

LESS IS MORE

EXPLORING THE CONNECTIONS BETWEEN ENERGY AND THE AIR WE BREATHE

A Guide for Teachers and Educators

Introduction

Energy, in its many forms, is something we use every day to fuel the vehicles we drive, to light and warm our homes and businesses, and to power our industries. While this energy has made our lives easier and more productive, our energy choices affect the air we breathe and the environment around us. The background information and activities below support your students in learning about where energy comes from, how it affects our lives, and what we can do to reduce its impact on our health and the environment.

Less is More (Introductory Activity)

Have students look at the images on the front of the poster. Next, have them write the word “Energy” across the top of a page and draw a line down the middle to create two columns. Label one column “Less” and the other column “More”. Ask students to think about what “less” and “more” mean when they think of the word energy and the images on the front of the poster. Have them write down any words or ideas that come to mind in each column. To assist students give them some examples of words or phrases for each section (e.g. - less: air pollution, energy waste; more: clean air, conservation). Ask students to share their ideas with a partner and then with the entire class. Have students save the results of this introductory activity. After completing the other activities on the poster, students can revisit this exercise and see how their ideas may have changed.

Curriculum Connections Prescribed Learning Outcomes for K - 7 Science and Social Studies

Grade	Sciences	Social Studies
K-7	Applications of Science	Applications of Social Studies (all criteria)
K-1	Physical Science: Changes	Environment (practice responsible behaviour in caring for their immediate environment)
2-3	Physical Science: Energy in Our Lives; Properties of Matter	Environment (demonstrate understanding of their responsibility to local and global environments)
4	Physical Science: Electricity	
5	Physical Science: Materials in Our World Earth and Space Science: Non-Living Resources	Environment (assess effects of lifestyles and industries on local and global environments)
6	Physical Science: Chemical and Physical Change	Economy and Technology (assess effects of urbanization and technology on lifestyles and environments)
7	Physical Science: Energy Sources and Options	Environment (analyze ways that people's interactions with their physical environment change over time.)

Background

Over the past 500,000 years the sources of energy people use have expanded and changed dramatically. Today, there are a number of energy sources available across the world, either for generating electricity or for direct use in powering machines or heating buildings. These sources include wood, fossil fuels, nuclear power, solar, hydro and wind energy.

The choice of energy sources used to meet a society's overall needs varies from country to country, and even from region to region within a country. In British Columbia, for example, 90% of our electricity generation comes from large-scale hydropower. In some BC communities, people choose wood-burning appliances for home heating, while others use electricity, oil or natural gas. And we all use fossil fuels to run our vehicles.

While the use of energy can change our lives for the better, it's not without consequences. The combustion of coal, oil and other fossil fuels contributes to local air pollution and to the production of greenhouse gases, which contribute to global climate change. The generation of large-scale hydropower requires dams and reservoirs to provide the necessary steady flow of water through the turbines. When we choose to heat our homes with wood, improperly burned wood can cause levels of smoke harmful to human health and that can create local visibility problems. While we often place the responsibility for these consequences on industry, the actions of individuals also play an important role in how society's energy choices affect air quality on a local and global scale. The choices we make as individuals have both direct consequences in the emissions we create from our daily activities (such as heating our homes and the method of transportation we use) and indirect consequences in the collective societal demand we help create.

The first choices we can make as individuals to reduce our immediate impact on air quality is to become more energy-efficient and use less energy; choose alternative forms of transportation instead of driving; install energy-efficient furnaces and other appliances; and, weatherproof our homes to reduce the demand on our home heating sources. By becoming more energy-efficient, we also reduce society's collective demand for energy and the associated emissions from sources such as wood or fossil-fueled electrical generation facilities or the production of natural gas.

The other choices to be made as a society are to consider energy efficiency at the community level; how we plan our cities, and how we provide energy for people and businesses to use. We can consider cleaner technologies for fossil fuel use, or alternative energy sources such as solar, wind, small-scale hydro, biomass and wood waste, and fuel cells. While the air quality impacts of alternative energy sources can be lower than fossil fuel sources, many of these alternative sources are intermittent, some are still costly, and some may lend themselves to only small-scale or localized developments. They may not be able to meet our overall societal demands for energy but they can form a part of BC's total energy mix. As BC's population increases, we will be faced with choices about how to meet and manage our energy demands, what consequences we are prepared to accept, and the personal and societal conservation choices that may entail.

Did You Know...

If every household in BC replaced two regular light bulbs with compact fluorescent bulbs, the electricity saved would be enough to power about 30,000 homes! What portion of your community would that represent?

Key Ideas

- Energy sources have changed over time and will continue to change as technology makes new sources more viable and existing devices more efficient.
- Energy use has social, economic and environmental consequences, including impacts on local air quality and contributions to global climate change.
- There are actions individuals can take to be more energy-efficient, reducing both personal and society's collective emissions.

Things We Can Do to Conserve Energy and Reduce Air Pollution

- If you use a wood-burning appliance for home heating, burn dry, well-seasoned wood.
- Don't leave your car idling while waiting for someone or doing "quick" errands.
- Use alternative transportation, such as public transit, cycling, walking, or ride-sharing whenever possible.
- Switch to energy-efficient devices, such as fluorescent light bulbs, low-energy appliances, EPA-certified high-efficiency wood-burning appliances and fuel-efficient or alternative-fuel vehicles.

Activity 1 – Energy Through the Ages

The web site of the Association for the Advancement of Science Education (APASE) has a section dedicated to energy issues: Introduction to Energy, History of Energy, Forms of Energy, Activities, and Careers. A good place to start is with the History of Energy information and activities. This gives students an idea of how energy sources have changed over the years.

www.swifty.com/apase/charlotte/corepage.html

Activity 2 – The Solar Cooker

Solar energy is a renewable resource that will never run out. The challenge is to find ways of harnessing it to put it to practical applications. In this activity, students will build their own solar cooker. Instructions for using a pizza box to build a solar cooker can be found on the Solar Now Inc. web site at www.solarnow.org/pizzabx.htm. There are additional solar cooker designs available at the web site www.solarcooking.org sponsored by Solar Cookers International. You may choose one design for all students to build, or divide the class into groups and have each group make a different type. After building and testing their solar cookers, have students discuss some of the following questions:

- How does a solar cooker work?
- Why do certain designs work better than others?
- Where would solar cookers be most useful?
- Why isn't there more widespread use of solar cookers?

See the Resources List for web sites that provide background information to support these follow-up discussions.

Extension: If different solar cooker designs are constructed, have a solar cooker challenge. The winner is the group that can warm 250 ml of water to the highest temperature in a half hour.

Activity 3 – Other Days, Other Ways

In addition to solar energy, there are other alternative energy sources that you and your students might want to investigate. On BC Hydro's web site is a module called "Powering our Future: Green Energy Options" that has information and activities to examine small-scale hydro, wood waste (biomass), fuel cells, wind energy, solar energy and overall energy efficiency. Check out these activities at:

www.bchydro.com/education/4-7/4-7_1093.html

To explore how batteries work, and begin a discussion about batteries as a source of energy, have students construct a simple battery using a lemon. You'll find this activity on the SchoolNet web site:

www.schoolnet.ca/general/electric-club/e/page8.html

Activity 4 – From Theory to Reality

Once students have completed the previous activities, it's time to apply their learning to the challenges their communities will face in making decisions about current and future energy supply and demand. Have students consider the following questions:

- Where does our community get its energy now? (Don't forget to include the energy used for residential, business and transportation purposes.)
- How might our community energy needs change in the future?
- What new energy sources might we consider to meet our future needs? What would be some of the social, environmental and economic consequences of the choices we make for the future? What ways are there to reduce negative consequences?
- How can we reduce our demands for energy? (Include energy efficiency and energy conservation - doing more with less.)

Did You Know...

A leaky hot water tap can waste up to 13,000 litres of water a year. Fix those leaky faucets and save the energy used to heat the water in the hot water tank. (Installing low-flow showerheads can save energy for hot water too!)

Taking Action

The Idea Bank - Have students discuss ideas they can do in their school, at home and in the community to save energy and help reduce air pollution. There may already be many things that your local community is doing. Refer to the Resources list for web sites that support this activity.

- Have students investigate what's going on in your community to save energy. Focus on success stories. Start with the local government to see what initiatives they have to reduce energy use in buildings and for transportation. (Try the planning department, environmental services, official community plans, growth strategies or transportation services.)
- Find out what BC Hydro, BC Gas and other utilities are doing in your community to help homes and businesses conserve energy. For example, BC Hydro's Power Smart program helps people use electricity wisely.

Spread the News - Have students create an Energy Newspaper, and write or illustrate stories about the ways that people in your community are trying to save energy. Another section could include stories from the future that explain what the students think their community could be like if some of their energy plans were implemented.

Did You Know...

A computer running for 24 hours a day uses more electricity than an energy-efficient refrigerator. The screen accounts for around 75% of the electricity used, so if you're leaving the computer for a short time, switch off the screen. (In case you wondered, a screen saver doesn't save energy.)

RESOURCES LIST

Energy Information

BC Hydro: Specific information on electricity generation in BC
www.bchydro.com/info/generation/generation860.html

Canadian Association for Renewable Energies: A non-profit association promoting the feasible application of renewable energies.
www.renewables.ca

Solar Now Inc.: A registered non-profit organization in the U.S. with the mission to educate on issues of renewable and alternative energy resources and stewardship of the Earth. Includes an extensive list of links to other related web sites. www.solarnow.org

Soltek Powersource: Information on various alternative energy sources and products; includes how to determine if the different options are appropriate for a given location. www.spsenergy.com/index.htm

Solar Cooking Archive: Information on solar cookers, including their use in communities all over the world. www.solarcooking.org

Centra Gas: Information about natural gas, including energy conservation tips. www.centragas.com

BC Gas: Information about natural gas and information on home improvements for energy efficiency. www.bcgas.com

Ballard Power Systems: Information about development and application of fuel cell technology. www.ballard.com

Canadian Association of Petroleum Producers: Information about the production and use of oil and natural gas in Canada, and what the industry is doing to minimize its environmental impacts. www.capp.ca

The Coal Association of Canada: Information about coal production and use in Canada, including how the industry is addressing its environmental consequences. www.coal.ca

Better Environmentally Sound Transportation (B.E.S.T.): Information about alternative transportation issues and community initiatives. www.best.bc.ca

David Suzuki Foundation: Information on several environmental issues, including climate change and clean energy. www.davidsuzuki.org

Pembina Institute: Information on several environmental issues, including energy efficiency.
www.pembina.org (general information);
www.re-energy.ca (resources on renewable energy);
www.climatechangesolutions.com (information on actions by individuals, communities, industries, and schools.)

BC Ministry of Energy and Mines: Information on provincial energy resources, policy, programs and legislation. www.gov.bc.ca/em

Natural Resources Canada, Office of Energy Efficiency: Information on energy efficiency, including the annual "Energy and the Environment" Calendar Artwork Contest for elementary students, and "anti-idling" community campaign materials. <http://oe.nrcan.gc.ca>

Community Information

Greater Vancouver Regional District: Explore urban environmental issues affecting the GVRD; workshops and resources for teachers on air quality and climate change. www.gvrd.bc.ca

Federation of Canadian Municipalities: Go to the information on the Partners in Climate Protection Program (PCP, under "Nat'l Programs") for a list of BC communities engaged in initiatives to reduce overall community energy use and emissions of greenhouse gases. www.fcm.ca

BC Energy Aware Committee: Information about community energy planning and actions in communities across BC.
www.communityenergy.bc.ca

Action Programs

Way to Go! School Program: Information on how to create opportunities for students to safely walk or cycle to school. Includes information for planning special events and on the establishment of "no idling" zones at schools. www.waytogo.icbc.bc.ca

Destination Conservation: A practical, activity-based program that combines hands-on activities with resource conservation in schools.
www.dcplanet.org/home.html

Additional Teaching Resources

Scientists and Innovators in the Classroom: Scientists and other experts can come to schools to talk to students about energy and the environment or careers in that field.
www.scienceworld.bc.ca/newsite/education/students/sis.php3

Association for the Advancement of Science Education (APASE): Site includes a careers section.
www.swift.com/apase/charlotte/energy.html

Science World - "Our World" gallery: A hands-on approach to learning about how humans impact the world we live in; includes an exploration of green energy sources and their potential.
www.scienceworld.bc.ca/newsite/whatson

Sunwind Solar Industries Inc. (based on Salt Spring Island): Information, lesson plans and educational kits for teachers to explore solar energy. www.sunwindsolar.com

Climate Change Calculator: An interactive tool that allows users to estimate personal CO₂ emissions and provides tips on how to reduce emissions. www.climcalc.net

Rechargeable Battery Recycling Corporation: Lesson plans about batteries and information on where to recycle rechargeable batteries.
www.rbrc.org/index.html

"Catching Sunshine" Challenge: Engages students in building solar cookers, with an event to test designs and compare results with other students. <http://scithon.terc.edu/CatchingSunshine>

BC Ministry of Water, Land and Air Protection: Previous years' Clean Air Day posters with educational resources on related air quality issues; information on air quality issues and air quality legislation in BC.
<http://wlapwww.gov.bc.ca/air/cad>

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