



LEARNING INQUIRIES

FOSSIL FUELS: CREATION, PRODUCTION AND RECLAMATION

TIME: 90 - 120 MINUTES

DEVELOPED BY: CANADIAN ASSOCIATION OF PETROLEUM PRODUCERS (CAPP)
AND CANADIAN GEOGRAPHIC EDUCATION



OVERVIEW/FOCUS QUESTION

In this lesson, students will be introduced to the term “fossil fuels.” Students will learn and explore how and where fossil fuels are found and produced, and how they are transported across the country. Students will gain an understanding of the ways in which Canada’s oil, natural gas, and coal companies are taking steps to manage the impacts of producing energy and how lands are reclaimed once production ends.

SUBJECT/TOPIC

FOSSIL FUELS

GRADE LEVEL

GRADES 1 - 6

LEARNING GOALS

- Students will learn about the history of fossil fuels, including the time period when fossil fuels were formed and where they are located.
- Students will learn about different types of fossil fuels and what they are used for.
- Students will be able to identify where fossil fuels are found across Canada.
- Students will be able to define and describe the term “reclamation” with reference to fossil fuel production.

MATERIALS NEEDED

- Package of handouts
- A pencil or pen
- Colouring pencils or markers
- Projector or a way to watch a video

CONNECTION TO THE CANADIAN GEOGRAPHY FRAMEWORK

CONCEPTS OF GEOGRAPHIC THINKING

- Spatial significance
- Geographic perspective

INQUIRY PROCESS

- Ask geographic questions
- Communicate
- Reflect and respond

GEOSPATIAL SKILLS

- Spatial representations

LESSON DESCRIPTION

MINDS ON

Students will be introduced to fossil fuels and learn the history of where they came from and how they were formed. Students will explore what the Earth was like millions of years ago to understand how we have fossil fuels today.

ACTION

Students will explore fossil fuels in the present day, including what fossil fuels are used for, how fossil fuels are moved and where different fossil fuels come from across Canada. Students will complete activities to further their learning.

CONCLUSION

Students will think about how it is important to balance energy production with taking care of the land and will discuss some of the conservation and reclamation requirements for responsible energy operations.

LESSON IMPLEMENTATION

MINDS ON

Start the lesson by writing the word “fossil” on the board, and ask students if they can tell you what a fossil is, taking note of keywords or phrases on the board. Discuss with your students that fossils are the remains of creatures that lived millions of years ago. Fossils are made up of organic materials (stop and check for understanding: organic material comes from plants and animals that were once alive) that were buried beneath layers of rock. Next, write the word “fuel” beside “fossil” and do the same thing by asking students what fuel is. Explain that fuel is a source of energy. Ask students what happens when you put the words together (fossil fuel = energy that comes from organic materials).

Explain that the oil and natural gas we use today began as plants and animals living in the ocean millions of years ago. When these plants and animals were alive, they absorbed energy from the sun, which was stored as carbon in their bodies. When the plants and animals died, they sank to the bottom of the sea. Over millions of years, the plants and animals were covered by many layers of rock, sand and dirt.

When bits of rock break into tiny pieces, it forms sediment, which is what fossils are trapped under. As new layers of sediment are added, the rocks become compacted and build pressure that mixes with the heat from the Earth, causing the organic matter to change into fossil fuel.

After several ice ages, some of the ancient oceans were covered up by land. Buried deep in what was once the ocean floor, the trapped fossils can be found and extracted. By using modern machines, we can drill deep into the Earth’s surface and find oil and natural gas that were formed millions of years ago. These machines can pump oil and natural gas to the surface, which are then used to make gasoline, jet fuel and other products.

Coal was formed millions of years ago when the Earth was covered with large, swampy forests. The plants in the forests died and sank to the bottom of the swamp. This created thick layers of dead plants that were compacted by water and dirt. With pressure and heat from the Earth, peat was formed, which turned into coal. When coal is burned, it can provide heat and energy.

Give students 15-20 minutes to complete [Activities 1-3](#), which will introduce them to some of the ideas discussed further in the lesson plan.

ACTION

Gather students' attention and explain that after drilling, oil is pumped to the surface and moved by pipelines to a refinery, where it is turned into products we can use. The oil is turned into gasoline to use in cars and trucks and turned into jet fuel to use in airplanes. Some of the oil is used in asphalt for the construction of buildings and roads. Some oil is used to heat buildings. Oil is also turned into plastics that are used in everyday things such as basketballs, frisbees, crayons, hockey helmets, plastic bottles and bags, and as parts for cell phones or computers. Once natural gas is pumped to the surface, it is used to heat our homes, used in some stoves and clothes dryers, and for barbeques. Natural gas and coal can also be used to generate electricity, which lights our homes and powers devices such as computers and TVs. Coal is mined either underground or on the Earth's surface and shipped by rail and ship. Coal is also used to make steel and cement.

Instruct students to complete [Activity 4](#) in the handout package, where they will sort items by which energy source they use. Give students a couple of minutes to complete this activity. Students will also bring the package home to complete a scavenger hunt to find products in their home that might be made from oil or use natural gas.

Next, watch the video [Moving Energy](#) as a class, and have students use the information they learned from the video to complete [Activity 5](#). Students will draw pictures to illustrate important things they saw in the video.

Have students complete [Activity 6](#) where they will use their new knowledge to mark on a map which provinces have which fossil fuels. (Note: this is different from which provinces produce fossil fuels). The objective is to help students understand that all provinces in Canada have fossil fuel resources, but not all provinces produce fossil fuels (e.g., Prince Edward Island). Students will use symbols to identify which fossil fuel is present in each province and territory, and they will colour in their own province.

Once the first six activities have been completed, begin a discussion about how it is important to take care of the land with respect to producing energy from fossil fuels. Discuss how oil, natural gas and coal are non-renewable resources—this means the resource can't be replaced once it's all used. Next, discuss how developing and producing oil, natural gas and coal can have an impact on the land.

Explain to students that Canada is a leader in responsible energy development, and that regulations are implemented at both the federal and provincial government levels to ensure that resource development is done responsibly while minimizing impacts on the environment. Companies that produce energy from Canada's fossil fuels are committed to reducing environmental impacts—before oil, natural gas and coal are produced, companies are required to make a plan for how to protect the land, wildlife and water. Plans are also developed to ensure that the land is returned to what it was like before the production of oil, natural gas or coal—this is called reclamation. Reclamation means removing any equipment or buildings used in production, replacing the soil and dirt, planting trees and shrubs, and ensuring any wetlands or water (lakes, rivers and streams) are clean. Once the land is reclaimed, it can be used for things like farming, forestry, hunting, fishing or housing.

Students should complete [Activity 7](#) in the package, where they will make a drawing of what land used for oil, natural gas or coal production would look like before, during and after production. The students will list five things that are different between the three pictures with a description of why it's important to bring the land back to what it was like before production.

CONCLUSION AND CONSOLIDATION

Conclude with a discussion about ongoing reclamation projects, and examples of sites that have been returned to a natural state after use. How do energy companies approach reclamation (e.g., they replace sites with wildlife habitats, recreation areas and other developments). Have students discuss in small groups how the objective of land reclamation is to restore a natural ecosystem and encourage them to research and define the term “reclamation specialist”. **Examples of ongoing reclamation initiatives are provided in the *Additional Resources* section below.**

EXTEND YOUR GEOGRAPHICAL THINKING

Students can create posters to post around their school or community to explain the importance of reclamation using the pictures they created in [Activity 7](#).

Students can write a paragraph on what they have learned, and reflect on their use of products that come from fossil fuels. They can also do further research about the different ways that energy companies are using innovation and technology to minimize impacts on the environment such as reducing emissions and increasing energy efficiency ([see Additional Resources section for examples of innovation and technology](#)). Likewise, they can research reclamation projects taking place at local, regional and national scales.

Extend this lesson by talking about renewable resources and have students compare renewable and non-renewable resources.

Have students record in a daily journal for a week all the products that they use that are produced from fossil fuels, and then have the students create ways they can limit their use of these products.

MODIFICATIONS

- Students can be given the package to complete online on a computer.
- Students can complete the activities together as a class.
- Students can complete these activities in pairs or groups.
- This package can be extended and done over several days.
- This can be turned into a research project where students research their own information.

ASSESSMENT OPPORTUNITIES

- The package can be collected for assessment.
- Anecdotal notes can be taken throughout the different discussions.
- Learning skills such as responsibility, organization, collaboration, and initiative can be assessed.

SOURCES AND ADDITIONAL RESOURCES

Continue the discussion about plastic usage by using the educational resources on [10,000 Changes](#).

Examples of reclamation are provided by [Suncor](#), [Canadian Natural](#), [Imperial Oil](#), [TransAlta](#) and [Teck Resources](#).

Examples of innovation and technology include [co-generation](#), [progressive reclamation](#), [carbon capture and storage](#), [oil sands innovation](#) and [converting carbon dioxide emissions into usable products](#).

Examples of things that can come from oil-based products or that can use natural gas (Activity 4) include [hand sanitizers](#), [kayaks](#), [contact lenses](#), [running shoes](#) and [LEGO](#).

STUDENT ACTIVITY SHEETS



ACTIVITY 1: FIND WHAT DOES NOT BELONG

Look at this picture of the ocean and circle objects that don't belong. Find the following:

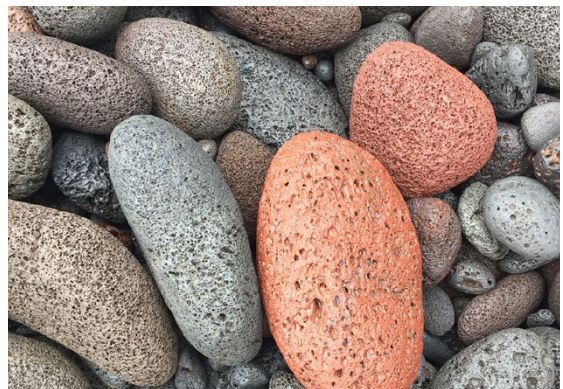
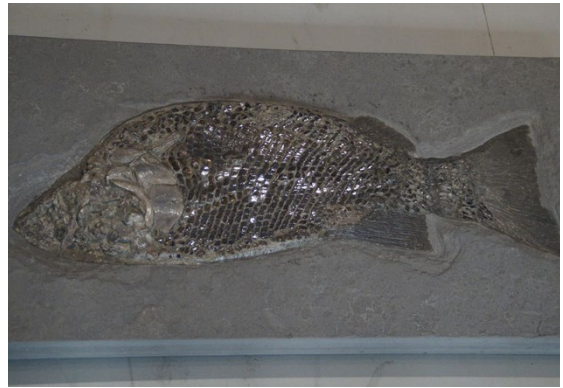
- | | |
|------------------|--------------------|
| 1. Canadian flag | 5. Plastic bottles |
| 2. Shoe | 6. Plastic bag |
| 3. Garbage | 7. Money |
| 4. Cell phone | |



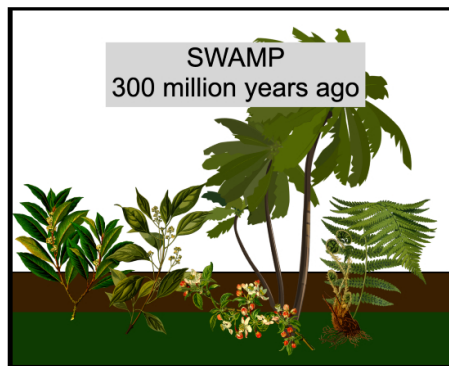
ACTIVITY 2: IDENTIFY THE FOSSILS

Someone who studies rocks and minerals is called a geologist. Someone who studies prehistoric life (such as dinosaurs) or fossils is called a paleontologist. Look at the following pictures and circle the ones that show fossils and try to identify them (what animal the fossil reminds you of).

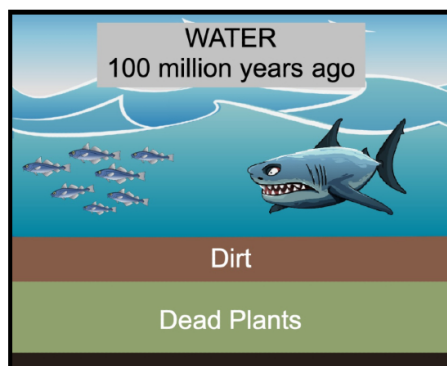
	
	



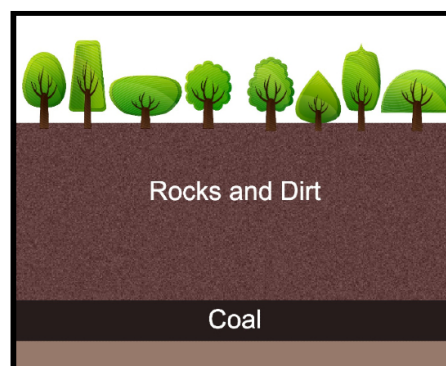
ACTIVITY 3: ALL ABOUT COAL



Before the dinosaurs, many giant plants died in swamps.



Over millions of years, the plants were buried under water and dirt.



Heat and pressure turned the dead plants into coal.

Word Search

S	N	H	O	T	A	R	G	E	C	O	E	A	F
P	U	N	P	E	A	T	U	P	I	S	S	T	O
I	C	S	R	B	U	N	T	L	E	T	H	S	U
P	L	W	N	I	W	A	E	A	R	T	H	A	R
H	E	A	T	U	R	T	A	N	E	W	O	G	M
L	A	M	H	F	A	C	J	T	N	A	M	A	L
I	Y	P	R	A	N	E	W	A	B	T	P	T	A
N	W	R	U	C	E	O	T	V	L	E	I	D	E
E	A	U	O	E	N	E	R	G	Y	R	E	K	R
C	K	S	E	T	S	A	E	A	T	C	O	A	L
V	R	O	C	K	S	W	E	S	U	P	H	K	N
S	R	A	T	U	R	A	D	T	P	B	I	M	Y

1. Tree
2. Heat
3. Coal
4. Plant
5. Earth
6. Swamp
7. Rocks
8. Water
9. Energy
10. Peat

ACTIVITY 4: MATCHING AND SCAVENGER HUNT

Oil, natural gas and coal are used for many different things. Write each use or item under the correct fossil fuel (note: some items/uses may fit under more than one fossil fuel).

Uses and items:

- Barbeque
- Generating electricity
- Steel
- Heating buildings and houses
- Cement
- Basketball
- Gasoline for a car
- Hockey helmet
- Chemical fertilizers
- Crayons
- Cooking food on a stove
- Soaps and solvents
- Clothes dryer
- Plastic parts for a cell phone/computer

OIL	NATURAL GAS	COAL

Complete the following activity at home—a scavenger hunt. Go into each of the rooms in your house and write down things that might come from oil-based products or might use natural gas.

ROOM	OIL-BASED PRODUCTS	USE NATURAL GAS
Kitchen		
Bathroom		
Bedroom		
Garage		
Backyard		

ACTIVITY 5: MOVING FOSSIL FUELS

Watch the video ***Moving Energy***:

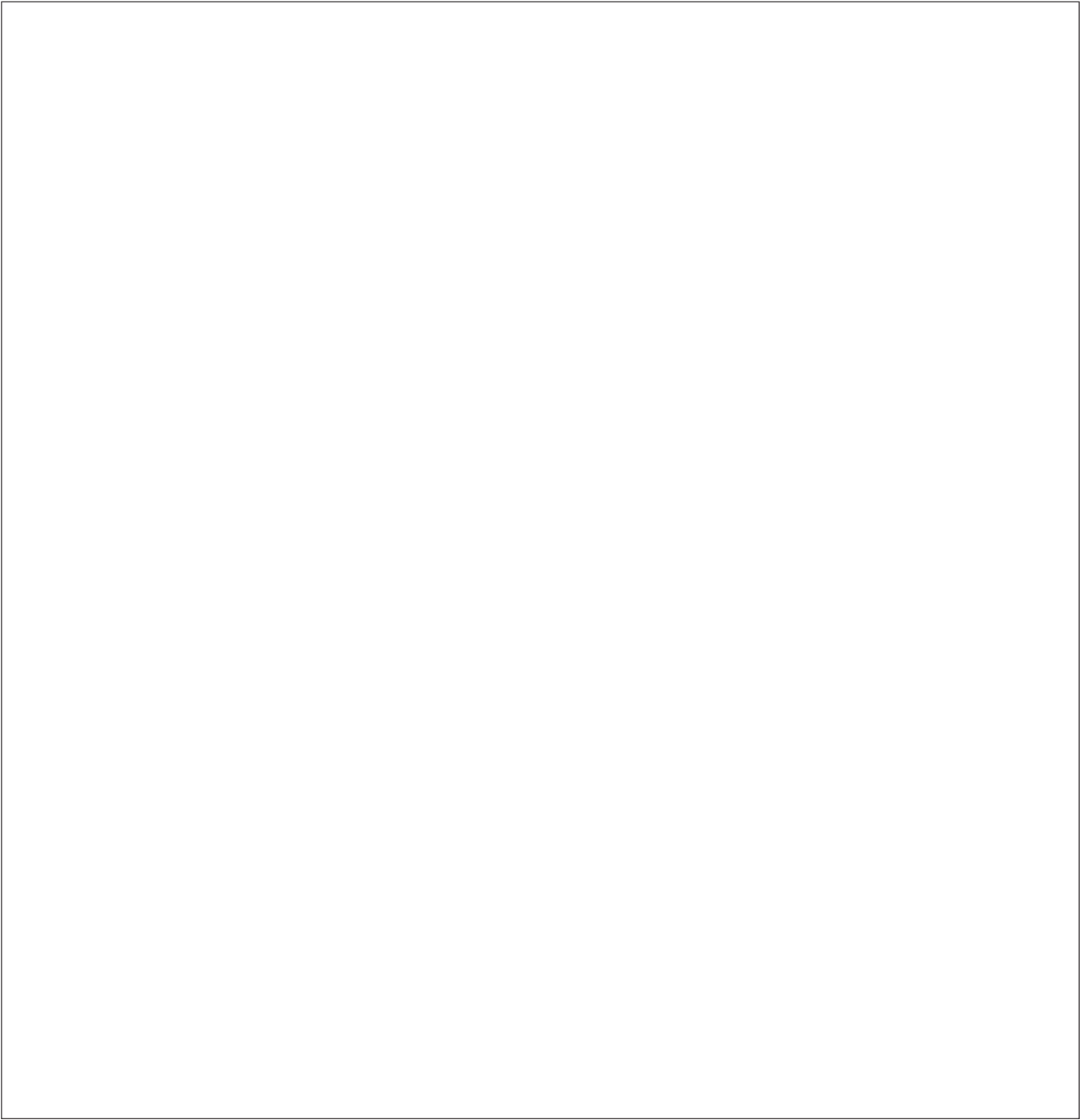
https://energyiq.canadiangeographic.ca/learning_centre/explainer_videos

Complete the following activity.

Draw a picture to show two ways coal is moved.

Draw a picture to show two ways oil or an oil product is moved.

Draw a picture of an “iron giant” (transmission tower).



ACTIVITY 6: FOSSIL FUELS IN CANADA

Many provinces and territories in Canada have oil, natural gas and coal (although not all of them make use of these fossil fuels).

- British Columbia has oil, natural gas and coal and is the second-largest producer of natural gas in Canada.
- Alberta has oil, natural gas and coal and is the largest producer of oil and natural gas in Canada.
- Saskatchewan has oil, natural gas and coal and is the second-largest producer of oil in Canada.
- Manitoba has oil.
- Ontario has oil and natural gas.
- Quebec has natural gas.
- New Brunswick has oil and natural gas.
- Nova Scotia has oil, natural gas and coal.
- Newfoundland and Labrador has natural gas and oil is produced offshore (at sea).
- Prince Edward Island has natural gas.
- Yukon has natural gas and oil.
- Nunavut has oil and natural gas.
- The Northwest Territories has oil and natural gas.

Draw the following symbols on the map for each province or territory to show which fossil fuel they have.
Colour in the province/territory you live in.

- | | |
|---------------|-------------------|
| ● Oil | ◆ Offshore |
| ▲ Natural gas | ○ #1 Oil producer |
| ■ Coal | △ #1 gas producer |



ACTIVITY 7: BEFORE, DURING AND AFTER

Draw three pictures. The first picture is going to show what the land would look like before oil or natural gas production. The second picture is going to show the land during oil and natural gas production. The third picture should show what the land would look like after reclamation has taken place.

BEFORE	DURING	AFTER

Differences between the three pictures:

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____

Use the differences in the three pictures to answer the following question: why is reclamation important?

ACTIVITY 3: ALL ABOUT COAL

Word Search Answer Key



1. Tree
2. Heat
3. Coal
4. Plant
5. Earth
6. Swamp
7. Rocks
8. Water
9. Energy
10. Peat