) After reading the rules, play the game.

   Rules

   → Players work together to evaluate a number of power sources by placing the happy, sad and neutral Smiley markers in the right spots on the game board.
   → When the game is over, ask students to jot down what they have learned on p. 17 of their E^2 Reporter's Notebook, as shown below:

	Availability	**Cost**	**Environmental impact**	**Renewability**
Hydroelectricity	☺	😐	😐	☺
Wind Power	😐	😐	😐	☺
Nuclear Power	😐	😐	😐	☹
Fossil Fuels	☹	☹	☹	☹
Solar Power	😐	☹	😐	☺

3. **Ask students what they think the "power sources of the future" are, and why**

Step C – Objectivation (optional)

1. Play the association game

The object of the game is to match each one of the ten *Who Uses What?* cards with the right place on the world map.

In preparation for the game, you should have already stuck a lump of adhesive putty on the following places: Germany, Saudi Arabia, Denmark, the United States, France, Québec, Argentina, Australia, China and the Democratic Republic of the Congo.

a) Ask for ten volunteers to play the game.
b) Each volunteer takes a card (taking care to cover the back, where the answer is found), reads it aloud and sticks it to the map on the corresponding country or region.
c) Once every card has been stuck on the map, have your students check their work by turning over each card and moving it to the right place, as required.

2. Ask students to explain why they think energy choices are so different from one place to another (availability, cost, environmental impact and renewability) and discuss the answers

- Every country or region uses the locally available source of energy.
- Québec, like the Democratic Republic of the Congo, has lots of rivers. Although Saudi Arabia doesn't have any rivers, it does have enormous quantities of oil!
- Denmark is the leading user of wind power, while France is the top user of nuclear power.
- Like most countries, the United States uses a combination of power sources to generate its electricity. However, fossil fuels predominate.
- Solar power still accounts for very little of the energy we use. Is it a viable option for the future?
- Students can find a table of the main power sources used around the world on pp. 18 and 19 of their E^2 Reporter's Notebook.

3. Wrap up the investigation

- The choice of power source depends on several factors. We cannot base our decision on a single factor.
- However, with global warming becoming a growing concern, we are paying more and more attention to environmental impact and looking more closely at renewable energies.
- Some sources of energy, like solar power, are very expensive at this time, but technological advances could change the situation.
- Québec is lucky because it has an abundance of one resource that ranks highly according to all the criteria: water. Five percent of Québec's rivers are harnessed to generate electricity.

Step D – Skill Check (optional)

Hand out a copy of Investigation 3 Skill Check (See Appendix 4, pp. 79 and 80) to each student

Ask students to fill out the skill check sheet, with or without the help of their E^2 Reporter's Notebook.

Step E – Enrichment (optional)

Suggestions for complementary activities

Activity 1
Have students try the games on pp. 16 and 20 of their E^2 Reporter's Notebook. The games and answers can also be found in Appendix 5, on pp. 97–100.

Activity 2
Have students watch a TV report on energy and environmental issues, write a one-page summary, draw a picture or create a cartoon based on the report, and then present it to the class.

→ Part 2 of MediCinema's DVD called "Energy Choices" (1996), which deals with the relationship between energy and the environment and Canada's main sources of energy.

Visit http://www.medicinema.com/energy.html

Activity 3
Check out the following Web sites:

→ Hydro-Québec's Web site:
http://www.hydroquebec.com/learning/index.html

→ An introduction to comparing power sources:
http://www.hydroquebec.com/sustainable-development/index.html

Activity 4
Visit a Hydro-Québec hydroelectric generating station to learn more about hydropower. Ask students to produce a photo report illustrating the generating process described in The Great E^2 Challenge.

Investigation 4

Gustville: Looking for the Perfect Solution!

Objectives

→ Define the term "energy efficiency"

→ Make young people aware of the importance of saving energy

→ Understand how hydroelectricity and wind power can help meet the planet's environmental challenges

→ Encourage young people to find ways to save energy

Materials

→ Investigation 4 video (on the DVD)

→ E^2 Reporter's Notebooks

→ Decks of four *Energy Solutions* cards

→ "Gustville: Looking for the Perfect Solution!" poster

→ Round power source markers (wind turbine, gas-fired plant, nuclear power plant, reservoir generating station and solar panels)

→ "Global Warming: What Source of Energy Should We Choose?" poster

Preparation

→ Put up the "Gustville: Looking for the Perfect Solution!" poster

→ Put the power source markers and adhesive putty next to it

Approximate duration: 75 minutes

Gustville: Looking for the Perfect Solution!

Step A – Context

Note

Investigation 4 is a follow-up to Investigation 3, which should be conducted first.

1. **Ask students the following open-ended questions**

   a) **What factors should you bear in mind when choosing a power source to generate your electricity?**

   Refer to the criteria for evaluating power source strengths and weaknesses found on p. 15 of the E^2 Reporter's Notebook.

   b) **New generating stations are built when people use more electricity. What would happen if we used less electricity?**

   Fewer generating stations would have to be built. Or the surplus clean energy could be sold and used instead of energy produced from fossil fuels, which would help cut down GHG emissions.

   c) **If we used less electricity, what would be the impact on the environment?**

   Less pollution and greenhouse gas would be produced.

2. **View the Investigation 4 video starring Elliott Evans and Emma Erwin**

Video summary

→ Emma Erwin is still covering the World Conference of Young Energy Scientists. She tells viewers about the shockwave that swept the conference when a keynote speaker made a sensational comment: What about energy efficiency? He suggested that energy management had to be considered in terms not only of GENERATING power, but also USING it. Saving energy is another way to protect the planet's future.

→ Emma Erwin also announces that she has managed to find out what scenarios Enercorp International is looking at to meet Gustville's energy needs. She believes that with these scenarios and the results of the power source evaluation carried out in Investigation 3, we should be able to tell which combination Enercorp International is getting ready to announce and get the scoop!

→ Elliott Evans decides that all this vital information has to be put to good use. He asks students to:

- come up with the ideal way to generate the electricity Gustville needs
- find ways to reduce our power consumption

3. Ask questions about the video

a) **Emma Erwin tells us that a long-term view of energy management also has to take account of … (complete the sentence)**

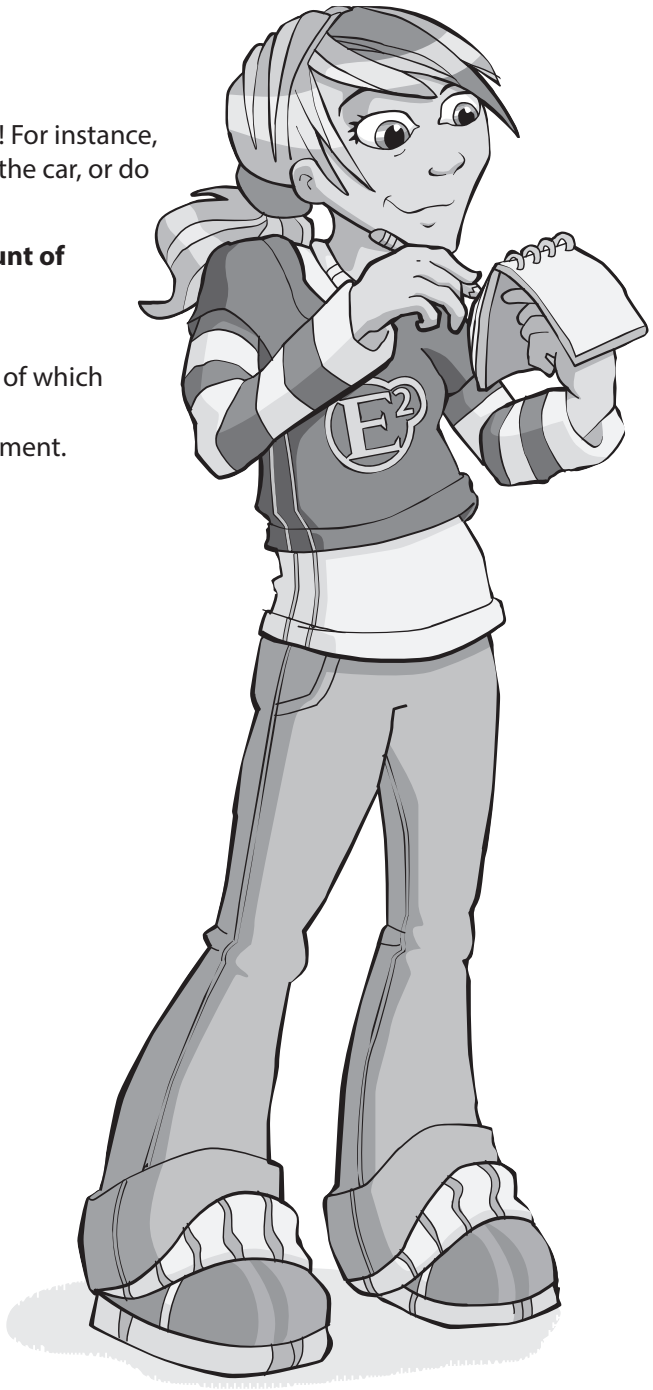
energy efficiency

b) **What is energy efficiency?**

All it really means is using energy more wisely! For instance, you could use your bicycle rather than taking the car, or do what you can to save electricity.

c) **What are the benefits of reducing the amount of electricity we use?**

- It saves money.
- We avoid wasting natural resources, not all of which are renewable.
- We limit the adverse effects on the environment.



Step B – Activity Outline

1. Present Investigation 4

a) Being energy-efficient means taking specific steps to save energy. In other words, it isn't always necessary to generate more electricity to meet society's growing needs (lighting, television, computers, etc.); instead, we can use less and use it more wisely!

b) In a nutshell, there are two main ways to meet our energy needs while looking out for our future and the environment:
- opting for "green" power sources
- saving energy

c) Emma Erwin has managed to find out what scenarios Enercorp International is looking at to meet Gustville's energy needs. Elliott Evans asks us to use the scenarios and the results of the power source evaluation carried out in Investigation 3 to determine which power source or combination of power sources is best.

d) Elliott Evans also wants us to think about energy efficiency and find ways to save energy.

2. Explain how the "Discovering ways to save energy" activity works

a) Being energy-efficient means taking steps to save energy and use it more wisely.

b) Students brainstorm in teams about what they could personally do to save energy. They write down their ideas on p. 24 of their E^2 Reporter's Notebook.

c) Students discuss the ideas they came up with all together.

3. Begin the "Discovering ways to save energy" activity

Suggestions:
- Use a thermostat to lower room temperatures at night
- Close your front door quickly in the winter
- Turn taps off tightly
- Take a short shower instead of a bath
- Close the fridge door quickly
- Keep your refrigerator's temperature set between 2°C and 4°C
- Turn off lights whenever they're not needed
- Walk or take your bike, and say "no thanks" when your parents offer to drive you somewhere
- Use compact fluorescent bulbs at home rather than incandescent bulbs

4. Explain and carry out the "Scenario" activity

a) Divide the class into teams. Each team receives the four *Energy Solutions* cards illustrating different ways to meet Gustville's energy needs.

b) Using the Power Source Evaluation Table on p. 17 of the E² Reporter's Notebook, each team chooses the most attractive scenario for Gustville, pretending they live there themselves.

c) Students stick the round power source markers representing the four scenarios on the "Gustville: Looking for the Perfect Solution!" poster.

d) On p. 22 of their E² Reporter's Notebook, students write which scenario their team chose and the reasons for their decision. They then illustrate their choice on the map found on p. 23.

Step C – Objectivation (optional)

1. **Invite one team to present and explain their ideal scenario**
   → Have team members stick the round power source markers representing the power sources they chose to the "Gustville: Looking for the Perfect Solution!" poster.
   → Invite students to ask their classmates questions and debate the scenario chosen.
   → Ask the following questions, if necessary:
   - About the gas-fired plant scenario: Did you think about the environmental impact and the greenhouse gas it produces?
   - About the nuclear power plant scenario: Did you think about how to handle the radioactive waste?
   - About the wind power, solar power and energy efficiency scenarios: Did you think about how available the resource was? What happens if it isn't windy or if the sun has set and everyone is using a lot of electricity?

2. **If any other teams chose a different scenario, invite them to present, explain and discuss their choice**

3. **Wrap up the investigation**
   - We saw that the Gustville area has several great assets, like a river and strong winds. That's what allows it to generate electricity without producing any significant adverse effects on the environment, such as greenhouse gas emissions.
   - That is not the case everywhere. Some countries, which do not have access to wind power or hydroelectricity, need as much energy as we do. They are forced to choose power sources that produce more pollution, like fossil fuels such as oil and coal.
   - One of the ways to reduce the impact of generating electricity is to generate and use less. Everyone can help protect the environment by using less energy.

Step D – Skill Check (optional)

Hand out a copy of Investigation 4 Skill Check (See Appendix 4, pp. 83–84) to each student

Ask students to fill out the skill check sheet, with or without the help of their E^2 Reporter's Notebook.

Step E – Enrichment (optional)

Suggestions for complementary activities

Activity 1
Hand out an Investigation 4 Game Sheet to every student (See Appendix 5, p. 101).

Activity 2

Ask students to find ways to help save energy at home by playing "Unplugged" on the Montréal Science Centre Web site:

http://www.montrealsciencecentre.com/en/jeunes/jeunes_jeux.htm

Activity 3
Have your students meet with your school's principal or administrative staff and investigate what the school is doing to save energy. They should present their findings to their classmates.

Activity 4
Ask students to visit the following Web sites:

→ Hydro-Québec's Web site on power generation:
http://www.hydroquebec.com/learning/production/index.html

→ A virtual tour of the La Grande-2 hydroelectric complex:
http://www.hydroquebec.com/visit/index.html

Activity 5
Examine the "Global Warming: What Source of Energy Should We Choose?" poster and find five questions to include in a written quiz. Check your students' answers and discuss them together in class.

Investigation 5

Everyone Gets a Say!

Objectives

→ Learn about public consultations and their role in major projects

Materials

→ Investigation 5 video (on the DVD)
→ E² Reporter's Notebooks
→ Deck of eleven *Public Consultation* cards (student cards)
→ Deck of eleven *Public Consultation* cards (teacher cards)
→ "Gustville: Everyone Gets a Say!" poster
→ Five Mitigation Measures cards

Preparation

→ Put up the "Gustville: Everyone Gets a Say!" poster

Approximate duration: 75 minutes

Everyone Gets a Say!

Step A – Context

1. View the Investigation 5 video starring Elliott Evans and Emma Erwin

Video summary

→ Emma Erwin announces that Enercorp International has unveiled its energy development project. The company is planning to build a reservoir generating station and a wind farm and to promote energy efficiency.

→ Even though hydropower and wind power are excellent sources of energy, they too have an impact on the environment. Enercorp International plans to hold a public consultation to listen to citizens' concerns and answer their questions.

→ Elliott Evans assigns your cub reporters a fifth investigation: to find out what a public consultation is.

2. Present Enercorp International's energy project

Before beginning work on its projects, Enercorp International has to make sure they meet the following three conditions:

→ They must be well received by local communities.
→ They must be environmentally acceptable.
→ They must be profitable.

Public consultations are one way of meeting these conditions.

Project description

a) The project proposed by Enercorp International involves building a reservoir hydroelectric plant on the Silver River. Water will collect behind the dam and flood the land where a forest currently stands, creating an immense artificial lake. That body of water is called the reservoir. The force of the water falling inside the power plant is converted into electricity.
b) In addition, plans call for a wind farm to be built on the northern shore. The wind turbines will be 120 metres tall, the same height as a 25-story building.
c) Power lines will be constructed to transmit the electricity into town.

3. Explain what a public consultation is (students will need this information to answer the quiz questions)

What is a public consultation?

- Following the announcement regarding construction of a generating station and a wind farm to meet the growing demand for electricity, Enercorp International invites the citizens of Gustville to a public consultation.

- At the consultation, participants receive information and can ask questions about the project and its impact on the surroundings. They are invited to express their concerns, worries and suggestions to Enercorp International's representatives. They can also talk about their expectations regarding measures to mitigate the project's impact on the community and environment.

Who takes part in the public consultation?

- Enercorp International representatives, including engineers, project managers, biologists, landscape architects, geographers and any other specialists involved in the project.
- Anyone living in a community affected or concerned by the energy project: residents, vacationers, business people, hunters, fishers, municipal and recreation department officials, hotel owners, shopkeepers and so on.

Where is the public consultation held?

- Public consultations are held in a place accessible to everyone, such as a recreation centre, community or city hall, school, etc.

How many meetings are there and how long do they last?

- The number of public consultations and their length vary depending on the type of project.
- The project's probable impact and the planned mitigation measures are presented at the public consultation.

a) Probable impact of Enercorp International's project

- Enercorp International believes that the proposed power sources are green because they use renewable energy (water and wind). However, the project could have some adverse effects on the environment and surrounding communities, including the following:
  - → Creating a reservoir will flood land, with the ensuing consequences for local plant life, animal habitats, and so on.
  - → Building a dam on the river will affect the flow rate, which could result in changes to ecosystems and activities like fishing.
  - → The landscape's appearance will be altered and there will be a risk of bird injuries.

b) Some measures mitigating the effects foreseen by Enercorp International

- Fishways will be built so that fish can get around hydroelectric facilities.
- New spawning grounds will be created for fish.
- Dikes will be built to alleviate flooding.
- Nesting platforms will be built to help birds reproduce.
- Infrared lights will be installed on turbine nacelles.
- Wind turbines will be built outside bird migration corridors.

Step B – Activity Outline

Give your students the quiz on public consultations

The quiz tests students' understanding of the public consultation process using the student version of the *Public Consultation* cards.

→ Seven cards are directly related to the Enercorp International public consultation.
→ Four cards concern sample questions that citizens may ask at public consultations.

There are two different ways to carry out this activity:
→ The teacher may ask a randomly chosen student to select a card, read the question aloud and answer in front of the class.
→ The teacher may form teams of three or four students and give each team a *student card.* After discussing the question, each team presents its answer to the class.

Questions on the public consultation

Type of Question	Question	Answers
Which ones don't belong?	Why does Enercorp International hold public consultations before going ahead with a project?	❒ To present the project to local residents ✓ To simulate an improv game ❒ To listen to citizens' concerns, suggestions and questions ✓ To only give business people and company owners a chance to speak
Which one doesn't belong?	Who attends the public consultation?	❒ Residents and other people with concerns about the project ❒ Enercorp International representatives ✓ Pilots of international jets flying over the region ❒ The local mayor
Complete the list	What community members attend the public consultation?	❒ Residents ❒ Vacationers ❒ Business people ❒ Municipal and recreation department officials ❒ Hotel and restaurant owners ✓ Farmers, etc.

Questions on the public consultation (cont'd.)

Type of Question	Question	Answers
Choose the right answer or answers	Where can public consultations be held?	✓ At the church hall ❒ At the post office ✓ At the local recreation centre ✓ At the school gymnasium ❒ On a tennis court
What's the right answer?	How many meetings with residents are held before the company proceeds with a project?	❒ 1 ❒ 10 ✓ It's different every time.
Complete the list	What kinds of Enercorp International employees can take part in the public consultation?	❒ Engineers ❒ Environmental project managers ❒ Landscape architects ❒ Biologists ❒ Geographers ✓ Communications officers ✓ Archaeologists ✓ Etc.
Choose the right answer or answers	What can participants discuss at the public consultation organized by Enercorp International?	✓ Navigation ✓ Fish movements ✓ Beaver dams ✓ Vacations ❒ Recipes ✓ Archaeological digs ✓ Bird nests ❒ Hurricanes ✓ Fishing

Questions on environmental mitigation measures

Type of Question	Question	Answers
True or false?	After Enercorp International builds a dam, it will not be possible to fish in the reservoir.	False. Fishing is excellent in reservoirs, because fish reproduce faster and grow bigger when they live in a bigger body of water.
Which one doesn't belong?	Before a project begins, an archaeological dig is carried out to ensure that no artefacts or fossils are destroyed. Which one will the archaeologists not find?	❒ A deer tibia ✓ A compact fluorescent lightbulb ❒ Corn kernels ❒ Pottery shards ❒ An arrowhead ❒ A pin ❒ Caribou bone sunglasses
What's the right answer?	How long will Enercorp International monitor and protect wildlife in the area once the generating station is in service?	❒ Ten years ❒ Three months ❒ A few weeks ✓ Fifteen years

Questions on environmental mitigation measures (cont'd.)

Type of Question	Question	Answers
What are the right answers?	What can Enercorp International do to prevent birds from hitting the wind turbines?	✓ Avoid installing wind turbines in major bird migration corridors. ✓ Install infrared lights on wind turbine nacelles. ❒ No action is necessary. Birds are not attracted by wind turbines because they are afraid of them. ❒ No action is necessary. Birds think that wind turbines aren't a sufficiently romantic setting for them to nest in.

In the E² Reporter's Notebook:
Open-ended question (to be asked following the quiz):

What question would you like to ask at the public consultation organized by Enercorp International?

Ask students to write their question on p. 28 of their E² Reporter's Notebook and to look at the youth section of Hydro-Québec's Web site for the answer:

http://www.hydroquebec.com/learning/durable/index.html

Step C – Objectivation (optional)

Wrap up the investigation

- Enercorp International says that this project is necessary to meet the region's need for electricity. The company wants to meet with residents to present its project and learn about their concerns. If the project is well received by the community, Enercorp International will go ahead with it.
- The proposed project will have an impact on the environment, but Enercorp International will take steps to mitigate its effects.
- Enercorp International is the energy company that supplies power to Gustville's citizens. In real life, Hydro-Québec is responsible for supplying electricity to residents of Québec. Its projects are very similar to those of Enercorp International.
- Further information on public consultations can be found on pp. 25 and 26 of the E^2 Reporter's Notebook.

Note

If the teacher does not plan to have students do the special report (the last module), it would nevertheless be beneficial to show the last video and organize a brief discussion to conclude the series of investigations.

These two steps are included in the last module, the special report, under the following headings:
→ Step A – Context (p. 50)
→ Step C – Objectivation, under point 2 entitled "Wrap up the series of investigations" (p. 52)

Step D – Skill Check (optional)

Hand out a copy of Investigation 5 Skill Check (See Appendix 4, pp. 87–89) to each student

Ask students to answer the questions, with or without the help of their E^2 Reporter's Notebook.

Step E – Enrichment (optional)

Suggestions for complementary activities

Activity 1
Hand out an Investigation 5 Game Sheet to every student (See Appendix 5, p. 103).

Activity 2
Have students read a newspaper article about a Hydro-Québec project in progress and present it to the class, expressing their opinion on the project.

Activity 3
With the help of their parents, have students compile a list of facilities in their neighborhood related to a specific power source. Ask them to determine their potential impact on people or the environment and identify the environmental mitigation measures that have been or could be put in place. Students should present their findings to the class in the form of a drawing or report.

Activity 4
Visit the following Web sites:

→ Hydro-Québec's Web site on the steps it takes to protect the environment:
http://www.hydroquebec.com/sustainable-development/index.html

→ Hydro-Québec's Web site on its construction projects in the province:
http://www.hydroquebec.com/projects/index.html


Gustville

Last Module
The E² Special Report

Objective

→ Assimilate and apply kit contents by producing a written or video report that:

- describes the environmental challenges associated with using energy
- suggests steps and solutions to protect the environment

Materials

→ Video for the last module (on the DVD)
→ E² Reporter's Notebooks
→ The kit's entire contents

Preparation

→ Find sources of information that students could find useful in producing their report

Approximate duration: Two to six hours

Note: The activity's duration depends on the chosen format (written or video).

The E² Special Report

Step A – Context

1. **View the video for the last module, The E² Special Report, starring Elliott Evans, Emma Erwin and Ethan Everett**

Video summary

→ Ethan Everett is finally on his way back from the Tundra, safe and sound.

→ Emma Erwin announces her intention to interview people for her special report on the energy challenges of the future.

→ Elliott Evans invites students to compile their investigation findings and produce a special report answering the following question: "How can we use energy without jeopardizing the planet?"

2. **Ask questions about the video**

   Ethan Everett is finally on his way back from the Tundra, safe and sound. Emma Erwin is now ready to do her own investigation to find solutions to the energy challenges of the future. And Elliott Evans is asking us to produce a special report to answer a very important question.

   What is it?

   "How can we use energy without jeopardizing the planet?"

Note

Teachers can also ask students to produce a video report.

Appendix 3 contains information and tips which should be of help.

You can photocopy the pages and hand them out to your students.
The steps are the same as for a written report, except that the reporting plan has to be adapted for video.
The video should then be shot and edited.

However, before choosing this option, teachers should consider the following factors:

→ the possibility of getting help from someone familiar with shooting and editing video and the associated technologies (video camera and software)

→ the availability of the required materials

→ the time requirements involved

Step B – Activity Outline

1. **Form teams of two or three students**

2. **Explain how to produce a report**

   a) Students can consult the following documents in the E^2 Reporter's Notebook:

   - the Reporter's Manual (pp. 31, 33 and 34)
   - the Reporting Plan (p. 32)

   b) Students should use a variety of sources, including their E^2 Reporter's Notebooks, their teacher, the Internet, etc. In addition, they should conduct an interview with at least one person (a parent, teacher, friend, etc.).

   c) Using the reporting plan as a starting point, each team should write a one-page, double-spaced report (about 250 words).

   - Set a time limit for writing the report.
   - Suggest inserting a visual or graphic (a drawing, graph, table, etc.) in their report.
   - Ask students to reread Step 3 in the Reporter's Manual on p. 33 of their E^2 Reporter's Notebooks.
   - For classes handing in a written report, ask students for a handwritten or typed report, depending on your preferences and time constraints.
   - Ask students to proofread and correct their report, using the Reporter's Manual on p. 34 of their E^2 Reporter's Notebooks as a guide.

Step C – Objectivation (optional)

1. **Discuss the following topics in groups:**

   a) What students learned from the kit.

   b) What they liked and didn't like about it.

   c) What changes they plan to make in their daily lives.

2. **Wrap up the series of investigations**

   We learned a great deal about energy and the environment from these investigations.

   - We all need energy every day: to travel, to light and heat our homes, to cook, to power our computers and to run schools and hospitals.
   - Using energy can have adverse effects on the environment, including air and water pollution, radioactive waste and greenhouse gas emissions, which lead to global warming and all the ensuing consequences.
   - We use various power sources to generate electricity. Not all power sources have the same capacity to supply the energy we need when we need it, at a reasonable cost, without harming the environment and using renewable sources.
   - In Gustville, Enercorp International is in charge of supplying electricity for residents. In reality, Hydro-Québec meets Quebecers' electricity needs.
   - Hydro-Québec believes that hydropower is green energy because it uses water, a renewable source of energy. It intends to continue to use hydroelectric power, supplemented by wind power, and to encourage people to use electricity responsibly.
   - The choice of power source we use to generate our electricity is important to us all; it is everybody's responsibility to learn about the available options and form an opinion.

Hydroelectricity

What is it?

Hydroelectricity, also called hydropower, is generated using the force of falling water that drives a turbine, which looks like a large airplane propeller. The turbine is connected to a generator, which converts the mechanical energy into electrical energy.

Hydroelectricity is our main source of renewable energy. Following the natural water cycle, water that moves through a turbine eventually flows into the ocean, where it is heated by the sun. It evaporates into the atmosphere and then falls again in the form of precipitation, collecting in our lakes and rivers. The cycle can then start again.

Power generation

Hydropower represents about 20% of the world's electricity. Canada is the world's top producer. In Québec, roughly 97% of the electricity we generate comes from hydropower.

There are different kinds of hydroelectric power plants. The most common ones are reservoir generating stations, which are built near a dam and take advantage of the substantial vertical drop, and run-of-river generating stations, which harness the natural current. Reservoirs allow us to store up all the water we need to meet the demand for electricity, whatever the season or time of day.

Environmental impact

Hydroelectricity is a clean and renewable source of energy. It doesn't produce any air pollution and very little greenhouse gas (GHG). In fact, hydroelectric generating stations produce 60 times less GHG than thermal stations that burn coal, a fossil fuel.

Building hydroelectric generating stations involves creating large bodies of water that can disturb human, animal and plant life. However, the environmental impact can be mitigated through corrective measures like building fishways and spawning grounds where fish can reproduce.

Appendix 1

Teacher's Fact Sheet No. 1 – Hydroelectricity

Hydroelectricity

What is it?

Hydroelectricity, also called hydropower, is generated using the force of falling water that drives a turbine, which looks like a large airplane propeller. The turbine is connected to a generator, which converts the mechanical energy into electrical energy.

Hydroelectricity is our main source of renewable energy. Following the natural water cycle, water that moves through a turbine eventually flows into the ocean, where it is heated by the sun. It evaporates into the atmosphere and then falls again in the form of precipitation, collecting in our lakes and rivers. The cycle can then start again.

Power generation

Hydropower represents about 20% of the world's electricity. Canada is the world's top producer. In Québec, roughly 97% of the electricity we generate comes from hydropower.

There are different kinds of hydroelectric power plants. The most common ones are reservoir generating stations, which are built near a dam and take advantage of the substantial vertical drop, and run-of-river generating stations, which harness the natural current. Reservoirs ensure we always have enough water on hand to meet the demand for electricity, which varies depending on the season and time of day. Québec has over 550 retaining structures such as dikes and dams.

Environmental impact

Hydroelectricity is a clean and renewable source of energy. It doesn't produce any air pollution and very little greenhouse gas (GHG). In fact, hydroelectric generating stations produce 60 times less GHG than thermal stations that burn coal, a fossil fuel.

Building hydroelectric generating stations involves creating large bodies of water that can disturb human, animal and plant life. However, the environmental impact can be mitigated through corrective measures like building fishways and spawning grounds where fish can reproduce.

Hydroelectricity (cont'd)

Advantages and disadvantages of hydroelectricity

Main advantages

→ It is a clean energy that produces no air pollution and very little greenhouse gas (GHG).

→ Electricity can be generated year-round.

→ Large quantities of water can be stored to meet the demand for power, which varies from day to day, as well as to compensate for fluctuations in precipitation levels over one or more years.

Disadvantages

→ Hydroelectric generating stations likely disturb human, animal and plant life due to the creation of large bodies of water and changes to the natural water cycle. However, the environmental impact can be mitigated through corrective measures, including building fishways and spawning grounds where fish can reproduce. In this way, natural habitats can be preserved.

Wind Power

What is it?

Wind power is generated when wind turns the blades of a wind turbine. The blades are connected to a generator, which produces electricity. Wind turbines look like huge standing fans and can be over 100 metres tall, approximately the height of a 25-story building.

Power generation

Wind power supplies about 0.5% of the world's electricity. Germany leads the way, generating 24% of the world's wind power (in 2007). In 2009, Québec will produce 1,000 MW (megawatts, or millions of watts) of wind power with some 720 wind turbines. For 2015, Québec is aiming to generate approximately 4,000 MW of wind power.

Environmental impact

Wind turbines have a visual impact on the landscape.

Wind power is clean and inexhaustible, but wind strength is variable and impossible to control. As a result, wind power cannot meet the demand for electricity on its own; a second, predictable source of power (like hydropower in Québec) is required. Some large wind power producers, like Germany, use wind power in combination with thermal generating plants that burn coal, a fossil fuel, to meet demand.

Appendix 1

Teacher's Fact Sheet No. 2 – Wind Power

Wind Power

What is it?

Wind power is generated when wind turns the blades of a wind turbine. The blades are connected to a generator, which produces electricity. Wind turbines look like huge standing fans and can be over 100 metres tall, approximately the height of a 25-story building.

Even though the blades spin at speeds of 20 to 30 revolutions per minute (RPM), the generator in the nacelle may reach speeds of 1,500 RPM. The turbine is equipped with sophisticated components, including a control system that continually adjusts the nacelle's orientation and the blades' angles to maximize performance.

Power generation

Wind power supplies about 0.5% of the world's electricity. Germany leads the way, generating 24% of the world's wind power (in 2007). In 2009, Québec will produce 1,000 MW (megawatts, or millions of watts) of wind power with some 720 wind turbines. For 2015, Québec is aiming to generate approximately 4,000 MW of wind power. The wind power industry is booming, and wind power is the world's fastest-growing renewable source of energy.

Environmental impact

Wind power is clean and inexhaustible, but wind strength is variable and impossible to control. As a result, wind power can't meet the demand for electricity on its own; a second, predictable source of power (like hydropower in Québec) is required. Some large wind power producers, like Germany, use wind power in combination with thermal generating plants that burn coal, a fossil fuel, to meet demand.

Wind Power (cont'd)

Advantages and disadvantages of wind power

Main advantages

→ Wind power is a clean, renewable energy that produces no air pollution and very little greenhouse gas.

→ Since wind farms can be built in the ocean, specifically in shallow coastal waters, wind power has incredible growth potential.

Disadvantages

→ The power produced cannot be stored.

→ Wind turbines cannot operate continuously because winds are variable and only winds between 12 and 90 km/h can be harnessed. At higher speeds, power generation has to be halted to avoid damaging the turbines.

→ To protect occupants from the risk of falling ice, wind turbines have to be installed hundreds of metres from people's homes.

→ Wind turbines have a visual impact on the landscape.

Fossil Fuels

What are they?

Fossil fuels are created by the decomposition of organic matter over millions of years. When they are burned, they release energy that is harnessed in a variety of ways, depending on the type of power plant used, to generate electricity. Most thermal generating stations burn heavy fuel oil or coal to produce energy in the form of steam. The steam pressure drives a turbine and generates electricity.

Power generation

Fossil fuels provide 65% of the world's electricity. The United States is the leading producer of electricity from fossil fuels. In Québec, fossil fuels account for less than 1% of its total power production in 2007.

Environmental impact

This source of energy is non-renewable because fossil fuel deposits can be exhausted over time. Coal- and fuel oil-fired thermal power plants are the most polluting of all power plants. They produce air pollution responsible for smog and acid rain, as well as 60 times more greenhouse gas than hydroelectric plants.

Fossil Fuels

What are they?

Fossil fuels are created by the decomposition of organic matter over millions of years in specific geophysical and geochemical conditions. When they are burned, they release energy that is harnessed in a variety of ways, depending on the type of power plant used, to generate electricity. Most thermal generating stations burn heavy fuel oil or coal to produce energy in the form of steam. The steam pressure drives a turbine and generates electricity.

Gas-fired plants burn light fuel oil or natural gas, and the combustion force drives a turbine. Combined-cycle natural gas-fired plants use two methods of generating electricity, harnessing both direct mechanical energy from the gas turbine as well as thermal energy recovered from the exhaust heat. These turbines are more flexible and can be modified quickly in response to fluctuating power demand. However, they are more expensive to operate.

Diesel generating stations do not have a turbine; instead, the mechanical energy produced by the diesel motor drives the generator directly. In Québec, generating stations of this kind are found mostly in outlying regions and supply power to off-grid systems. Hydro-Québec's main diesel power plant is located in the Îles-de-la-Madeleine region.

Power generation

Fossil fuels dominate the energy industry, providing 65% of the world's electricity. The United States, which is the leading producer of electricity from fossil fuels, is home to one third of this installed capacity. In 2007, Québec generated 1,665 MW of power from fossil fuels, less than 1% of its total production.

Fossil Fuels (cont'd)

Environmental impact

This source of energy is non-renewable because fossil fuel deposits can be exhausted over time. Coal- and fuel oil-fired thermal power plants are the most polluting of all power plants. In the United States, 70% of the country's electricity comes from fossil fuels.

Advantages and disadvantages of fossil energy

Main advantages

→ Fossil fuels like coal are widely used and relatively inexpensive.

→ Combined-cycle natural gas-fired plants, the cleanest of any thermal generating stations after nuclear power plants, produce 25% less greenhouse gas than conventional coal-fired plants.

→ Since gas-fired and combined-cycle thermal plants can be turned on and off in just a few minutes, they can respond quickly to fluctuations in power demand.

Disadvantages

→ Created through the transformation of organic matter over millions of years in ideal geological conditions, fossil fuels are non-renewable sources of energy.

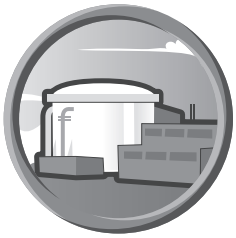
→ Of all the sources of energy, they create the most pollution and produce the most greenhouse gas. For instance, one conventional coal-fired plant produces 60 times more greenhouse gas than a hydroelectric generating station.

→ Oil must often be transported over long distances, resulting in additional greenhouse gas emissions and posing a risk of oil spills at sea and along coastlines.

→ The cost of fossil fuel is increasing as resources dwindle.

→ Gas-fired thermal plants are more flexible, but their operating costs are highly variable.

Nuclear Power



What is it?

Nuclear power is generated by the fission of uranium atoms. The heat released is used to produce steam, and the steam's pressure drives a turbine to generate electricity.

Power generation

Nuclear power supplies about 16% of the world's electricity. France is the biggest single user, producing about 80% of its electricity from nuclear power. In Canada, 18 nuclear power plants generate nearly 15% of the country's electricity. In Québec, one nuclear power plant, Gentilly-2 near Trois-Rivières, generates roughly 3% of the province's electricity.

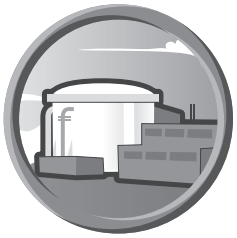
Environmental impact

Nuclear power is a clean energy that doesn't produce any greenhouse gas. However, the fuel it uses, uranium, is not a renewable resource. In addition, operating a nuclear power plant produces radioactive waste that must be stored safely.

Appendix 1

Teacher's Fact Sheet No. 4 – Nuclear Power

Nuclear Power



What is it?

Nuclear power is generated by the fission of uranium atoms. The heat released is used to produce steam, and the steam's pressure drives a turbine to generate electricity. Nuclear power plants are very energy-efficient.

Power generation

Nuclear power supplies about 16% of the world's electricity. France is the biggest single user, producing about 80% of its electricity from nuclear power. In Canada, 18 nuclear power plants generate nearly 15% of the country's electricity. Québec has a single nuclear power plant, Gentilly-2 near Trois-Rivières, which generates roughly 3% of the province's electricity.

Environmental impact

Nuclear power is a clean energy that doesn't produce any greenhouse gas. However, the fuel it uses, uranium, is not a renewable resource. It's worth knowing that Canada has the world's largest uranium mine, located in McArthur River in northern Saskatchewan.

In addition, nuclear power plants produce radioactive waste that must be stored safely right at the generating site.

Nuclear Power (cont'd)

Advantages and disadvantages of nuclear power

Main advantages

→ Nuclear power plants do not produce any greenhouse gas (GHG).
→ Converting thermal energy produced from nuclear sources into electricity is very efficient.

Disadvantages

→ Uranium is a non-renewable ore.
→ Operating a nuclear power plant produces radioactive waste that must be stored safely.

Solar Power

What is it?

There are two methods of harnessing power from sunlight: photovoltaic and thermal systems.

Photovoltaic systems convert sunlight into electricity by means of solar panels. Each panel is composed of small photovoltaic cells. When these cells are exposed to the sun, the silicon atoms in the cells begin to move, producing an electric current.

Thermal systems use tubes filled with water, which are heated by the sun and then used to heat buildings, service water or swimming pools.

Power generation

Photovoltaic power gets marginal use, accounting for less than 0.1% of worldwide power generation. Germany is the leader in photovoltaic electricity generation, with just over half the world's production. Other countries, like Spain and Japan, are very active in generating solar power.

Environmental impact

Solar power is clean and inexhaustible, but it is available only in the daytime and depends on the number of hours of sunshine.

By replacing electricity produced from fossil fuels, solar power can help reduce GHG emissions.

Despite its many assets, photovoltaic solar power is still much more expensive to generate than electricity from other sources.

Appendix 1

Teacher's Fact Sheet No. 5 – Solar Power

Solar Power

What is it?

There are two methods of harnessing power from sunlight: photovoltaic and thermal systems.

The word "photovoltaic" is composed of "photo," which means "light," and "volt," which is the unit used to measure the driving force of an electric current. Photovoltaic systems convert sunlight into electricity by means of solar panels. Each panel is composed of small photovoltaic cells. When these cells are exposed to the sun, the silicon atoms in the cells begin to move, producing an electric current.

Thermal systems use tubes filled with water, which are heated by the sun and then used to heat buildings, service water or swimming pools. In some systems, the recovered heat is so great that it produces steam under pressure, which is then used to drive a turbine and generate electricity.

Power generation

Photovoltaic power gets marginal use, accounting for less than 0.1% of worldwide power generation. That corresponds to some 6,000 MW, or the equivalent of two nuclear power plants working at full capacity. Germany is the leader in photovoltaic electricity generation, with just over half the world's production in 2007. Other countries, like Spain and Japan, are very active in generating solar power.

The purified silicon used in manufacturing photovoltaic panels accounts for about half their cost and poses an obstacle to greater use of photovoltaic technology. Research targeting more economical manufacturing methods, along with more efficient techniques for storing the energy, is under way. Japan is the leading producer of photovoltaic panels. Because of the strong demand for these products, the industry is growing by roughly 35% a year.

Solar Power (cont'd)

Environmental impact

Solar power is clean and inexhaustible, but it is available only in the daytime and depends on the number of hours of sunshine. As a result, it cannot meet the demand for electricity on its own; a second, predictable source of power is required.

By replacing electricity produced from fossil fuels, solar power can help reduce GHG emissions. A number of common devices today are equipped with photovoltaic cells that provide an autonomous power supply: examples include watches, road signs and telephone booths. Despite its many assets, photovoltaic solar power is still much more expensive to generate than electricity from other sources.

Advantages and disadvantages of solar power

Main advantages

→ Solar energy is the most abundant source of energy on the planet: the sun provides 6,000 times more energy than we use.

→ It is a clean form of energy that produces no air pollution and very little greenhouse gas.

→ Solar power can be used immediately or stored in batteries, and surplus power can be fed into the main grid.

→ Available worldwide, photovoltaic energy could be used to power communities not connected to a power grid.

→ By incorporating solar technologies into our buildings, we can considerably reduce our consumption of energy from other sources.

→ Once they are more affordable, photovoltaic modules could be installed on every house, which would then become mini-generating stations.

Disadvantages

→ Although it is steadily dropping, the cost of photovoltaic power remains much higher than the cost of electricity generated from conventional sources.

→ Power generation is nil at night and varies during daytime, depending on the amount of sunshine.

→ Photovoltaic panels take up considerable space.

→ Silicon, the main material used in manufacturing photovoltaic modules, is very expensive.

→ Manufacturing solar panels produces substances harmful to workers' health.

→ Large solar panel installations can have a detrimental visual impact on the landscape.

Hydroelectricity

Wind Power

Nuclear Power

Fossil Fuels

Solar Power

Appendix 2

Power sources used around the world, 2002

	Fossil Fuels	Hydro-electricity	Nuclear Power	Other Renewable Energies
Africa				
Algeria	98.78%	0.22%	0%	0%
Democratic Republic of the Congo	0.34%	99.66%	0%	0%
Egypt	82.76%	0%	16.96%	0.27%
South Africa	92.90%	1.15%	5.83%	0.12%
Asia				
China	80.94%	17.31%	1.60%	0.15%
India	84.86%	11.26%	3.15%	0.73%
Japan	62.39%	7.87%	27.05%	2.69%
Saudi Arabia	100%	0%	0%	0%
Vietnam	47.87%	52.13%	0%	0%
Europe				
Denmark	80.62%	0.08%	0%	19.30%
France	9.27%	11.33%	78.42%	0.98%
Germany	62.26%	4.17%	28.54%	5.03%
Norway	0.40%	99.31%	0%	0.29%
Russia	64.14%	20.64%	14.86%	0.36%
Spain	58.60%	9.91%	26.02%	5.47%

Appendix 2

Power sources used around the world, 2002

	Fossil Fuels	Hydro-electricity	Nuclear Power	Other Renewable Energies
North America				
Canada	26.65%	59.67%	13.36%	1.45%
Québec	**0.96%**	**96.68%**	**2.27%**	**0.09%**
Mexico	80.57%	12.13%	4.55%	2.75%
United States	70.60%	6.84%	20.17%	2.39%
Oceania				
Australia	91.24%	7.48%	0%	1.27%
New Zealand	28.01%	61.98%	0%	10.01%
South America				
Argentina	48.06%	43.78%	6.64%	1.52%
Brazil	9.39%	82.09%	4.42%	4.10%

Notes:

Fossil fuels: coal, natural gas and oil

Hydroelectricity: water

Nuclear power: uranium

Other renewable energies: solar power (sun), wind power (wind), geothermal power (Earth's heat), biomass (organic matter) and tidal power

Sources:

The World Factbook 2007,
CIA, US Government

Annual Energy Outlook 2006,
Energy Information Administration
Department of Energy, US Government

Human Development Report 2006
United Nations Development Programme (UNDP)

Kyoto Protocol
Entry into force: February 2005

Appendix 3

Video Reporting Guide

Reporting plans for articles and videos

The first steps in producing a video are pretty much the same as those in writing an article. After gathering your information and organizing it in a reporting plan, you should try to imagine what it could look like on the screen.

In this table you'll find a few ideas for transposing your content to the screen:

Article	Video
Title	
How can we use energy without jeopardizing the planet?	
Introduction	
Paragraph introducing the subject and the points to be covered.	Images and narration introducing the subject and the points to be covered.
Development	
Subheading and paragraph on the reasons for our rising energy consumption.	Interview with someone who explains the reasons for our rising energy consumption.
Subheading and paragraph on the impact of consuming energy.	Images of cars and exhaust fumes. Narration about the impact of consuming energy.
Subheading and paragraph on ways to protect the environment.	Interview with a person you know on ways to protect the environment.
Conclusion	
Concluding paragraph expressing your own opinion on the subject.	Images of children playing in a natural setting.

Appendix 3

Video Reporting Guide

Shooting

Once you've finished your video reporting plan, it's time to head out with your camera for the shoot!

"Shooting" means recording the video images that you will use in your report. They will accompany the script you wrote.

Giving team members clear responsibilities is crucial! It is very important for everyone to stick to his or her role throughout the process.

Role	Tasks
Producer	Prepares the shooting plan and directs the work of the interviewer and camera operator.
Interviewer	Develops the interview plan and prepares and asks questions.
Camera operator	Shoots the video and checks image and sound quality.

How to operate a video camera

→ Use a new cassette.
→ Make sure the batteries are fully charged.
→ Focus on your subject: your image should not be blurry.
→ Shoot your video in a quiet location to make sure you can clearly hear the interview.

Shot scales and camera angles

Here are a few examples of shots used for people:

Shot scale	Image
Head shot	Head
Bust shot	Head and chest
Waist shot	Waist up
Full body shot	Entire body

Here are few examples of shots used for sets and scenery:

Shot scale	Image
Full shot	Character
Master shot	Character and buildings
Vista shot	Horizon views

Here is an example of a shot used for objects or fine details:

Shot scale	Image
Close-up shot	Draws the viewer's attention to a detail, such as a hand holding a glass.

Editing

Editing is the process of arranging images and sounds to create the final, complete version of your report. It's the last step in the creation process!

Step	Who …	… does what!
Viewing and digitization	The whole team	The team reviews the filmed content, digitizes it using editing software and identifies it all clearly.
Image editing	Designate someone	The editor has to assemble and arrange each shot, one after another, in keeping with the script set out in the reporting plan. Under the producer's direction, he or she determines the exact point where each shot begins and its duration, in accordance with the scene's purpose.
Sound editing	The same person that does the image editing	Sound editing involves adjusting dialogues and incorporating music, sound effects and narration.

Appendix 4

Investigation 1 Skill Check

Check what you learned in Investigation 1 by answering the questions below.

Got your pencil ready? *On your mark, get set, go!*

1. To find the definition of "energy," put the following words back in the right order:

to is a fly Energy run, to etc. us force to enables think, a plane, that

_____

2. What is a fossil fuel?
Check the right answer.

- A substance that we burn in a fireplace, like wood or paper ❒
- A substance formed by the decomposition of plants and animals in the ground and which can burn ❒
- A substance on which the impression of an animal or plant that lived a long time ago can be seen ❒

3. Which of the following activities uses mainly electricity?
Check every right answer.

- Listening to music on your MP3 player ❒
- Watching TV ❒
- Driving a car ❒
- Toasting bread in your toaster ❒
- Lighting your home ❒
- Heating your home with fuel oil ❒

Appendix 4

Investigation 1 Skill Check – Answer Sheet

1. What is energy?

Energy is a force that enables us to run, to think, to fly a plane, etc.

2. What is a fossil fuel?
Check the right answer.

A substance that we burn in a fireplace, like wood or paper	❒
A substance formed by the decomposition of plants and animals in the ground and which can burn	**X**
A substance on which the impression of an animal or plant that lived a long time ago can be seen	❒

3. Which of the following activities uses mainly electricity?
Check every right answer.

Listening to music on your MP3 player	**X**
Watching TV	**X**
Driving a car	❒
Toasting bread in your toaster	**X**
Lighting your home	**X**
Heating your home with fuel oil	❒

Appendix 4

Investigation 2 Skill Check

Check what you learned in Investigation 2 by answering the questions below.

Got your pencil ready? *On your mark, get set, go!*

1. True or false? *Check the right answer.*	**True**	**False**
Using energy has very little impact on the environment.	❒	❒
The expression "global warming" means it's time to change your air conditioner.	❒	❒
Global warming is caused by the increase in greenhouse gas (GHG) emissions.	❒	❒
Using fossil fuel (coal, oil and natural gas) does not release any GHG into the atmosphere.	❒	❒
Without greenhouse gases in our atmosphere, life on Earth would be impossible.	❒	❒
Global warming is likely to affect every aspect of our environment (human health, our lifestyle, animal life, plant life, water, air and the ground).	❒	❒
Global warming won't have any dire consequences tomorrow morning, but it could have adverse effects in the long run. That's why we have to do something about it now.	❒	❒

2. What do the letters "GHG" stand for?

_____

3. Name three aspects of the environment that can be affected by GHGs.

_____

Appendix 4

Investigation 2 Skill Check – Answer Sheet

1. True or false? *Check the right answer.*	**True**	**False**
Using energy has very little impact on the environment.	❒	**X**
The expression "global warming" means it's time to change your air conditioner.	❒	**X**
Global warming is caused by the increase in greenhouse gas (GHG) emissions.	**X**	❒
Using fossil fuel (coal, oil and natural gas) does not release any GHG into the atmosphere.	❒	**X**
Without greenhouse gases in our atmosphere, life on Earth would be impossible.	**X**	❒
Global warming is likely to affect every aspect of our environment: human health, lifestyle, animal life, plant life, water, air and the ground.	**X**	❒
Global warming won't have any dire consequences tomorrow morning, but it could have adverse effects in the long run. That's why we have to do something about it now.	**X**	❒

2. What do the letters "GHG" stand for?

"GHG" stands for "greenhouse gas." Greenhouse gas, a natural component of the atmosphere, traps some of the heat from the sun's rays, most of which are reflected back into space. Now, however, the concentration of greenhouse gas is too high and the Earth is warming up.

3. Name three aspects of the environment that can be affected by GHGs.

GHGs can affect various aspects of the environment, including human health, our lifestyle, animal life, plant life, the ground, the air, weather, the seasons and water.

Appendix 4

Investigation 3 Skill Check

Check what you learned in Investigation 3 by answering the questions below.

Got your pencil ready? *On your mark, get set, go!*

1. True or false? *Check the right answer.*	**True**	**False**
In this Investigation, we defined "power source" as the various **sources** of a specific form of energy and the **means** used to generate, transmit and use that energy.	❒	❒
Fossil fuels produce very little greenhouse gas.	❒	❒
In Québec, 97% of our electricity is generated from water power.	❒	❒

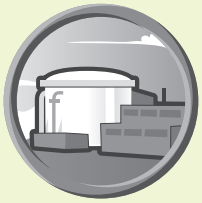
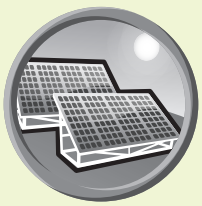
2. Connect each criterion below to the corresponding description:

1) Availability	a) Sufficient quantity when needed
2) Cost	b) Pollution, waste
3) Environmental impact	c) The resource's inexhaustibility
4) Renewability	d) The price of generating electricity

Appendix 4

Investigation 3 Skill Check

3. Fill in the blanks, using p. 14 of the E² Reporter's Notebook to help you.

	Power source	To generate electricity, this power source uses:	Clue
	Hydroelectricity	_____ _____	Dam
	Wind Power	_____ _____	Blades
	_____	the force of the steam produced by water heated by nuclear fission.	Uranium
	_____	the force of the steam produced by water heated by burning oil, coal or natural gas.	Oil tanker
	Solar Power	_____ _____	Solar panel

Appendix 4

Investigation 3 Skill Check – Answer Sheet

1. True or false? *Check the right answer.*	**True**	**False**
In this Investigation, we defined "power source" as the various **sources** of a specific form of energy and the **means** used to generate, transmit and use that energy.	X	❒
Fossil fuels produce very little greenhouse gas.	❒	X
In Québec, 97% of our electricity is generated from water power.	X	❒

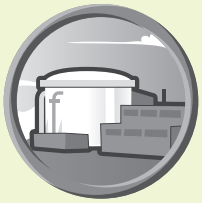
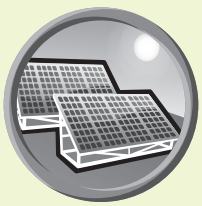
2. Connect each criterion below to the corresponding description:

1) Availability →	a) Sufficient quantity when needed
2) Cost →	d) The price of generating electricity
3) Environmental impact →	b) Pollution, waste
4) Renewability →	c) The resource's inexhaustibility

Appendix 4

Investigation 3 Skill Check – Answer Sheet

3. Fill in the blanks, using p. 14 of the E² Reporter's Notebook to help you.

	Power source	To generate electricity, this power source uses:	Clue
	Hydroelectricity	the force of falling water.	Dam
	Wind Power	the force of blowing wind.	Blades
	Nuclear Power	the force of the steam produced by water heated by nuclear fission.	Uranium
	Fossil Fuels	the force of the steam produced by water heated by burning oil, coal or natural gas.	Oil tanker
	Solar Power	energy from the sun.	Solar panel

Appendix 4

Investigation 4 Skill Check

Check what you learned in Investigation 4 by answering the questions below.

Got your pencil ready? *On your mark, get set, go!*

1. True or false? *Check the right answer.*	**True**	**False**
Combining solar power and wind power can provide a constant supply of electricity at all times.	❒	❒
Energy efficiency is a good way to protect the environment and reduce the quantity of energy we have to generate.	❒	❒
Gas-fired power plants are the least polluting solution.	❒	❒
Nuclear power plants do not produce any radioactive waste.	❒	❒
A combination of hydroelectricity, wind power and energy efficiency is a good solution to ensure Québec's long-term energy development.	❒	❒

2. How can you save energy? *Check the right answers.*	
Use a thermostat to lower room temperatures at night.	❒
Turn taps off tightly.	❒
Take a short shower instead of a bath.	❒
Leave the TV and computer on all the time.	❒
Close the fridge door quickly.	❒
Keep every room the same temperature, all the time.	❒
Leave the water running while you brush your teeth.	❒

Appendix 4

Investigation 4 Skill Check

3. Being energy-efficient = using energy more wisely

There are many advantages to using energy wisely. Name two of them.

_____

_____

_____

_____

4. Name two "green" power sources.

_____

_____

_____

_____

Appendix 4

Investigation 4 Skill Check – Answer Sheet

1. True or false? *Check the right answer.*	**True**	**False**
Combining solar power and wind power can provide a constant supply of electricity at all times.	❒	X
Energy efficiency is a good way to protect the environment and reduce the quantity of energy we have to generate.	X	❒
Gas-fired power plants are the least polluting solution.	❒	X
Nuclear power plants do not produce any radioactive waste.	❒	X
A combination of hydroelectricity, wind power and energy efficiency is a good solution to ensure Québec's long-term energy development.	X	❒

2. How can you save energy? *Check the right answers.*	
Use a thermostat to lower room temperatures at night.	X
Turn taps off tightly.	X
Take a short shower instead of a bath.	X
Leave the TV and computer on all the time.	❒
Close the fridge door quickly.	X
Keep every room the same temperature, all the time.	❒
Leave the water running while you brush your teeth.	❒

Appendix 4

Investigation 4 Skill Check – Answer Sheet

3. Being energy-efficient = using energy more wisely

There are many advantages to using energy wisely. Name two of them.

The many advantages of being energy-efficient include:

→ Spending less money

→ Saving the resource used

→ Producing less GHG

→ Protecting the environment

→ Looking out for future generations

→ Etc.

4. Name two "green" power sources.

"Green" power sources include hydroelectricity, wind power, solar power, tidal power and geothermal power.

Appendix 4

Investigation 5 Skill Check

Check what you learned in Investigation 5 by answering the questions below.

Got your pencil ready? *On your mark, get set, go!*

1. True or false? *Check the right answer.*	**True**	**False**
Public consultations are held to present a project and listen to citizens' concerns.	❒	❒
Many people are reassured when they learn more about a project and the steps taken to attenuate its impact on people and the environment.	❒	❒
Energy projects take local residents' concerns into consideration.	❒	❒
Public consultations are a way of pleasing everybody, no matter what their concerns are.	❒	❒
Energy projects include measures to mitigate the impact on people, plants and animals.	❒	❒

2. How many public consultations are organized before a project starts? *Check the right answer.*	
One	❒
Ten	❒
The number varies, depending on the need.	❒

Appendix 4

Investigation 5 Skill Check

3. What Enercorp International employees can take part in the public consultation?
Complete the list.

→ Engineers

→ Environmental project managers

→ Geographers

→ _____

4. What community members attend the public consultation?
Complete the list.

→ Residents

→ Business people

→ Restaurant owners

→ _____

5. What can participants discuss at a public consultation?
Check the right answers.

Navigation	❒
Beaver dams	❒
Fish	❒
The Northern lights	❒
Tsunamis	❒
Bird nests	❒

6. Before construction begins, an archaeological dig is carried out to ensure that no artefacts or fossils are destroyed. Which one will the archaeologists not find?

Which one doesn't belong?

A deer tibia	❒
Corn kernels	❒
Caribou bone sunglasses	❒
An MP3 player	❒
A pin	❒

7. To prevent birds from hitting the wind turbines, Enercorp International _____ installing wind turbines in major bird migration corridors.

Fill in the blank.

Appendix 4

Investigation 5 Skill Check – Answer Sheet

1. True or false? *Check the right answer.*	**True**	**False**
Public consultations are held to present a project and listen to citizens' concerns.	X	❒
Many people are reassured when they learn more about a project and the steps taken to attenuate its impact on people and the environment.	X	❒
Energy projects take local residents' concerns into consideration.	X	❒
Public consultations are a way of pleasing everybody, no matter what their concerns are.	❒	X
Energy projects include measures to mitigate the impact on people, plants and animals.	X	❒

2. How many public consultations are organized before a project starts? *Check the right answer.*	
One	❒
Ten	❒
The number varies, depending on the need.	X

Appendix 4

Investigation 5 Skill Check – Answer Sheet

3. What Enercorp International employees can take part in the public consultation?
Complete the list.

→ Engineers

→ Environmental project managers

→ Geographers

→ Biologists, communications officers, archaeologists, etc.

4. What community members attend the public consultation?
Complete the list.

→ Residents

→ Business people

→ Restaurant owners

→ Vacationers, fishers, farmers, elected officials, etc.

5. What can participants discuss at a public consultation?
Check the right answers.

Navigation	X
Beaver dams	X
Fish	X
The Northern lights	❐
Tsunamis	❐
Bird nests	X

Appendix 4

Investigation 5 Skill Check – Answer Sheet

6. Before construction begins, an archaeological dig is carried out to ensure that no artefacts or fossils are destroyed. Which one will the archaeologists not find?

Which one doesn't belong?

A deer tibia	❒
Corn kernels	❒
Caribou bone sunglasses	❒
An MP3 player	**X**
A pin	❒

7. To prevent birds from hitting the wind turbines, Enercorp International ___*avoids*___ installing wind turbines in major bird migration corridors.

Appendix 5

Investigation 1 Game Sheet: Yesterday and Today

Unscramble the letters to form words related to Investigation 1.
For clues, refer to pp. 3–6 of your E² Reporter's Notebook.

To help you find the solution, we've indicated what each object ***is used for****.*

		Use
D O W O	___ ___ ___ ___	Heating and cooking
N V E O	___ ___ ___ ___	Cooking
L P M A	___ ___ ___ ___	Lighting
O T R O M	___ ___ ___ ___ ___	Power
C U R K T	___ ___ ___ ___ ___	Transportation
V S O T E	___ ___ ___ ___ ___	Heating and cooking
A T N R L E N	___ ___ ___ ___ ___ ___ ___	Lighting
Y E B L C C I	___ ___ ___ ___ ___ ___ ___	Transportation
E O T C O S R	___ ___ ___ ___ ___ ___ ___	Transportation
C R U B E E B A	___ ___ ___ ___ ___ ___ ___ ___	Cooking
T R I D O R A A	___ ___ ___ ___ ___ ___ ___ ___	Heating

Appendix 5

Investigation 1: Yesterday and Today – Answers

Unscramble the letters to form words related to Investigation 1.
For clues, refer to pp. 3–6 of your E² Reporter's Notebook.

*To help you find the solution, we've indicated what each object **is used for**.*

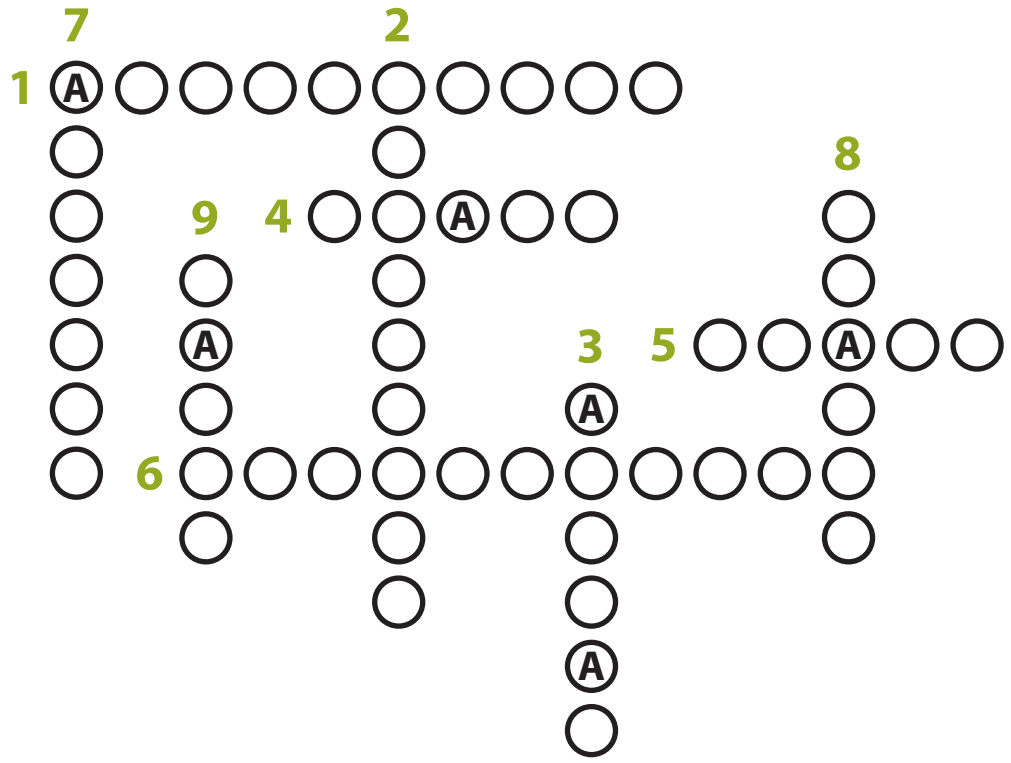
		Use
D O W O	W O O D	Heating and cooking
N V E O	O V E N	Cooking
L P M A	L A M P	Lighting
O T R O M	M O T O R	Power
C U R K T	T R U C K	Transportation
V S O T E	S T O V E	Heating and cooking
A T N R L E N	L A N T E R N	Lighting
Y E B L C C I	B I C Y C L E	Transportation
E O T C O S R	S C O O T E R	Transportation
C R U B E E B A	B A R B E C U E	Cooking
T R I D O R A A	R A D I A T O R	Heating

Appendix 5

Investigation 2 Game Sheet: Energy and the Planet

Find the intersecting words using the definitions provided. (Hint: you can find them all on pp. 7 to 10 of your E² Reporter's Notebook.)

*To give you a head start, we've given you all the **A**'s.*



Definitions

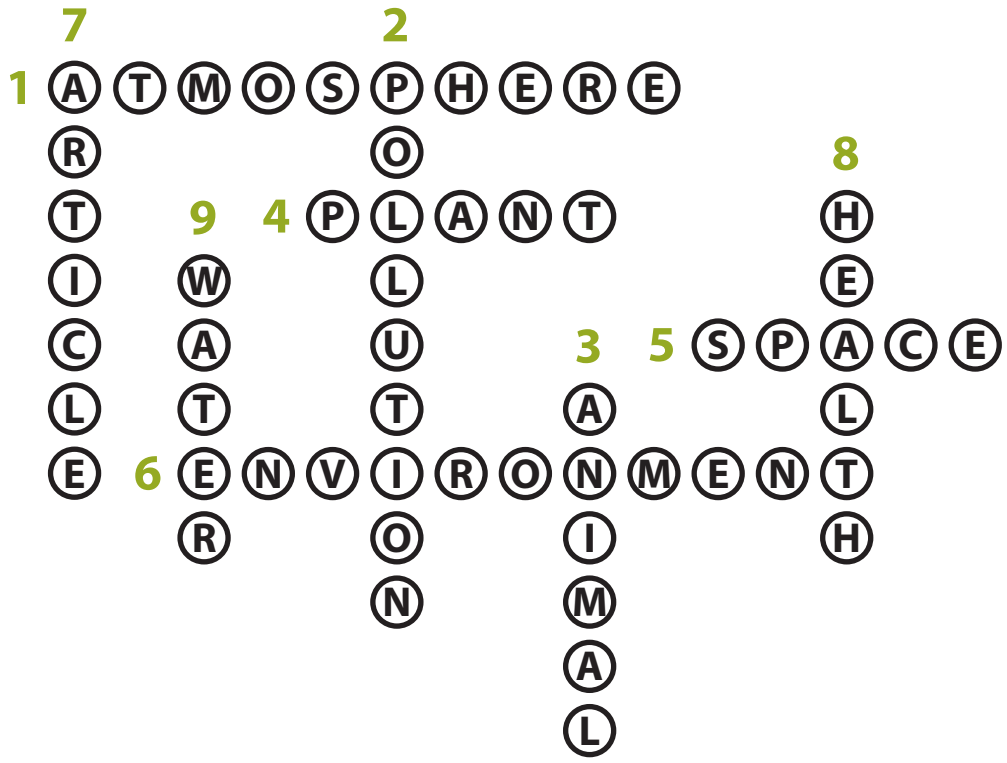
1. The protective layer of gas that surrounds our planet
2. A possible effect of energy consumption
3. Mammals, insects and birds are examples of … life
4. Trees, grass and flowers are examples of … life
5. Upon reaching the atmosphere, some of the sun's energy is reflected back here
6. The milieu in which we live
7. You read one on the impact of using energy
8. Absence of illness
9. It's a good idea to drink some every day

Appendix 5

Investigation 2: Energy and the Planet – Answers

Find the intersecting words using the definitions provided. (Hint: you can find them all on pp. 7 to 10 of your E^2 Reporter's Notebook.)

*To give you a head start, we've given you all the **A**'s.*



Definitions

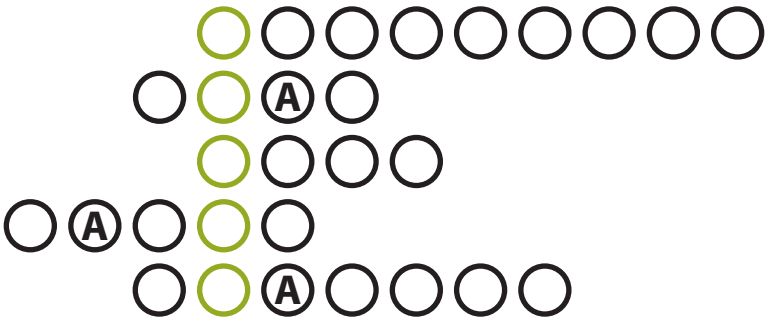
1. The protective layer of gas that surrounds our planet
2. A possible effect of energy consumption
3. Mammals, insects and birds are examples of … life
4. Trees, grass and flowers are examples of … life
5. Upon reaching the atmosphere, some of the sun's energy is reflected back here
6. The milieu in which we live
7. You read one on the impact of using energy
8. Absence of illness
9. It's a good idea to drink some every day

Appendix 5

Investigation 3 Game Sheet: Generating Electricity

This game appears on p. 16 of the E² Reporter's Notebook.
In the horizontal lines below, you'll find five resources used to produce … (The missing word is hidden in the green column.) Refer to p. 14 of your E² Reporter's Notebook if you need help!

To give you a head start, we've given you all the ***A****'s.*



Appendix 5

Investigation 3 Game Sheet: Generating Electricity – Answers

This game appears on p. 16 of the E² Reporter's Notebook.
In the horizontal lines below, you'll find five resources used to produce … (The missing word is hidden in the green column.) Refer to p. 14 of your E² Reporter's Notebook if you need help!

To give you a head start, we've given you all the ***A****'s.*

Answer: The grid contains five raw materials used to produce **power** (the word hidden in the green column).

Appendix 5

Investigation 3 Game Sheet: Power Sources

Solve the riddles on p. 20 of your E² Reporter's Notebook. Use the following clues to find the hidden power sources, piece by piece. Review the list on p. 14 if you need help!

My first is the opposite of old.
And my second is something you grasp right away.

My whole is a power source _____

My first is the underside of your new running shoe.
And my second means "is" when you're not one, but two.

My whole is a power source _____

My first is a warm, friendly greeting you say.
When you first feel my second, you head indoors to play.
And there are always 24 of my third in a day.

My whole is a power source _____

My first is the note following do, re and mi.
My second sits between r and t.
My third describes someone who's sick as can be.
My fourth comes along after c, d and e.
My fifth is a pronoun that's the opposite of "me".
And my sixth is a consonant you'll find in "lily."

My whole is a power source _____

My first is a verb that's better than "lose."
My second's a consonant that begins the word "dues."
My third is the sound of a punch that leaves a bruise.
And my fourth is my second of Riddle no. 2!

My whole is a power source _____

Appendix 5

Investigation 3 Game Sheet: Power Sources – Answers

Solve the riddles on p. 20 of your E² Reporter's Notebook. Use the following clues to find the hidden power sources, piece by piece. Review the list on p. 14 if you need help!

My first is the opposite of old.
And my second is something you grasp right away.

My whole is a power source — **New-clear** = nuclear

My first is the underside of your new running shoe.
And my second means "is" when you're not one, but two.

My whole is a power source — **Sole-are** = solar

My first is a warm, friendly greeting you say.
When you first feel my second, you head indoors to play.
And there are always 24 of my third in a day.

My whole is a power source — **Hi-drop-hour** = hydropower

My first is the note following do, re and mi.
My second sits between r and t.
My third describes someone who's sick as can be.
My fourth comes along after c, d and e.
My fifth is a pronoun that's the opposite of "me".
And my sixth is a consonant you'll find in "lily."

My whole is a power source — **Fa-s-ill-f-you-l** = fossil fuel

My first is a verb that's better than "lose."
My second's a consonant that begins the word "dues."
My third is the sound of a punch that leaves a bruise.
And my fourth is my second of Riddle no. 2!

My whole is a power source — **Win-d-pow-are** = wind power

Appendix 5

Investigation 4 Game Sheet: Looking for the Perfect Solution!

Find the hidden words in the wordsearch game below and circle the letters. The remaining letters will spell out a nine-letter mystery word. Most of the words come from your E² Reporter's Notebook.
Hint: In Québec, most of the energy is …

T	S	E	N	I	B	R	U	T	N	N	R
N	A	E	L	C	D	E	S	R	R	O	E
W	T	N	R	N	R	S	U	E	U	I	N
A	N	R	I	I	Y	E	N	E	B	T	O
R	E	W	O	P	O	R	D	Y	H	U	I
M	I	C	E	I	E	V	W	G	A	L	G
I	C	A	R	I	V	E	R	R	A	O	E
N	I	P	O	I	R	A	N	E	C	S	R
G	F	O	S	S	I	L	H	N	S	E	A
B	F	D	L	E	T	A	R	E	N	E	G
E	E	S	A	V	I	N	G	S	B	S	R
F	U	E	L	M	R	A	E	L	C	U	N

List of words

behavior
burn
cap
clean
dam
dry
efficient
energy
fossil
fuel
gas
generate
hydropower
ice
nest
nuclear
region
reserve
reservoir
river
savings
scenario
sea
solution
sun
tree
turbine
use
warming
wind

Appendix 5

Investigation 4 Game Sheet: Looking for the Perfect Solution! – Answers

Find the hidden words in the wordsearch game below and circle the letters. The remaining letters will spell out a nine-letter mystery word. Most of the words come from your E^2 Reporter's Notebook.
Hint: In Québec, most of the energy is …

→ **Answer:** renewable

T	S	E	N	I	B	R	U	T	N	N	R
N	A	E	L	C	D	E	S	R	R	O	E
W	T	N	R	N	R	S	U	E	U	I	N
A	N	R	I	I	Y	E	N	E	B	T	O
R	E	W	O	P	O	R	D	Y	H	U	I
M	I	C	E	I	E	V	W	G	A	L	G
I	C	A	R	I	V	E	R	R	A	O	E
N	I	P	O	I	R	A	N	E	C	S	R
G	F	O	S	S	I	L	H	N	S	E	A
B	F	D	L	E	T	A	R	E	N	E	G
E	E	S	A	V	I	N	G	S	B	S	R
F	U	E	L	M	R	A	E	L	C	U	N

List of words

behavior
burn
cap
clean
dam
dry
efficient
energy
fossil
fuel
gas
generate
hydropower
ice
nest
nuclear
region
reserve
reservoir
river
savings
scenario
sea
solution
sun
tree
turbine
use
warming
wind

Appendix 5

Investigation 5 Game Sheet: Public Consultation

Solve the following riddles, syllable by syllable. The solutions are words used in Investigation 5. You'll find all of them (or pictures of them) on pp. 25–28 of your E^2 Reporter's Notebook.

My first's a small bed for an unexpected guest.
And my second's not sight, smell or taste, but one of the rest.

Some vacationers spend their holidays in my whole. _____

My first is the sound that you hear from a horse.
And my second's a one-syllable word for "Of course!"

Many people love my whole and want to protect it. _____

My first is a word that's the opposite of "go."
My second is the vowel between t and v.
My third is a two-letter homonym of "know."
And my fourth from pot to cup does flow.

My whole is a group of people. _____

My first is an insect that collects pollen with a hum.
And my second's the colour (in French) of mint gum.

My whole is a Canadian animal that builds dams. _____

My first's what we all do on sofas and chairs.
My second's a vowel in the middle of "lairs."
And my third's what you use to smell flowers or taste pears.

My whole describes many of the people who attend public consultations. _____

My first is the proper name for our sun.
My second is a pronoun you use when addressing someone.
My third is a noise you make to quiet down library fun.
And my fourth is a prefix that means something's not done.

My whole is what is presented at a public consultation. _____

Appendix 5

Investigation 5 Game Sheet: Public Consultation – Answers

Solve the following riddles, syllable by syllable. The solutions are words used in Investigation 5. You'll find all of them (or pictures of them) on pp. 25–28 of your E² Reporter's Notebook.

My first's a small bed for an unexpected guest.
And my second's not sight, smell or taste, but one of the rest.

Some vacationers spend their holidays in my whole. **Cot-touch** = cottage

My first is the sound that you hear from a horse.
And my second's a one-syllable word for "Of course!"

Many people love my whole and want to protect it. **Neigh-sure** = nature

My first is a word that's the opposite of "go."
My second is the vowel between t and v.
My third is a two-letter homonym of "know."
And my fourth from pot to cup does flow.

My whole is a group of people. **come-you-no-tea** = community

My first is an insect that collects pollen with a hum.
And my second's the colour (in French) of mint gum.

My whole is a Canadian animal that builds dams. **be-vert** = beaver

My first's what we all do on sofas and chairs.
My second's a vowel in the middle of "lairs."
And my third's what you use to smell flowers or taste pears.

My whole describes many of the people who attend public consultations. **sit-i-sense** = citizens

My first is the proper name for our sun.
My second is a pronoun you use when addressing someone.
My third is a noise you make to quiet down library fun.
And my fourth is a prefix that means something's not done.

My whole is what is presented at a public consultation. **Sol-you-shh-un** = solution

Appendix 6

Kit Contents

Presentation materials

→ One E² Teacher's Guide – 2009G1314A
→ One E² Reporter's Notebook – 2009G1315A
→ One "Job Offer" poster – 2009G1316A
→ One DVD – 2009G1317A

Investigation 1

→ One deck of five *Miming* cards – 2009G1318A

Investigation 2

→ One e-mail from Ethan Everett – 2009G1319A
→ One *Planet Express!* newspaper – 2009G1320A
→ One "Illustration of the Greenhouse Effect" poster – 2009G1321A
→ One "Electricity Generation in Canada and in the United States" map

Investigation 3

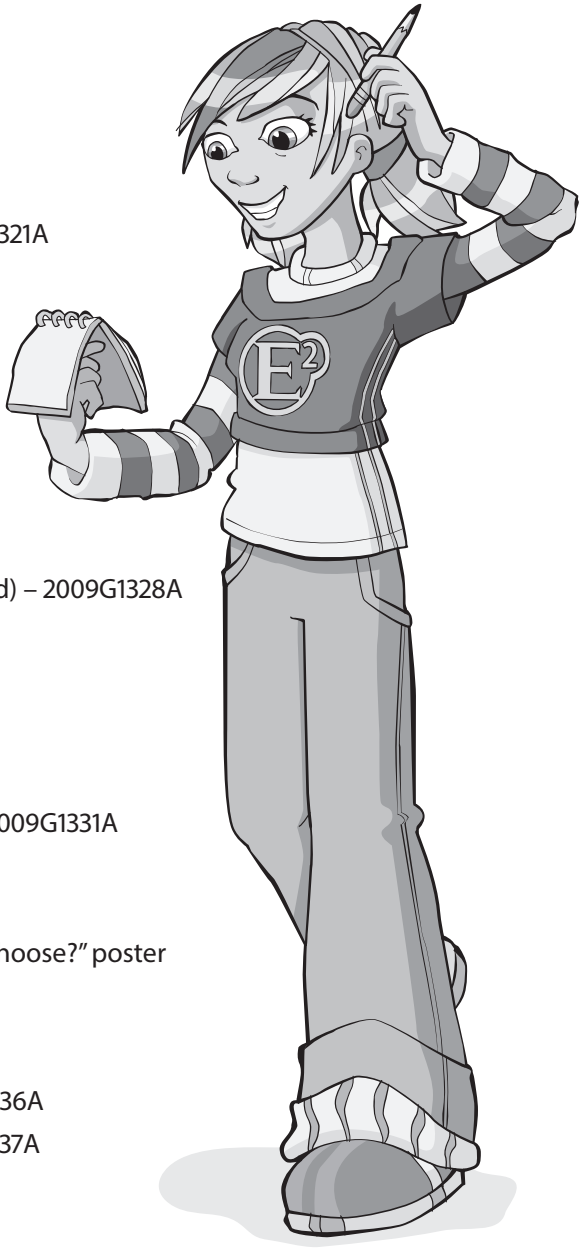
→ One deck of ten *Who Uses What?* cards – 2009G1323A
→ Eight decks of twenty-five *Challenge* cards – 2009G1324A
→ Eight decks of twenty-six *Question* cards – 2009G1325A
→ Eight "The Great E² Challenge" game boards – 2009G1326A
→ Eight sets of twenty Smiley markers (happy, neutral and sad) – 2009G1328A
→ Eight sets of four game pieces and a die
→ Eight "The Great E² Challenge" rule sheets – 2009G1327A
→ One "The Five Main Power Sources" poster – 2009G1330A

Investigation 4

→ One "Gustville: Looking for the Perfect Solution!" poster – 2009G1331A
→ Eight decks of four *Energy Solutions* cards – 2009G1332A
→ One set of five power source markers – 2009G1333A
→ One "Global Warming: What Source of Energy Should We Choose?" poster

Investigation 5

→ One "Gustville: Everyone Gets a Say!" poster – 2009G1335A
→ Eleven Public Consultation cards (Student cards) – 2009G1336A
→ Eleven Public Consultation cards (Teacher cards) – 2009G1337A
→ One deck of five *Mitigation Measures* cards – 2009G1338A



Produced by the Direction principale – Communications

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