

THE FACTS ON: OIL SANDS

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THE FACTS

Research indicates that Canadians want a balanced discussion about energy, the economy and the environment. This pocket book is designed to give you fast, easy access to oil sands facts that will help you get in on the discussion.

Facts are sourced from credible third parties or are developed using CAPP data that is checked against other data sources, including government reports.



GET THE FACTS ON OIL SANDS ON YOUR MOBILE DEVICE!

A mobile version of this fact book is now available as a **FREE** download to Apple, BlackBerry and Android devices. Downloading is easy. From your mobile device search “oil sands” in the app stores. Get the app, and get in on the oil sands discussion.



DIG DEEPER

We couldn't cover it all in this little book! So we have provided links to various sources at the end of the book.

Go ahead, dig deeper.

MORE FACTS?

Are you curious about facts that aren't covered here? Send your questions to publications@capp.ca. We will respond. We will also consider your input when developing future fact books.

UPDATES

The facts provided in this book are current as of August 2015. A regularly updated version is available online at www.canadasoilsands.ca or via the app.

To order printed copies of The Facts on Oil Sands,
email publications@capp.ca

WHY DEVELOP THE OIL SANDS?

We will need all forms of energy to meet the world's growing energy needs. We are going to be using oil for a long time to come — both in Canada and around the world.

As long as we are using oil to power our lives and improve our quality of life, we must develop it in a way that benefits us economically and is environmentally responsible.

Canada has a tremendous resource base combined with a stable, democratic political environment and skilled people that make it the ideal place to develop natural resources.

Canadian oil sands development benefits all Canadians by providing needed energy, stimulating economic growth and generating significant revenues for governments.

Canadians have a long and successful track record in applying innovation to address energy, environmental and social challenges, including oil sands production.

UNIT 1: THE RESOURCE

WHAT ARE OIL SANDS?

Canada has the **third largest oil reserves in the world**. **96%** of these reserves are located in the oil sands.



OIL SANDS

Oil sands are a natural mixture of sand, water, clay, and bitumen.

BITUMEN

Bitumen is oil that is too heavy or thick to flow or be pumped without being diluted or heated. Some bitumen is found within 70 metres (200 ft) from the surface but the majority is deeper underground.

At 10°C
bitumen is
as hard as a
hockey puck.



LOCATION

Canada's oil sands are found in three deposits — the Athabasca, Peace River and Cold Lake deposits in Alberta and Saskatchewan. The oil sands are at the surface near Fort McMurray but deeper underground in the other areas.

RECOVERING THE OIL

Oil sands are recovered using two main methods: mining and drilling (in situ). The method used depends on how deep the reserves are deposited.

Oil sands that lie more than 70 metres (200 ft) below the ground are recovered using drilling methods.

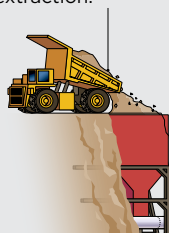
20% COULD BE MINED

20% of the oil sands reserves are close enough to the surface to be mined using large shovels and trucks.

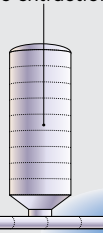
Stage 1:
Large shovels scoop the oil sands into trucks.



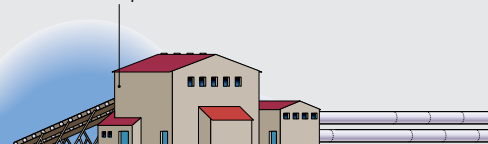
Stage 2:
Crushers break down clumps of clay to prepare the oil sands for extraction.



Stage 3:
Hot water is added to the oil sands and then transported via hydrotransport to the extraction plant.



Stage 4:
Bitumen is extracted from the oil sands in the separation vessels.



MINING METHOD

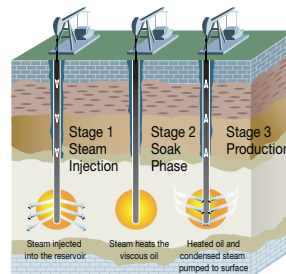
80% COULD BE DRILLED (IN SITU)

80% of oil sands reserves are too deep to be mined. These reserves are recovered in place, or in situ, by drilling wells. Drilling (in situ) methods create minimal land disturbance and do not require tailings ponds.

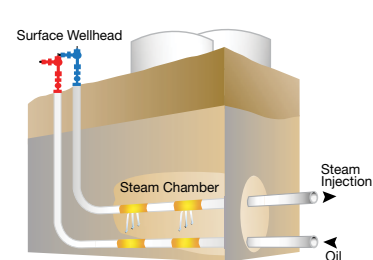
Advanced technology is used to inject steam, combustion or other sources of heat into the reservoir to warm the bitumen so it can be pumped to the surface through recovery wells.

IN SITU METHODS

CYCLIC STEAM STIMULATION DRILLING (IN SITU) METHOD



STEAM ASSISTED GRAVITY DRAINAGE (IN SITU) METHOD



REGULATION

Reliable, long-term environmental monitoring based on sound science is in everybody's best interest. Oil sands operators must adhere to stringent regulations. Approvals from numerous regulatory agencies are required at every phase, from construction and operation to decommissioning and reclamation.

MONITORING

Existing monitoring systems gather valuable data for independent scientific review and inform new monitoring needs as industry grows.

JOSM

JOINT OIL SANDS MONITORING

The Alberta and Canadian governments worked together to implement JOSM, a world-class monitoring program that integrates all environmental components — air quality, water quality and quantity, aquatic ecosystems, terrestrial biodiversity, and habitat.

AEMERA

ALBERTA ENVIRONMENTAL MONITORING, EVALUATION AND REPORTING AGENCY

The Alberta government has created AEMERA, an arm's length agency, responsible for operating a comprehensive, science-based monitoring system in Alberta.



WBEA

THE WOOD BUFFALO ENVIRONMENTAL ASSOCIATION

WBEA manages programs that include air, land and human exposure monitoring, and operates the most extensive ambient air network in Alberta.

LARP

THE LOWER ATHABASCA REGIONAL PLAN

LARP established new environmental frameworks to protect regional air and surface water quality and increased the amount of land set aside for conservation to more than two million hectares. LARP is the first of seven regional plans to be developed under Alberta's Land-Use Framework.

The total conserved land through LARP is three times the size of Banff National Park.



UNIT 2: ENERGY

WHY DO WE NEED OIL SANDS?

The oil sands are a vital energy source for Canada and the world.

OUR ENERGY FUTURE

The world relies on an energy mix that includes oil, coal, natural gas, hydro, nuclear, and renewables. All forms of energy production must increase to meet growing global demand. Canada is uniquely positioned to provide an abundance of safe, secure energy.

166 BILLION BARRELS

Canada has 172 billion barrels of oil that can be recovered economically with today's technology. Of Canada's 172 billion barrels of oil, 166 billion barrels are located in the oil sands.

SOURCE: AER 2015 AND OIL AND GAS JOURNAL 2014.

TECHNOLOGY

New technology and innovation are critical to developing the oil sands and improving environmental performance.

Canada has the third-largest oil reserves in the world.

INVESTMENT

The majority (80%) of world oil reserves are owned or controlled by national governments. Only 20% of total world oil reserves are accessible for private sector investment, 50% of which are found in Canada's oil sands.

SOURCE: CAPP 2015

ENERGY DEMAND

GLOBAL NEEDS

Global demand for energy is expected to increase 37%* by 2040 as economies in both developed and emerging countries continue to grow and standards of living improve.

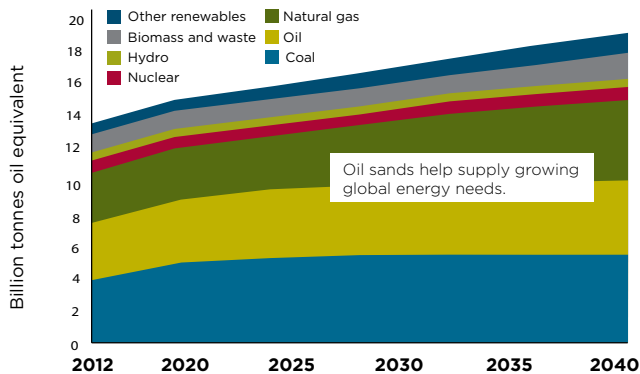
SOURCE: IEA 2014

*GROWTH FROM 2012 TO 2040, NEW POLICIES SCENARIO.

UNCONVENTIONAL

All sources of energy, developed responsibly, will be needed to meet growth in global demand. With conventional oil supply declining, the need for unconventional resources, like oil sands, is increasing.

GLOBAL PRIMARY ENERGY DEMAND (NEW POLICIES SCENARIO)*



*SOURCE: IEA 2014

ENERGY SUPPLY

FUELING NORTH AMERICA

Canada's oil sands are uniquely positioned to contribute to meeting the growth in energy demand. In North America, oil sands production provides secure and reliable supply, reducing reliance on foreign imports and providing economic growth in both Canada and the U.S.

PRODUCTION

Over the last 35 years, Canadian crude oil production has increased by 2.2 million barrels/day mostly due to the growth in supply from the oil sands.

CANADIAN PRODUCTION: BARRELS/DAY

YEAR	1980	2014	2025 F	2030 F
Crude Oil (incl. oil sands)	1.5 million	3.7 million	5.0 million	5.3 million
Oil Sands	0.1 million	2.2 million	3.5 million	4.0 million

In 2014, 58% of Canada's crude oil production was from the oil sands.

SOURCE: CAPP 2015

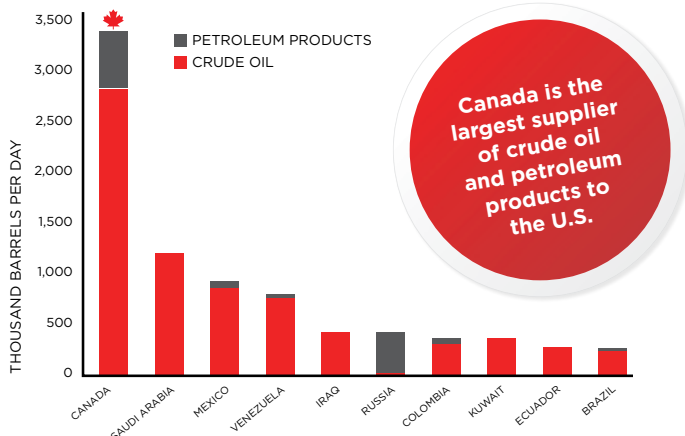
3.7 million barrels/
day is about twice
Canada's current oil
consumption.

ENERGY SUPPLY

TRUSTED NEIGHBOURS

Canada is the largest supplier of crude oil and petroleum products to the U.S.

U.S. IMPORTS OF CRUDE OIL & PETROLEUM PRODUCTS BY COUNTRY OF ORIGIN 2014



SOURCE: EIA 2015

SECURITY OF SUPPLY

Supplying energy to Canada and beyond generates economic benefits across the country.* For global customers, importing energy from Canada makes sense. Canada is politically stable, our infrastructure is robust and environmental standards are high.

*LEARN MORE ABOUT ECONOMIC BENEFITS ON PAGE 25.

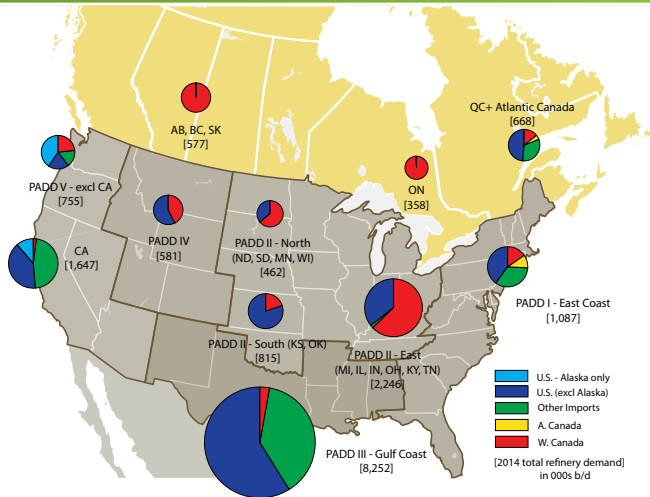
UNIT 3: MARKETS & TRANSPORTATION

Canadian crude oil producers continue to build new markets for their expanding production.

MARKETS

Canadian crude oil producers continue to build new markets for their expanding production. New market opportunities include Eastern Canada, the U.S. and growing economies in Asia.

2014 CANADA AND U.S. CRUDE OIL DEMAND BY MARKET REGION



SOURCE: CAPP, CA ENERGY COMMISSION, EIA, STATISTICS CANADA

DIVERSIFICATION

Diversifying markets for Canadian oil production is vital to ensure Canada receives full value for its natural resources.

EAST

Eastern Canada currently imports almost two-thirds of its oil from foreign suppliers.

WEST

The West Coast is a critical outlet for Canadian oil to reach customers in Asian markets.

SOUTH

Even with increased domestic supply, the U.S. will need oil imports to meet its energy demands. As long as the U.S. is importing oil, Canada is the best supplier.

PIPELINES



TRANSPORTATION

Bitumen and crude oil are transported three ways; pipeline, marine transport and rail car.

DILUTED

To flow, the bitumen — which was separated from the sand at the source — is diluted with condensate or upgraded light crude oil. Once mixed with a diluent, the dilbit does not separate, but is a new mixture.

Today Canada has limited pipeline infrastructure to move crude oil from Western Canada to Eastern Canada, and the U.S.

As a result of strong growth in U.S. and Canadian oil production, crude oil pipeline capacity is expected to become constrained in the next few years, requiring new pipelines and pipeline expansions to provide access to new markets. A number of pipeline projects are being proposed to connect the growing supply with growing markets in India, China and Eastern Canada.

If laid end to end, Canada's existing major oil and natural gas pipelines would circle the Earth almost 3 times.

SOURCE: CEPA 2012, CAPP

MARINE TRANSPORT

SAFE FOR 80 YEARS

Oil tankers have been moving safely and regularly along Canada's West Coast since the 1930s.

SOURCE: TRANSPORT CANADA 2012

580 MILLION BARRELS

Each year, approximately 580 million barrels of oil are safely transported along Canada's East and West coasts via tanker.

SOURCE: TRANSPORT CANADA 2012

500 TANKER VISITS

At present, fewer than 500 oil tankers transit along Canada's West Coast each year. While most West Coast oil tankers are U.S.-bound, about 200 call on Port Metro Vancouver. There hasn't been an oil tanker issue in the Port of Vancouver for 50 years.

SOURCE: IHS CERA 2013

HIGH STANDARDS

All oil tankers using Port Metro Vancouver are subject to the same international agreements, rules and strict national and port authority standards.

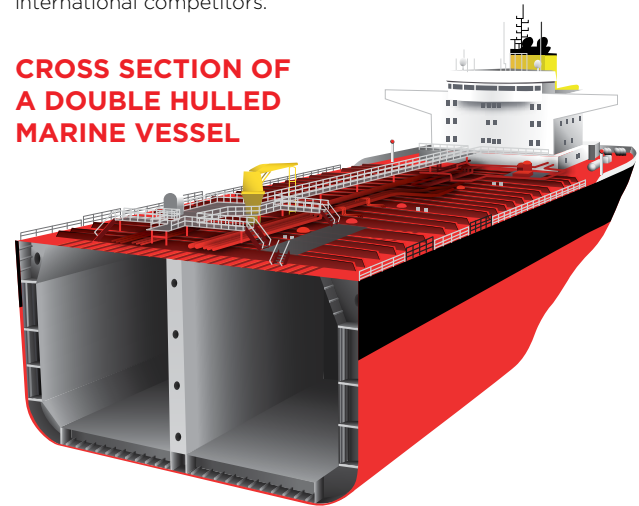
SOURCE: IHS CERA 2013

Canada has the world's longest coastline, at more than 243,000 kilometres.

CLOSER TO ASIA

Asian markets are an 8 to 11 day sail from proposed West coast terminals, two days closer than most of our international competitors.

CROSS SECTION OF A DOUBLE HULLED MARINE VESSEL



DOUBLE HULLED

Large single-hulled crude oil tankers were prohibited in 2010 and can no longer operate in Canadian waters. Double hulled means the bottom and sides of a vessel have two complete layers of watertight hull surface.

SOURCE: TRANSPORT CANADA 2013



RAIL TRANSPORT



In the first six months of 2015, about 125,000 barrels/day of crude oil — or 3.5% of Western Canada’s production — were moved by rail.

SOURCE: CAPP 2015

RAIL CAPACITY

Rail loading capacity in Western Canada is currently about 776,000 barrels/day.

SOURCE: CAPP 2015

UPGRADING & REFINING

Some bitumen from the oil sands is upgraded from heavy to light oil and sent to refineries in Canada and the U.S. to be converted into petroleum products, such as gasoline, diesel and jet fuel.

1.1 MILLION

In 2014, about 1.1 million barrels/day of Alberta’s bitumen was upgraded in Alberta.

SOURCE: CAPP 2015

EXPORTS

In 2014, Canadian crude oil exports averaged almost 2.9 million barrels/day. Growth in exports of Canadian oil creates significant economic benefits, including jobs, for Canadians across the country.

SOURCE: STATISTICS CANADA 2015

IMPORTS

In 2014, Eastern Canada imported 542,000 barrels/day of crude oil. The top five sources were the U.S., Saudia Arabia, Iraq, Norway and Algeria.

SOURCE: CAPP 2015



UNIT 4: ECONOMY

HOW DO OIL SANDS CONTRIBUTE?

Canada's oil sands industry provides economic benefits to Canada and across North America.

ECONOMIC CONTRIBUTION

\$4,057,754,000,000

Oil sands development is expected to contribute over \$4.0 trillion dollars to the Canadian economy over the next 20 years — more than \$200 billion per year.

SOURCE: CERI 2015

\$1.2 TRILLION

The oil sands industry will pay an estimated \$1.2 trillion in provincial (\$285 billion) and federal (\$464 billion) taxes and provincial royalties (\$490 billion) over the next 20 years.

SOURCE: CERI 2015

NORTH AMERICA

The oil sands have significant economic impact outside Alberta — in the rest of Canada, the U.S. and around the world. Almost every region in Canada has been stimulated by oil sands development through job creation and economic activity.

SOURCE: CERI 2015

JOBS

In addition to paying significant royalties and taxes, the oil sands industry is a major employer and creates jobs throughout North America.

350,000

Direct employment in Canada as a result of oil sands investments is expected to grow from 151,000 jobs in 2015 to over 350,000 jobs in 2035. When including indirect jobs, employment numbers almost double across Canada in both years.

SOURCE: CERI 2015

The goods, materials and services used to construct and operate oil sands projects, mines and upgraders come from across North America. Many of the components — tires, trucks, gauges, valves, pumps, etc. — are produced in Central and Eastern Canada.

ALBERTA

While Alberta receives close to 90% of the economic benefits from oil sands, the economic impact across the rest of Canada is significant.

SOURCE: CERI 2015

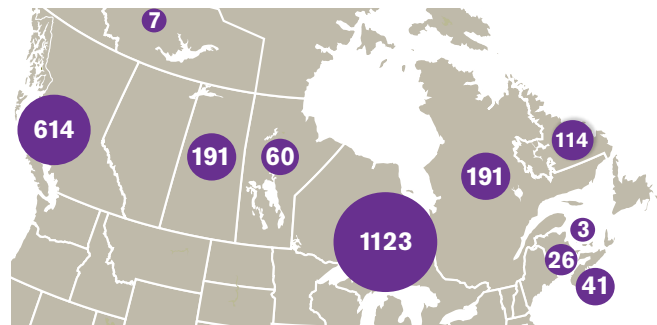
CANADIAN BENEFITS

OVER 2000 DIRECT SUPPLIERS

In 2015, over 2000 companies from across Canada had direct business (goods and/or services) with the oil sands.

SOURCE: CAPP 2015

NUMBER OF COMPANIES THAT HAVE DIRECT BUSINESS WITH THE OIL SANDS — PROVINCES OUTSIDE ALBERTA



SOURCE: CAPP 2015

JOB CREATION

For every direct job created in Alberta's oil sands industry, approximately one indirect and one and a half induced jobs will be created in the rest of Canada.

SOURCE: CERI 2015



BEN SPARROW, SALTWORKS

INDUSTRY IN ACTION

FROM OIL SANDS TO NASA

The challenges faced by Canada's oil sands industry inspired the bright minds behind Saltworks to develop a unique approach to recycling wastewater.

Invented and patented in Canada, Saltworks's machines combine low-grade heat energy with saline water to create distilled water. Engineers Ben Sparrow and Josh Zoshi first met while pursuing their business degrees. A shared industrial background and passion for technology led them to a new solution to wastewater management. Today, the company is based in Vancouver and offers water treatment solutions to a number of industries. Saltworks was recently approached by NASA to treat saline water at the International Space Station.

Saltworks manufactures their products right in Vancouver, which supports domestic jobs and tax revenues. The company's talented team is continuously developing new technology and takes pride in using science to solve environmental challenges.

READ MORE INDUSTRY IN ACTION STORIES: WWW.CAPP.CA

ECONOMY



LOCAL BENEFITS

Most of the oil sands are located in the Athabasca area. Fort McMurray is the largest community in the area which also includes several smaller and Aboriginal communities.

GROWTH

The Regional Municipality of Wood Buffalo (including Fort McMurray) is one of the fastest growing communities in North America with average annual population growth of approximately 7.1% from 2000 – 2012.

SOURCE: REGIONAL MUNICIPALITY OF WOOD BUFFALO 2012

The average age of the population in Regional Municipality of Wood Buffalo is 32.7 years old.
SOURCE: REGIONAL MUNICIPALITY OF WOOD BUFFALO 2013

LOCAL JOBS

21,115 people were directly employed in oil sands operations jobs in Fort McMurray in March 2011.

SOURCE: REGIONAL MUNICIPALITY OF WOOD BUFFALO.

ABORIGINAL COMMUNITIES

Alberta's aboriginal population is young and growing, with several communities located close to oil sands developments in remote regions of the province.

Solid relationships with aboriginal communities have created mutually beneficial employment and business opportunities.



DISTANCE
 FORT CHIPEWYAN TO FORT MCMURRAY = 220 KM
 FORT MCKAY TO FORT MCMURRAY = 60 KM



CONSULTATION

Industry works with potentially affected aboriginal groups to seek ways to mitigate impacts of oil sands development.

Aboriginal groups, through consultation and engagement in regulatory processes, and through Canada's legal system, are afforded multiple levels of due process.

COMMUNITY

In 2013, oil sands companies contributed more than \$6 million to aboriginal communities in the Wood Buffalo and Lac La Biche regions for school and youth programs, celebrations, cultural events, literacy projects and other community programs.

SOURCE: OSCA 2014

\$11.9 MILLION

Members of the Oil Sands Community Alliance (OSCA) made corporate donations of more than \$11.9 million to aboriginal groups and organizations in the Wood Buffalo and Lac La Biche regions in 2013.

SOURCE: OSCA 2014

\$10 BILLION

Over the past 14 years aboriginal companies* have earned about \$10 billion through working relationships with the oil sands industry, including \$1.9 billion in contract work performed by Wood Buffalo and Lac La Biche- based companies in 2013 alone.

SOURCE: OSDG 2014

300

In 2013 and 2014, over 300 aboriginal companies from across Alberta had direct business (goods and/or services) with the oil sands. These companies represent 54 communities across Alberta.

SOURCE: CAPP 2015

\$11.7 MILLION

OSCA members spent \$11.7 million to facilitate consultation with Wood Buffalo and Lac La Biche area aboriginal communities in 2013.

SOURCE: OSCA 2014

*COMPANIES WERE CLASSIFIED BY THE FOLLOWING DESCRIPTIONS: FIRST NATIONS OWNED, PRIVATE BUSINESSES OR JOINT VENTURES.



WWW.FORTMCKAYGROUP.COM

INDUSTRY IN ACTION

The Fort McKay Group of Companies LP (FMGOC), which works extensively with oil sands operations through its 6 divisions, brings in more than \$150 million in revenue annually. FMGOC is completely owned and controlled by the Fort McKay First Nation.

SOURCE: FORT MCKAY GROUP OF COMPANIES

SYNCRUDE CANADA

Syncrude is one of 13 companies in Canada to be accredited at the Gold Level in the Progressive Aboriginal Relations (PAR) Program of the Canadian Council for Aboriginal Business. PAR measures corporate performance in aboriginal employment, business development, capacity development and community relations.

READ MORE INDUSTRY IN ACTION STORIES: WWW.CAPP.CA

U.S. BENEFITS



JOBS

As investment and production of the oil sands ramps up in Canada, the demand for U.S. goods and services will increase, creating hundreds of thousands of highly skilled and well paying U.S. jobs (manufacturing, engineering, construction, etc.).

\$BILLIONS

The demand for U.S. goods and services will climb between 2011 and 2035, adding an estimated \$5.8 billion to U.S. GDP in 2015, \$12.9 billion in 2020, \$26.6 billion in 2025 and \$42.6 billion in 2035.

SOURCE: CERJ 2011

INDUSTRY IN ACTION

The Caterpillar 797 is one of the world's largest trucks with the capacity to haul up to 400 tonnes per load. Currently, more than 300 of these trucks have been purchased for use in Canada's oil sands, giving an economic boost to at least four U.S. states.

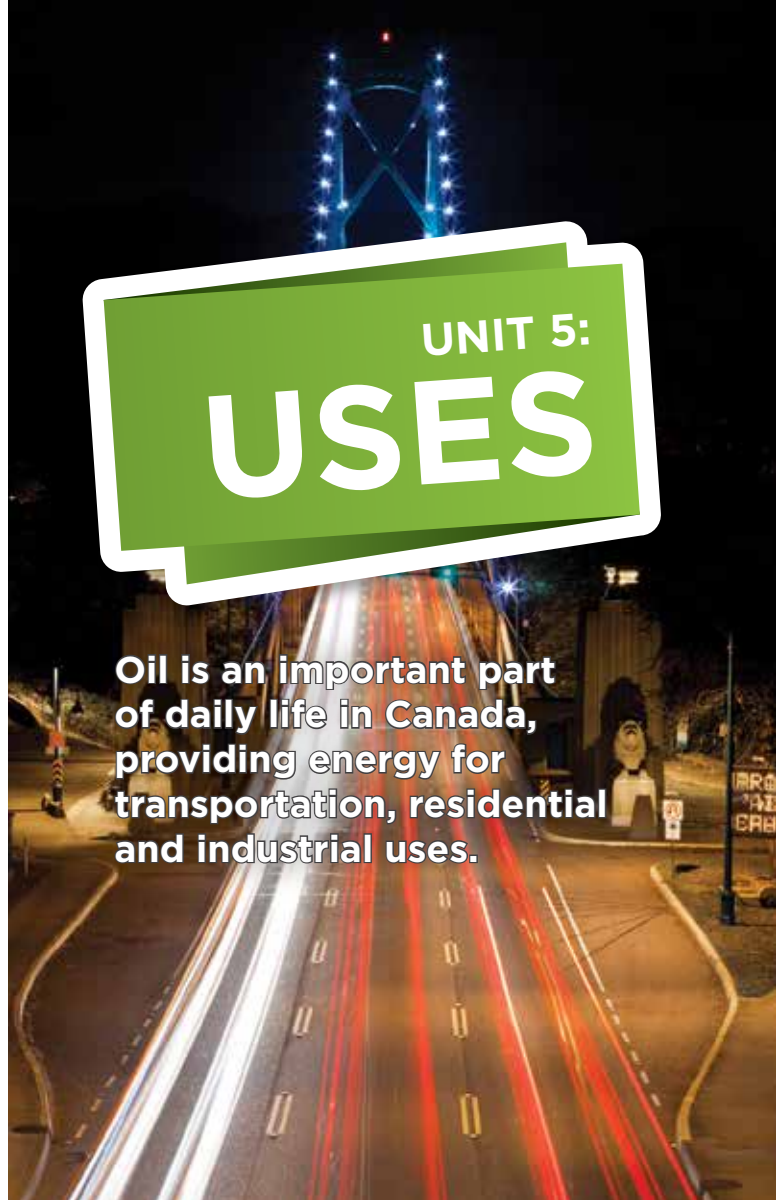
OIL SANDS MINING TRUCK



- Engine made in Indiana
- Cab is fabricated and engine installed in Illinois
- Largest frame component is cast in Louisiana
- Giant Michelin® tires made in South Carolina

UNIT 5: USES

Oil is an important part of daily life in Canada, providing energy for transportation, residential and industrial uses.



ENERGY USE

Canadians consume a lot of energy. We need it to stay warm, do our work and get from place to place.

Crude oil derived from the oil sands is sent to refineries across North America to make gasoline, diesel, aviation fuel and other consumer products.

FUELS

GASOLINE

Gasoline is the fuel designed for spark-ignition internal combustion engines. It is commonly used in automobiles.

DIESEL

Diesel is a fuel designed for engines commonly used in trucks, buses, locomotives and farm and heavy equipment. It contains more energy and power density than gasoline.

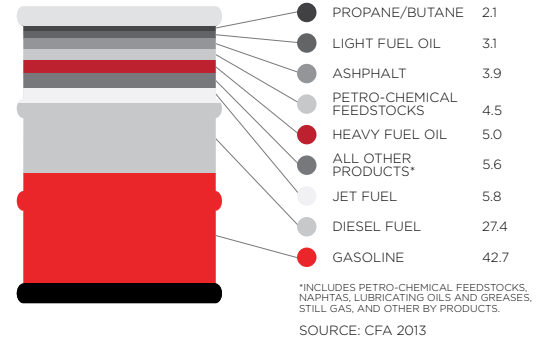
AVIATION FUELS

Aviation fuels are specialized petroleum-based fuels used to power various types of aircraft.

PRODUCTS

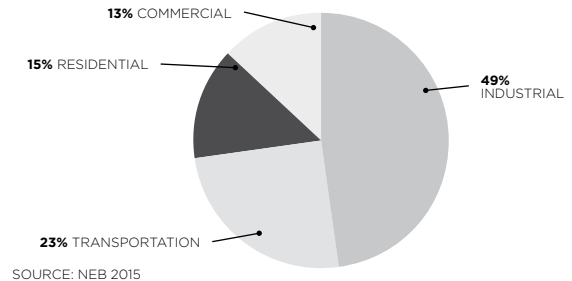
Thousands of everyday products get their start from crude oil. Raw materials used to create items including ink, crayons, dishwashing liquids, deodorant, eyeglasses, CDs and DVDs, tires, ammonia, and heart valves are derived from feedstocks from crude oil.

AVERAGE OUTPUT FROM A BARREL OF OIL (%), CANADA



Transportation accounts for 23% of the total energy that Canadians consume — second only in consumption to Canada’s industrial sector. That translates to 200 million litres of gasoline and diesel pumped into fuel tanks across the country on a daily basis just for mobility, without which our modern lifestyle would be impossible.

ENERGY DEMAND BY SECTOR, 2014



UNIT 6: AIR

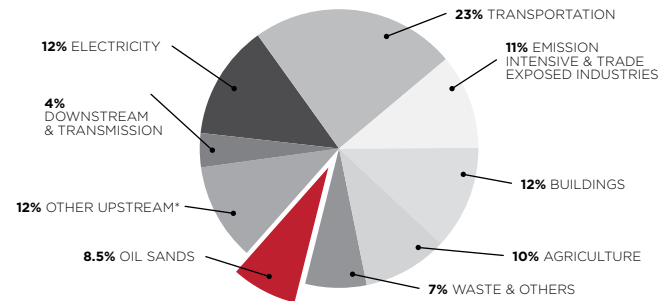
Since 1990 Canada's oil sands industry has reduced greenhouse gas (GHG) emissions per barrel by 30%.

GHG EMISSIONS

Canada, with 0.5% of the world's population, produces about 2% of global CO₂ equivalent emissions.

Oil sands account for 8.5% of Canada's GHG emissions and about 0.12% of global GHG emissions.

CANADA'S GHG EMISSIONS BY SECTOR 2013



* Includes conventional oil and natural gas producing sector

SOURCE: ENVIRONMENT CANADA 2015

62 MEGATONNES

Oil sands' total GHG emissions in 2013 were 62 megatonnes.

SOURCE: ENVIRONMENT CANADA 2015

2013 emissions from the U.S. coal fired power generation sector is equivalent to 25 times the oil sands total GHG emissions (62 megatonnes) in the same year.

SOURCE: ENVIRONMENT CANADA 2015, U.S. D.O.E.

GHG EMISSIONS

Carbon dioxide (CO₂) is a GHG. CO₂ is emitted into the air by burning fossil fuels for electricity generation, industrial uses, transportation and for heat in homes and buildings.

WELLS-TO-WHEELS

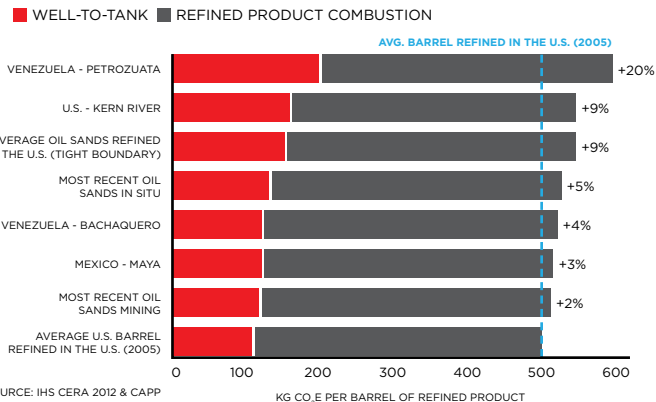
Measuring GHG emissions from the start of oil production (wells) through to combustion (wheels) is called a wells-to-wheels or life-cycle analysis.

INTENSITY

Oil sands crude has similar CO₂ emissions to other heavy oils and is 9% more intensive than the U.S. crude supply average on a wells-to-wheels basis.

SOURCE: IHS CERA 2012

FULL-CYCLE GHG EMISSIONS OIL SANDS & U.S. REFINED CRUDES



SOURCE: IHS CERA 2012 & CAPP

GHG REDUCTIONS

30% BETTER*

GHG emissions associated with every barrel of oil sands crude produced were reduced by 30% between 1990 and 2013.

SOURCE: ENVIRONMENT CANADA 2015

REGULATED

In 2015, the Government of Alberta updated the Specified Gas Emitters Regulations calling for a 15% reduction in GHG emissions intensity starting in 2016 - increasing to 20% in 2017. All large industrial emitters, including existing oil sands facilities, will face levies if they do not meet these targets.



SOURCE: ALBERTA ENVIRONMENT & PARKS

CCS

The federal and provincial governments are investing about \$3 billion to help make Canada a global leader in carbon capture and storage (CCS) technology. Industry and government are cooperating to demonstrate the commercial and technical viability of CCS in Canada.

SOURCE: ALBERTA ENVIRONMENT AND PARKS

*REFLECTS GAINS IN EFFICIENCY AND A CHANGE IN PRODUCTION MIX.

AIR QUALITY

24 HOURS/365 DAYS

The Wood Buffalo Environmental Association (WBEA) monitors the air in the oil sands region in and around Fort McMurray 24 hours a day, 365 days a year. WBEA's air quality monitoring network is one of the most extensive in North America.

Air monitoring information is available in real time at www.wbea.org

IMPROVING OR STATIC

Data collected over the past 10 years at monitoring stations across Alberta indicate air quality is improving in some areas and remaining consistent in others.

SOURCE: WBEA AND CASA

NO DETERIORATION

Based on analysis of average concentrations of common air pollutants, overall air quality has not deteriorated in the Wood Buffalo region even with an increase in industrial activities and population growth.

SOURCE: WBEA AND CASA

Air quality in Fort McMurray is better than many North American cities — including Toronto, Edmonton and Seattle — benchmarked by the Alberta Clean Air Strategic Alliance (CASA).



cosia®

CANADA'S OIL SANDS
INNOVATION ALLIANCE

WWW.COSIA.CA

INDUSTRY IN ACTION

CANADA'S OIL SANDS INNOVATION ALLIANCE

Canada's Oil Sands Innovation Alliance (COSIA) is an alliance of oil sands producers focused on accelerating the pace of improvement in environmental performance in Canada's oil sands through collaborative action and innovation. Through COSIA, participating companies capture, develop and share the most innovative approaches and best thinking to improve environmental performance in the oil sands, focusing on four Environmental Priority Areas (EPAs) — tailings, water, land and greenhouse gases.

To date, COSIA member companies have shared 560 distinct technologies and innovations that cost over \$900 million to develop. Through this sharing of innovation and application of new technologies, members can accelerate the pace of environmental performance improvements.

[READ MORE](http://WWW.CAPP.CA) INDUSTRY IN ACTION STORIES: WWW.CAPP.CA

UNIT 7: WATER

Canada's oil sands industry recycles water and continues to look for ways to reduce fresh water use.

0.3 BARRELS

In 2014, drilling (in situ) production required an average 0.3 barrels of fresh water for every barrel of bitumen produced.

SOURCE: CAPP 2015

2.8 BARRELS

In 2014, mining required an average 2.8 barrels of fresh water for every barrel of bitumen produced.

SOURCE: CAPP 2015



80-95%

Oil sands producers recycle 80-95% of water used.

SOURCE: GOVERNMENT OF ALBERTA

168 MILLION M³

Oil sands fresh water use in 2014 was about 168 million m³.

SOURCE: CAPP 2015

WATER USE

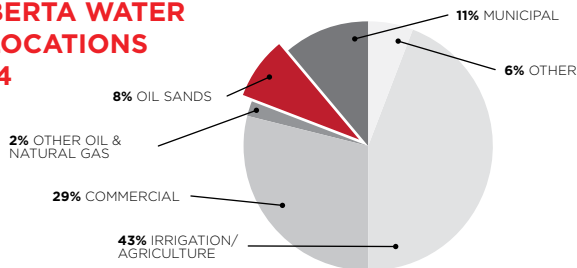
REGULATED

The Alberta Energy Regulator oversees the industry's use of water. Large water users must apply to divert fresh water from its original source. The amount of water allocated is based on sustaining Alberta's groundwater and surface water.

Each sector applies for water licenses and the government allocates water based on these applications. In 2014, the oil sands industry represented about 8% of total provincial water allocations. But not all of that water was actually used. The oil sands industry uses less than one third of its total water allocation per year.

Strict regulations restrict water withdrawal when river flow is low.

ALBERTA WATER ALLOCATIONS 2014



ATHABASCA RIVER

The Athabasca River is the main source of water for oil sands mining projects.

LESS THAN 3%

In 2014, 59% of the fresh water used for oil sands mining was from the Athabasca River (100 million m³). This is 0.5% of average annual river flow and 2.2% of the minimum monthly flow in 2014.

SOURCE: AER 2015

WATER SUPPLY

Northern Alberta, where oil sands operations occur, has more than 86% of Alberta's water supply.

SOURCE: AER 2015

Central and Southern Albertans, 88% of the province's population, rely on 13% of Alberta's surface water supply, found in the North and South Saskatchewan River Basins.

TAILINGS PONDS

TAILINGS

After the oil sands have been mined, oil is separated from the sand and sent for further processing. "Tailings" are the leftover liquid mixture of mostly sand, some water and clay and residual bitumen.

220 KM²

The total area of existing tailings ponds is 220 km² including associated structures such as ditches and dykes. The total surface area of all fluid tailings is 88 km².

SOURCE: ALBERTA ENVIRONMENT & PARKS 2015

SETTLING PONDS

Settling or tailings ponds are large engineered dam and dyke systems designed to contain and settle the water, sand, fine clays, silts, residual bitumen and other residual hydrocarbons of the oil sands mining and extraction process.

WATER RECYCLING

Tailings ponds are settling basins that enable process water to be separated and continuously recycled. Oil sands producers recycle 80–95% of water used, reducing use of fresh water from the Athabasca River and other sources.

DYKE WATER MANAGEMENT

Dyke water comes from dyke construction, pond operation and surface water run-off. For example, ditches around tailings facilities capture this water and continuously pump it back into the tailings ponds.

FLUID TAILINGS

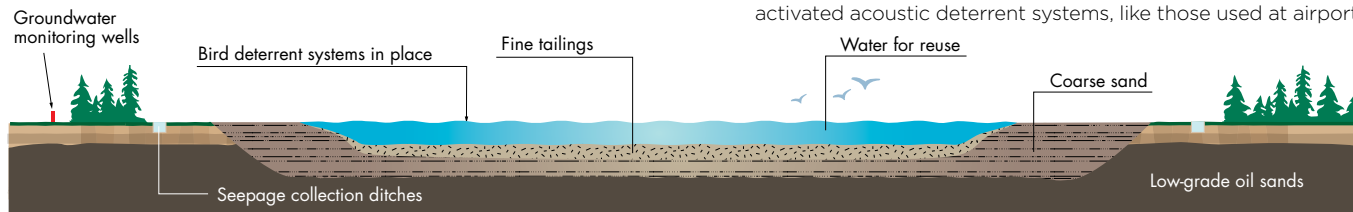
This combination of water and clay will take decades to consolidate and dry out. New technologies are accelerating the timing of consolidation.

RECLAMATION

The Government of Alberta requires all oil sands operators to have plans in place to convert fine tailings to reclaimable landscapes.

BIRDS

Varying amounts of bitumen can be found on the surface of most tailings ponds. This can pose a threat to waterfowl that land on the pond. Several mechanisms are in place to deter birds from landing, including propane cannons and radar/laser activated acoustic deterrent systems, like those used at airports.



WATER QUALITY

INDUSTRY IN ACTION

SUNCOR'S TAILINGS POND 2007

SUNCOR'S TAILINGS POND 2013

SUNCOR ENERGY

Wapisiw Lookout is Suncor's first tailings pond, developed to support mining operations in the 1960s. As the first tailings pond to be reclaimed to a solid surface, the goal is to establish a diverse, self-sustaining locally common boreal forest ecosystem. And great progress has been made. Many species, from amphibians to bears, now call Wapisiw home.

[READ MORE](http://WWW.CAPP.CA) INDUSTRY IN ACTION STORIES: WWW.CAPP.CA

MONITORED

Water quality, quantity and aquatic ecosystems health data in the Athabasca region is collected through various federal and provincial agencies, including Environment Canada and the Alberta Environment Monitoring, Evaluation and Reporting Agency (AEMERA). This data can be accessed through the Oil Sands Information Portal and the Alberta Environmental Monitoring, Evaluation and Reporting Information Service (AEMERIS).



MANAGED

A Surface Water Quality Management Framework was developed as part of the Lower Athabasca Regional Plan (LARP). The framework includes ambient surface water quality triggers and limits. Triggers are intended to give advance notice of less favourable trends, while limits are established as the upper boundaries that must not be crossed. A management response is required if quality triggers or limits are exceeded.

The federal and provincial governments are constantly working to enhance regional water monitoring.

INDUSTRY IN ACTION



SUNCOR'S FIREBAG OPERATION

SUNCOR ENERGY

In February 2013, Suncor implemented an industry-leading process to send tailings water from its oil sands base plant through an existing pipeline to be used as make-up water in its Firebag in situ operations.

Reusing tailings water for make-up water is new not only to Suncor, but also to the entire industry. Through this new innovation, Suncor is reducing the volume of its tailings ponds and eliminating the need for new ponds at its current mine, resulting in a smaller footprint on the environment. Suncor has demonstrated that reusing water from the end of one project's cycle to another part of its business improves Suncor's water management practices over a larger geographical area and can help reduce overall regional fresh water use.

Suncor has cleared the technical, regulatory and operational hurdles to allow sharing of recycled tailings between its operations, and proving that a deemed 'waste product' can in fact be reused as a valuable resource for other production purposes. Suncor is now further expanding the project by collaborating with industry partners to send its recycled tailings water to other in situ operators to further reduce regional water demand across the industry.

WATER



DRY TAILINGS

INDUSTRY IN ACTION

COSIA'S TAILINGS ROADMAP

The Government of Alberta requires all oil sands operators to have plans in place to convert fine tailings to reclaimable landscapes.

COSIA's Tailings Environmental Priority Area (EPA) is focused on improving the management of oil sands tailings. COSIA and Alberta Innovates — Energy and Environment Solutions (AI-EES) recently released a Tailings Technology Roadmap and Action Plan Project, a collaboration that also involved Alberta Energy, Natural Resources Canada, Alberta Environment & Sustainable Resource Development and the Alberta Energy Resources Conservation Board. This plan provides a comprehensive review of technologies that will help industry identify a suite of actions that will accelerate the development of new and improved commercial tailings treatment technologies.

[READ MORE](http://WWW.CAPP.CA) INDUSTRY IN ACTION STORIES: WWW.CAPP.CA

UNIT 8: LAND

Canada's oil sands industry is committed to reducing its footprint, reclaiming all land affected by operations and maintaining biodiversity.

94%

An Alberta Biodiversity Monitoring Institute (ABMI) report states that the Lower Athabasca region's living resources are 94% intact. This compares to 54% in Southern Alberta.

SOURCE: ALBERTA ENVIRONMENT & PARKS

0.02%

Only 0.02% of Canada's boreal forest has been disturbed by oil sands mining operations over the past 40 years.

SOURCE: ALBERTA ENVIRONMENT & PARKS

10%

Since operations began in the 1960s, approximately 10% of the active mining footprint has been or is being reclaimed by industry. Reclaimed land will be certified by government when it can be returned to public use.

SOURCE: ALBERTA ENVIRONMENT & PARKS

90,000 KM²

In Alberta alone, approximately 90,000 km² (or about 24%) of the boreal forest is protected from development (includes national parks, etc.).

SOURCE: CAPP 2015

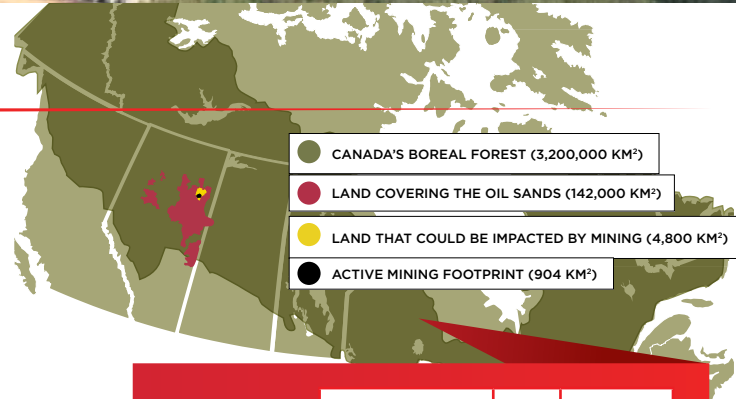
90,000 km² is about the size of Portugal or South Carolina.



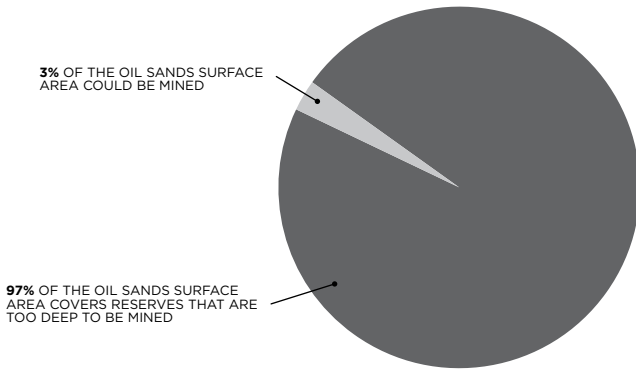
LAND IMPACTS

Alberta's oil sands lie under 142,000 km² of land. Only about 3%, or 4,800 km², of that land could ever be impacted by the mining method of extracting oil sands.

The remaining reserves that underlie 97% of the oil sands surface area are recoverable by drilling (in situ) methods which require very little surface land disturbance.*



OIL SANDS LAND USE



*FOR MORE INFORMATION ON HOW OIL SANDS ARE EXTRACTED, SEE PAGES 6 AND 7.

SOURCE: AER 2013

HOW BIG IS 904 KM²?

AREA (KM ²)	CITY PROPER	GREATER METROPOLITAN
CALGARY, ALBERTA	848	5,107
HAMILTON, ONTARIO	1,117	1,371
CHARLOTTE, N. CAROLINA	605	8,119
MADRID, SPAIN	605	4,609

THE SIZE OF ENGLAND?

Some organizations claim the oil sands are destroying an area the size of England (about 130,000 km²). In fact, the total mining footprint covers an area about 0.6% the size of England and 10% of that land has been or is being reclaimed. The total area that could be impacted by mining is about 4% the size of England.

SOURCE: ALBERTA ENVIRONMENT & PARKS, OIL SANDS PORTAL 2015

LAND RECLAMATION

LAW

Alberta law requires all lands disturbed by oil sands operations be reclaimed. All companies are required to develop a reclamation plan that spans the life of the project.

CERTIFICATION

Reclamation is an ongoing process during the life of a project. Companies apply for government reclamation certification when vegetation is mature, the landscape is self-sustaining and the land can be returned to the Crown for public use.

PROCESS: IT TAKES TIME

The reclamation process involves monitoring, seeding, fertilizing, tree planting, seed collecting, topsoil salvaging and replacing. It also involves significant landform creation and contouring.

SOURCE: OSCA

It can take up to 80 years for a conifer tree to grow to maturity.

LAND

TOPSOIL BARLEY CROP

INDUSTRY IN ACTION

TOPSOIL RECONSTRUCTION

Subsoil takes hundreds of years to turn into topsoil through natural processes such as biodegradation. Imperial Oil has developed a technology to transform subsoil into topsoil in just five years. A field study using humalite, a low grade oxidized (weathered) coal which doesn't decompose and mimics the portion of natural soil that encourages microbial life and nutrient retention, is underway at two Imperial Oil lease sites.

CARIBOU HABITAT RESTORATION

Two major COSIA initiatives are underway to address legacy linear disturbances and return the boreal forest to high- quality caribou habitat. The Algar Historic Restoration Project (Algar) and the Linear Deactivation Project (LiDea) are both aimed at addressing rehabilitating seismic lines. The two projects involve different approaches and methodologies, with the intent of sharing learnings across the COSIA companies as the projects progress.

READ MORE INDUSTRY IN ACTION STORIES: WWW.CAPP.CA

FIND OUT MORE ABOUT THE OIL SANDS INDUSTRY



Alberta Biodiversity Monitoring Institute (ABMI)

www.abmi.ca

Alberta Chamber of Resources

www.acr.alberta.com

Alberta Energy

www.energy.alberta.ca

Alberta Energy Regulator (AER)

www.aer.ca

Alberta Environment and Parks

www.aep.alberta.ca

IHS (CERA)

www.cera.com

Canadian Fuels Association

www.canadianfuels.ca

Canadian Association of Petroleum Producers (CAPP)

www.capp.ca www.oilsandstoday.ca

Canadian Energy Research Institute (CERI)

www.ceri.ca

Canada's Oil Sands Innovation Alliance (COSIA)

www.cosia.ca

Clean Air Strategic Alliance (CASA)

www.casahome.org

International Energy Agency (IEA)

www.iea.org

Oil Sands Community Alliance

www.oscaalberta.ca

National Energy Board (NEB)

www.neb-one.gc.ca

The Royal Society of Canada

www.rsc.ca

Transport Canada

www.tc.gc.ca

U.S. Energy Information Administration (EIA)

www.eia.doe.gov

Wood Buffalo Environmental Association (WBEA)

www.wbea.org

CANADIAN OIL SANDS PRODUCERS

Canada's oil sands producers represent 17 companies responsible for more than 90 per cent of the oil sands produced and transported to markets.

THE CANADIAN ASSOCIATION OF PETROLEUM PRODUCERS

The Canadian Association of Petroleum Producers (CAPP) represents companies, large and small, that explore for, develop and produce natural gas and crude oil throughout Canada. CAPP's member companies produce about 90 per cent of Canada's natural gas and crude oil. CAPP's associate members provide a wide range of services that support the upstream crude oil and natural gas industry. Together, CAPP's members and associate members are an important part of a national industry with revenues from oil and natural gas production of about \$120 billion a year.

CAPP's mission, on behalf of the Canadian upstream oil and gas industry, is to advocate for and enable economic competitiveness and safe, environmentally and socially responsible performance. Competitiveness, in North America and globally, is necessary so as to attract the capital necessary to grow production and expand markets to deliver value to the Canadian public and to our investors. Public confidence, from governments, Aboriginal peoples, the public, stakeholders and the communities in which we operate, will be determined by our collective performance and the effectiveness of our communications and outreach.

NOTES

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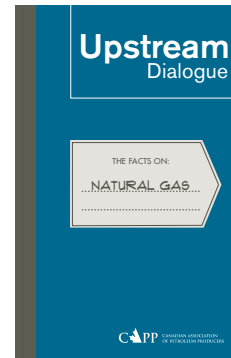
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AUGUST 2015 2015-0014

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