Lessons in a Backpack

United Nations Educational, Scientific and Cultural Organization

GEORGIAN BAY BIOSPHERE MNIDOO GAMII Spirit of the Water

Our Environmental Footprint
Looking at Energy

Description of Lesson

Energy is in everything! We use it for everything we do, from playing basketball to baking cookies to sending astronauts to space. Energy comes from nature, and in different forms. In this lesson, students will explore different sources of energy and the amount of energy that they consume everyday.

Connect with the Georgian Bay Biosphere

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At a Glance

Grade Level: 1 and 2

Learning Environment: Indoor Classroom

Prep Time: 10 minutes

Length of Lesson: 1 hour

Key Vocabulary: Renewable and Non-Renewable

Staffing: 1 educator

Materials:
Images of different sources of energy.
list of appliances and watts per hour
2 light bulbs: incandescent and CFL lamp
limbo stick
limbo game cards
Environmental Footprint Tree and/or chart paper and marker
clipboards
energy in our community sheets

All materials are available from GBB. To get this resource, please call (705) 774-0978.

Groupings: Whole class, and small groups of 2 or 3

Teaching/Learning Strategies:
Hands-on learning, inquiry

Lesson Outline

TIME	ACTIVITY	LOCATION	MATERIALS (from Resource Box)
5 min	What is energy?	Indoors	Images of different sources of energy.
10 min	Ranking Appliances	Indoors	list of appliances and watts per hour
10 min	Wasting Without Knowing	Indoors	2 light bulbs: incandescent and CFL lamp
10 min	In Limbo	Indoors	limbo stick limbo game cards
5 min	Count Yourself In: Shrink Your Energy Footprint!	Indoors	Environmental Footprint Tree and/or chart paper and marker
15 min	Walk About	Indoors	clipboards energy in our community sheets

Curriculum Expectations
Grade 1 and 2 Science and Technology

Grade 1: Understanding Matter and Energy-Energy in Our Lives

Overall Expectations

1. Assess uses of energy at home, at school, and in the community, and suggest ways to use less energy;

2. Investigate how different types of energy are used in daily life.

Specific Expectations

1.1 Describe their own and their family's uses of energy

3.1 Demonstrate an understanding that energy is what makes the things they do or see happen

Grade 2: Understanding Life Systems-Growth and Changes in Animals

Overall Expectations

1. Assess ways in which animals have an impact on society and the environment, and ways in which humans have an impact on animals and the places where they live.

Specific Expectations

1.2 Identify positive and negative impacts that different kinds of human activity have on animals and where they live.

Background

Renewable Energy: comes from sources that can be used again and again, and they will never run out. As a result, they are called sustainable. Examples used in this lesson include energy from sunlight, and wind. Other renewable sources come from the biomass of things like trees or corn, from running water, and from geothermal heat generated deep within the earth.

Sunlight: Photovoltaic (PV) solar cells directly convert sunlight into electricity. The simplest cells are used to operate wristwatches and calculators, and more complicated systems are used to light houses.

Wind: When the wind turns the blades of a windmill, it spins a turbine inside a small generator to produce electricity, just like a big coal power plant. A windmill on a farm can make only a small amount of electricity, enough to power a few farm machines. To make enough electricity to serve lots of people, power companies build "wind farms" with dozens wind turbines.

Non-renewable Energy: comes from sources we are using up and cannot easily replace in a short time. These sources of energy are considered unsustainable. Examples of non-renewable energy sources that are used in this lesson are coal, oil, natural gas, and nuclear power.

Coal: Coal is a non-renewable energy source because it takes millions of years to create. The energy in coal comes from the energy stored in plants that lived hundreds of millions of years ago, when the earth was partly covered with swampy forests. They were buried in swamps and were subjected to intense heat and pressure. Coal miners use giant machines to remove coal from the ground via two methods; surface, or underground mining. The coal is then cleaned to remove dirt, rock, ash, etc. Finally, the coal is sent to a power plant where it is burned to create steam. The steam turns large turbines that create electricity.

Oil: Like coal, oil was formed from the remains of plants and animals that lived millions of years ago. The plants and animals that turn into oil once lived in a marine environment and were covered with layers of mud. To get oil, engineers drill a hole deep into the ground . Above the hole, a structure called a “derrick” is built to house tools and pipes going into the well. When finished, the drilled well will bring oil to the surface.

Source: “Connecting with Nature: An educational guide for grades four to six” by the David Suzuki Foundation.

Did you Know?!

In Ontario, 8% of our electricity comes from natural gas or other, 18% comes from coal or oil, 22% comes from hydroelectricity and other renewables, and 52% comes from nuclear energy. www.canadaenergy.ca

Energy Use At Home

The majority of homes in Canada are heated and cooled using non-renewable sources. Home heating in Canada accounts for nearly 60% of the energy used in the home. Appliances and electronics account for about 13% of household energy use.

Refrigerators use the most energy of any home appliance because they are on all the time. Make sure your frig is away from any heat sources (including the sun!) so it doesn't have to compete with the heat.

Is it better to use a **dishwasher** or to wash dishes by hand? It depends on how you use the dishwasher, what kind you buy, and how you wash dishes by hand. If you use a dishwasher, make sure it's full when you run it! Use the air-dry feature or dry the dishes by hand.

An electric **clothes dryer** can generate more than six pounds of greenhouse gases with every load. A clothesline generates zero. Hanging clothes can save the average household about $100 a year in energy costs. If you do use a dryer, keep the lint filter clean for best efficiency.

Get rid of **vampire power**! Many appliances use power even when they are switched off, and some of them use as much power as when they are turned on. Many electrical products need to be unplugged to be completely switched off (e.g. Air conditioners, DVD players).

If your family needs to replace any of it's appliances, they should look for the **Energy Star label** to ensure they're buying the most efficient appliance they can afford.

When we're using a lot of electricity at the same time, we create a peak demand period. During peak demand periods the system can fill up and make it hard to meet all of the electrical demands. This can cause blackouts where the system is forced to shut down. This can be hard on nature because of all the additional electricity plants that must be built just to meet peak demand.

Check the **Ontario Electricity Time-of-Use Price Periods** to see when is the best time to use energy. www.ontarioenergyboard.ca/OEB/Consumers/Electricity/Electricity+Prices

Source: "Connecting with Nature: An educational guide for grades four to six" by the David Suzuki Foundation.

Teaching and Learning

Part A. What is Energy?

Ask students to discuss where electricity comes from.

Using the provided pictures and information, explain to the class how energy is created via wind, solar, oil, and coal. Explain the difference between renewable and non-renewable energy.

Ask students: *What impact does each source have on nature?*

Part B. Ranking Appliances

Ask students to brainstorm to create a list of the electrical appliances used around the home and school.

Tell students that we will focus on five appliances; the fridge, clothes dryer, clothes washer, TV, and dishwasher. Ask the students to rank these appliances according to how much energy they think each uses in one hour.

Reveal the actual ranking as follows:

Ranking	Appliance	Watts per Hour
1	Clothes Dryer	1800-5000
2	Dishwasher	1200-2400
3	Fridge	170-750 (but it works all the time!)
4	Clothes Washer	350-500
5	T.V.	65-170

If students are curious, here are more:

Appliance	Watts per hour
Clothes iron	1000-1800
Computer monitor	Asleep: 30, awake: 150
Laptop	50
Fridge	725 (but they're always on!)
Hair Dryer	1200-1875
Toaster	800-1400
Vacuum	1000-1440

Part C. Wasting Without Knowing

Discuss with the class: it is easy to waste energy without knowing it. When we turn on a light it uses energy. We want the energy to make light but it also makes something we don't want-heat. That's wasted energy.

Present two types of light bulbs; incandescent (really old) and the compact fluorescent bulb (a fairly new invention).

Screw the incandescent bulb into the lamp and turn it on. Invite one student to time how long it takes for the bulb to get hot by holding their hand slightly away from the bulb. Warn the student ahead of time that it will happen fairly quickly, and not to touch the bulb directly. A second student should be recording the time.

Remove the bulb and screw in the CFL bulb. Again, invite a student to time how long it takes for the bulb to get hot. The students should notice that it takes quite a bit longer and that the bulb never gets hot, only warm.

Discuss the advantages of each bulb (CFL bulbs do not use much energy and last a great deal longer than incandescent bulbs.) The take-home message is that we can make choices to buy more energy-efficient items for households.

Part D. In Limbo

What are some other ways that we can save energy? Get students to raise ideas.

Have students line up in front of a limbo bar. Each turn, have a student select an “energy use” card.

As a group, decide whether the bar should be raised or lowered. Raise the bar for an energy efficient use and lower the bar for an inefficient energy use.

Part E. Count Yourself In!

After each student has gone under the limbo stick, have them sit back at their desks. Make a list of easy ways to save energy at home or school. As a class, pick 5 that are attainable, and use them as goals for the Environmental Footprint Tree.

Part F. Walk About

Take students on a “green energy hunt” to find how much green (renewable) energy is being used in the community. Have students point out any power related items (electrical outlets, street lamps, power lines, etc.). Point out any green energy uses (for example, solar panels, windmills, hybrid vehicles). Challenge them to find other places where green energy could be used.

If there is time, walk around the school and point out exterior gaps, cracks, and damage that could allow cold air to come inside and heated air to go outside.

Extension Activities

Community/Home Engagement

Ask students to look around at home (or in the breakfast club room at school) and list any appliances with the Energy Star label.

Optional Class Activities

Evaluate your school's energy efficiency. Have the custodian come in and take the class for a walk around the school to discuss the appliances your school uses. Do any of the appliances have the Energy Star label?

Integrating Arts: Encourage students to design an energy-efficient home of the future. Ask them to consider heating, cooling, appliances, lights, trees, and anything else you can think of.

Integrating Math: Develop a math activity to determine how much energy the school could save by lowering the thermostat by two degrees. Multiply that energy use over a day, week, month, and year. Then discuss how students could wear sweaters to decrease energy consumption.

Many ideas were adapted from the David Suzuki Foundation's "Connecting with Nature: An educational guide for grades four to six". Check out this resource for more information and ideas!

LIMBO CARDS

Dry the washing on the clothesline.	**Use solar lights on your garden pathway.**
Run the dishwasher half full.	**Run an empty freezer.**
Leave the lights on when you leave the room.	**Put on a sweater when it is chilly.**
Leave your computer monitor on all night.	**Close the drapes at night in the winter (to help insulate the windows).**
Put a sensor in your classroom that will turn off the lights if there is nobody in the room.	**Take a long, hot shower.**
Keep the drapes closed on a sunny day in the winter (the sun can't get in!)	**Cook a baked potato in a small toaster oven.**
Insulate the hot water heater.	**Unplug electrical appliances when not in use.**
Leave the TV on when you leave the room.	**Use incandescent light bulbs.**
Use a hot water bottle to heat up your bed.	**Use a large fridge with only a few items in it.**

Run your washing machine using cooler water.	**Take a good long look in the fridge before deciding what you need.**
Use compact fluorescent light bulbs.	**Open the oven door every 10 minutes to make sure the cookies you're baking aren't burning.**

Energy can be made in something called a nuclear power plant. Nuclear power plants get energy from a metal that is found in rocks. This metal is called uranium. Although uranium is a common metal found all over the world, nuclear power plant use a very specific kind of uranium, called uranium-235. Uranium-235 is very rare.

Uranium, like everything else in the world, is made up of tiny particles. In nuclear power plants, they are able to split the particles of uranium-235 in half, which releases a great amount of energy as heat (and radioactive waste). This heat is used to heat water, which creates steam. The steam turns giant turbines, which generate electricity.

Nuclear power plants harm the environment because the uranium must be dug from the earth, which destroys the homes of plants and animals. Also, the readioactive waste made by nuclear power plants can be very very dangerous to human health if they aren’t managed properly.

Nuclear

Energy can come from running water. This is called hydroelectricity (“hydro” means water!). Electricity is created in a hydroelectric dam when running water pushes against and turns blades in a turbine. These spinning blades spin a generator that creates electricity.

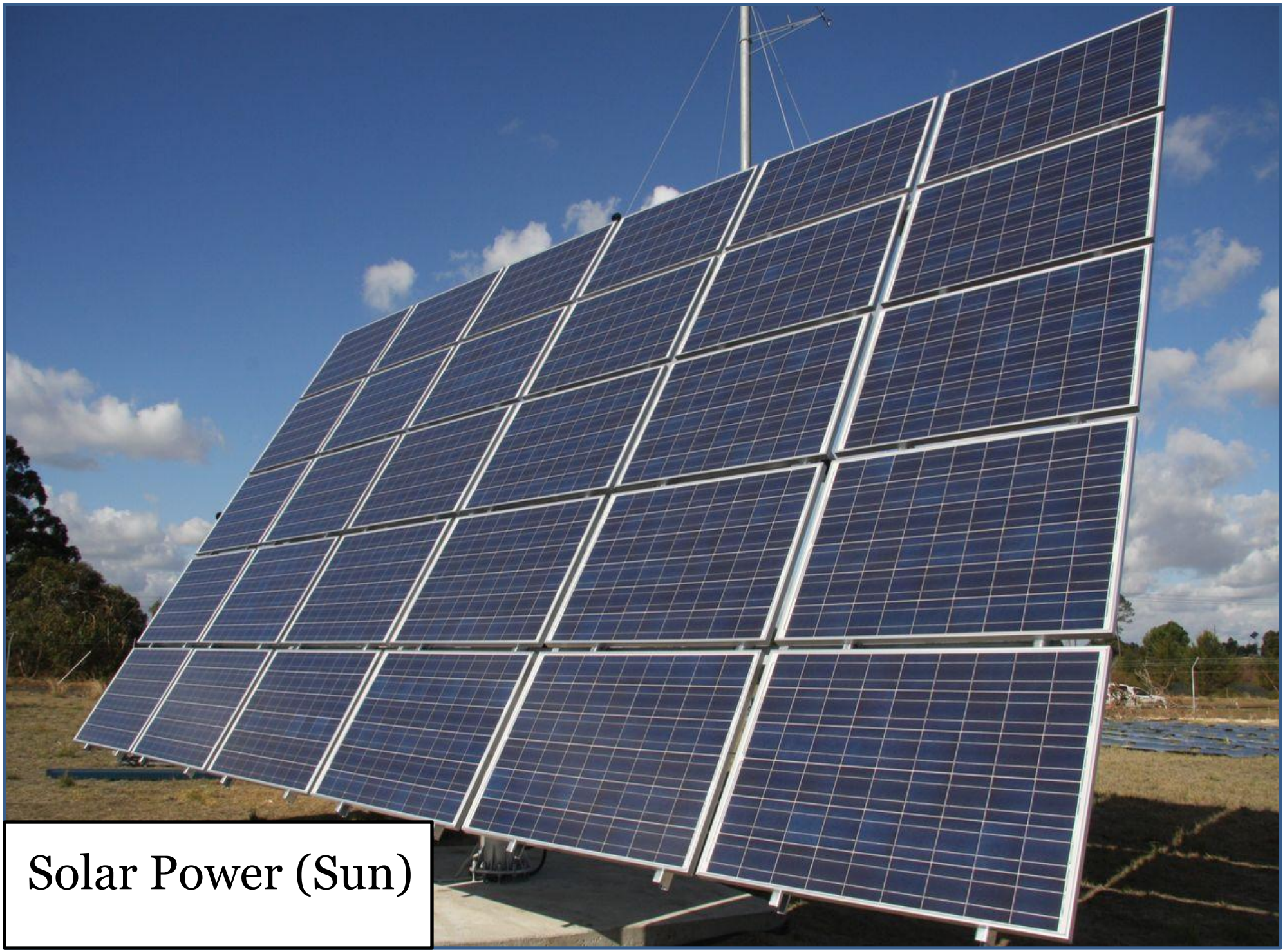
Hydro dams do not pollute the air or the water. However, they can cause some environmental harm. For example, when fish need to swim upstream to lays eggs, they are blocked by these dams. A dam can also change natural water temperatures and levels, which can harm plants and animals.

WATER (Hydro)

Solar energy comes from the sun's rays that reach the earth. Energy from the sun can be used to heat water or heat houses. Or, solar energy can be turned directly into electricity to power our appliances and electronics, using solar panels.

Solar panels are made up of things called photovoltaic cells, which capture the suns energy and makes positive and negative terminals on each surface (like on a battery). When the two surfaces are connected through an external load (like an appliance) electricity flows.

Using solar energy does not make air or water pollution, and does not contribute to global warming. Therefore the environmental impact of using solar energy is very low.



Solar Power (Sun)

Wind can be used to create electricity, using wind turbines. As wind blows the blades on the turbine, they spin. The blades are connected to a drive shaft, which turns an electric generator to produce electricity.

Wind turbines do not pollute the air or water. They are a very clean, environmentally friendly source of energy.


Wind

Oil (or petroleum) is a smelly yellow to black liquid that is usually found underground. Oil was formed from the remains of plants and animals that lived millions of years ago in a marine environment before the dinosaurs. When these plant and animal remains were covered with layers of dirt and silt, the heat and pressure caused them to turn into oil. The word petroleum actually means “rock oil” or “oil from the earth”.

To get oil, scientists and engineers drill holes deep into the earth. Above the hole, a structure called a “derrick” is built to house the tools and pipes going into the well. When finished, the drilled well will bring a steady flow of oil to the surface. After the oil comes out of the ground, it is refined (different parts of the oil are separated). The crude oil that comes from the ground can be separated to make gasoline, diesel, propane, and other petroleum products. Many people across North America use propane to heat their homes.

Although oil products make our lives much easier, finding, producing, moving and using them can harm the environment through air and water pollution. When they are burned as fuel, they release harmful gases into the air (carbon dioxide, carbon monoxide, sulphur dioxide, etc.) These gases cause global warming, acid rain, etc. and can be very bad for human health.

Finally, if oil is spilled into rivers or oceans, it can hurt or kill wildlife.


OIL

Coal is a black or brownish black rock that is burned to make energy. It takes millions of years to make coal. The energy in coal comes from energy stored in plants that lived hundreds of millions of years ago, when the earth was partly covered in swampy forests. At that time, plants would die and get covered by layers of water and dirt, trapping the energy. The heat and pressure from the top layers of dirt and water helped the plant remains turn into coal.

Coal miners use giant machines to remove coal from the ground. After the coal comes out of the ground it is moved to a place where it is cleaned and processed (unwanted dirt, rocks, ash, etc. are removed). Then it is shipped (usually on a train) to a power plant where they burn it to make steam. The steam turns turbines that generate electricity.

Coal hurts the environment for a few reasons. When digging for coal, habitat is lost and water is polluted. In some cases coal companies will use explosives to blow away entire mountain tops in search of coal.

By 2014, Ontario is set to become the first jurisdiction in North America to be almost entirely coal-free! (99% of energy will be from non-coal sources).

COAL