

Energy Production and Transmission

Canada is rich in energy resources. It produces nine types, from fossil fuels to renewables, which travel through a network of pipelines and transmission lines that could circle the Earth more than five times. As global demand for energy increases and resources start to wane, it is vital for future generations to understand where our energy comes from and how it gets to us.

Canadian Geographic Education and the Canadian Association of Petroleum Producers have produced this giant floor map to assist Canadian students in learning Canada's energy story and to help them make informed decisions about the country's energy future.

With hundreds of energy facilities, transmission lines, shipping routes and more, this map depicts an abundance of information. Before diving into the 10 curriculum-linked activities included in the teacher's guide, we recommend that both you and your students spend some time exploring the map and the hand-held legends.

We have also included some additional readings and information to help you and your students understand Canada's energy mix. Included in the trunk are printed materials and below is a list of websites we encourage you to explore with your class.

We would love to hear how your class interacted with the map and how the lessons took shape. Please send us your feedback at info@ccge.org.

Enjoy your time with the map!

Resources

canadiangeographic.ca/energy

canadahydro.ca

canbio.ca

cansia.ca

canwea.ca

capp.ca

centreforenergy.com

cga.ca

cna.ca

coal.ca

neb-one.gc.ca

nrcan.gc.ca

pembina.org

ABOUT THIS RESOURCE

IN this binder you will find 10 curriculum-linked activities designed for all Canadian students at the elementary and secondary levels. The activities incorporate the hands-on learning resources found in the trunk, including image cards, pylons and more, to help bring Canada's energy story to life.

The activities

1. Understanding Canada's Energy Mix

This activity teaches students how to read the giant floor map by taking a closer look at its symbols, colours and labels. The students will then examine where Canada's energy is produced and how it is transmitted.

2. Water, Water, Everywhere

This activity examines the close relationship between Canada's water resources and the country's energy production and transmission. Students will explore Canada's main watersheds and how water is used in the extraction and production of energy resources.

3. The Pipeline Process

This activity looks at the roles of current pipelines and transmission lines in Canada and the challenges that come with creating new infrastructure.

4. Imports vs. Exports

This activity examines the role of energy imports and exports in Canada. Students will use their mathematical skills to predict how much energy is produced, imported and exported and consumed, and will discover the importance of energy resources to Canada.

5. Canada's Energy Story

This activity investigates how energy is produced in each province and territory. Students will create a visual explanation of the energy produced in each region and how it influences Canada as a whole.

6. Resources in Motion

This activity explores the different ways Canada's energy resources are transported across the country. Students will compare each type of transportation and determine how Canada's geographical landscape influences the movement of energy resources.

7. Picturing Energy

This activity teaches students to read latitude and longitude in order to locate energy facilities and key energy production regions in Canada.

8. On Top of the World

This activity explores Canada's North as a region rich in energy resources. Students will investigate how energy is transported to the North, the challenges faced by northern communities and how the region's energy story compares to the rest of the country.

9. Shifting the Oilsands

Students will take a look at the oilsands and their role in Canada's energy landscape. Students will predict how Canada's environment and economy would change if the oilsands were located in other parts of the country.

10. Reviewing Renewable

This lesson focuses on renewable energy sources in Canada. Students will learn the meaning of renewable energy and explore the relative amounts of greenhouse gas emissions produced by each energy source.

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APPENDICES

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Learning objectives

This activity teaches students how to read the giant floor map by taking a closer look at its symbols, colours and labels. The students will then examine where Canada's energy is produced and how it is transmitted.

Time required

20-25 minutes

Grades

K-12

Materials

- Energy icons (45)
- Arrow cards (30)
- Teacher energy information card

Set-up

Organize the energy icons by type and read over the teacher energy information card to familiarize yourself with Canada's different energy resources.

Links to Canadian National Standards for Geography

Essential element 1:

The world in Spatial Terms

- Locations of continents and oceans
- Major cities of provinces
- Provinces and territories of Canada

Essential element 2:

Places and Regions

- Concept of physical features (e.g., mountains, plains, hills, oceans and islands)
- Regional analysis of geographic issues and questions

Essential element 4:

Human Systems

- Transportation (people and goods) and communication networks
- Types of economic activity (resources, manufacturing, service)
- Regional development in Canada and the world

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Introduction

Introduce students to the map and allow them time to explore it. Ask what the five main components of a map are: title, border, compass, legend and scale. Have students locate each component on the giant floor map. Teach students how to read the map in further detail by examining its different colours. Ask them to identify the colours of the land and water first.

Next, bring students' attention to the colours that depict energy on the map. Ask them to explore what each colour and line represents. Finally, using the legends, have students look at the energy symbols on the map. What symbol is used for oil sands mining? Where are the hydro facilities?

Explain that there are many ways to produce energy in Canada. It can be produced using crude oil, natural gas, water, wind, coal, uranium, biomass and solar resources. Using the percentages provided on the teacher energy information card, inform your students about how much energy is produced by each type. Are your students surprised by these percentages? Do these percentages match the dominant colours on the map (red, purple and blue transmission lines)?

Development

Using the teacher energy information card, define energy terms and provide facts for your students. Then, have them place the arrow cards on the map to show the direction of flow of energy resources based on the additional information, such as the poster map, included in the trunk. Highlight how some energy sources, like natural gas and crude oil, are first transported to production facilities. Energy from wind, nuclear and hydro sources does not need to be processed in this way.

For younger students, do this as a class. For older students, divide the class into groups, assign each a different type of energy and have them determine the direction of energy flow. Lead a discussion about where the majority of our energy resources go. Ask your class what they notice about the directions of flow (e.g., oil flowing south, electricity flowing south) and if this is what they expected.

Conclusion

Using the teacher energy information card, inform your students about the different types of energy produced in Canada, corresponding to the energy icons provided in the trunk (what they are, how we use them, how we transport them and how we depend on them). Lead a discussion asking: What is energy? How does the geography of Canada influence how energy is produced and transmitted?

In groups (divide students up if you have not already done so), have students explore the map and use the energy icons to identify areas where production of that type of energy is highest. Ask them to identify the province/territory, major cities/towns and the type of landforms in that region. Allow each group to present their findings to the rest of the class and conclude with a discussion about the energy mix in Canada. Ask your students to discuss their own energy consumption. How is your town and the surrounding area influenced by energy (use, production, transmission)?





Extend your geographic thinking

Locate your town or city on the map. Are there any production facilities nearby? What about in your province or territory? Have students compare energy production by type in each province and territory and try to find relationships between these energy types and geographic features.

Essential element 5: Environment and Society

- Introduction of resources
- Human modification of the physical environment (e.g., construction of dams, strip mining, draining wetlands)
- Effects of human modification of the physical environment (e.g., global warming, deforestation, desertification, urbanization)



Learning objectives

This activity examines the close relationship between Canada's water resources and the production and transmission of energy. Students will explore Canada's main watersheds and how water is used in the extraction and production of energy resources.

Time required

30-40 minutes

Grades

4-12

Materials

- Coloured pylons (4 colours)
- Coloured chains (4 colours)
- Watershed information cards (4)
- Arrow cards (30)
- Water energy information cards (4)

Set-up

Place coloured chains, pylons and arrow cards on the border of the map. Familiarize yourself with Canada's watersheds by visiting canadiangeographic.ca/watersheds.

Links to Canadian National Standards for Geography

Essential element 1:

The World in Spatial Terms

- Location of major human and physical features on Earth
- Map, globe and atlas use (e.g., observing and analyzing relationships)

Essential element 2:

Places and Regions

- Physical and human characteristics of places and regions in Canada and the world

Essential element 5:

Environment and Society

- Renewable (land, forests, water) and non-renewable (minerals, fossil fuels) resources
- Environmental issues (e.g., water supply, air quality, solid waste)
- Watershed management
- Use and sustainability of resources

Introduction

After students have had a chance to explore the map independently, ask them to stand on it. Ask them to locate the three oceans, five great lakes, rivers and other large bodies of water. For those not standing on water, ask them to raise their hand and locate the closest body of water to them. Note that no matter where you are in Canada, there is water nearby.

Discuss the role that fresh water plays in Canada and explain that our country has 20% of the world's fresh water resources (canadiangeographic.ca/watersheds). Next discuss how Canadians use water in our daily lives. Explain that water also plays an important role in the production and transmission of energy in Canada.

Development

Divide your class into four groups, each representing a main watershed in Canada (Arctic Ocean, Pacific Ocean, Hudson Bay and Atlantic Ocean). Give each group a watershed information card and direct them to outline their watershed on the giant floor map using a coloured chain. Have students read the information out loud and locate the main river within their watershed using another chain or pylon. Then ask them to look at the physical landscape of their watershed and use an arrow card to guess which way the water flows. Explain that all water in a watershed flows in the same direction and is influenced by surrounding mountains, hills and valleys.

Point out the small part of southern Saskatchewan that is not included in the four outlined watersheds. Explain that there is one more major watershed — the Gulf of Mexico watershed — that covers this area. This is a very large watershed that drains into the Gulf of Mexico, over 2,750 kilometres farther south; the Mississippi River is its primary route.

While each group is standing inside their watershed, connect this water with the energy story on the map. Ask your students to discuss how each watershed is connected to the various types of energy produced in Canada. Ensure that students discover the most common type of energy produced in their watershed and think about what issues may arise in that area when energy production expands/develops. Ask all groups to share their answers with the class.

Conclusion

Using the water energy information cards, have each group investigate four different ways water is used to produce and transmit energy (oil and gas, tidal power, hydroelectricity and nuclear power). Instruct students to use the coloured pylons to locate their type of energy on the map. When they are finished, invite each group to present their information to the class, defining their type of energy, explaining how water is used to produce it and describing the places they have highlighted on the map.

Examine the role that water plays in the transmission of energy. Explain that water is also used to transport energy across Canada and around the world. Ask students which types of energy can be transported (natural gas, crude oil, coal, uranium for nuclear power) over



2 WATER, WATER, EVERYWHERE

water. Have students stand on the purple dotted lines in the Atlantic Ocean. What do these lines represent? Explain that the oil used in Eastern Canada is imported from other countries by ship. Additionally, diesel is shipped to Canada's territories through northern ports. The ships used to transport oil are called oil tankers and can carry up to 500 tonnes of oil in one shipment — about the weight of 115 elephants. Ask students about the benefits and drawbacks of shipping energy resources over water.

Finally, highlight Canada's offshore oil platforms on the East Coast. Describe how large deposits of oil and natural gas deposits are found deep below the ocean floor, and that massive offshore oil platforms drill deep to extract these resources. Canada has three major offshore projects producing over 300,000 barrels of oil per day: Hibernia, Terra Nova and White Rose (CAPP).

Conclude your lesson by connecting how Canadians use water directly and indirectly every day. When we take a shower, we use water directly, but when we turn on our lights and drive a car, we use water indirectly.

Extend your geographic thinking

After completing this activity, help your students discover your local watershed by using *Canadian Geographic's* online interactive map (canadiangeographic.ca/watersheds). Explore the energy resources that exist within your watershed and how they can affect the watershed.

**Learning objectives**

This activity looks at the roles of current pipelines and transmission lines in Canada and the challenges that come with creating new infrastructure.

Time required

30 minutes

Grades

4-12

Materials

- Coloured chains (4 colours)
- Coloured pylons (4 colours)
- Pipeline rule cards (4)
- Arrow cards (30)
- Energy icons (45)

Set-up

Place a coloured chain and pylon as well as a rule card on each corner of the map.

Links to Canadian National Standards for Geography**Essential element 1:****The World in Spatial Terms**

- Location of major human and physical features on Earth
- Physical/political maps of the province, Canada and the world

Essential element 2:**Places and Regions**

- Physical and human characteristics of places and regions
- How culture affects places and regions (e.g., cultural landscapes)

Essential element 4:**Human Systems**

- Development of transportation and communication networks
- Types and patterns of economic activity (primary, secondary, tertiary, quaternary)

Essential element 5:**Environment and Society**

- Renewable (land, forests, water) and non-renewable (minerals, fossil fuels) resources

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Introduction

Once students have had an opportunity to explore the map on their own, ask them to locate either a pipeline or an electrical transmission line and stand on it.

Ask each student to determine the type of pipeline/transmission line and its start and end points. Give an arrow card to each student and ask them to determine the direction in which the energy flows through the pipeline/electrical transmission line. Note that some pipelines and transmission lines flow towards production facilities and some flow away.

Explain to your students that pipelines and electrical transmission lines are a convenient way of transporting large volumes of oil, natural gas and electricity over long distances.

Discuss the benefits and drawbacks of Canada's energy infrastructure:

- *What story do pipelines and electrical transmission lines tell us about Canada's energy?*
- *Where are most of Canada's pipelines/electrical transmission lines located?*
- *Why are there very few pipelines/electrical transmission lines in the North?*
- *How are the East and West different?*

Challenge your students to calculate the length of the pipeline/transmission line on which they are standing. Have younger students use their feet as counters and encourage older students to use the scale found in each corner of the map to roughly calculate its length.

Development

Bring your class's attention to the dotted lines connected with pipelines on the map. Explain that these dotted lines show proposed pipelines and define what that means (pipelines that have not yet been approved).

Trace over some proposed pipelines using the chains provided in the trunk. What kind of energy resources would they transport? In which direction would it flow?

Designing and building pipelines is a long and complicated process. Factors such as landscape, environmental impact, national/international laws and regulations and many others determine where a pipeline can and cannot go.

Divide your students into four groups, one for each corner of the map, and give them a pipeline rule card. Explain that each group is going to propose the location of a new pipeline. Students are to use the chains provided in the trunk to highlight it on the map.

They must follow the rules on the card and pay close attention to the physical geography of the area they choose. Explain that pipelines usually start on or near a resource deposit such as an oil or natural gas field. Have students place pylons on the start and end point of their pipeline.





Conclusion

When all groups have mapped their proposed pipeline, allow each to share their proposal with the rest of the class. After each presentation, the other students can act as the governing body and question the group using the regulations found on the rule cards as a guide. Vote as a class to approve or decline each proposal. How many pipelines did your class approve? What factored into their decision-making process?

Extend your geographic thinking

Research existing and proposed pipelines and electrical transmission lines in your local area. What kind of newspaper articles can you find about pipelines/electrical transmission lines in Canada? What messages do these stories convey?

- World patterns of resource distribution and utilization
- Impacts of technological hazards/disasters on the physical environment

Essential element 6: The Uses of Geography

- Role of multiple points of view in contemporary geographic policies and issues



Learning objectives

This activity examines the role of energy imports and exports in Canada. Students will use their mathematical skills to predict how much oil, electricity, coal and natural gas is produced, imported and exported and consumed, and will discover the importance of energy resources to Canada.

Time required

30-40 minutes

Grades

4-12

Materials

- Energy icons (45)
- Arrow cards (30)
- Stacking blocks (100)
- Country flag cards (6)
- Student number cards (4)
- Teacher guide card (1)

Set-up

Ensure that all materials are present.

Links to Canadian National Standards for Geography

Essential element 2:

Places and Regions

- Physical and human characteristics of places and regions
- Factors that influence people's perception of places and regions

Essential element 4:

Human Systems

- Types of economic activity (resources, manufacturing, service)
- Development of transportation and communication networks
- Global economic interdependence (e.g., regional specialization, trade, transnationalism, multinationals)

Essential element 5:

Environment and Society

- Renewable (land, forests, water) and non-renewable (minerals, fossil fuels) resources
- World patterns of resource distribution and utilization
- Use and sustainability of resources

Introduction

When students have had an opportunity to explore the map on their own, divide them into four groups. Ask each group to think about things that they do every day that require energy, and about how that energy is produced. Have your class share their ideas.

Explain to students that we use energy produced from natural resources every day. Cooking, watching TV and travelling all require energy. Depending on where you are in the country, your power comes from different sources, some from Canada and some from other countries. Energy plays a pivotal role in our lives and will continue to do so in the future as global demands are expected to increase by 35% by 2035 (International Energy Agency).

Development

Review the terms “import” and “export” with your class. Explain that Canada imports and exports many different energy resources, such as oil, natural gas, electricity and coal, and that exporting our resources to other countries helps Canada's economy. In 2012, the dollar value on Canada's oil exports to the United States was \$73.7 billion dollars. Place the American flag card somewhere in the United States.

Assign an energy resource (electricity, coal, oil or natural gas) to each group and ask them to place their arrow card on an area of the map where Canada is exporting that energy resource and show the direction of flow. **Note:** Some of Canada's imported and exported coal is used to generate electricity, while some is metallurgical (used to create steel).

Divide the counting blocks among the four groups and give each group a number card. Have your students estimate and show with blocks how much of their natural resource is exported from Canada each day. Ensure that all students understand how much energy is represented by one block. Allow all groups to share their answers.

Next, your class can look at how much of their resource is imported to Canada each day. Ask them to show this with the blocks, using the scales outlined on their cards.

Conclusion

Ask your students what similarities and differences they notice between their two piles of blocks. Explain that although Canada is rich in natural resources, some energy resources are still imported. Looking at the transmission lines on the map, can students estimate why Canada must import so many resources? Do they see any gaps in the transmission lines?

Have students explore the map and place their arrow cards on locations where they think resources are imported into Canada. Encourage students to look at the country flag cards and discuss where Canada's energy is imported from and exported to. Discuss whether they think it could ever be possible for Canada to stop importing/exporting. Use the prompts on your teacher guide card to direct this discussion.



4 IMPORTS VS. EXPORTS



Extend your geographic thinking

Explain to your class that 33,476,688 people were counted in the Canadian 2011 census (Statistics Canada). Ask students to use blocks to show how many people they think have jobs in the oil and gas industry, if one block represents 100,000 people.

After students have shared their estimates, explain that more than 550,000 Canadians have jobs related to the oil and gas industry. How many blocks would that be (five to six blocks)? Instruct your students to look at the map and estimate where they think most oil and gas jobs are located. Have them do the same for all other types of energy.



**Learning objectives**

This activity investigates how energy is produced in each province and territory. Students will create a visual explanation of the energy produced in each region and how it influences Canada as a whole.

Time required

30-40 minutes

Grades

7-12

Materials

- Provincial/territorial flags (14)
- Province/territory information cards (13)
- Coloured stacking blocks (100)
- Energy icons (45)
- Coloured chains (4)
- Coloured pylons (4)
- Arrow cards (30)

Set-up

Place one energy icon, one arrow card and coloured stacking blocks on each province/territory information card and set them near the map's black and red border.

Links to Canadian National Standards for Geography**Essential element 1:****The World in Spatial Terms**

- Provinces and territories of Canada
- Major cities of the provinces, Canada and the world

Essential element 2:**Places and Regions**

- Physical and human characteristics of places and regions in Canada and the world

Essential element 4:**Human Systems**

- Population characteristics of the province and Canada (e.g., density, distribution, growth rates)
- Types of economic activity (resources, manufacturing, service)

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Introduction

Once students have had an opportunity to explore the giant floor map on their own, test their geographical knowledge by having them place each provincial/territorial flag card on its respective capital city. Connect each capital city with the story of Canada's energy production and transmission on the map by asking if they play an important role in the energy mix. Ask students if they see any connection between energy resources and the development of large cities.

Development

Explain to students that each province and territory has different energy needs.

Divide the class into 13 groups and ask each to choose a province/territory information card and a pile of props. Using these props, have each group explain the relationship between their province/territory and energy, as described on the information card. They should use the blocks to show the percentage or amount of energy found in their province/territory and use the arrow card to show in which direction energy resources move. Finally, ask students to present their province/territory's energy story in an engaging and entertaining way to the class.

Conclusion

When all students have presented, discuss the differences and similarities of each province and territory's energy story. Read each phrase below to the class and have the groups raise their flag card when a phrase is true of their province or territory.

- Natural gas is produced here.
- Crude oil is produced here.
- Nuclear energy is produced here.
- Biomass is produced here.
- Tidal power is produced here.
- Hydroelectricity is produced here.
- Wind energy is produced here.
- Coal is used to generate electricity here.
- The oilsands are found here.
- Offshore oil extraction is found here.
- A major energy production facility is found here.
- Many energy resources are exported from here.
- More energy resources are imported than produced here.
- This area is resource rich but does not have many production facilities.





Extend your geographic thinking

Use the chains to connect the movement of energy resources in Canada.

- *Where does the majority of Canada's energy go?*
- *Which provinces/territories produce the most energy?*

Discuss where the country's energy resources are located.

Show students the two maps from the “On Top of the World” activity highlighting oil and natural gas deposits. Explain that there are many oil and gas fields located all across Canada and more are discovered every day. Explain that this map shows primarily where our energy is produced and transmitted, not where every resource exists.

- Types and patterns of human settlement (from villages to megacities)
- Regional development in Canada and the world
- Economic development by world regions, countries and regions within countries

Essential element 5: Environment and Society

- Renewable (land, forests, water) and non-renewable (minerals, fossil fuels) resources
- Use and sustainability of resources



Learning objectives

This activity explores the different ways Canada's energy resources are transported across the country. Students will compare each type of transportation and determine how Canada's geographical landscape influences the movement of energy resources.

Time required

30 minutes

Grades

K-12

Materials

- Energy icons (45)
- Coloured chains (4)
- Transportation image cards (25)
- Transportation fact cards (10)
- Teacher answer card (1)

Set-up

Lay the transportation fact cards along the map's border.

Links to Canadian National Standards for Geography

Essential element 2:

Places and Regions

- Perceptions of places and regions
- Changes in places and regions over time

Essential element 4:

Human Systems

- Transportation networks in daily life
- Transportation (people and goods) and communication networks
- Transportation and communications networks in Canada and the world

Essential element 5:

Environment and Society

- How human activities change Earth (e.g., agriculture, transportation, industry)

Essential element 6:

The Uses of Geography

- Role of multiple points of view in contemporary geographic politics and issues

Introduction

Once students have had an opportunity to explore the map, ask them to stand on an energy symbol. Ask students to count the number of different energy types. Have them place energy icons on spots where they see many of the same symbols or a cluster of different symbols.

Ask students which energy resources need to be transported to facilities in order to be processed into usable materials. For energy resources that require transportation from the source to a processing facility, ask students how these resources are transported. Have them think about how location plays a role in determining which transportation methods are used.

Development

Ask students if they know how resources were transported in the past and how that has changed. Be sure to focus on how energy demands have changed over the past several decades.

Divide your students into five groups and distribute one set of transportation image cards to each group. As the students explore the map, have them use the legend to locate their group's mode of transportation and then place their cards in the appropriate locations on the map.

Next, ask each group to choose a transportation route on the map – matching their group's mode of transportation – that they feel plays an important role in transmitting Canada's energy sources.

- *Why did they choose this route?*
- *Where is it located?*
- *Are any other modes of transportation used in the same area?*

Discuss trends as a class, and help the students decide which mode is the most common by looking at how each is depicted on the map. Ask for your students' opinions about which mode is the most cost effective, environmentally friendly and covers the most distance.

Make sure that they explain their reasoning.

Conclusion

Bring attention to the fact cards placed around the map's border. There are two fact cards for each mode of transportation examined in class. As a class, work to match these fact cards to the various modes of transportation, and encourage students to explain their reasoning. Use the teacher answer card to confirm that the cards have been matched correctly.

Extend your geographic thinking

Lead a class discussion about how resources might be transported in the future. Which modes will become more or less common?





Learning objectives

This activity teaches students to read latitude and longitude in order to locate energy facilities and key energy production regions in Canada.

Time required

30 minutes

Grades

K-12

Materials

- Provincial/territorial flags (14)
- Image cards (40)
- Chains (4)

Set-up

Disperse the image cards around the perimeter of the map.

Links to Canadian National Standards for Geography

Essential element 1:

The World in Spatial Terms

- Personal directions (e.g., left/right, up/down, front/back)
- Latitude, longitude and the global grid
- Map types (e.g., topographic, navigational, thematic)
- Map projections (e.g., size, shape, distance and direction)

Essential element 2:

Places and Regions

- Factors that influence people's perceptions of places and regions
- Regional analysis of geographic issues and questions

Essential element 3:

Physical Systems

- Basic components of Earth's physical systems (e.g., landforms, water and weather)

Essential element 4:

Human Systems

- Patterns of land use and economic activity in the community (e.g., agriculture, industrial, commercial, residential, educational, recreational)
- Human settlement patterns and land use
- Regional development in Canada and the world

Introduction

Quickly review the five essential components of a map and how to use a legend (see the lesson, “Understanding Canada’s Energy Mix,” for detailed instructions). Ask students if everything they see on the map physically exists in real life. Point out the white lines of latitude and longitude on the map and explain that although they appear on the map, you cannot actually see them in real life.

The horizontal lines on the map are lines of **latitude**, also known as “parallels”; they measure north and south positions between the Earth’s poles. To show that these lines never touch, choose three volunteers from your class and ask each of them to follow one line of latitude.

Lines of **longitude** run vertically on the map. Explain that these imaginary lines measure degrees east and west, meet at the poles and are farthest apart at the equator. Again, choose three volunteers from your class and ask each to follow a line of longitude starting at the northernmost point on the map. Have them describe what is happening as they move south toward the equator. Together, lines of latitude and longitude help us find the exact location of places and objects on the Earth.

Test your students’ new understanding by asking them to find the latitudinal/longitudinal coordinates of:

- Their hometown
- The capital of Canada (place the Canadian flag card here once the coordinates have been found)
- The capital cities of each province and territory (have students mark them with the correct provincial/territorial flag card)

Development

Ask your students to read out the coordinates on the back of the image cards and place them, image side up, in their correct locations on the map. When all cards have been placed on the map, walk around the perimeter and look at all of the images. Lead a class discussion about Canada’s energy mix based on what they see in these cards. Ask what your students have learned about Canada from these images. Why are there more images in one province/territory than others? Do they feel that any images are missing?

Conclusion

Connect Canada’s landform regions to the images on the map. Using the chains provided in the trunk, have students find Canada’s different landform regions (Cordillera, Interior Plains, Canadian Shield, Great Lakes–St. Lawrence Lowlands, Appalachian, Arctic Lands). How can we connect these landforms to the images we see on the map?

Extend your geographic thinking

Have students clear the cards off the map and ask them to stand on areas of Canada that are highly populated. How did they know that these are highly populated areas? Then have students stand on mountainous regions. How were they able to identify these regions? Finally, test your students by asking them what kind of map they are standing on (they could answer either “a thematic map” or “a physical map”). How would this map be different if it were a political map? A road map? A climate map? How would the energy story change?





Learning objectives

This activity explores Canada's North as a region rich in energy resources. Students will investigate how energy is transported to the North, the challenges faced by northern communities and how the region compares to the rest of the country.

Time required

25-30 minutes

Grades

4-12

Materials

- Coloured chains (4)
- Coloured pylons (4)
- Natural gas fields map (1)
- Oilfields map (1)
- Potential hydro power map (1)
- Potential wind power map (1)

Set-up

Place the map cards, along with chains and pylons, on four different corners of the map.

Links to Canadian National Standards for Geography

Essential element 1:

The world in Spatial Terms

- Latitude, longitude and the grid of the world
- Map, globe and atlas use (e.g., observing and analyzing relationships)

Essential element 2:

Places and Regions

- Perceptions of places and regions
- Regions defined by multiple criteria
- How culture affects places and regions (e.g., cultural landscapes)
- Interdependence of places and regions

Essential element 3:

Physical systems

- Climate types
- Ecozones (major ecological communities such as boreal forest, polar regions, grassland, wetlands and desert)

Essential element 4:

.../continued

Introduction

Once students have had an opportunity to explore the giant floor map on their own, challenge them to locate and stand on the southern border of the territories. Facing north, have a class discussion about what life is like in Canada's territories. Talk about what they see on the map in terms of energy transmission lines. Since there is little energy infrastructure in the North, ask students how they think energy resources get there.

Next, point out the purple dotted lines in the Arctic Ocean. Without using the legend, ask students what they think these lines represent. Explain that the purple dotted lines in the Atlantic Ocean illustrate shipping routes. Energy resources, such as oil and gas, are brought into Canada's North by ship because large production facilities do not exist. Ask students where these energy resources are shipped from.

Discuss what may have inhibited the development of more energy infrastructure in the North. Explain that although most of Canada's northern regions have their energy resources brought in, Canada's North is filled with pockets of oil, natural gas fields, water and wind resources. Ask your students why energy resources are mostly brought in when the region has the same resources. Why is resource extraction and transmission so difficult in the North?

Development

To show the oil and gas fields in Canada's North, divide your class into four groups. Have each group refer to their map card and use the chains and pylons provided in the trunk to map out where those resources, as well as water and wind resources, are located in the country's northern and southern regions.

Ask students to compare their energy resources in the territories to those in the provinces.

- *What are some similarities and differences?*
- *How many transmission lines are located in each region?*
- *How many production facilities?*
- *Where is it easier to extract/harness resources?*
- *How are those resources extracted/harnessed?*

Conclusion

Explain to your students that more resources are being extracted/harnessed in the North each year. New technologies are being developed, new facilities are being built and entire communities are being expanded due to energy development. Ask each group to think of two pros and two cons for the expansion of energy resource production in the North and share them with the class. Make sure that they consider politics, environment, technology, culture, economy, international relations and future demands. Allow each group to share their views with the class.

Look at energy resources other than oil, gas, water and wind in Canada's northern region and use energy icons to mark them on the map. How successful are solar, nuclear, biomass and coal in Canada's North? What is their potential?





Extend your geographic thinking

Have your class do a case study on Inuvik, located in the Mackenzie Delta in the Northwest Territories.

For years this small community relied on the local natural gas reserve for up to 90% of its electricity and heating. Today, however, the reserve is almost depleted. There are still large natural gas fields below the surface, as indicated by the pylons and chains that the students placed on the map. Discuss why this community is not currently drawing on a new reserve.

The answer is related to the Mackenzie Valley pipeline, a proposed pipeline designed to tap into northern natural gas reserves and transport it to communities in the North and then south. In 2012, however, this pipeline was put on hold. Check out canadiangeographic.ca/energy for more information.

Share Inuvik's situation with your class and have them conduct a case study (using either internet research or past newspaper clippings) about this community. Ask:

- *What problems are facing Inuvik?*
- *What are some possible solutions?*
- *What concerns have been voiced by members of the community?*
- *Why was the Mackenzie Valley pipeline put on hold?*
- *Could Inuvik be powered using another energy resource?*

Human Systems

- Processes of cultural diffusion
- Patterns of culture in Canada and the world (e.g., religion, language, ethnicity, economy)
- Types and patterns of economic activity (primary, secondary, tertiary, quaternary)

Essential element 5: Environment and Society

- Renewable (land, forests, water) and non-renewable (minerals, fossil fuels) resources
- World patterns of resource distribution and utilization
- Use and sustainability of resources

**Learning objectives**

Students will take a look at the oilsands and their role in Canada's energy landscape. Students will predict how Canada's environment and economy would change if the oilsands were located in another part of the country.

Time required

30 minutes

Grades

7-12

Materials

- Coloured chains (4)
- Oilsands information card (1)
- Oilsands maps (4)

Set-up

Place one coloured chain and one oilsands map on each corner of the map.

Links to Canadian National Standards for Geography**Essential element 1:****The world in Spatial Terms**

- Map projection (e.g., size, shape, distance and direction)
- Location/allocation situations (e.g., the best location for a fast food outlet and the extent of its market area; the best location for a hospital and the area it serves)

Essential element 2:**Places and Regions**

- Physical and human characteristics of places and regions in Canada and the world
- Concepts of formal, functional and perceptual regions
- The importance of places and regions to individual and social identity

Essential element 3:**Physical Systems**

- Physical processes shape patterns in the physical environment

Essential element 4:**Human Systems**

- Economic development by world regions, countries and regions within countries

.../continued

Introduction

Once students have had an opportunity to explore the giant floor map, bring their attention to the province of Alberta. What do they see in Alberta and how does this differ from other provinces/territories? What does this tell us about energy production and transmission in Canada?

Referring to the oilsands information card, use the red chain to outline the general areas of the oilsands as a class. Have students sit in a circle around the area and discuss what the oilsands are, using the information on the back of the card. Discuss the positive and negative perceptions of the oilsands. Ask your students to guess the size of the oilsands and then calculate the area using hands or the scale on the map.

Development

Divide your students into four groups and instruct each to sit on a different corner of the map. Using the coloured chain and the oilsands map, have each group outline the general area of the new location of the oilsands on the giant floor map.

Conclusion

After all groups have outlined the new oilsands locations, ask them to decide how the oil will be extracted and transported, and to think about how local communities will change. When all groups have presented, ask how Canada could change economically, environmentally, culturally and politically. Have students refer to the questions on the back of the map card to organize their answers. As a class, decide where you think the oilsands would be most beneficial for Canada and why.

Extend your geographic thinking

Explore how different Canada would be if the oilsands did not exist. How would our economy change? Do you think that our relationships with other countries would change if we didn't have this resource? What impact would this have on the environment?

9 SHIFTING THE OILSANDS



**Essential element 5:
Environment and Society**

- Effects of human modification of the physical environment (e.g., global warming, deforestation, desertification, urbanization)
- Limits and opportunities of the physical environment for human activities





Learning objectives

This lesson focuses on renewable energy sources in Canada. Students will learn the meaning of renewable energy and explore the relative amounts of greenhouse gas emissions produced by each energy source.

Time required

30-40 minutes

Grades

4-12

Materials

- Energy icon cards (45)
- GHG emissions teacher card (1)
- Province/territory flag cards (14)
- Number cards (11)

Set-up

Divide the energy icons into four sets, each containing one icon for each type of energy produced in Canada. Read over your GHG emissions teacher card and the lesson plan and ensure that your students are comfortable with the content level.

Adjust to fit grade level.

Links to Canadian National Standards for Geography

Essential element 1:

The World in Spatial Terms

- Provinces and territories of Canada
- Distribution of major human and physical features at country and global scales

Essential element 2:

Places and Regions

- Physical and human characteristics of places and regions within the province and Canada

Essential element 5:

Environment and Society

- Renewable (land, forests, water) and non-renewable (minerals, fossil fuels) resources
- World patterns of resource distribution and utilization
- Changes in the importance of energy resources

.../continued

Introduction

Once students have had an opportunity to explore the giant floor map independently, give each an energy icon. Have students search the map and stand on a symbol that matches their energy icon. Ask students to identify their location in Canada. Can they name the province/territory and city/town? Can they determine how far it is from their hometown? Direct students to find another place in Canada that has the same symbol. Explain that Canada is rich in energy resources.

Ask students to explore the map and stand on a symbol that they believe is a renewable energy source. Ask them to identify the type of energy and the area in which they are standing. Ask students what the term “renewable” means.

Renewable energy is also commonly referred to as green or sustainable energy. Renewable energy uses natural resources that are continuously replenished by the Earth. Explain to your students that because these resources are continuously replenished, renewable energy is more sustainable, meaning that it can be used for a very long time with minimal long-term effects on the environment.

Ask students which types of energy they feel are the most sustainable. Show the energy icons for each renewable energy source: wind, hydro, biomass, solar and geothermal. Ask students to estimate how much of Canada’s total energy production comes from these sources based on the number of facilities they see on the map. Explain that, in total, only about 10% of Canada’s primary energy production comes from renewable sources. But, hydro alone accounts for 62% of the country’s electricity production. Highlight biomass, geothermal and solar energy and explain why they do not play a major role on this map. Explain that these forms of energy make up less than 1% of the total energy produced in Canada. They are labelled on the map because they are forms of energy that help us generate heat and electricity.

Development

Ask students about the term “greenhouse gas.” Have they heard of this term? Can they define it? Explain that invisible gases, called greenhouse gases or GHGs, such as Carbon Dioxide (CO₂), Methane (CH₄), Nitrous oxide (N₂O) and many others enter our atmosphere due to different activities, such as the burning of fossil fuels. GHGs have been linked with climate change and, as a result, Canada and other countries are actively working to reduce their GHG emissions. Ask students if they know of ways to reduce GHG emissions.

Bring attention back to the map. Explain that Canada produces a lot of energy, for itself and other countries, and because of this, GHGs are emitted into the air each year. Globally, Canada produces about 2% of all GHG emissions, however, it is the third largest producer of GHG emissions per capita. Using the GHG emissions teacher card, discuss the emissions of each country and how students feel about Canada’s level of emissions.

Divide students into four groups and give each group a pile of energy icon cards (each pile representing one type of energy produced in Canada). Ask the groups to brainstorm about the positive and negative aspects of their type of energy and share their ideas with the class.





After all groups have presented, have students rank each sector from most renewable to least. Allow each group to share their ideas with the class and use the teacher card to assist students. After discussing different energy types and how renewable each type is, ask students if any type of energy produced in Canada can be 100% renewable. Explain that this is a complicated question and there is no right or wrong answer. Most people however, believe that no energy source is 100% sustainable.

Conclusion

Challenge your students' knowledge of provincial/territorial flags. Have them work as a class and place the correct flag on the proper provincial/territorial capital.

Place the Canadian flag on Ottawa, Canada's capital. Next, have 11 students stand up and receive a number card. Explain that the numbers represent the percentage of GHG emissions that each province is responsible for, with one number representing all three territories. As a class, predict which provinces/territories match the numbers and place the cards beside the corresponding flags.

Use the GHG emissions teacher card to ensure that students choose the right number. Compare the results to the diagram on the back of your pie chart card and discuss what may account for the differences between Canada and the United States.

Extend your geographic thinking

Research the potential for renewable energy in your community.

- *Are there any green buildings in your area?*
- *How does your community support sustainable energy?*
- *Is there a place within your community that would be ideal for a new renewable energy production facility such as a wind or solar farm?*
- *Are there other ways to implement renewable energy in your community?*

- Environment issues (e.g., air pollution, water pollution and solid waste, including hazardous and toxic materials)
- Use and sustainability of resources

Essential element 6: The Uses of Geography

- Role of multiple points of view in contemporary geographic policies and issues
- Local, regional and world politics and issues
- Local, regional and world policies and problems with spatial dimensions