

# ENERGY AND ELECTRICITY IN CANADA

## Overview

In this activity, students will be introduced to the Great Canadian Electricity Giant Floor Map. Students will have the opportunity to explore the map using legends and activity cards with the purpose of better understanding energy sources, and electricity production and transmission in Canada. They will consider the relationship between geography and the distribution of electricity facilities in the different provinces and territories. Students will engage in a discussion about the positive and negative aspects of different energy sources and production methods. Students will also reflect on their role in helping to reduce greenhouse gas emissions.

After completing the lesson, students will be able to answer the following questions:

- How is electricity produced and transported across Canada?
- How does geography play a role in Canada's energy production and transmission?
- What are the advantages and disadvantages of different energy sources and production methods?
- How can I contribute to a more sustainable future?

## Time

120 minutes (can be divided)

## Grade

8 - 10 (modifications provided for older and younger students)

## Lesson implementation

### Minds on (40 minutes)

Welcome students onto the Great Canadian Electricity Giant Floor Map and give them time to explore it freely.

After their initial exploration, have students stand around the border of the map. Ask them to identify the five key components of a proper map (title, border, compass, legend, and scale). Discuss the locations of each of these components and why they are necessary for understanding a map. Ensure all students have a proper understanding of the extent and orientation of the map.

Invite students to share what they think the map represents based on the colours, symbols, and data types they observed. What information stood out to them during their initial walkthrough? Have students confirm their observations by dividing the class into five groups and providing each group with a handheld legend.

Ask each group to follow along as you progress through each symbol on the legend as a class. For example, ask the groups to locate and stand next to a hydroelectric symbol, a broadleaf deciduous forest, Métis settlement land, a modern treaty region, etc. Have students identify which symbols or terms on the legend they have difficulty interpreting and provide an explanation/definition for each to ensure all students understand the information being presented.

Focus students' attention on the electricity facility symbols on the map. Describe how the electricity we use everyday, to power our homes, our devices, and even our vehicles, is generated using a number of different energy sources, including hydropower, wind, solar, biomass, coal, nuclear, natural gas, and fuel oil (a petroleum product produced from crude oil, and is stored in different types of facilities, including Energy Recovery Generation facilities (ERG) and energy storage facilities. Ensure that students can locate on the map at least one symbol for each type of facility, and make note of the ease or difficulty with which they locate each symbol.

Create a table with the categories of "renewable" and "non-renewable." As a class, brainstorm definitions for these terms. To guide students in understanding these terms, ask the following questions:

- What words or images do you associate with renewable versus non-renewable?
- On the map legend, what symbols and colours are used for renewable versus non-renewable energy facilities? What does this tell you? Why might the cartographer have chosen these symbols/colours?
- Are there types of energy that don't neatly fit into one of the two categories? Why might that be?

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## Subjects

- Social studies
- Geography
- Science
- Technology

## Topics

Renewable and non-renewable energy sources; energy production, transmission, and consumption; geography of Canada; geographical distribution of energy sources

## Materials

- Legends (5)
- Electricity sources cards (9)
- Energy efficiency card (1)
- **Optional:** Blank paper and writing utensils
- **Optional:** Ropes and pylons

## Learning objectives

Upon completion of the lesson students will be able to:

- Describe how electricity is produced and transported across Canada.
- Define the ways in which geography plays a role in Canada's energy production and transmission.
- List examples of advantages and disadvantages of different energy sources and production methods.
- List ways in which they can make meaningful contributions to a more sustainable future.

If students struggle to differentiate the two terms, use the following definition to aid them in their understanding:

*"Renewable energy is derived from natural processes that are replenished at a rate that is equal to or faster than the rate at which they are consumed... Renewable energy is generated from sources such as solar, wind, geothermal, hydropower and ocean resources, solid biomass, biogas, and liquid biofuels. However, biomass is a renewable resource only if its rate of consumption does not exceed its rate of regeneration."*

- Canadian Centre for Energy Information

Next, guide students through an exercise in identifying patterns and trends on the map. Use the following questions to facilitate discussion and exploration:

- What is the most common symbol on the map? What is the least common symbol on the map? Why might this be the case?
- What parts of Canada are lacking symbols or have fewer symbols? What could explain these patterns?
- Where on the map are renewable energy facilities located versus non-renewable energy facilities? Is there a relationship between the distribution of these symbols and the locations of towns/cities?
- What is the relationship between the different land cover types and the distribution of facility symbols?
- Where do electrical transmission lines appear on the map? Are there certain areas with more transmission lines than other areas?
- What relationship do you see between Indigenous communities and nearby energy facilities or transmission lines? How do these patterns differ across Canada?

## Action (50 minutes)

Break students into 10 groups and provide each group with an **Electricity sources card**. Ask students to locate a symbol on the map that represents the electricity source on their card. Invite them to sit down on the map around the symbol and read through the information on their card.

Once everyone is finished reading, have them focus on the land and water regions in the vicinity of the symbol they have located on the map. Have them consider the geography of the region, such as the topography, nearby urban areas, transportation infrastructure, land cover, and protected areas. Ask students to also locate the transmission lines that connect to their energy facility. Have students discuss the following questions in their groups:

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## Connections to the Canadian Geography Learning Framework

### Geoinquiry

- Formulate questions
- Gather and organize
- Interpret and analyze
- Evaluate and draw conclusions
- Communicate

### Geospatial skills

- Foundational elements
- Spatial representations

### Concepts of geographic thinking

- Interrelationships
- Patterns and trends

- How does geography affect the choice of the energy facility that was built here?
- How does geography affect the distribution of transmission lines?
- What are the environmental impacts of this energy facility?
  - Is this a renewable or non-renewable energy source?
  - Does this energy source emit greenhouse gases? If it does, is this a low or high greenhouse gas emitting energy source? (Consider emissions during the construction of the facility and its operation.)
  - Are there any other environmental impacts on the surrounding landscape? (Consider short and long-term impacts.)

Once students have had time to discuss their energy source in their groups, invite a member of each group to share the results of their discussion. Synthesize the class's overall understanding of the advantages and disadvantages related to the different energy types. Connect back to the earlier discussion about the patterns students observed on the map. Now that students have learned more about each energy source, ask them again to consider how geography affects the patterns of energy facilities across Canada. Possible questions to consider:

- What are the geographical limitations of various energy sources?
- Why are there more solar facilities in the south?
- Why are there more natural gas and oil facilities in Alberta and Saskatchewan?
- Why were nuclear facilities built in southern Ontario?
- Why are there not as many hydro facilities in Alberta and Saskatchewan?
- What challenges might exist in transporting energy sources or electricity generated from energy facilities? How does this vary across Canada?

### Conclusion (30 minutes)

Now that students understand the different energy sources available in Canada and the geography and challenges of transporting energy across a large country, explain that Canada is one of the highest consumers of electricity on a per capita basis (i.e., per person), and the sixth-largest producer of electricity. Brainstorm as a class reasons for why Canada consumes so much electricity and record the answers on the board. (Answers might include: energy-intensive industries; cold winters requiring lots of indoor heating or hot summers requiring air conditioning; Canada is a relatively high-income country.)

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Inform students that the Canadian government has begun transitioning to renewable energy sources such as solar and wind and exploring other energy alternatives like tidal, geothermal, biofuels, and hydrogen. Research is being conducted to better understand how Canada could adopt cost-effective technologies to reduce electricity consumption, and the energy sector is beginning to expand infrastructure and upgrade technology to provide cleaner energy.

There are many opportunities for all Canadians to contribute to Canada's commitment to a greener future (see Activity 4 on Careers in the energy sector), starting with the decisions we make about energy demand and consumption at home.

Hand out copies of the **Energy efficiency card** to students or project it onto the board. Read the information together as a class or have students read individually.

Then, create a table with each of the sectors listed on the card as a heading (Oil and gas production, transportation, buildings, heavy industry, agriculture, electricity, waste and other). As a class, have students reflect on how they can contribute to a more sustainable future and write down their ideas for each sector. They should also consider how energy production and transmission could be more efficient and what kind of energy future they envision for Canada. Provide the following questions to facilitate brainstorming of ideas:

- What can we do at home to reduce our environmental footprint?
- How can we influence change as consumers through our buying habits? How about through the food we eat?
- What changes can we make when it comes to the ways in which we get around and travel?
- Are there places in Canada where the distribution of energy facilities in relation to communities could be more efficient?
- How could transmission lines be reorganized to better meet electricity demand? Consider east to west connections and where new energy facilities could be created.

## Modifications

There are many ways in which this activity can be modified for different age groups. Here are some of our suggestions:

*Younger students:*

- Perform the activities as a class rather than in groups.
- Have students use the ropes and pylons to identify geographical areas with similar patterns, trends, or symbols.



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- Have students locate their community on the map and follow the transmission lines to see where electricity comes from to power their homes and school.

## *Older students:*

- Have students use the ropes to connect the movement of energy resources in Canada. Where does the majority of Canada's energy go? What factors might account for this distribution of energy? Which provinces and territories produce the most energy? Discuss the spatial significance of where the country's energy resources are located. How might all Canadians have equal access to affordable energy?
- Have students research the different energy profiles for Canada's provinces and territories and connect their newfound knowledge to the patterns and trends seen on the map.
- Have students debate in groups if future investment in a particular energy type is warranted and if there are opportunities to improve the production and transmission of electricity using this energy source in an effort to support a more sustainable energy mix. Encourage students to consider local examples of resource extraction sites or production facilities.

## **Extend your learning**

Once students have had a chance to interact with the Giant Floor Map, encourage them to take their learning beyond the classroom! Here are some extension activities which should allow students to take action based on their knowledge of Canada's energy sector:

- Have students calculate their carbon footprint using a calculator. Once they better understand their household's carbon footprint, they can come up with a family plan to work towards a net-zero lifestyle!
- Have students research the Net-Zero Challenge. If feasible, consider taking part in the Challenge as a class.
- Canadian Geographic recently launched the Live Net Zero program for families. Have students review the lessons learned by previous participants and brainstorm a list of activities to share with their family members.
- Have students compose letters to their local MPs enquiring about opportunities for their class to get engaged in local initiatives aimed at supporting citizens with energy reduction and green solutions.

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## Supporting resources

- Government of Canada - [Net-Zero Emissions by 2050](#)
- Canada Energy Regulator - [Market Snapshot: Why Canada is one of the world's largest electricity consumers](#)
- Government of Canada - [Sustainable Development Goal 7: Affordable and clean energy](#)
- Government of Canada - [Canada launches consultations on a Clean Electricity Standard to achieve a net-zero emissions grid by 2035](#)