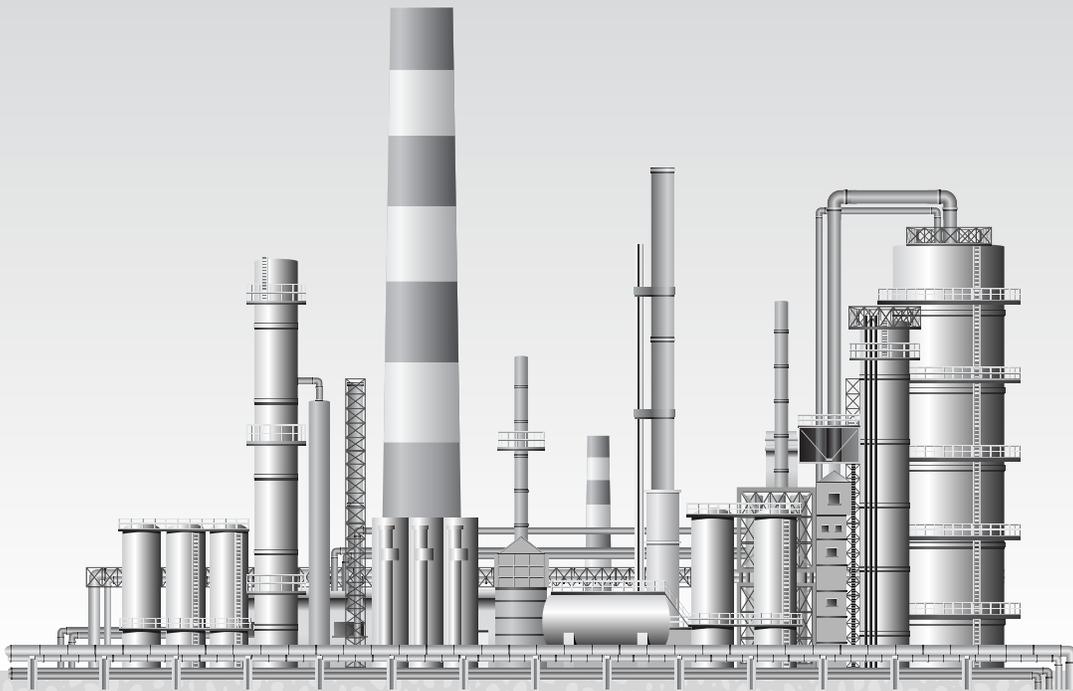


# OILSANDS FIELD TRIP

Teacher's Guide  
Grades 4-6



The logo for 'Inside education' features the word 'Inside' in a large, stylized font with a sun icon above the 'i'. Below it, the word 'education' is written in a smaller, simpler font.

## WELCOME TO AN OIL SANDS FIELD TRIP!

### Why an educational resource on oil sands?

Oil sands development in Northern Alberta is significant to our province. From economic contributions, to job creation, to the energy and petroleum products Albertans use everyday; the impact of the oil sands is far-reaching.

With so much attention given to Alberta's oil sands, information can sometimes be confusing or overwhelming. This video series aims to provide science background and current information that is student friendly and encourages critical thinking.

### What is included in this resource?

#### *Oil Sands Field Trip DVD*

This video series provides students in *grades four through nine*, background information on oil sands recovery and development. The DVD contains four video segments, each approximately five minutes in length, covering key topics related to the oil sands.

*Video 1: What are the oil sands?* - Explains the composition of oil sands, how they formed, where they are found and shows how bitumen can be extracted from oil sand.

*Video 2: Mining* - Provides a history of oil sands mining projects, outlines the steps involved in mining and introduces tailings.

*Video 3: In situ* - Presents an alternative method for extracting bitumen from deep reserves through SAGD (Steam Assisted Gravity Drainage).

*Video 4: Meeting the challenges* - Proposes concerns and solutions to oil sands' production, striking a balance between energy and environmental needs.

#### *Teacher's Guide*

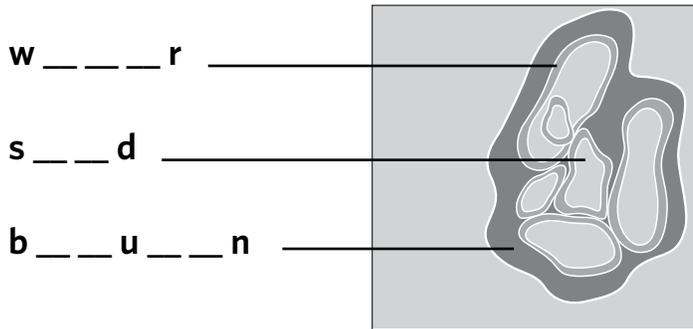
This teacher's resource includes:

- **Student Worksheets** contain questions that focus on key concepts presented in the videos - Page 3
- Student Worksheet **Answer Keys** - Page 11
- **Extension Activities** that encourage students to further their knowledge of the oil sands - Page 13
- A **Glossary** of important terms and definitions - Page 15
- **Additional Resources** that support oil sands education - Page 16

# STUDENT WORKSHEETS

## VIDEO 1: WHAT ARE THE OIL SANDS?

1. Fill in the missing letters to show what oil sands are made of.



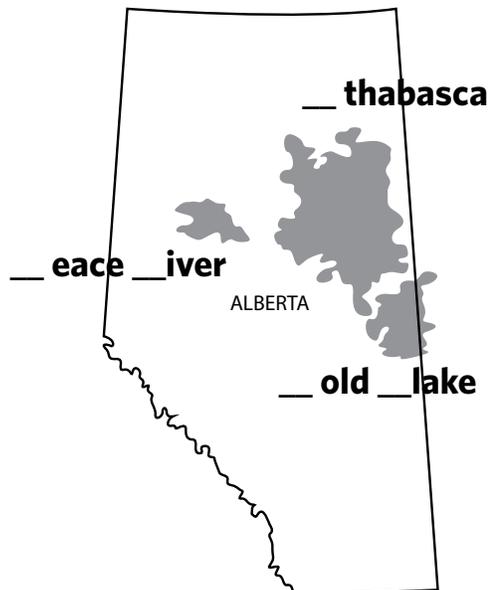
2. Order the events from 1 to 5 to explain how oil sands were formed millions of years ago.

Plants are buried by layers of sediment.	Oil is soaked up into sandstone.	Alberta is covered in swampland.	Bacteria consumes lighter oil leaving bitumen behind.	Heat and pressure transform plants into oil and natural gas.
_____	_____ 4 _____	_____ 1 _____	_____	_____

3. In the past, First Nations people used bitumen for waterproofing \_\_\_\_\_.

- a) teepees
- b) snowshoes
- c) canoes

4. Complete the location names on the map to show where oil sands are found in Alberta.



5. It is predicted that bitumen could meet Canada's energy needs for the next \_\_\_\_\_ years.
- a) 100
  - b) 500
  - c) 800

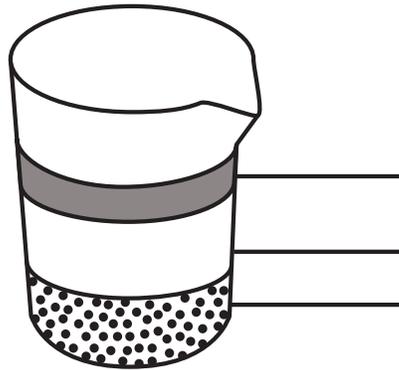
One method of extracting bitumen from oil sands is to add \_\_\_\_\_.

- a) hot water
- b) cold water
- c) warm air

6. During the *extraction* phase, oil sands separate into three main parts. Label the beaker to show the layers that form.

Word Bank:

**water            sand            bitumen**

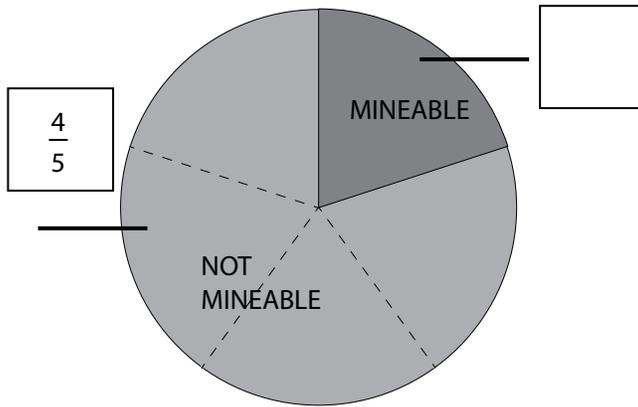


7. Turning bitumen into something useful requires two steps: upgrading and refining.
- a) Fill in the blank. First, bitumen is upgraded into a cleaner, runnier liquid called synthetic \_\_\_\_\_ oil.
  - b) At the refinery, oil is made into many useful products. Place a check mark beside any thing that can be produced from bitumen.
 

<input type="checkbox"/> vegetables	<input type="checkbox"/> diamonds
<input type="checkbox"/> gasoline	<input type="checkbox"/> diesel fuel
<input type="checkbox"/> petroleum products	<input type="checkbox"/> paper

## VIDEO 2: MINING

- Complete the chart to show what fraction of bitumen is MINEABLE at the surface.



- Create a timeline of oilsands formation by matching the date to an event.

DATE	EVENT
Early 1900's	Huge deposits of conventional oil are found and interest in the oil sands fade.
1925	Scientists and engineers explore ways to <b>separate bitumen</b> from oil sands.
1940's	Conventional oil supplies decline, <b>demands for energy rise</b> and oil sands are revisited.
Today	<b>Karl Clark</b> extracts bitumen by mixing oil sands with hot water.

3. Demonstrate the process used to mine oil sands by filling in the blanks using the words below.

WORDBANK			
water	extraction	soil	
trucks	sand	crushers	

- a. First, the \_\_\_\_\_ and vegetation called overburden is removed.
- b. Next, power shovels scoop up the oil sands and load them onto big \_\_\_\_\_.
- c. The trucks carry the oil sands to the \_\_\_\_\_, which break up any large chunks.
- d. The oil sands are mixed with hot \_\_\_\_\_ and travel by pipeline to the extraction plant.
- e. Along the way, the bitumen begins to separate from the \_\_\_\_\_ and minerals.
- f. The separation process continues in the \_\_\_\_\_ plant.

4. Circle the word that best completes each sentence.

Waste materials that are left over from mining oil sands are called \_\_\_\_\_. They are placed into large artificial ponds.

- a) tailings
- b) garbage
- c) overburden

If left untouched, tailings will take many \_\_\_\_\_ to settle.

- a) years
- b) decades
- c) centuries

5. Companies working in the oil sands use different methods to keep wildlife away from tailings ponds. List the two methods that were suggested in the video:

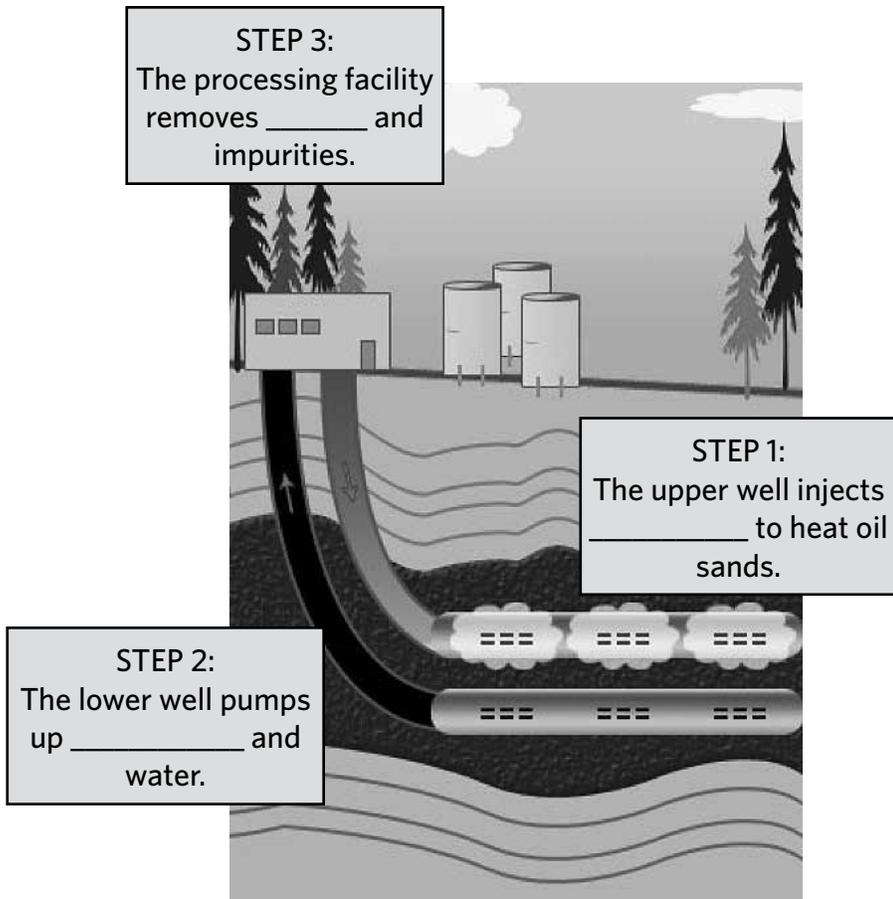
- a.
- b.

### VIDEO 3: IN SITU

1. Oil sands found deep underground can be extracted using *in situ* techniques. In Latin, the word *in situ* means \_\_\_\_\_
2. Complete the words below to identify a common method used during in situ operations.  
\_S\_ team  
\_\_ ssisted  
\_\_ ravity  
\_\_ rainage
3. Fill in the missing words to describe the process of SAGD.

**Word bank:**

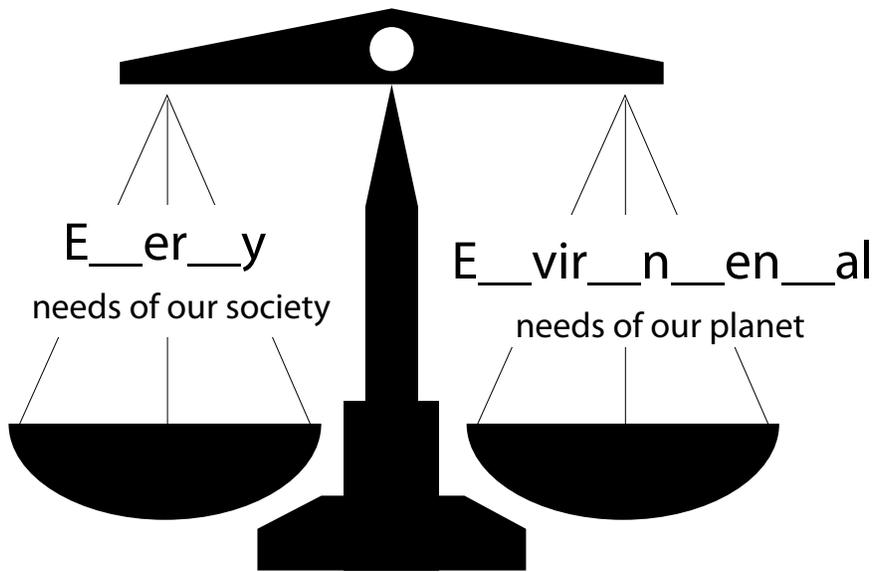
steam  
bitumen  
water



4. To create steam required for SAGD the energy primarily comes from burning \_\_\_\_\_.
- a) coal
  - b) wood
  - c) natural gas
5. What happens with the water after it is used in the SAGD process? (*Check all that apply*).
- Water is recycled and used over again
  - Water isn't used in SAGD
  - Water is put into Tailings Ponds
  - Water is injected deep underground
6. Not all of the bitumen found in deep oil sands can be extracted using SAGD.  
Complete the fractions to show how much bitumen is left behind.  /4 to  /4
7. Fill in the blank to complete the sentence.  
Researchers are constantly working to make the in situ process more productive and reduce its impact on the \_\_\_\_\_.

## VIDEO 4: MEETING THE CHALLENGES

1. Circle the answer that correctly completes the sentence.  
In the future, it is expected that the demand for Alberta's oil sands will \_\_\_\_\_.  
a) increase  
b) decrease  
c) stay the same
  
2. Complete the words on both sides of the scale to show which needs must be balanced when considering oil sands operations.



3. Use the words below to complete the environmental statements.

WORDBANK		
gas	water	bacteria
tailings	land	

- a. Fresh \_\_\_\_\_ is precious. We simply can't waste it.
- b. Eventually, researchers hope to clean up \_\_\_\_\_ as quickly as they are produced.
- c. Finding ways to reduce energy saves money and reduces greenhouse \_\_\_\_\_ emissions.
- d. Researchers believe they have found \_\_\_\_\_ and enzymes that will digest bitumen.
- e. Before any new oil sands project begins, it must include a plan for reclaiming the \_\_\_\_\_.

4. Circle the word that correctly completes the sentence.

The oil sands industry provides jobs for \_\_\_\_\_ of Canadians.

- a) hundreds
- b) thousands
- c) millions

5. Place a check mark beside all of the jobs that are directly related to oil sands development.

- environmental specialist
- dentist
- author
- truck driver
- hairdresser
- researcher

Can you think of any others? \_\_\_\_\_

## STUDENT WORKSHEETS ANSWER KEY

### Video 1: What are the oil sands?

1. Water, Sand, Bitumen
2. **2, 4, 1, 5, 3**
3. c) **canoes**
4. **Peace River, Athabasca, Cold Lake**
5. b) **500**  
a) **hot water**
6. **bitumen** (top), **water** (middle), **sand** (bottom)
7. a) synthetic **crude** oil  
b) **gasoline, diesel fuel, petroleum products**

### Video 2: Mining

1. MINEABLE - 1/5
2. **Early 1900's** - Scientists and engineers explore ways to **separate bitumen** from oil sands.  
**1925** - **Karl Clark** extracts bitumen by mixing oil sands with hot water.  
**1940's** - **Huge deposits** of conventional oil are found and interest in the oil sands fade.  
**Today** - Conventional oil supplies decline, **demands for energy rise** and oil sands are revisited.
3. 1) **soil** 2) **trucks** 3) **crushers** 4) **water** 5) **sand** 6) **extraction**
4. a) **tailings**  
b) **decades**
5. **noise-making cannons, scarecrows**

### Video 3: In situ

1. **in place**
2. Steam
  - Assisted
  - Gravity
  - Drainage
3. The upper well injects **steam** to heat oil sands.  
The lower well pumps up **bitumen** and water.  
The processing facility removes **water** and impurities.
4. c) **natural gas**
5. **Water is recycled and used over again**  
**Water is injected deep underground**
6. **1/4 to 3/4**
7. **environment**

### Video 4: Meeting the challenges

1. a) **increase**
2. **Energy, Environmental**
3. a) **water** b) **tailings** c) **gas** d) **bacteria** e) **land**
4. b) **thousands**
5. **environmental specialist, truck driver, researcher**

## EXTENSION ACTIVITIES

### From Toothpaste to Balloons

From the video, we learned that oil sands are refined into gasoline, diesel fuel and other petroleum products. To help students recognize their connection to these products, have them tally how many times in the past week they used each of items listed below.

List of Petroleum Products: Toothpaste, Crayons, Sneakers, Styrofoam cups, Garden hose, Laundry detergent, Candles, Basketballs, Bicycle tires, Fleece sweaters, Linoleum floors, Plastic water bottle, Bandages, Lipstick, Balloons

Products Made from Petroleum	Number of Uses this Week
Toothpaste	
Crayons	
Sneakers	
Etc...	

### The Conservation Situation

Oil Sands are a non-renewable resource; they cannot naturally replace themselves within our lifetime. Since there is a fixed supply of these resources, it is important to conserve and take care of them. We can do this by reducing the number of petroleum products we use everyday. As a class, discuss ways you could help reduce the amount of petroleum being used when:

- o making your lunch
- o traveling to school
- o giving a gift to a friend
- o Etc. . . .

### Bird's Eye View

To visualize the size and scope of oil sands operations in Alberta, check out <http://www.baseloc.com/dls>. Use the satellite images to prompt a comparison discussion of oil sands mining with SAGD development.

Follow the directions below to locate oil sands sites in Alberta.

1. Switch to the satellite view using the drop down menu in the top right corner.
2. Enter the following coordinates into the Lat Lng Decimal box on the right and press submit.
  - a) Mining Operation (North of Fort McMurray) 57.0, -111.478
  - b) SAGD Operation (Northwest of Cold Lake) 54.6, -110.45
3. Zoom toward the map marker indicating the location.

### Understanding the Issues

Now that you are familiar with oil sands, brainstorm the opportunities and challenges of using bitumen as a resource. Encourage students to think critically about the many factors that need to be considered when exploring an issue. Create a chart and record ideas to support both opportunities and challenges.

Opportunities	Challenges
<ul style="list-style-type: none"><li>▪ creates jobs for Albertans</li><li>▪</li><li>▪</li><li>▪</li></ul>	<ul style="list-style-type: none"><li>▪ extraction requires a lot of water</li><li>▪</li><li>▪</li><li>▪</li></ul>

### In the News

Encourage students to search online or in the local newspaper for articles that relate to oil sands in Alberta. Create a current events display where students can post their stories. Ask students to present their articles by summarizing the main points. Have them report the, who, what, where, when and why of their story.

### Separating Oil Sands

If you would like to experiment with oil sands' separation in your classroom, Oil Sands Chemistry Kits (containing samples) can be purchased for \$39.99 (+ GST and shipping) from the:

#### Oil Sands Discovery Centre

515 Mackenzie Blvd. Fort McMurray, Alberta T9H 4X3

Phone: (780) 743-7167 Toll Free: 310-0000

[www.oilsandsdiscovery.com](http://www.oilsandsdiscovery.com)

## **GLOSSARY**

**Bitumen** - a thick, sticky form of unconventional oil found in oil sands. It is similar in consistency to molasses at room temperature.

**Conventional crude oil** - liquid oil, produced by drilling wells and pumping it to the surface.

**Crusher** - a machine that receives oil sand from the mine, breaks up lumps and removes rocks.

**Environmental monitoring** - the process of checking, observing and measuring the environmental quality of the air, land and water.

**Extraction** - the processes involved in separating bitumen from the oil sands.

**Heavy hauler** - the largest trucks in the world. They are used to transport the oil sand from the mine to the processing facility. They can carry up to 400 tonnes of oil sand.

**In-situ** - a Latin term meaning "in place." It describes the method used to recover deeply buried bitumen deposits.

**Oil sand** - grains of sand surrounded by a layer of water and film of bitumen.

**Open-pit mine** - an open hole, dug for the purpose of extracting natural resources.

**Overburden** - the topsoil and vegetation that sits on top of an oil sands deposit.

**Petroleum products** - useful materials derived from refining crude oil.

**Reclamation** - the process of returning the disturbed landscape back to a healthy, productive ecosystem.

**Refinery** - the facility where impurities are removed and oil is converted into gasoline, diesel and other petroleum products.

**SAGD** - an in-situ method that uses steam injection to heat and separate the bitumen from the oil sands. Once the bitumen is more fluid it can be pumped to the surface.

**Synthetic crude oil** - the product derived from upgrading bitumen at a processing facility. It has a similar density and viscosity to conventional crude oil.

**Tailings** - the wastewater left over from the extraction process; containing sand, clay and traces of bitumen.

**Upgrader** - the facility where heat and pressure are used to break down bitumen into synthetic crude oil.

## **ADDITIONAL RESOURCES**

### **[www.canadaoilsands.ca](http://www.canadaoilsands.ca)**

Producers of the oil sands respond to concerns related to the environmental and social impacts of developing unconventional oil. This website provides a forum for discussion, current news articles and updates on innovations and technology.

### **[www.capp.ca/oilsands](http://www.capp.ca/oilsands)**

The Canadian Association of Petroleum Producers represents and supports companies involved in the oil and natural gas industry. This website contains extensive information and short video clips answering many questions about oil sands development.

### **[www.centreforenergy.com/](http://www.centreforenergy.com/)**

The Centre for Energy represents a diverse group of energy stakeholders. They partner with organizations to explore energy and environmental issues and to develop educational resources.

### **[www.oilsands.alberta.ca](http://www.oilsands.alberta.ca)**

This Government of Alberta website is a comprehensive source for oil sands information. The Oilsands Information Portal is a valuable resource focusing on the cumulative effects of oilsands development

### **[www.oilsandsdevelopers.ca](http://www.oilsandsdevelopers.ca)**

The Oil Sands Developers Group works in cooperation with multiple interest groups to address issues related to oil sands development. On this site you will find fact sheets, current project information and an interactive map of the oil sands region.

### **[www.oilsandsdiscovery.com](http://www.oilsandsdiscovery.com)**

The Oil Sands Discovery Centre is an educational facility whose goal is to increase awareness and appreciation of the oil sands industry. Oil sands samples and other teaching tools can also be found here.

### **[www.pembina.org/oil-sands](http://www.pembina.org/oil-sands)**

The Pembina Institute aims to find practical, multi-stakeholder solutions to energy and environmental issues. On this Oil Sands Watch website, you will find fact sheets and report summaries that provide an environmental perspective on oil sands.

### **For more information contact:**

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