Canadian Geographic EDUCATION

ENERGY IQ
QI ÉNERGÉTIQUE

LEARNING INQUIRIES

LET'S GET ENERGIZED: THE STORY OF ENERGY PRODUCTION IN CANADA

TIME: 90 MINUTES (CAN BE DIVIDED OVER NUMEROUS BLOCKS)

DEVELOPED BY: CANADIAN GEOGRAPHIC EDUCATION

OVERVIEW/FOCUS QUESTION

What is energy, why do we need it, and what are the different types of energy in Canada?

SUBJECT/TOPIC

GEOGRAPHY, SCIENCE AND TECHNOLOGY

GRADE LEVEL

GRADES 1 - 4
(CAN BE ADAPTED FOR OLDER GRADES)

LEARNING GOALS

- Be able to define energy
- Identify types and locations of energy sources in Canada
- Describe energy use in everyday life
- Identify ways to use less energy on a daily basis

MATERIALS NEEDED

- Chart paper, whiteboard, smartboard, or blackboard
- Juice box with straw
- Pinwheel
- Bucket and jug of water
- Map of Canada

CONNECTION TO THE CANADIAN GEOGRAPHY FRAMEWORK

CONCEPTS OF GEOGRAPHIC THINKING

- Interrelationship
- Geographic perspective

INQUIRY PROCESS

- Formulate questions
- Interpret and analyze
- Communicate

GEOSPATIAL SKILLS

- Foundational elements: direction
- Spatial representations: map elements

LESSON DESCRIPTION

MINDS ON

Students will discuss what they already know about where energy comes from (types of energy) and how they use energy in their daily lives.

ACTION

Students will learn the definition of energy and the different types of energy found in Canada. Through demonstrations, students will understand how different energy types are extracted or harnessed, and make the connection between types of energy and how we use that energy in our everyday lives. Students will learn that there are renewable and non-renewable types of energy.

CONCLUSION

Students will reflect on the effort and resources it takes to obtain energy, and will identify ways to conserve energy in their lives.

LESSON IMPLEMENTATION

MINDS ON

Explain to students that they will be learning about energy. Have a group discussion to see how much students already know about energy, how we use it, and where it comes from. Record students' answers to the following questions:

1. Have you heard the word "energy" before? Where?
2. What do you think "energy" means?
3. How do you think we use energy every day?
4. Where do we get energy from?

ACTION

After discussing students' answers, give students the definition of energy: energy is what makes things change and move; it is the ability to do work. This means that anytime something moves or changes—a light turns on, a car moves, the furnace heats our home—it is all because of energy. Energy is all around us and it is involved in all parts of our day. Have students think about everything they did that day from the time they got up and identify ways they came across energy. For example, they may have turned on a light, used the stove to make breakfast, taken a shower, used a car or bus to get to school, and used a cell phone.

Now that students have identified how they use energy in their lives, ask students how items in our life get the energy they need to work. For example, how does a lamp work? Would it work if it was not plugged in? What does plugging it in do? It allows the lamp to use electricity to work (light up). But how does the building get electricity to give to the lamp to allow it to work? Explain to students that they will be learning about the different types of energy in Canada: crude oil, natural gas, hydroelectricity, nuclear, coal, wind, tidal, biomass, and solar. Some of these are renewable (which means they will not run out) or non-renewable (they will eventually run out).

Use the materials suggested below to demonstrate to students different energy types and how they are produced. If appropriate, allow students to try as well. A simple way to categorize energy for students is to group energy types by those that can be found underground (crude oil, natural gas, coal, and uranium for nuclear energy) or from things above the surface of the earth (hydroelectricity, wind, tidal, solar, biomass).

Types of energy from underground: Crude oil, natural gas, coal, nuclear

These are non-renewable types of energy. Companies get these types of energy from underground through mining (coal, uranium for nuclear energy) or other extraction methods such as drilling wells (natural gas and crude oil) to allow the material to come to the surface.

- Use a juice box* to demonstrate how companies get natural gas and crude oil from underground. Stick the straw (to represent a well) into the juice box (like a company digging underground), and the juice (natural gas, crude oil) can flow up to the top. Explain to students that crude oil is similar to a liquid but natural gas is like air, it is not hard or liquid. Crude oil can also be found under the ocean floor. Natural gas can be used to heat homes and provide electricity. Crude oil is used to create products (e.g., plastic) and also different types of fuel (e.g., gasoline for cars, jet fuel).
- Ask students to think about a time where they have dug in the dirt and found rocks. Similarly, miners will dig up coal from the ground. Coal is a lumpy rock made up of organic material (plants and other living things that were hardened over time) that can be burned. When coal is burned, it powers a generator (a machine that turns one type of energy into another type of energy), which makes electricity. Ask students how they use electricity.
- Nuclear energy is made through a process called nuclear fission. Nuclear fission is when atoms (the microscopic building blocks of life) break apart and give off energy. The specific atoms used in nuclear energy are uranium atoms. Uranium is a heavy metal that is mined and it is radioactive (which means it can be dangerous so it needs to be handled properly and safely). When the uranium atom breaks into smaller atoms, it gives off energy. This energy creates heat, which is then turned into electricity. This happens inside a nuclear power plant when the heat that is created boils water, making steam, which gives power to the generator, which in turn produces electricity. Illustrate this process as you describe it to give students. You can also ask students to imagine that they have a warm bread bun (a uranium

atom). When they rip the bun in two, heat escapes. Imagine that heat warms up water. What happens when there is a pot of boiling water on the stove? You get steam. That steam is what is used to power the generator which turns it into electricity.

***Note:** It is important to communicate to students that the juice box exercise simulates the case where oil is accessed by drilling a well in situ and pumping the oil out. Not all oil is obtained in this way. For example, some oil comes from oil sands that are mined very close to the surface. The main difference between these two methods is that steam or hot water are necessary to thin the oil sufficiently before it can be pumped, as it is too thick to flow on its own.

Types of energy from above the surface: Hydroelectricity, wind, tidal, solar, biomass

These are renewable types of energy. Companies get these types of energy from above the ground by using running water, wind, plant life, and the sun.

- Show students the pinwheel. Explain that two types of energy—wind and hydroelectricity—are produced using a turbine (which resembles this pinwheel). A turbine is a machine that makes power when a wheel is turned by something (like air or water). Blow on the pinwheel. Explain that wind will turn the blades of the windmill or wind turbine, which activates (turns on) a generator. The generator is inside the windmill (point to the part of the pinwheel that connects the blades). The wind turns on the generator which makes electricity.
- Explain that hydroelectricity also uses a turbine but with water instead of air. The turbine (pinwheel) spins a generator, which turns one type of energy into another type of energy (electricity). Take the jug of water and the bucket. Have a student hold the pinwheel over the bucket as you slowly pour water over the blades to demonstrate how water can turn a turbine.
- Tidal energy also uses energy, but this type of energy uses the power of the ocean tides (the change in water level). When the water level changes, that movement of water pushes water through a turbine, which gives power to a generator, which then makes electricity. Ask students to imagine draining a bathtub filled with water. What would happen to the pinwheel if you were holding it under the water when the water was draining out?
- Solar: The sun gives off a lot of energy. Solar energy harnesses the power of the sun with photovoltaic technology, which is where solar panels capture light and turn it into electricity

with the help of different materials. Ask students to think about what plants need. Plants need water, nutrients (from soil) and sun. What happens to plants in the dark? They wilt and die. That's because plants get energy from the sun to survive.

- Biomass: Biomass is a name for things like trees, hay, and household garbage that can be burned to make electricity (using steam and a generator) or turned into fuel.

Now that students know about the different types of energy, it's time to explore what parts of Canada produce these different types. Display the map of Canada. Have students look at the map and discuss the different areas of Canada (north, south, east, west), bodies of water (oceans, rivers, lakes), and what students already know about different provinces. Ask students to think about the different types of energy and where they might be found in Canada and why. For example, what part of Canada might produce tidal energy and why? What is needed for hydroelectricity—where might it be produced? Where would be a good place for a wind turbine?

Provinces/Territories and types of energy produced:

- Yukon: hydroelectricity
- Northwest Territories: hydroelectricity, crude oil, natural gas and wind
- Nunavut: no major energy sources (except for solar)
- British Columbia: hydroelectricity, natural gas, biomass, crude oil and wind
- Alberta: crude oil, natural gas, coal, wind, hydroelectricity and biomass
- Saskatchewan: crude oil, natural gas, hydroelectricity, coal and wind
- Manitoba: hydroelectricity, crude oil and wind
- Ontario: nuclear, hydroelectricity, wind, natural gas, crude oil and solar
- Quebec: hydroelectricity, and wind
- Newfoundland and Labrador: hydroelectricity, crude oil, natural gas, wind and biomass
- New Brunswick: nuclear, hydroelectricity, natural gas, wind and biomass
- Nova Scotia: coal, wind, hydroelectricity, tidal and biomass
- Prince Edward Island: wind

CONCLUSION AND CONSOLIDATION

Students now have an understanding of the different types of energy that Canada produces, whether they are renewable or non-renewable, and where they are produced across the country. Now ask students to think again about how they use energy in their daily lives and have them discuss ways they can conserve energy and not waste it. If appropriate, have students walk around the classroom and look for ways they can save energy (e.g., turning off lights, opening the blinds, putting on a sweater and turning down the thermostat).

EXTEND YOUR GEOGRAPHICAL THINKING

Explore the Energy IQ website to find videos, infographics, and factbooks for more information.

MODIFICATIONS

Where appropriate, allow students to participate in the demonstration of the different ways that energy types are harnessed.

Create symbols for the different types of energy to help students remember the names, and display them on the map of Canada.

Body break: if students need a body break, and to help reinforce the names of the different types of energy, assign a movement to each type of energy. Call out the different types of energy and have students do the accompanying move. For example, solar could be creating a star shape, nuclear could be jumping jacks, wind could be turning in a circle, etc.

For older students: students can do independent or group research on individual types of energy and present to the class.

Extension: Students can create models of the different types of energy.

ASSESSMENT OPPORTUNITIES

Teachers can observe and assess students' participation in class discussion.

Teachers can observe and assess students' ability to read and draw conclusions from the map of Canada.

If teachers decide to have students do independent or group projects, then they can assess students' presentations and projects.

SOURCES AND ADDITIONAL RESOURCES

Energy IQ

Canadian Association of Petroleum Producers

Canadian Wind Energy Association

Canada Energy Regulator - Provincial and Territorial Energy Profiles

Canada Energy Regulator - Energy Facts

	NOT YET MEETING EXPECTATIONS 1	DEVELOPING EXPECTATIONS 2	MEETING EXPECTATIONS 3	EXCEEDING EXPECTATIONS 4
Organization Does the order of research findings make sense and allow the presentation to flow?				
Mechanics Are there errors in spelling, grammar, or punctuation that impede the presentation?				
Presentation Was there eye contact, good voice tempo, and enunciation? Do you engage your audience as you speak?				
Visuals Does your presentation contain helpful visuals and images?				

KWL CHART:
CLIMATE CHANGE IN CANADA

In the first column, write what you already know about the topic (three items minimum).
In the second column, write what you want to know about the topic (three items minimum).
After you have completed this class activity, write what you learned in the third column.

WHAT I KNOW NOW	WHAT I WANT TO KNOW	WHAT I LEARNED

STUDENT ACTIVITY SHEETS