

A COMPREHENSIVE GUIDE TO THE ALBERTA OIL SANDS



UNDERSTANDING THE ENVIRONMENTAL AND HUMAN IMPACTS, EXPORT IMPLICATIONS, AND POLITICAL, ECONOMIC, AND INDUSTRY INFLUENCES

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ABOUT THIS REPORT

Just as an oil slick can spread far from its source, the implications of Oil Sands production have far reaching effects. Many people only read or hear about isolated aspects of these implications. Media stories often provide only a 'window' of information on one specific event and detailed reports commonly center around one particular facet.

This paper brings together major points from a vast selection of reports, studies and research papers, books, documentaries, articles, and fact sheets relating to the Alberta Oil Sands. It is not inclusive. The objective of this document is to present sufficient information on the primary factors and repercussions involved with Oil Sands production and export so as to provide the reader with an overall picture of the scope and implications of Oil Sands current production and potential future development, without perusing vast volumes of publications.

The content presents both basic facts, and those that would supplement a general knowledge base of the Oil Sands and this document can be utilized wholly or in part, to gain or complement a perspective of one or more particular aspect(s) associated with the Oil Sands. The substantial range of Oil Sands-related topics is covered in brevity in the summary.

This paper discusses environmental, resource, and health concerns, reclamation, viable alternatives, crude oil pipelines, and carbon capture and storage. It also provides some insight into the political and economic factors that have influenced Oil Sands development and, with some variance, continue to do so; furnishes a sampling of government inadequacies and ignored findings; and includes subjects not often in the forefront, such as the exploitation of Temporary Foreign Workers and the lives of mobile workers.

Note: In 1995 the Alberta Tar Sands were framed as a "national treasure" and the term "oil sands" was selected as the new, cleaner sounding brand name. Both names continue to be used interchangeably. [1]

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The information included in this report, often multiple sourced for verification, is dependent on the references utilized, and any conclusions drawn, though based on this information, are the opinion of the author.

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COVER PAGE PHOTOS

Background: BOREAL FOREST ALONG THE ATHABASCA RIVER, Photo: David Dodge, Pembina Institute

Foreground: ALBERTA OIL SANDS MINING, Source: WWF-UK (top);

OIL SANDS PROCESSING BESIDE THE ATHABASCA RIVER. Photo: Garth Lenz (bottom)

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SUMMARY

The Alberta Oil Sands is the largest energy project on the planet, lying beneath 140,200 square kilometers of northern Alberta forest, an area almost as large as the state of Florida. This area represents 21% of Alberta and 37% of Alberta's Boreal Forest Natural Region. As of mid-2009, there were approximately 5,012 oil sands (mineral rights) agreements with the Province and 91 active Oil Sands projects. [2]

While only 686 square kilometers of the boreal forest have so far been disturbed by Oil Sands mining, as of mid-2010, 85,000 square kilometers of land had been leased out to companies for extraction. The other 39% is still available for leasing. Even the currently developed portion of the Oil Sands region is already experiencing severe fragmentation effects on the ecology of the boreal forest. And, of the area disturbed, over 25% is covered by toxic liquid tailings on long-term storage behind dikes. The UN's senior advisor on water, Maude Barlow, said after touring the Alberta Oil Sands: " *We were devastated by what we saw and smelled and experienced. The air is foul, the water is being drained and poisoned and giant tailing ponds line the Athabasca River.*" [3]

As devastating as the Oil Sands already are, it is the prospect of the potential magnitude of future development that will exponentially reap disastrous and irreversible levels of environmental destruction. Oil Sands production is expected to triple by 2030. As Avatar film director James Cameron recently stated, " *The capacity for an ecological disaster here on an unprecedented scale is possible.*" [4]



OIL SANDS LANDSCAPE

Photo: Garth Lenz, Source: Before Its News



SUNCOR AND SYNCRUDE – foreground: tailings ponds, upper right: Suncor's upgrader, top left: Syncrude's upgrader
Photo: David Dodge, Pembina Institute

The first part of this paper presents the environmental and human repercussions of Oil Sands development, related government inadequacies, and viable alternatives. The second part provides information on crude oil pipelines, carbon capture and storage, and political, economic, and industry influences. The paper concludes with discussion of low carbon performance, global warming, and growing concern about increased oil sands development and global exploitation of unconventional fossil fuels.

PART 1: Environmental and human impacts, government inadequacies, viable alternatives

Natural gas consumption. Oil sands production is both energy and water intensive. Natural gas consumption for the production of one barrel of Oil Sands crude oil is between 700 and 1700 cubic feet, enough to heat the average Canadian home for 2.5 to six days. Under the anticipated expansion in Oil Sands production, not only could the Oil Sands project severely compromise Canada's natural gas supplies, but Canadian natural gas may also be inadequate to supply the energy needs of the Oil Sands. Turning to unconventional sources would substantially increase the intensity and total amount of greenhouse gas emissions from the sector.

Water consumption. For mining operations, new water consumption per barrel of synthetic crude oil is 2.5 to 4.5 barrels. This comes primarily from the Athabasca River, which has seen a decline in average flows due to climate warming. There are concerns that the Oil Sands industry is already overtaxing the River and detrimentally affecting the First Nations and the aquatic life inhabiting the region. In situ extraction operations utilize significant amounts of groundwater, approximately one barrel per barrel of bitumen produced and knowledge is lacking as to whether the aquifers in the Athabasca Oil Sands region can sustain the Oil Sands groundwater demands and losses. It is projected that water resources will not be able to meet anticipated Oil Sands production growth.

Greenhouse gas emissions. While Canada is only responsible for 2% of the world's greenhouse gas (GHG) emissions, it is in the top ten of the world's GHG emitters and is the second highest of these countries on a per capita basis. [5] The Alberta Oil Sands is Canada's fastest growing source of GHG emissions. Under the Canadian government's business-as-usual projections, Oil Sand emissions will reach 108 megatonnes (Mt) by 2020, growing to 12% of Canada's emissions.

Industry average emissions for oil sands production and upgrading (well-to-pump) are estimated to be 3.2 to 4.5 times as carbon intensive as conventional crude produced in North America. The Oil Sands industry argues that oil sands-based fuels are only approximately 15% more carbon-intensive than conventional crude oil. However, their figures are based on a well-to-wheels measurement, where the full product life cycle is considered from production to the use of the fuel in a vehicle. Combustion accounts for the major portion of life cycle GHG emissions.

Production-related emissions. Canada's *National Inventory Report's* (NIR) total GHG emissions for 'Oil Sands - Mining, In situ, Upgrading' is often loosely interpreted by the media and the public as representing the total Oil Sands emissions produced in the process of extracting and converting bitumen into an end use fuel. However, this figure, 37.2 Mt for 2008, does not take into account several GHG emission sources that are directly or indirectly related to Oil Sands processing prior to combustion. The NIR is only responsible for reporting GHG emissions that occur in Canada. It does not reflect emissions associated with upstream land use or the downstream upgrading and refining that is done outside of Canada. Additionally, the NIR's reporting structure does not categorize as part of Oil Sands emissions, the emissions from production of the natural gas that is utilized in Oil Sands production or the refining of synthetic crude oil from the Oil Sands that is done at various Canadian refineries.

This paper provides an accounting of these production-related emissions. Though the amounts are averaged estimates, they show that taking all well-to-pump Oil Sands emissions into account could bring the total pre-combustion GHG emissions for Oil Sands oil to approximately double the widely-referenced NIR figure.

Tailings ponds. Tailings ponds now cover more than 170 square kilometers, an area one and a half times the size of the city of Vancouver, and are growing, with liquid tailings rapidly expanding by 200 million litres every day. It is estimated that 2000 to 2500 litres of total tailings material is produced on a per barrel basis. As result, there are a total of 5.5 trillion litres of impounded tailings on the Oil Sands landscape. Of this, mature fine tailing, the bottom layers of clays, fine sand, water and bitumen, comprise 840 billion litres. The tailings ponds are now leaking 4 billion litres per year (11 million litres a day) of contaminated water into the environment and, should proposed projects go ahead, this volume could reach 25 billion litres a year within a decade.



"...Tar Island Pond One, situated right on the banks of the [Athabasca] river, built 300 feet high above the river. It leaks 67 litres of toxic tailings water per second." Water expert, Dr. Kevin Timoney [6] Photo: David Dodge, Pembina Institute

Air pollutants. Oil Sands operations also release large volumes of pollutants into the air. These pollutants, in high doses, have been linked to respiratory illness, heart disease, emphysema, bronchitis, headaches, nausea, spontaneous abortion, and impaired neurological function. Environment Canada's National Pollutant Release Inventory emissions data indicates all 13 elements considered priority pollutants under the U.S. Environment Protection Agency's Clean Air Act are being spewed into the atmosphere by the Oil Sands industry in increasing amounts.

Reclamation. Though some breakthroughs in reclamation have been made, they are small in comparison to the pace and scale of disturbance from Oil Sands mines. As well, no tailings lakes have ever been successfully reclaimed and there is no demonstrated effective long-term way to deal with liquid tailings. Nor has the reclamation of wetlands or peatlands in the Athabasca Boreal region ever been demonstrated, and peatlands contain seven times more carbon than normal boreal forest soils.

In situ versus mining. Proponents of in situ development increasingly assert that it has considerably lower environmental impacts than mine-based production. However, when land fragmentation is considered, the in situ land area influence is greater than mining. As well, in situ processes utilize over twice as much natural gas as mine-based processing. As a result, in situ operations prior to bitumen upgrading generate 2 to 2.5 times as much greenhouse gas per barrel of bitumen as mining.

Aquatic life. Oil Sands pollution is having an evident effect on regional aquatic life. An August 2010 study led by Erin Kelly and David Schindler of the University of Alberta found that levels of the pollutants cadmium, copper, lead, mercury, nickel, silver and zinc exceeded federal and provincial guidelines for the protection of aquatic life in melted snow or water collected near or downstream from oilsands mining. Schindler said, *"Embryos of fish exposed to oilsands' water and sediment have very high rates of mortality, and among the survivors, there are very high rates of deformities."*

Land animals. The industrial development of the Oil Sands and the resulting forest fragmentation is already affecting the boreal ecosystem and could lead to irreversible ecological damage and loss of biodiversity. Many species of land animals are already in decline and Environment Canada has concluded that all woodland caribou herds would likely be lost from northeastern Alberta, as a result of cumulative disturbances within their ranges. Thousands of acres of diverse bird habitats have been destroyed and the Oil Sands belt is on the migratory route of North American ducks and other waterfowl. A cumulative impact study projects that over the next 30 to 50 years, millions of birds could be lost due to loss of breeding and staging areas, and from birds landing in tailing ponds of waste that look like real bodies of water.

Impacts on First Nations people. Downstream of the Oil Sands, Aboriginal people are experiencing an increase in respiratory diseases, cardiovascular problems and rare cancers suspected to be caused by toxic substances leaching downstream from Oil sands production. Oil present in local watersheds has led to arsenic contamination of moose meat, a dietary staple of local First Nations people, of up to 33 times acceptable levels. Game animals in the area are being found with tumours and mutations. Toxic substances and carcinogens have been found in fish, waterfowl, beavers, moose and muskrat. 6-7% of the fish caught at Fort Chipewyan, located on the northwestern tip of Lake Athabasca, have skin or lip carcinomas and elevated mercury levels in the fish inhibit human consumption. Drinking water has been contaminated. Water withdrawals from the Athabasca River and the loss of wildlife are adversely affecting the First Nations' traditional way of life.

First Nations treaties. The impact of the Oil Sands on the region's First Nations is in violation of Treaties 6 and 8, which were signed by First Nations peoples in 1876 and 1899 and several First Nations groups have launched legal actions. The treaties surrendered to the federal government over one million square kilometers of what is now central and northern Alberta as well as adjoining areas of British Columbia, Saskatchewan and the Northwest Territories in return for the guarantee that the First Nations would retain their hunting, trapping, and fishing rights in support of sustaining their traditional livelihood, in perpetuity. These rights were affirmed by the Constitution Act of 1982. "We were assured that our way of life would not be changed and that it would be protected," state Chief Allan Adam, Athabasca Chipewyan First Nation and Chief Roxanne Marcel, Mikisew Cree First Nation. [7]

Lack of government oversight and action. Since 2001, Canada has ranked second to last in the Organization for Economic and Co-operative Development (OECD) countries on its environmental performance, mainly due to poor environmental policies. This paper discusses these inadequacies in the areas of water, energy, greenhouse gas emissions, and environmental assessment and monitoring.

Water issues. In Canada, there is no national strategy to address urgent water issues, no federal leadership to conserve and protect our water, and Canada does not have legally enforceable drinking water standards. The Federal Water Policy is more than 30 years old. The last comprehensive assessment of Canada's groundwater resources was published in 1967.

Energy resources. Canada has failed to exercise any fiscal accountability over its non-renewable oil wealth. It has no sovereign fund and has saved no wealth to date. Canada does not have a strategic petroleum reserve and despite its abundance of oil, Canada is the most vulnerable member of the International Energy Agency to short-term shocks. A major percentage of Oil Sands crude oil is exported to the U.S. and Canada is still buying oil from the Middle East and from North Sea countries. Canada does not have a national energy strategy, which is currently being called for by the oil and gas industry, the renewable energy industry, the business community, and environmentalists. Canada has no policies to enable large-scale renewable-energy adoption and has cut funding for renewable power development.

Emissions reduction. Canada's GHG emissions in 2008 were 24% higher than in 1990 and 30% higher than the country's KYOTO commitments. While many other industrialized countries have committed to emissions reductions of 20 to 40% below 1990 levels by 2020, the Canadian government's current target - 17% below 2005 levels by 2020 - translates to 2.5% above 1990 levels. Even achieving this low target is dubious as the government has predicted no net reduction in GHG emissions from federal action up to 2012 and Canadian governments haven't yet agreed on an outline for a national approach to reducing greenhouse gases. No federal government measures for carbon pricing have yet been adopted and Canada does not have a low carbon growth

plan. Out of 57 countries that together are responsible for over 90% of global energy-related CO₂, Canada ranks 2nd last in climate protection.

Assessment and monitoring. Canada has one of the worst records of pollution enforcement of any industrial nation. Its air quality objectives have not changed since the 1970's. The OECD has cited Canada as having one of the worst records for air emissions, specifically particulate matter and ground level ozone. Canada does not have a Fisheries Act compliance strategy for the industries and activities that must comply with the Act's prohibition requirement against the deposit of harmful substances in water frequented by fish. And neither the federal nor the provincial government has ever studied the effects of reduced flow rates on the Athabasca River and the 31 species of fish that populate it.

Living and working conditions. The Oil Sands carries the image of bountiful, high-paying jobs. Yet the lives of mobile workers, away from their families for long stretches of time, the majority of them living in work camps, is far from ideal and many suffer from vulnerability and stress, some even turning to hard drugs or alcohol as an escape. Temporary foreign workers, who are brought in to fill Canadian labour shortages (60,000 in Alberta in 2010) often experience exploitation, abuse, racial discrimination, and lack of rights. Even community members employed in jobs outside the Oil Sands are finding the 'boom town' growth of Fort McMurray a strain.

Viable alternatives. There are viable alternatives to continued development of the Oil Sands in providing jobs and also in supplying energy. According to analysts from the Center for American Progress, relative to spending on fossil fuels, clean-energy investments create 2.6 to 3.6 times more jobs for people, depending on their education level. According to Greenpeace projections, low-impact renewable energy can supply 96% of electricity and 92% of Canada's total heating needs by 2050, and Canadians could save about \$135 per person a year on their energy bills over the next 40 years by reducing energy use and switching away from increasingly costly fossil fuels.

Part 2: Pipelines, CCS, and politics

Crude oil pipelines. A massive web of pipelines is already involved in the transfer of bitumen blends and crude oil, and several expansions have been proposed. The Keystone XL expansion alone would more than double the crude oil pipeline capacity of 2009. Two of the proposed expansions would result in additional transfer of Oil Sands crude by oil tanker. Currently, the Enbridge pipeline proposal is in the forefront of much debate and concern, somewhat overshadowing the facts that Oil Sands crude is already being transported by tanker out of Vancouver and there are plans to increase this traffic.

There are major environmental concerns relating to both pipeline and tanker transportation of bitumen blends and crude oil. Pipeline construction and operation can cause damage to soils, surface and groundwater, air quality, vegetation, wildlife, and fish populations. Pipeline spills can lead to direct loss of various species as a result of contaminated food intake, reduced respiratory functions, or ingestion of oily water. Oil spills from tankers can have numerous adverse effects including shoreline contamination, catastrophic species loss, ocean sediment contamination, water quality deterioration, commercial fishing industry closures, and, in many areas, impacts on tourism and traditional Aboriginal culture.

Carbon Capture and Storage. The Alberta Oil Sands stand as the single greatest obstacle to Canada meeting its global climate change responsibilities and Carbon Capture and Storage (CCS), is being lauded as the key to reducing greenhouse gas emissions from the Oil Sands and other fossil fuel production.

The Canadian and Alberta governments are defending the continuance and further development of the Alberta Oil Sands by saying that CCS will collect carbon dioxide emissions from Oil Sands operations and make them environmentally and socially sustainable. The governments know that there are vast technological differences between CCS for coal and CCS for oil sands, the latter being so much more complex because of the number and diversity of emission sources and locations, and because their CO₂ streams tend to be relatively small and diluted. Such is stated in a 2008 joint Canada and Alberta task force report: "*Oil sands operations are very diverse and only a small portion of the carbon dioxide streams are currently amenable for carbon capture and storage.*"

CCS technology is also expensive, increasing electricity costs by an estimated 30 to 80% even for coal power plants. As well, it is energy and water intensive, requiring an additional 10 to 40% of energy, and 23 to almost 100% more water at a time when the world is facing water shortages. Using CCS to further Oil Sands development mirrors the same lack of humane consideration as utilizing food for biofuel to power vehicles while the world is experiencing food shortages – something the Canadian government has also aggressively supported and even legislated, even if the result is minimal or even negative greenhouse gas emissions reduction. [8]

There are additional concerns about the safety, capacity, and liability of storing carbon dioxide underground, and the expediency and extent of contributions that CCS can actually make to cutting global CO₂ emissions.

There is also the danger that CCS has evolved into a justification and diversion for prolonging dependence on fossil fuels, assuaging public fears about resulting CO₂ emissions and delaying efforts to aggressively convert to more cost-effective, renewable, low-energy systems. While the Canadian government is investing heavily in CCS research, it has cut program funding for energy efficiency and renewable energy. *"Almost all of the money this government claims is climate change work is about getting more oil out of the ground,"* said John Bennett, executive director of Sierra Club Canada. [9]

Fossil fuel subsidies. According to the International Institute for Sustainable Development, the Canadian and Alberta governments provided \$2.84 billion to support oil production in 2008. This aid was received regardless of the companies' profits or growth and regardless of the fact that the oil and gas industry is the most profitable of all Canadian industries. In 2009, the G-20 and the Asia-Pacific Economic Cooperation (APEC) made commitments to phase out fossil-fuel subsidies that encourage wasteful consumption. Yet Canada, as a member, has proposed no new plans for reducing its remaining subsidies. The G-20 reasoned, *"Inefficient fossil fuel subsidies encourage wasteful consumption, distort markets, impede investment in clean energy sources and undermine efforts to deal with climate change."*

Political, Economic, and Industry Influences. There are numerous political and industry influences that strive to deny the scientific facts of global warming and promote increased Oil Sands production. For years, substantial lobbying has been done to shape legislation in industry's favour and also to ensure that those industries benefit from the billions of dollars in government grants being issued for clean energy and emissions-reduction projects. Federal lobbyist records show that corporate oil executives have frequent access to the highest officials in Ottawa. Not only has Oil Sands production heavily influenced the Canadian government's lack of action on global warming and fueled Canada's undermining of progress in global negotiations on climate change, on behalf of Oil Sand development the Canadian government has also been crossing boundaries in attempts to stifle other countries' efforts to support cleaner fuels.

Historically the United States has been a huge proponent for the development of the Oil Sands, striving to reduce its overseas oil imports and also investing in the Oil Sands. As well, the Oil Sands has attracted investors from Japan, Norway, France, South Korea, the Netherlands, Thailand, and China. Committed funds for current and proposed projects total \$200 billion.

Unheeded recommendations from government reports. Reported concerns about Oil Sands development go back well over 30 years. As early as 1973, a series of reports for the Alberta Department of the Environment warned about the threat of dike failure, seepage and groundwater pollution from growing waste ponds. In 2007, Natural Resources Canada made several recommendations and concluded, *"...it would be irresponsible to continue on a 'business-as-usual' course; a business-as-usual approach...is not sustainable; [and] it is time to begin the transition to a clean energy future"*.

The number of reports and recommendations regarding the environmental repercussions of Oil Sands production is vast, yet they have done little to change the Alberta and federal governments' approach to Oil Sands development. Even samples of deformed fish from Lake Athabasca and the widely publicized 2010 study conducted by internationally renowned water expert, Dr. David Schindler, and his team, which concluded that the Oil Sands industry is substantially increasing loadings of toxic priority pollutants to the Athabasca River and its tributaries, appear to have lead only to discussions on improved government monitoring.

Part 3: Closing points and information

Low-carbon performance. Canada has fallen far behind most other industrialized countries in emissions reduction, renewable energy technology, and overall low-carbon performance. As Canada's National Round Table on the Environment and the Economy says, "Most of our competitors...are all investing more and preparing their economies for the low-carbon transition". By 2008, the UK and Germany had already reduced their GHG emissions by 19 and 22%, respectively. Germany and China have taken the lead on research and manufacturing of solar photovoltaic cells and wind turbines. And Pembina's analysis found an 18:1 per capita ratio for stimulus spending between the U.S. and Canada on renewable energy programs for 2010. And in 2011, the U.S. proposes to eliminate fossil-fuel subsidies worth \$12 billion.

Global warming. The increasing exploitation of Canada's Oil Sands amounts to a massive investment - locking in a high carbon North American transportation system at the same time that Canada and the rest of the world need to urgently tackle climate change. There can be no energy security, or indeed any kind of lasting security, without a stable climate. The current lack of action on climate change mitigation is setting the world on a path to reach a projected rise in global temperature of 3.5°C over the next 25 years, meaning that governments worldwide will have failed in their pledge to hold global temperature below 2°C.

As a member of the G8 and G20, Canada has a significant role to play among industrialized countries in reaching adequate commitments to mitigate global warming. Yet the Canadian government has been in the forefront of stalling successful climate change negotiations, in large part to protect the continuance of Oil Sands development. By not taking substantive action on climate change and not addressing the repercussions of Oil Sands development, the Canadian government is not taking consequences for future generations into account.

Experts predict we could reach 4°C of warming as early as the 2060s. Among the potential catastrophes, a 4°C global temperature rise could result in: sea levels rising up to 2 metres by 2100; ocean ecosystems and food chains collapsing; swaths of southern Europe turning to desert; half of the world becoming uninhabitable; and 85% of the Amazon rainforest being killed off by 2100. *"It doesn't have to be this way. If politicians agree to cut emissions by 3% every year, the world can limit temperature rise to a 'safe' 2°C"*, says the UK's Met Office.

Growing concern about the Oil Sands. A recent report released by Ceres, a coalition of investors and environmental and public interest organizations that studies challenges to sustainability, shows that the environmental and financial risks of producing oil in Canada's Oil Sands region may be even greater than deepwater oil production in the Gulf of Mexico.

As the world's attention reflects on the disastrous consequences of offshore drilling, it should also consider the risk of one of the large Oil Sands tailings ponds, held in check by barrage dams up to 100 metres high, breaching, especially in winter when it is impossible to clean up under the ice. Catastrophic amounts of toxic waste would flow into the Athabasca River, make their way into the Great Slave Lake and the Mackenzie River, and enter the Beaufort Sea. Dr. David Schindler has noted: *"If any of these tailings ponds ever burst the world would forever forget about the Exxon Valdez."* [10]

The world may also forget about the Exxon Valdez if an oil spill from one of the tankers carrying Oil Sands crude fouls British Columbia's waters and coastline. And the recent earthquake in Japan warrants serious reservation in regards to employing CCS and the related potential danger of seismic events unleashing deadly buried CO₂.

Further exploitation of unconventional fossil fuel. Huge unconventional fuel reserves - extra heavy crude, oil sands, and oil shale - lie untapped across the globe. Canada is currently the only major centre of production. However, new deposits of oil sands and other unconventional oil have been discovered or are already being exploited in several other countries. If all 1.1 trillion barrels of probably extractable Canadian and U.S. unconventional oils were exploited within the next century, WWF estimates it would result in emissions of 980 gigatonnes (Gt) CO₂ - 183 Gt CO₂ from the Oils Sands and 797 Gt CO₂ from US shale oils - equating to an estimated increase in atmospheric CO₂ levels of between 49 and 65 parts per million (ppm), enough to likely tip CO₂ levels beyond the climate stabilization threshold of 450 ppm CO₂ equivalent. Rather than leading the way on the path to eliminate the use of fossil fuels and reduce global warming, Canada is leading the way down the road of exploiting unconventional reserves and the use of the most GHG intensive fossil fuels.

Closing comments. Canadian governments and the Oil Sands industry argue in favour of further Oil Sands development, saying that on a global basis the GHG emissions and the environmental destruction of the Alberta Oil Sands are small. However, what this development represents is huge. The Alberta Oil Sands are impeding the enforcement of adequate environmental policies and emissions reduction within Canada and adversely influencing Canada's role in global climate change initiatives. They are also setting the stage for further extraction and processing of unconventional fossil fuels on a worldwide scale, which would lead to substantive increases in GHG emissions from fossil fuels. The potential for increased exploitation of unconventional fuels is also providing a means for global governments and industry to perpetuate the heavy use of fossil fuels rather than seriously tackling the necessary conversion to renewable energy, low carbon transportation and energy supplies, and reductions in energy use.

Thus development of the Alberta Oil Sands stands as an icon representing a huge barrier to aggressive action on climate change, not only in Canada, but also globally. It exhibits the single-mindedness of corporations and governments in putting this industry in the way of achieving adequate measures to abate global warming and preserve integrity of life for current and future generations. Given the projected repercussions of climate change based on current emissions reduction commitments, only short-term thinking and maintaining local pollution, global warming, and loss of habitat as 'externalities' allow the ever-expanding Oil Sands project to continue.

"The more a nation becomes dependent on a single resource such as oil, the less democratic it becomes over time. Oil begins to make the decisions. You introduce these incredible political imbalances to the system that slowly and incrementally change the very character of your democracy." Andrew Nikiforuk, author of *Tar Sands: Dirty Oil and the Future of a Continent*

* To provide the flexibility of accessing sections independently, a minimal amount of repetition has been utilized.

** Only the referenced information that is not in the body of the main report has been footnoted in the Summary.

INTRODUCTION

There are an estimated 1.7 trillion barrels of oil sands in the Athabasca-Wabiskaw oil sands of north northeastern Alberta, the Cold Lake deposits of east northeastern Alberta, and the Peace River deposits of northwestern Alberta, of which 170 to 175 billion barrels are recoverable using current technology. Since 1967, Alberta has produced 6.99 billion barrels of raw crude bitumen from the Oil Sands. [1]

In 1967 Alberta's first oil sands mine opened, started by the Great Canadian Oilsands Company, which is now called Suncor Energy. In 2009, Alberta produced 302 million barrels from the mineable area and 242 million barrels from the in situ area, totaling 544 million barrels, equivalent to **1.49 million barrels per day**. The 2009 yearly total represents a 14% increase over Alberta's 2008 Oil Sands production. **Alberta's Energy Resources Conservation Board projects that by 2019 total raw bitumen production will reach 3.2 million barrels per day and the Canadian Energy Research Institute projects production could more than triple by 2030.** [2]

What is Oil Sands oil and how is it mined?

Oil sands oil is found in the ground in the form of bitumen, a hydrocarbon that is solid at normal temperatures and mixed in with sand, clay and water. Crude bitumen comprises about 10% of the oil sands. When it is less than 75 metres below the surface it is extracted using open pit mining techniques; when further below the surface high-pressure steam injection (in situ) technology is required to remove it. Most in situ deposits are 350 to 600 metres below the surface.



HANDFUL OF BUTUMEN Source: sqwalk.com

For open pit mining, the area is first cleared of trees, then the muskeg is drained of water and removed, then the underlying clay, silt and gravel are removed to expose the oil sands deposit. **Two tons of overlay rocks and soil are removed and another two tons of oil sands are processed to produce one barrel of oil (roughly 1/8 of a ton).** Both extraction processes and subsequent upgrading are very water and energy intensive. 60% of current Oil Sands production is currently from open pit mining. [3]

Non-upgraded bitumen refers to the portion of crude bitumen production that is not upgraded but is blended with some lighter-viscosity product (referred to as a diluent) in order to meet pipeline specifications for transport in pipelines. Upgraded bitumen refers to the portion of crude bitumen production that is upgraded to synthetic crude oil and is primarily used by refineries as feedstock. In 2009, bitumen produced from mining was mainly upgraded and the bitumen crude produced from in situ operations was mainly marketed as non-upgraded crude bitumen. [4]

The Athabasca River

The Athabasca River is the ninth longest river in Canada running an estimated 1400 km from the Columbia Ice Fields near the Alberta-British Columbia border to its mouth in Lake Athabasca. It is the third longest undammed river in North America and flows north through the municipality of Wood Buffalo and the middle of the Athabasca oil sands deposit in northern Alberta to the Peace-Athabasca Delta, a large (6000 square kilometers) complex of wetlands and lakes at the western end of Lake Athabasca, one of the world's largest freshwater deltas and the largest boreal delta. The delta contains over 1000 lakes, has supported large communities of aboriginal people for millennia, and is an important staging area for migratory waterfowl. Up to 400,000 birds use the Delta in spring and more than 1 million use it in autumn. It is the prime range for 5,000 bison.

From the Delta the water flows north via several channels towards the Peace River and the Slave River. At the north end of the 434 km Slave River lies the Slave Delta, on the southern shore of Great Slave Lake. From there the water flows north in the Mackenzie River to the Beaufort Sea. The entire Mackenzie Basin is 1,790,000 square kilometers and covers 20% of the land mass of Canada. The Athabasca River is the primary source of fresh water for communities in northern Alberta and the mining side of the Oil Sands industry. [5]



PART 1: ENVIRONMENTAL AND HUMAN IMPACTS, GOVERNMENT INADEQUACIES, AND VIABLE ALTERNATIVES

RESOURCE USAGE:

165-175 litres of water + 1600 cubic feet of natural gas is used to produce one barrel of in situ crude oil and 300-475 litres of water + 700 cubic feet of natural gas is used to produce one barrel of mined crude oil from the Oil Sands. [6]

Natural gas consumption:

The Oil Sands are a major consumer of natural gas, representing about 20% of Canadian demand. Alberta Oil Sands extraction utilizes enough natural gas to heat approximately 3.5 million Canadian homes. Meanwhile Canadian natural gas production is projected to peak in 2011 and therefore decline in subsequent years.

It takes three times more units of energy to extract bitumen from oil sands than oil from conventional wells. [7]

- According to the National Energy Board (NEB), it takes about 34 cubic metres (1200 cu ft) of natural gas, enough to heat the average Canadian home for over 4 days, to produce one barrel of bitumen from in situ projects and about 20 cubic metres (700 cu ft) for integrated projects (mining, extracting and upgrading the bitumen into synthetic crude oil). A further 400 to 500 cu ft of natural gas is utilized to upgrade the in situ bitumen to crude oil. [8]
- According to the Canadian Association of Petroleum Producers, total gas requirements for Oil Sands operations could rise to 1.8 billion cubic feet per day by 2020, compared with 1.0 billion cubic feet per day in 2008. [9]
- At the Oil Sands rate of natural gas consumption, Natural Resources Canada calculated that the project could severely compromise the nation's natural gas supplies by 2030 (using up to 60% of Canada's supply). If predicted expansion occurs, the Oil Sands could eventually use enough natural gas to heat all of Canada's households (over 12 million). [10]
- Natural gas produces 30% less CO₂ emissions per unit of energy than crude oil and 45% less than coal. **In 2007, Natural Resources Canada recommended, "conserving this resource for a more valuable use".** [11]
- In 2009 Oil Sands production was 1.49 million barrels per day (bpd). The Alberta government predicts bitumen production is expected to more than double to 3 million bpd by 2018. The Canadian Energy Research Institute's 2009 forecast envisioned raw bitumen production climbing to around 4 million bpd in 2025. This would mean that Canadian natural gas would likely be inadequate to supply the anticipated expansion in Oil Sands output. [12]

Alternate energy sources

- With the energy needs of an expanding Alberta Oil Sands and its rapid depletion of conventional natural gas, the industry is turning to unconventional sources such as natural gas from coal, offshore gas, shale gas, and bitumen and bitumen residues, the waste from Oil Sands upgrading (petroleum coke and asphaltene). These are often more difficult and costly to produce, and would also substantially increase the intensity and total amount of greenhouse gas pollution and air emissions from the sector. [13]
- As well, the Alberta and Canadian governments have studied the viability of using Candu reactors to power the Oil Sands. In 2007, then-Minister of Natural Resources, Gary Lunn, stated that it is not a matter of "if," but "when" a nuclear reactor will be built to supply energy to oil sands production facilities. Parliament's Natural Resources committee later concluded that almost 20 nuclear reactors would be needed to meet the production growth planned up to 2015 and recommended that no decision be made on using nuclear energy to extract oil from the Oil Sands until the repercussions of this process are fully known and understood. [14]

Water consumption:

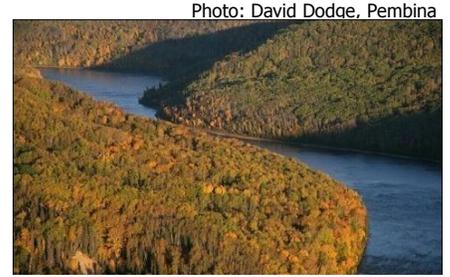
Oil sands extraction is a water-based process. Large volumes of water are needed to separate bitumen molecules that are trapped in sand and clay. Oil Sands mining operations use surface water and recycled water and their primary source of fresh water is the Athabasca River

For in situ projects, the biggest use of water is to generate steam to be injected underground. Some surface water is used but most operations use fresh and saline groundwater as their source. According to the Canadian Association of Petroleum Producers (CAPP), in 2008, 45% of the water used by in situ Oil Sands developments was saline water from deep underground zones. [15]

Water consumption for mining operations:

Approximately 12 barrels of water are required to produce each barrel of bitumen in surface mined Oil Sands operations. The water recovered from the bitumen extraction process is recycled. However, water is lost to evaporation and the pore space between the clay and sand grains in the tailings, originally occupied by the bitumen. The result is that up to 70% of the water is reused, leaving a net use of about four barrels of fresh water per barrel of bitumen production. [16]

- According to National Energy Board figures, **the new water required to produce one barrel of synthetic crude oil in a mining operation ranges from 2.5 to 4.0 barrels of water.** Every day, along with its exported Oil Sands crude, Canada essentially exports millions of barrels of virtual water. [17]



ATHABASCA RIVER AND BOREAL LANDSCAPE

Water consumption for in situ operations:

- The average amount of water required for *in situ* oil sands extraction is 2.4 to 3.6 barrels of water to produce one barrel of recovered bitumen. After recycling of process water, the average amount of new water used per barrel of bitumen produced is 0.39 to 0.52 barrels. However, because the space that is filled by bitumen in underground rock formations must be filled by water as the bitumen is removed, **the final ratio of water used in in situ operations is approximately 1 barrel of water for each barrel of bitumen.** [18]
- **Upgrading of the bitumen requires approximately 0.4-0.5 barrels of fresh water per barrel of Synthetic Crude Oil (SCO) produced,** bringing the total water use for production of SCO from *in situ* operations to an average of 1.4 to 1.5 barrels per barrel of oil. [18]
- For in-situ production, it is expected that over one-third of total water supply is expected to continue to come from fresh shallow groundwater. Saline water must first be treated to create steam. In 2009, annual in situ freshwater consumption was 16 million cubic metres. [19]

Water resources – surface water

Oil Sands projects are now licensed to divert more than 652 million cubic meters of freshwater from the rivers and aquifers in the Athabasca Basin each year, 7 times the water needs of the Edmonton area. 82% is for water from the mainstem of the Athabasca River and 13% is water from major tributaries. The balance is for the collection and use of run-off.

The Lower Athabasca River is most sensitive to water withdrawals during low flow conditions (both within and across years). Low flow conditions occur mainly during the winter season but can also occur at other times during years of low precipitation. [20]

- The average annual flow of the Athabasca River just downstream of Fort McMurray is 625 cubic metres per second (cms), but the Athabasca has highly season flow rates and flows are highly variable. The highest flow recorded (July 2001) was 4,700 cms and the lowest recorded flow (December 2001) was 75 cms. [21]
- **During the open water season (April–November) flows average 859 cms, whereas when the river is covered with ice (December–March) flows average 177 cms.** Flows have been well below average for most years since 1980. [22]

According to the Alberta government, all existing and approved Oil Sands projects together will withdraw less than 3% of the average annual flow of the Athabasca River. During periods of low river flow, water consumption is limited to the equivalent of 1.3 per cent of annual flow. At times, this can mean industrial users will be restricted to less than half of their normal requirement. [23]

Expressing allocations in terms of a percentage of annual flow can be misleading when considering the impacts of water withdrawals on the aquatic system during the winter months and other low-flow periods when the Oil Sands industry has much greater impacts. There is no requirement to halt Oil Sands withdrawals during low-flow periods when the river is at risk and Oil Sands operations are allowed to continue to withdraw water, even at the expense of fisheries and habitat. [24]

- Based on the above figures, existing and proposed Oil Sands projects could withdraw 7 to 17% of the Athabasca River's water flow during its lowest flow periods.
- According to CAPP, Oil Sands projects recycle 80 to 95% of the water used. However, according to WWF, ultimately only 5-10% is returned to the river – the rest being too toxic. [25]

"If we haven't already passed it, we're on the brink of overtaking the Athabasca River because of the oil sands." Dr. David Schindler, Professor of Ecology, University of Alberta

Water resources – groundwater

Oil sands mining uses surface water while in situ methods utilize groundwater. In situ operators heat water to produce steam, which is then injected into the reservoir to liquefy the viscous bitumen. Wastewater is often disposed of in deep disposal wells. When considering the scale of in situ operations (242 million barrels of bitumen in 2009), the annual water withdrawals are significant. Since 80% of the total bitumen reserves are accessible only by in situ, the demand for groundwater could be as great, or greater, than the demand for surface water. [26]

- Knowledge is lacking as to whether the aquifers in the Athabasca oil sands region can sustain the Oil Sands groundwater demands and losses. In January 2008, the Alberta Water Council noted that “there was a concern that research and technology support is unable to sustain the planning envisioned by the *Alberta Water for Life Strategy*.” It further referenced the need for more mapping of quality and quantity of groundwater. Without sufficient data, government agencies and other institutions are unable to assess the risk posed by large scale in situ developments. [26]
- In 2009, annual in situ freshwater consumption was 16 million cubic metres. While it can be expected that in situ Oil sands operations will become more efficient, it is still projected that total freshwater use may almost triple to 45 million cubic metres by 2020. [27]
- The wastes from treating saline and recycled water are either put into deep wells or sent to landfill, where there is a risk that it may eventually leach into fresh groundwater. [28]



IN SITU MINING Photo: David Dodge, Pembina Institute

Water resources and climate change

The changing climate is having a profound effect on water resources in Alberta and the Northwest Territories. WWF predicts that warming temperatures will significantly reduce both water quality and quantity in the region.

Average summer and winter low flows of the Athabasca River have declined for over 30 years as a result of climate warming and decreased snow. Runoff has decreased by 50% in the 93.7% of the Athabasca Basin that is downstream of the Rocky Mountains. Models based on forecast climate warming for the 21st century predict a further decrease in snowpacks, runoff, and river flow.

Climate change affects river flows, lake levels, pollutant concentrations, and freeze-up and break-up dates. According to a 2007 University of Alberta study, Fort McMurray and Fort Chipewyan experienced temperature increases of 2.2 degrees C and 3 degrees C respectively between 1945 and 2005. According to Environment Canada, the Mackenzie District experienced an increase of 2.4 degrees C between 1948 and 2007. [29]

- Temperature increases not only cause a decline in the supply of water, they also inversely cause an increase in demand. Summer flows in the Athabasca River declined by 29% between 1970 and 2005. At the source of the Athabasca, in the Columbia Icefields of Jasper National Park, shrinking glaciers, declining snowpacks and earlier spring melt will result in even lower water flows in the summer months. The Athabasca Glacier has already receded 1.5 kilometers and lost a third its volume and the Athabasca River is already experiencing loss of glacial water from the Columbia Ice Fields. [30]
- Schindler, Donahue and Thompson (2007) projected that, based on the combination of climate warming and increasing water withdrawals, winter flows less than 100 cubic metres per second (cms) will occur with increasing frequency in the future. They also projected that water flows in the watersheds of the Oil Sands region would decrease by an additional 8 to 26% with an average temperature increase of 3 degrees C by 2050. [31]
- Across the prairies, temperature increases are projected to reach 6 C by the end of the next century, which will further decrease flows in the northern rivers. [32]

The combined impact of climate change and water use by the oil sands and other industries could irreparably affect the ecological health of the Peace-Athabasca Delta and ecosystems downstream. This could also have important implications for the availability of water for the Mackenzie River system. [32]

Future water demands - ecological concerns and water security



THE AMPHIBIOUS LANDSCAPE OF THE MACKENZIE RIVER DELTA

Source: Intranet Lab

A variety of industry and government agencies have recognized that the intensive water requirements of unconventional oil, combined with climate change, may threaten the water security of two northern territories, 300,000 aboriginal people, and Canada's largest watershed, the Mackenzie River Basin.

Schindler, Donahue and Thompson (2007) predicted that projected bitumen extraction in the Oil Sands will require too much water to sustain the river and Athabasca Delta, especially with the effects of predicted climate warming. [33]

Without clear limits on water use, oil sands operations could damage aquatic life in northern Alberta, the Department of Fisheries and Oceans (DFO) has noted in an October 2010 report:

“A flow should be established for the Lower Athabasca River below which there would be no water withdrawal. . . This flow should be established using a precautionary approach.” Clear benchmarks, the DFO predicts, would “preserve ecosystem function” and “limit harm to fish and fish habitat” on one of Canada's most ecologically important rivers. [34]

- While the tributaries of the Athabasca River do not constitute a large spatial area relative to the overall drainage basin and thus likely contribute relatively little to the overall flow of the river, they likely provide important spawning and rearing habitat necessary to sustain the fish populations in the Lower Athabasca River. [34]
- In August 2008, there were 7 mine projects, 9 upgrader projects, and 19 in situ projects in operation or scheduled for start up within the year. By the 2030s, there may be as many as 40 upgraders, 33 mines and 83 in situ projects, based on what has been announced, applied for, or is currently in operation. The further expansion of the oil sands industry may have an effect on the amount and quality of water and the health of the ecosystems in the Mackenzie River Basin. These effects will compound the changes already experienced as a result of climate change in the region. [35]



THE ATHABASCA DELTA

Photo: David Dodge, Pembina

Source: Circle of Blue

Future water demands - industry concerns

According to May 2010 report prepared for Boston-based investor and environmental advocacy group Ceres, under current expansion plans, Oil Sands companies could run out of adequate winter water supplies as early as 2014. [36]

- The National Energy Board has questioned the sustainability of water withdrawals: *“At current rates of withdrawal from the Athabasca River, there would be insufficient volumes to support all the announced oil sands mining projects. River flows are low in the winter and the removal of large volumes of water during these periods is a concern.”* [37]
- A 2006 Alberta report, *Investing In Our Future*, noted, “over the long term the Athabasca River may not have sufficient flows to meet the needs of all the planned mining operations and maintain adequate stream flows.” The report also concluded that Alberta Environment had failed “to provide timely advice and direction” on water use. [37]
- “Canada has a lot of fresh water,” states Mike Hightower, an engineer at Sandia National Laboratories and one of the top American experts on the competition between energy and water. “But we are beginning to see limits on development of the oil sands. You will see limits where production hits a plateau and won't get above it. The point is that a couple of years ago they were talking about three million or four million barrels a day. The water resources won't allow them to go there. They will cap out at 2.5 million.” [38]

GREENHOUSE GAS EMISSIONS:

With the carbon-intensive nature of oil sands development, the Alberta Oil Sands is Canada's fastest growing source of greenhouse gas (GHG) emissions. They stand as the single greatest obstacle to Canada meeting its global climate change responsibilities.

A University of Ottawa 2007 study showed that the estimated value of damages associated with GHG emissions for oil sands oil is reasonably large. *“Based on 2004-2005 data, our analysis indicates that a central estimate of 18% for the impact of climate change damages on net benefit would not be unreasonable, although the estimates vary widely.”* [39]

Well-to-pump vs Well-to-wheels emissions

The difference in total carbon emissions from oil sands to that of other crude oil sources occurs mainly in the extraction and processing phases - also called “well-to-pump” or “well-to-retail pump”. Although there is a high degree of variation, **industry average emissions for oil sands production and upgrading are estimated to be 3.2 to 4.5 times as carbon intensive as conventional crude produced in North America**, making Alberta Oil Sands oil some of the dirtiest on the planet.

- On a well-to-pump basis, GHG emissions per barrel of crude oil production are: 62 to 164 kg CO₂e for the production and upgrading required to produce synthetic crude oil from oil sands mining and 99 to 176 kg CO₂e for synthetic crude oil from in situ. (Production of Canadian conventional crude emits 27 to 58 kg CO₂e.) [40]

The Oil Sands industry states that oil sands-based fuels are only approximately 15% more carbon-intensive than conventional crude oil. However, their figures are based on a well-to-wheels measurement, where the full product life-cycle is considered from production (wells) to the use of the fuel in a vehicle (wheels) and includes oil recovery, upgrading, transport, refining, distribution, and combustion emissions. **60 to 80% of greenhouse gas emissions on a wells-to-wheels basis come from the combustion of transportation fuels by the end user.**



SUNCOR OIL SANDS EXTRACTION FACILITY

Photo: Mark Ralson, AFP/Getty Images, Source: Global Maritimes

However, constructing reliable life-cycle models of oil sands pathways is challenging for a variety of reasons, including limited data availability (and the proprietary nature of industry data), the rapid expansion of the industry, the unique and complex nature of each oil sands project, and the evolving technologies being applied in the industry. As well, life cycle studies vary in their well-to-wheel analysis. Reviews conducted by the National Resources Defense Council (NRDC) in 2008 and 2010, showed a range of 8 to 37% higher emissions versus the U.S. average petroleum baseline. In researching 13 life cycle GHG emission studies, Charpentier et al found that most studies did not calculate supply chain and fugitive emissions (or did so incompletely) nor did they fully include emissions from flaring, venting, and what appear to be ‘secondary’ stages: transport to refinery, distribution, storage, and dispensing. Even from a full life-cycle “well-to-wheels” perspective, oil sands are still one of the most greenhouse gas intensive fuel sources. [41]

- A 2010 NRDC report estimated that, not including emissions from land use changes, on a well-to-wheel basis, the average emissions for oil sands production is 14% greater for oil sands produced from surface mining versus the U.S. 2005 average gasoline baseline (EPA). For in-situ methods, the average is 25% greater emissions for synthetic crude oil produced, 18% greater emissions for dilbit produced in-situ (a mixture of bitumen and diluent, such as natural gas condensates – see Diluent, page 46), and 17% greater emissions for synbit (a mixture of bitumen and synthetic crude oil). [42]
- In 2009, 55% of Oil Sands products processed in the United States were bitumen blends. The most common bitumen blend is dilbit. According to IHS CERA, producing a barrel of condensate emits one fifth of the GHG emissions associated with producing the same volume of bitumen; and refining a barrel of condensate emits one third of the GHG emissions associated with refining bitumen. Therefore, when the raw bitumen is diluted with the less carbon-intensive condensate, the resulting barrel of dilbit has lower life-cycle emissions than a barrel of bitumen because only 70% percent of the dilbit barrel is derived from oil sands. [43]

Overview of Oil Sands emissions:

Emissions associated with mining & oil and gas extraction alone increased by 61% (9.0 megatonnes (Mt)) between 2004 and 2008, largely due to increased activity at the Alberta Oil Sands. Environment Canada's 2008 National Inventory Report (latest available figures at time of writing), attributes 37.2 Mt - 24.9 Mt from Oil Sands mining, extraction and upgrading; 12.2 Mt from in situ bitumen - of greenhouse



SYNCRUDE OIL SANDS OPERATION, with tailings ponds in foreground
Photo: David Dodge

gas emissions to Oil Sands production. Almost all oil sands production emissions come from energy use. [44]

- Alberta is responsible for 52% of Canada's emissions growth since 1990, despite being responsible for only 18% of GDP growth and 19% of population growth. Combined with Saskatchewan, the two provinces account for 74% of national GHG growth. According to Environment Canada, the oil and gas sector is responsible for nearly 40% of total national emissions growth since 1990, with this growth concentrated in B.C., Alberta and Saskatchewan. [45]
- On a per capita basis, Alberta's GHG emissions are more than three times those of either Canada or the U.S. [46]

Bacterial production of methane (25 times the global warming potential of CO₂) from tailings ponds contributes to GHG production. At the Mildred Lake Settling Basin (Syncrude's largest), 60 to 80% of the gas flux across the pond's surface is due to methane; the pond produces the equivalent methane of 0.5 million cattle per day. [47]

Upgrading and refining of Oil Sands bitumen

Oil Sands companies process bitumen into either synthetic crude oil (SCO) or bitumen blends (dilbit: bitumen + diluent, or synbit: bitumen + SCO – see page 46). The upgrading process centres on adding hydrogen to the bitumen at elevated temperatures and pressures, yielding SCO. The SCO that is produced can be refined into various petroleum products, such as gasoline, diesel, and jet fuel, in existing refineries in much the same way that conventional crude oil is refined. Though many types of blends and qualities of SCO are exported, the properties of SCO are similar to conventional crude oil and it is often equated to West Texas Intermediate (WTI), or conventional light medium.

Some companies decide not to upgrade the bitumen and instead sell it, as dilbit or synbit, to refineries that have the capability to both upgrade and refine the bitumen. In 2008, about 59% of total crude bitumen produced in Alberta was also upgraded in the province.

The Alberta Energy Resources Control Board forecasts that by 2019, while SCO production will almost double to 494 million barrels, only 50% of total crude bitumen produced in Alberta will be upgraded in the province due to expected narrow price differentials of bitumen relative to light crude oil. [48]

A December 2010 report from Communities for a Better Environment, says that refining fuel from inferior feedstocks, [such as bitumen blends] can sharply elevate CO₂ emissions. "Fuel combustion increments observed predict that a switch to heavy oil and tar sands could double or triple refinery emissions and add 1.6-3.7 gigatonnes of carbon dioxide to the atmosphere annually from fuel combustion to process the oil. This raises the possibility that a switch to these oils might impede or foreclose the total reduction in emissions from all sources that is needed to avoid severe climate disruption."

Greg Karras, the author of the report, points out that refineries need expensive technology to process low-quality fuels. And once they've bought that equipment, they'll want to use it to get a return on their investment. A better approach, he says, is to avoid low-quality feedstocks altogether, in favour of alternative energy sources: *"Once we go down the road of refining low-quality crude, it's going to be hard to change direction."* [49]



SURFACE MINING IN THE OIL SANDS Source: gofrm.com

Accounting of Oil Sands production-related GHG emissions:

Canada's *National Inventory Report on Greenhouse Gas Sources and Sinks in Canada* is only responsible for reporting Oil Sands emissions that occur in Canada. This includes extraction, and the emissions associated with upgrading that occurs in Canada. The National Inventory Report (NIR) does not reflect emissions associated with upstream land use or the downstream upgrading and refining that is done outside of Canada. Additionally, the NIR's reporting structure does not categorize as part of Oil Sands emissions, the emissions from production of the natural gas that is utilized in Oil Sands production or the refining of SCO from the Oil Sands that is done at various Canadian refineries.

The NIR's total of GHG emissions for the Oil Sands (37.2 Mt for 2008), is the amount most commonly referenced, in particular by governments and industry, as the total emissions related to Oil Sands production. This amount represents approximately 5% of Canada's total GHG emissions (734 Mt for 2008) as reported in the NIR, and is often loosely interpreted by the media and the public as representing the total Oil Sands emissions produced in the process of extracting and converting bitumen into an end use fuel. However, **the 37.2 Mt figure does not take into account several GHG emission sources that are directly or indirectly related to Oil Sands processing prior to combustion. These GHG emissions constitute a considerable percentage of additional Oil Sands emissions that are generated as part of the well-to-pump, or production, processes, most of which will also increase as Oil Sands production increases.** (Oil Sands emissions could almost triple by 2020, according to Canadian government forecasts.) [50]

- According to Alberta's Specified Gas Emitters Regulation, **only companies that emit at least 100,000 tonnes of greenhouse gas pollution each year must report their emissions.** About 14% of Oil Sands production comes from small companies that are not required to report their emissions. If these companies produce emissions at the same rate as the larger emitting companies, emission from small Oil Sands companies would represent 5.21 Mt of GHG emissions. [51]
- According to IHS Cambridge Energy Research Associates' (CERA) figures, for the average oil sands product exported to the U.S. in 2009 (based on 55% dilbit blends and 45% SCO) **upgrading and refining of emissions make up approximately 60% of well-to-pump emissions.**

Upgrading: According to the NIR, upgrading requires significant amounts of natural gas and process gases in order to provide process fuel, produce electricity, and generate hydrogen. Increasingly, bitumen from the Oil Sands is being shipped to the United States where a much greater upgrading and refining capacity exists for heavier grades of oil (NEB 2006). Statistics Canada data shows the ratio of bitumen to synthetic crude oil production in Canada rose by 93% between 2002 and 2008 (CAPP 2009).

Emissions from upgrading that occurs in the U.S. for bitumen that is exported from Canada before it is upgraded are not accounted for in the National Inventory Report. In fact, the NIR states, "As a result of the growing quantity of bitumen in the production mix, emissions associated with the upgrading and refining of bitumen have been increasingly avoided in Canada". This is reflected in the proportionately smaller amount of GHG emissions attributed to 'in situ bitumen' (12.2 Mt) vs 'mining extraction and upgrading' (24.9 Mt), even though in situ operations generate more GHG emissions than mining production and, in 2008, accounted for 45% of Oil Sands production.

- According to the ERCB and CAPP, in 2008, 264 million barrels of bitumen were produced from mining and 213 million barrels were produced from in situ. Approximately 92% of the in situ production (about 196 million barrels) was exported for upgrading (ERCB, 2009), which, based on average bitumen output volume in Canada, would yield about 166 million barrels of SCO.
- According to RAND (sources Pembina Institute and GREET-Argonne National Laboratory), emissions produced per barrel of SCO for upgrading are 0.047 to 0.072 tonne CO₂e. Based on these figures, the upgrading to produce 166 million barrels of SCO could account for 7.8 to 12.0 Mt CO₂e that was also exported, but relates directly to Oil Sands production. According to the Pembina Institute, estimates suggest GHG emissions for upgrading can be in the range of 52 to 79 kg of CO₂e per barrel of bitumen. Using Pembina's figures, upgrading of 196 million barrels of bitumen could result in 10.2 to 15.5 Mt of CO₂e. The average from these two ranges would be 11.4 Mt of GHG emissions from exported upgrading.

The Alberta Energy Resources Conservation Board projects that by 2019, only 50% of total crude bitumen produced in Alberta will be upgraded in the province, which will increase the portion of exported GHG emissions from upgrading.

Resulting GHG emissions from actual upgrading in the U.S. would likely vary somewhat from the above estimates. As well, additional GHG emissions may result from transporting bitumen blends vs local upgrading of bitumen as, not only is the transportation volume increased substantially due to the addition of diluent or SCO for blending, but a paper from the University of Calgary reports that pipeline transportation of dilbit is roughly 2.5 times more GHG-intensive than that of SCO.

Refining: Refining emissions are also significant. **Therefore refining of SCO from the Oil Sands that is done outside of Canada represents additional exported CO₂e emissions.** Moreover, the NIR states that the 'Petroleum Refining' category mainly includes emissions from the combustion of fossil fuels during the production of refined petroleum products. **Therefore, the refining of SCO that was done at Canadian refineries represents a substantial amount of GHG emissions that are not categorized under 'Oil Sands' in the NIR.**

In 2008, the yield from bitumen that was upgraded in Alberta was 239 million barrels of SCO (ERCB, 2009). The NEB reported that 122 million barrels of SCO were exported to the U.S., which would equate to 119 million barrels being refined in Canada.

- IHS CERA estimates refining of SCO at 0.047 tonne CO₂e/barrel of refined product and Karras (2010) estimates average refining emissions at 0.048 tonnes/barrel of refined product. Emissions from refining depend on many variables, such as crude feed quality and properties, properties of other crudes being refined at the same time, refined products slate, refinery configuration/processes, fuels burned for process energy, the volume of various refined products produced, and the quality of the refined product. As well, the above estimates on emissions are based on the volume of refined product, which also varies, is made up of a variety of end products, and could not be determined as a direct correlation from Oil Sands SCO.
- However, according to the NEB, refinery runs of crude oil in Canada in 2008 were estimated to be 657 million barrels per year. If emissions from refining of Oil Sands crude in Canada are categorized under 'Petroleum Refining' in the NIR (17.5 Mt in 2008), the approximately half of Oil Sands SCO that was refined in Canada would represent 18% of the total crude refined in Canada, which would translate to 3.2 Mt of GHG emissions. This figure may also represent a rough estimate of the GHG emissions for the almost equivalent amount of Oil Sands SCO that was upgraded in the U.S., bringing the total refining estimate to approximately 6.4 Mt of GHG emissions.

According to the NIR, the Petroleum Refining category of Canada's greenhouse gas sources also includes a small portion of combustion emissions that result from the upgrading of heavy oil from oil sands mining and in situ extraction to produce synthetic crude oil and/or other refined products such as diesel oil for sale. [52]

- If the NIR includes only GHG emissions that occur in Canada, **transportation of SCO and bitumen blend for upgrading in the U.S. would represent a small, but additional GHG contribution related to Oil Sands emissions.** A 2009 WWF report shows transportation to U.S. refineries at 2.8% of well-to-wheels emissions (Woynillowicz, 2008) while IHS CERA reports that transportation makes up 1% and that the average GHG emissions for the transportation of any bitumen or crude within North America is 5.5 kg CO₂e per barrel, with a range of 1 to 14 kg CO₂e. Using IHS CERA's average and the NEB's total of 245 million barrels of SCO and bitumen blend exported to the U.S., this would amount to over 1 Mt of GHG emissions from transportation to refineries.

Further emissions are involved in distribution of refined products, which IHS CERA reports at 2.1 kg CO₂e per barrel on average, with a range of 2 to 2.6 kg CO₂e, for distribution from refinery to point of sale. [53]

- **Externalized emissions from the production and processing of the natural gas that is utilized in Oil Sands production is not included as part of the Oil Sands 37.5 Mt of GHG emissions.** Based on the 1 billion cubic feet per day, or 365 billion cubic feet per year, of natural gas that the Oil Sands uses and Canada's average annual production of 6.4 trillion cubic feet as reported by Canadian Natural Gas, of the 56 Mt that were attributed to natural gas production and processing in 2008 in Canada's NIR, externalized emissions from Oil Sands use of natural gas could proportionately amount to about 3 Mt of GHG emissions for 2008.

Additional related emissions are incurred in the transportation of the natural gas used in oil sands processing. [54]

- **The National Inventory Report does not address the loss of biological carbon due to land use changes.** In a 2009 report, Global Forest Watch Canada estimated that under a full development scenario Oil Sands releases would be 238 Mt of carbon, 873 Mt of CO₂, or 41% of the total carbon contained in the area disturbed by bitumen industrial operations. Over 100 years, this would average out to 8.7 Mt CO₂ per year due to land use changes. [55]

- **Since thousands (26,284 in 2008, with over 50% from outside Alberta) of Oil Sands workers are mobile and travel long distances to and from work shifts, the emissions related to routine air and land travel are significant.** According to the U.S. Department of Energy and the Energy Information Administration, burning a gallon of jet fuel produces 21.1 lbs of CO₂. The result is that each domestic passenger-mile creates about half a pound of CO₂ and each international passenger-mile creates one pound of CO₂. However, the Climate Neutral Network estimates that non-CO₂ greenhouse gas emissions from air travel are at least as significant as the CO₂ impacts (doubling the emissions as expressed in CO₂-equivalents) and upstream processes add an additional 8%, bringing the total to 1.1 lbs. of CO₂e emissions per passenger-mile traveled domestically and 2.1 pounds of CO₂e emissions per passenger-mile internationally. [56]
- There are also other indirect production emissions that are incurred during the construction, maintenance, and decommissioning of the production site - for example, the emissions associated with the manufacture of heavy-duty vehicles that are required to construct and operate the extraction facility and light-duty vehicle manufacture and/or disposal. [57]

Though the calculations in this subsection are averaged estimates and not exact, they do show that in taking into account all of the above Oil Sands production-related GHG emissions (which roughly represent over 35.7 Mt for 2008) and adding them to the NIR's 'Oil Sands (Mining, In-situ, Upgrading)' figure, the total pre-combustion GHG emissions for the Oil Sands could be approximately double the widely-referenced NIR figure.

Even if well-to-pump emissions can be reduced, since 60 to 80% of total emissions on a well-to-wheel basis come from combustion, re-engineering the transportation sector (eg. improved mass transit, electric vehicles, high fuel efficiency standards) would go a long way in reducing emissions and fossil fuel dependence. [58]

Biocarbon and the boreal forest:

Boreal carbon pools account for more of the overall carbon stock than tropical forests and boreal forest regions store almost twice as much carbon per acre as tropical forests. The carbon stored below ground in the boreal forest dwarfs the surface carbon in the trees. Boreal peatlands store 85% of global peat and contain approximately 6 times more carbon than tropical peatlands. [59]

- **According to a 2009 report by Canadian and American researchers, the "boreal biome is the world's largest and most important forest carbon storehouse", storing as much as 208 billion tons of carbon in its trees, peatlands, and soils – the equivalent of 26 years of the world's carbon emissions that spew into the atmosphere from fossil fuels. Therefore, the boreal forest's ecosystem and carbon storage services are globally important in mitigating climate change.** [59]



BEFORE AND AFTER preparing the ground for open-pit mining

Photo: Jiri Rezac-Eyevine

- When boreal forest vegetation or soils are disturbed carbon is released, climate change is accelerated, and biotic carbon storage is diminished. Keeping boreal forest carbon reservoirs intact forestalls and limits initiation of feedback loops that could greatly accelerate the pace of global warming. [60]
- Global Forest Watch, an independent network of organizations, has reported that only 14% of the boreal forest in Alberta is considered intact, by far the lowest percentage in Canada. They also estimate that **the capacity of Alberta's forests and wetlands to absorb industrial GHG emissions was already exceeded in 2003.** In other words, the region now exports vast amount of CO₂ emissions to other parts of Canada and the rest of the planet. [61]

The global importance of the boreal forest is even further magnified by the fact that in both 2005 and 2010, severe droughts in the Amazon resulted in high tree mortality. A February 2011 study predicted the Amazon forest would not absorb its usual 1.5 billion metric tonnes of CO₂ from the atmosphere in both 2010 and 2011, and that the dead and dying trees from the two droughts would release 5 billion metric tonnes of CO₂ in the coming years, making a total impact of about 8 billion metric tonnes - probably enough to have cancelled out the carbon absorbed by the forest over the past 10 years. [62]

Future emissions:

In 2010, Environment Canada reported that petroleum extraction from the Oil Sands is expected to steadily increase, with 2015 production projected to be almost double that of 2008 (Nyober and Tu 2010). The Tyndall Centre for Climate Change Research estimates, in the absence of mitigation efforts by 2015, GHG emissions from the Oil Sands could be between 81 and 122 Mt, depending on how many projects proceed.

Under business-as-usual conditions, the Canadian government projects Oil Sands emissions to reach 108 Mt in 2020, growing to 12% of Canada's emissions. This amount exceeds the GHG emissions of many European countries as well as the total GHG emissions currently produced by the passenger transport sector in Canada. (Based on this projected near tripling of Oil Sands emissions scenario, inclusion of the estimated emissions under 'Accounting of Oil Sands emissions' (pages 18-20) could bring well-to-pump Oil Sands emissions to almost 200 Mt by 2020.)

IHS CERA projects, in absolute terms, by 2030, emissions resulting from oil sands production and upgrading could grow to as much as 160 Mt (stretch growth case) CO₂e by 2030. [63]

- **In Environment Canada's business-as-usual projection, if Oil Sands emissions rise to 12% of national emissions by 2020, they would account for 44% of the total increase in Canada's emission from 2006-2020. IHS CERA's 'looking forward' Oil Sands scenarios envision that emissions from the Oil Sands will grow from 6% of Canada's emissions in 2009 to between 14% (3.1 million bpd moderate growth case) to 21% (5.7 million bpd stretch growth case) by 2030.** [64]
- The anticipated Oil Sands growth and corresponding GHG emissions would make the Alberta Oil Sands a huge relative contributor to Canadian emissions, but still a relatively minor one in the U.S. and in global contexts. If, however, policy efforts manage to slash other emissions, as they must if goals for reducing the risk of catastrophic climate change are to be met, the relative prominence of the Oil Sands would greatly increase. **If Oil Sands emissions rise as expected over the next two decades, even if they managed to stabilize by 2030, while total U.S. and Canadian emissions dropped by 80% by 2050 (the science-based emission reduction requirement to keep global warming below the 2 degrees C threshold), Oil Sands emissions would then become equivalent to about 10% of U.S. emissions by 2050, representing almost all emissions from Canada at that point. Therefore, though Oil Sands' emission may not currently represent a large percentage of Canada's GHG emissions, future Oil Sands' emissions will be critical to deal with in the long term.** [65]
- In December 2008, Alberta released a draft policy that would allow Oil Sands companies operating in situ projects to switch from burning natural gas to much dirtier, more greenhouse gas-intensive fossil fuels. The policy includes a requirement that in situ plans be designed to be capable of capturing carbon emissions in the future, but the government has not defined "capable". With the financial and technical challenges of implementing carbon capture and storage for the Oil Sands region (see section on CCS, page 53), this requirement is meaningless in practice and this policy, in effect, could further increase the carbon footprint potential of Oil Sands operations. [66]

Life cycle policies call for reductions in the well-to-wheels emissions associated with the fuel itself, meaning that improving vehicle fuel economy is not an option to achieve compliance. Low-carbon fuel standards (LCFS) are an example of this type of regulation. LCFS are in place in California, British Columbia, and the European Union, and are under consideration in other jurisdictions. North American jurisdictions implementing or considering LCFS policies represent 34% of the U.S. gasoline market and close to 50% of the Canadian gasoline market.

- LCFS in place today call for reductions in life-cycle GHG emissions of up to 10% from the current average within a decade. As oil suppliers control only 20 to 30% of the well-to-wheels emissions of petroleum fuel, a 10% reduction would require suppliers to cut the emissions from crude oil extraction, processing, and distribution by one-third to one-half. Oil Sands crudes would require about twice the volume of low-carbon fuels to offset emissions as compared with the average crude. [67]

Emission intensity reductions in the Oil Sands

The higher GHG emissions intensity associated with SCO compared to conventional oil production primarily results from the higher fossil fuels used to extract bitumen and to upgrade it into a lighter and more valuable product such as SCO. Environment Canada reported that overall emission intensity (the amount of emissions per unit of production) from producing oil from Oil Sands operations declined by 39% between 1990 and 2008, but that the increase of bitumen export to the U.S. for refining contributed to this reduction.

Another factor was likely fuel source changes for Oil Sands operation, transitioning from sources of energy such as coal and petroleum coke to natural gas, with which came substantial improvements in Oil sands emission intensity. More recently, improvements in GHG intensity have essentially stalled and the Pembina Institute reported that, according to Government of Canada data, there has been little improvement in average emissions intensity over the past five years. IHS CERA projects that the average carbon intensity of Oil Sands blends in 2030 will remain about the same as in 2010. [68]



ALBERTA OIL SANDS BESIDE SYNCRUDE

Photo: Katakanadian via Flickr

- In July 2007, Alberta’s Specified Gas Emitters Regulation came into effect, requiring facilities that emit more than 100,000 tonnes of GHGs a year to reduce emissions intensity by 12%. However, **firms are free to “meet” the targets by making low-cost payments into a fund, instead of securing actual emission reductions.** [69]
- Shell reported, in 2009, while compliance resulted in approximately 2.6 Mt of actual reductions and investing in verified offsets created by other Alberta projects, companies chose to pay approximately \$40 million into Alberta’s Climate Change and Emissions Management Fund. In the past 3 years, more than \$187 million has been received by this fund. It is not yet known how effectively investments made by this fund will cut GHG emissions. [69]

Emissions intensity reduction means that emissions have to be reduced per barrel, but overall emissions are allowed to grow as industry increases output. Even with the achieved gains in reduction of emissions intensity to-date, and even if firms had to meet the targets with actual emission reductions, **increased production of Oil Sands oil not only counterbalances gains in emission intensity reduction, but overall emissions will continue to grow because of the fast pace of projected increases in production.** [70]

Current federal and Alberta GHG emission reduction plans

In order to prevent catastrophic consequences from global warming, developed countries are required to reduce their carbon dioxide emissions to 25-40% below 1990 levels by 2020 and at least 80% by 2050. The Canadian government’s latest emissions plan calls for a reduction of only 17% below 2005 levels by 2020, which is equivalent to 2.5% above 1990 levels. [71]

- **2010 government-reporting projections show no decrease by 2012 from 2008 GHG emissions, which were 24% above 1990 levels.** [71]
- The Conservative government’s emission reduction plan calls for intensity based targets. To-date all gains in energy efficiency or decreases in GHG intensity have been completely overwhelmed by the growth of the Oil Sands industry. [72]
- The Alberta government’s GHG emission reduction plan is to achieve a 14% reduction below 2005 levels by 2050. The plan, however, actually allows emissions to increase for another 10 years and then stabilize in 2020. The Alberta Climate change plan contains no targets for reducing GHG emissions in absolute terms and no requirements for large polluters, such as Oil Sands operations, to make absolute emissions reductions. [72]
- The International Energy Agency’s (IEA) World Energy Outlook 2009 includes a business-as-usual reference scenario in which the output from the Canadian Oil Sands would triple over the next 20 years. According to the IEA, the possible future that includes such a rapid expansion of the Oil Sands “takes us inexorably towards a long-term concentration of greenhouse gases in the atmosphere in excess of 1,000 parts per million CO₂ equivalent ... [This] would result in the global average temperature rising by up to 6 degrees Celsius. This would lead almost certainly to massive climatic change, and irreparable damage to the planet.” [73]

“The Alberta Tar Sands place an entire generation on the wrong side of history. At a time when the solutions to averting catastrophic climate change are all around us, Canada and multinational oil companies are recklessly promoting a dirty oil that only exacerbates the problem.”
Kumi Naidoo, Executive Director, Greenpeace International



Source: Downstream Today

TAILINGS `PONDS`:

What are tailings ponds?

After oil sands are mined, they must be either thinned or heated to move through a pipeline. The ore is mixed with hot water (and sometimes caustic soda) to wash oil from sand. The slurry is then pumped via pipeline to the extraction plant and fed into primary separation vessels where the heaviest layer, mostly sand, settles to the bottom. A mixture of sand, water and bitumen (called middlings) remains suspended in the middle and an impure bitumen froth (60% bitumen, 30% water and 10% solids by weight) floats to the top and is removed for further processing.

The sand at the bottom of the tank, mixed with water, is pumped into the large settling basins called tailings ponds and the middlings go through a secondary separation process where an addition 2-4% of the bitumen is removed as froth. (90% or more of the bitumen is recovered using this hot water extraction technique.) The sand and middlings make up the waste byproduct called tailings, which consist of water, sand, silt clay, residual (unrecovered) hydrocarbons and water with dissolved components. [74]

- **It is estimated that 2–2.5 cubic meters (2000-2500 litres) of total tailings material is produced on a per barrel basis. This translates to approximately 1.8 billion litres per day of tailings waste. As result, there are a total of 5.5 trillion litres, of impounded tailings on the Oil Sands landscape.** [75]

What are mature fine tailings (MFT)?

Once deposited, tailings separate into coarse sand, a denser fluid and water. The coarse sand fraction settles quickly to form beaches. Most of the fine silts and clays enter settling basins to form a stable suspension that requires a long time to fully consolidate. As this suspension settles, it is referred to as mature fine tailings (MFT). MFT settle to become less liquid and more dense over time, reaching approximately 30% by weight of fine sand and clays. The remaining 70% is composed of water that cannot be recycled because of the suspended sediments.

MFT represents a liability because it is too toxic to be released to the aquatic environment and too fluid to serve as a substrate for dry land reclamation. Methane, a potent greenhouse gas, is emitted from the stored MFT as it ages. [76]

- **It is estimated that 0.25 cubic meters, or more than 1.5 barrels, of mature fine tailings (MFT), the bottom layers of clays, fine sand, water and bitumen in the tailings ponds, are produced for every barrel of produced bitumen. MFT has been accumulating since the first commercial oil sands mine opened in 1967. Today, more than 840 billion litres of waste MFT are stored in tailings ponds.** [77]
- According to WWF, Alberta regulators projected that the inventory of MFT waste could reach 2.4 trillion litres by 2040, a figure that could be seriously underestimated given the rates of MFT growth in recent years. [92]
- The settling process for the finest tailings has turned out to take much longer than expected – up to 150 years – meaning that these tailings lakes will remain a toxic legacy long after industry has left. According to Suncor, left on its own, the MFT could take centuries to solidify. Suncor currently has eight oil sands tailings ponds covering a total of 3,154 hectares. Most are close to 45 metres in depth. [78]
- In a 2010 report WWF states, *“The amount of MFT currently stored in tailings lakes, 25,000 litres for every Canadian, is staggering. The enormity of this toxic legacy and the fact that it is still growing are clear indicators that the industry has thus far failed to find a sustainable way to treat its voluminous waste.”* [79]

Environmental concerns

About 90% of the water used to process the Oil Sands ends up in these acutely toxic tailings ponds that line the Athabasca River and threaten the health of the whole river basin. [80]

- **Tailings ponds cover more than 170 sq km, an area one and a half times the size of the city of Vancouver, and are growing, with liquid tailings rapidly expanding by 200 million litres every day.** Tailings are expected to almost double in size by 2040. The largest tailings pond, controlled by Syncrude, has a water surface of 13 sq km and contains over 400 million cu m of fine tailings - equivalent to 160,000 Olympic-sized swimming pools. [81]
- Among other toxins, tailings ponds contain arsenic, cyanide, naphthenic acids, mercury, sulphuric acid, and polycyclic aromatic hydrocarbons (PAHs). Andrew Nikiforuk states in his *Tar Sands* book that the quantity of PAHs (many of which are known carcinogens) held in tailings ponds represents about 3,000 Exxon Valdezes. [82]
- **Tailings ponds are so toxic that propane cannons are used to keep ducks from landing on them. Annual bird mortality on current Oil Sands tailings ponds could range from more than 8,000 birds to well over 100,000,** depending on mortality rates during oiling events, which have been documented to be as high as 80% to 90%. [83]

- In April 2008, 1600 ducks died after landing on one of Syncrude’s ponds, which did not have noisemakers set up. In June 2010, in provincial court, Syncrude was found guilty of “failing to prevent a hazardous substance from coming into contact with wildlife” and of “depositing a substance harmful to migratory birds”. Syncrude was later fined \$3 million. [84]
- In October 2010, at least 350 ducks perished after they landed on Syncrude’s Mildred Lake tailings pond. Many of the ducks had to be euthanized. The Alberta government reported ducks also landed at facilities run by Suncor Energy Inc and Royal Dutch Shell. The birds were likely forced down by a freezing-rain storm. [84]



SYNCRUDE’S AURORA TAILINGS POND
Photos: Todd Powell, supplied, edmontonjournal.com



A Golden Eye on the shore of Syncrude’s Aurora tailings pond – April, 2008



Two mallard drakes dead, floating semi-submerged in a bitumen mat

Tailings ponds leakage:

How are tailings ponds constructed?

Tailings ponds are constructed with materials created during the mining and extraction process. The containment dyke is first constructed using the overburden, the surface rock and soil that must be removed to access the oil sand resource below. Once oil sands processing begins, the coarse tailings sand is used to build dykes around the periphery. The fine tailings are then contained in the centre of the pond.

Tailings ponds leak because they are built directly on ground that conducts water, and the ponds have walls that are built out of the material that oil sands companies take out of the ground, which also conducts water. This means that contaminated water from the tailings ponds leaks through the base and the sides of the tailings ponds.

Leakage through the base can also be more severe depending on the nature of the ground. Suncor’s south tailings pond, for example, is built over glacial meltwater channels that provide faster pathways for leaking water. [85]



In 1998, a large tailings pond dam failed at Spain’s Los Frailes mine [at left], which was owned by the Canadian company Boliden Ltd. The dam cracked and abruptly broke and 5-7 million cubic meters of acidic, metals-laden water and slurries spilled through the gap. 3 rivers and 11,000 acres of farmland were affected and damage was caused in the Donana

National Park. Foundation failure was cited as the cause.

Source: http://daveslandslideblog.blogspot.com/2010_10_01_archive.html tailings.info



Photo: AP Photos/MTI, Gyoergy Varga, Source: Boston.com

On October 4th, a large reservoir filled with toxic red sludge in western Hungary ruptured, releasing approximately 700,000 cubic meters of stinking caustic mud (a byproduct of refining bauxite into alumina), which killed many animals, 10 people, and injured approximately 120 people - many with chemical burns. The 12-foot-high flood of sludge flooded almost 2,000 acres hectares of surrounding areas, inundating several towns and sweeping cars off the road as it flowed into the nearby Marcal River. [Upper right - note the excavators at bottom to give a sense of scale.] World Information Service on Energy lists well over 100 major tailings dam failures that have occurred since 1960. [86]

Leakage amounts and concerns

As part of its Oil Sands public relations campaign, the Government of Alberta is circulating a brochure on the Oil Sands with the claim that measures are taken in the Alberta Oil Sands “to prevent any seepage from entering groundwater systems or waterways.” In the Alberta Legislature, the Alberta Premier and Environment Minister have dismissed evidence of tailings leakage by suggesting that this is only a problem with older tailings ponds, or that leaking water is captured.

Yet, the tailings ponds are now leaking 4 billion litres per year (11 million litres a day) of contaminated water into the environment and, should proposed projects go ahead, this volume could reach 25 billion litres a year within a decade.

All tailings ponds leak, even the new ones and contaminated tailings leakage has now reached surface waters. [87]

- Adding up the annual leakage, the cumulative toxic leakage into the groundwater could reach almost a trillion litres per year by 2080, and that is without counting the new projects that will inevitably be proposed. This amount would fill Olympic swimming pools placed end to end from St. Johns, Newfoundland to Victoria, BC four times over. [88]



TAR ISLAND 1 TAILINGS POND

Source: Straight Outta Edmonton

- It was noted in the 1997 Decision report for the Application for Amendment for Approval No. 7632 for Proposed Steepbank Mine Development, that 1600 cubic metres per day seeps from the Tar Island Pond into the Athabasca River. [89]
- Tar Island Dyke was constructed in the mid 1960's by Suncor and has been expanded several times. It is now 92 metres high and stands directly next to the Athabasca River. Tailings are no longer placed in the pond. The current leakage rate of contaminated water from Tar Island Dyke into the river is estimated to be 67 litres a second or almost 6 million litres a day. [90]
- A 1998 study prepared for Suncor showed that arsenic and other metal in coke (a by-product of refining oil sands bitumen) leach into groundwater "at concentrations exceeding regulator guidelines". [91]

- In 2004, the National Energy Board wrote, "*The principal environmental threat from tailings ponds are the migration of pollutants through the groundwater system and the risk of leaks to the surrounding soil and surface water . . . the scale of the problem is daunting.*" [92]
- Environment Canada's web page on groundwater contamination states: "*It has often been assumed that contaminants left on or under the ground will stay there. This has been shown to be wishful thinking. Groundwater often spreads the effects of dumps and spills far beyond the site of the original contamination. Groundwater contamination is extremely difficult, and sometimes impossible, to clean up.*" [93]
- In a 2009 Memorandum to Canada's Environment Minister from his deputy Minister, Environment Canada acknowledges the leakage issue, "*Seepage would now likely be directly into surface waters, but move first into groundwater. It may take decades to reach surface waters. In their environmental assessments, many Tar Sands companies acknowledge that this may occur.*" [94]

Andrew Nikiforuk and William Marsden, both authors of books on the Tar Sands, reported that the Alberta government allows Tar Sands companies to dump up to 60 to 70 kg of arsenic each into the Athabasca River every year. [91]

AIR AND SITE POLLUTION:

On average, bitumen is composed of 83% carbon, 10% hydrogen, 5% sulphur, 0.9% oxygen, 0.4% nitrogen, small quantities of methane and hydrogen sulphide, and 1,000 parts per million heavy metals. [95]

In addition to greenhouse gases, Oil Sands operations release large volumes of pollutants into the air.

- These include nitrogen oxides, sulphur dioxide, hydrogen sulphide, volatile organic compounds and particulate matter (small particles in the air). These chemicals are known to affect human health and contribute to air pollution problems. Sulphur dioxide and nitrogen oxides are major contributors to acid rain formation. [96]

In 2009, independent researches conducted a long-term air and water study which estimated about 34,000 tonnes of particulates are falling every year near Suncor's and Syncrude's facilities.

- These particles carry 3.5 tonnes of raw bitumen and carcinogenic polycyclic aromatic compounds (PACs) – a group of organic contaminants containing several known carcinogens, mutagens, and teratogens. This was nearly 5 times greater than the industry-funded and government-supported Regional Aquatics Monitoring Program (RAMP) had reported. [97]



SYNCRUDE Photo: David Dodge, Pembina Institute

- **Environment Canada’s National Pollutant Release Inventory emissions data indicates all 13 elements considered priority pollutants (PPE) under the U.S. Environment Protection Agency’s Clean Air Act are being spewed into the atmosphere by the Oil Sands industry in increasing amounts, which the companies are reporting to Environment Canada. For example, mercury emitted from upgrader plants has increased three-fold in 7 years, lead has increased four-fold in 6 years, and arsenic three-fold in 6 years.** [98]

In May 2010, an Environmental Defense analysis of air quality data collected by industry-funded monitors found that companies violated the province’s air quality standards more than 1,500 times in 2009. The report says the pollutants in high doses have been linked to respiratory illness, heart disease, emphysema, bronchitis, headaches, nausea, spontaneous abortion, and impaired neurological function. [99]

- Alberta government officials have said that the spike in exceedances comes largely from a rise in hydrogen sulphide associated with one of Suncor’s tailings ponds. The rotten egg smell of hydrogen sulphide wafts into the community of Fort McKay (north of Fort McMurray) on a regular basis, causing community members to raise concerns about the impacts of the polluted air on their health and the health of the land. [100]
- Over winter, aerial deposition of particulate dust results in accumulations on the region’s ice- and snow-covered landscape. With snowmelt in late April, accumulated pollutants are carried in meltwater into soil, groundwater, and surface water. Over summer, the season’s heat releases thousands of tonnes of volatile organic compounds (VOCs) from the exposed tailings ponds, including large amounts of benzene, which is a human carcinogen and a “non-threshold” pollutant, meaning that there is a risk of harm at any level of exposure. [101]
- The Oil Sands industry has reduced air emissions of sulphur dioxide by stripping out sulphur into solid form, but as a result has created another problem in the form of massive yellow mounds of sulphur. Because of a glut in the sulphur market, it is not economical to sell the extracted sulphur (currently 1.2 million tonnes per year and expected to reach 4 million tonnes by 2015) so it is stockpiled on site. The storage of sulphur is complicated by errant sulphur dust contaminating groundwater and acidifying soils. [102]



SYNCRUDE SULPHUR STORAGE AT PROCESSING FACILITIES

Photo: David Dodge, Pembina Institute

In terms of acid rain, reductions in emissions of sulphur dioxides are undermined by the steady rise in another acidifying emission – nitrogen oxides. At La Loche Lake in Saskatchewan, across from the Oil Sands, falling rain has been measured as having three times the acid level as unpolluted rain. [103]

LAND AND WILDLIFE IMPACTS:

Industrial development of the scale of the Alberta Oil Sands could push the boreal ecosystem over its tipping point and lead to irreversible ecological damage and loss of biodiversity.

Photos: David Dodge, Pembina Institute



THE CLEARWATER RIVER

which branches off the Athabasca River near Fort McMurray



ATHABASCA RIVER RUNNING THROUGH THE BOREAL FOREST

A recent promotional film from the Canadian Association of Petroleum Producers states that the oil sands industry is “one of the most highly regulated”. However, as of June 2009, about 60% of the total oil sands area (85,000 sq km of land) had been leased to companies for extraction by the Alberta government prior to land-use planning and without environmental assessment. The land area open to leases covers about 20% of Alberta. [104]

The land

- The boreal forest represents three to four thousand years' accumulation of peat, with pine trees surrounded by wetlands, natural canals and shallow lakes. **Oil Sands oil companies have destroyed thousands of acres of boreal forest wetlands, including bogs, rare fens, swamps, marshes and shallow open-water ponds, plowed up and drained in order to get at the oil sands beneath.** [105]
- The boreal plains comprise a large part of the boreal forest, especially in Alberta. Approximately 35% of the boreal plains is composed of wetlands, while some areas have 85 to 95% wetland ground coverage, which combine with complex uplands to create a diverse mosaic of bird habitats. **Most of these wetlands are connected through surface and groundwater hydrology and are highly susceptible to damage from Oil Sands development.** [105]

Aquatic life

- According to a 2006 report by the federal Department of Fisheries and Oceans, nobody yet knows what impact the ongoing destruction from the Oil Sands has had on the Athabasca River, its downstream flows to the Athabasca delta, and its fisheries. "A key concern is the ongoing removal of tributary streams that contribute food and nutrients and are used for spawning and rearing habitat within the mineable Oilsands area." [106]
- An August 2010 study led by Erin Kelly and David Schindler of the University of Alberta found that levels of the pollutants cadmium, copper, lead, mercury, nickel, silver and zinc exceeded federal and provincial guidelines for the protection of aquatic life in melted snow or water collected near or downstream from oilsands mining. *"Embryos of fish exposed to oilsands' water and sediment have very high rates of mortality, and among the survivors, there are very high rates of deformities."* David Schindler [107]

Land animals

- Beyond the ecosystem services it provides, the boreal forest is home to a wide variety of wildlife, including bears, wolves, lynx, and some of the largest populations of woodland caribou left in the world. Its wetlands and lakes provide critical habitat for 30% of North America's songbirds and 40% of its waterfowl. [108]
 - Many species are in decline as a result of industrial development in northeastern Alberta, including caribou, lynx, marten, fisher, and wolverine. A 2008 report by the Cumulative Environmental Management Association (CEMA), an industry group, disclosed that **in situ steam plants, as currently designed, would exterminate caribou, fish, bear and moose over a region of 400,000 hectares, due to habitat fragmentation.** [109]
 - In documents released by the government in 2010, detail from just three Oil Sands companies showed, in the Oil Sands area between 2000 and 2008, 27 black bears, 67 deer, 31 red foxes and 21 coyotes were killed, along with moose, muskrats, voles, beavers, and martens. [110]
 - The woodland caribou is a threatened species in Canada and Alberta. Industrial development within caribou ranges is largely responsible for these declines. A 2008 study by Environment Canada concluded that all woodland caribou herds would likely be lost from northeastern Alberta, as a result of cumulative disturbances within their ranges. A study completed by leading caribou expert, Dr. Stan Boutin, found herd populations in the Beaver Lake Cree Nation's traditional territories have plummeted by more than 70% in just 12 years. [111]
- 
- WOODLAND CARIBOU Source: The Co-operative Group
- The Oil Sands belt is also on the migratory route of North American ducks and other waterfowl. Combining the various estimates of the loss of birds from mining and in situ operations, the Boreal Songbird Initiative, National Resources Defense Council, and Pembina Institute project **a cumulative impact over the next 30 to 50 years ranging from 6.4 million to 166 million birds that could be lost, due to loss of breeding and staging areas, and from birds landing in tailing ponds of waste that look like real bodies of water.** [112]
 - Each year between 22 million and 170 million birds breed in the areas of boreal forest likely to be developed for the Oil Sands. The projected strip-mining of 740,000 acres of forests and wetlands will result in the loss of breeding habitat for between 480,000 and 3.6 million adult birds over the next 30-50 years, a corresponding impact on breeding that could mean a loss of 4.8 million to 36 million young birds over a 20-year period [112]
 - From the current and projected impacts on birds from the toxins that seep into the air and water from Oil Sands operations - the largest danger to birds is likely to come from the accumulation of toxins in tissues, from the degradation of aquatic ecosystems from acid rain and nitrogen deposition, and from air pollution. Inhalation or ingestion of the toxins, as well as external contact with the feathers, skin, and eyes, can also harm birds. [113]
- Because of the effects of global warming, intact northern forest ecosystems will become very important to the forest birds and wildlife that will need to migrate northward in order to survive. [114]

IMPACTS ON FIRST NATIONS PEOPLE:

Health concerns:

Downstream aboriginal populations are experiencing increased respiratory diseases, cardiovascular problems, and rare cancers, suspected to be caused by toxic substances leaching downstream from Oil Sands production. [115]

- Oil contamination in local watersheds has led to arsenic in moose meat - a dietary staple for First Nations peoples - up to 33 times acceptable levels. A 2005 report for Suncor predicted this could go up to 453 times the acceptable level. Game animals are being found with tumours and mutations. [116]
- A 2005 report, conducted as part of an environmental impact assessment by Suncor, concluded: *“Total metal levels (including arsenic and mercury) in the Athabasca River have been above water quality guidelines, similar to other water bodies in the Oil Sands Region. . .Chronic toxicity has been observed when laboratory organisms are exposed to Athabasca River sediment.”* [116]
- A 2008 independent study done by ecologist and water researcher, Dr. Kevin Timoney, showed carcinogens and toxic substances in fish, waterfowl, muskrat, beavers, moose, water and sediment downstream of the Oil Sands projects are higher than would be considered safe. *“The three contaminants of most concern are arsenic, PAHs [polycyclic aromatic hydrocarbons] and mercury. When you put arsenic and PAHs together, the carcinogenic effect can increase by 8-18 fold and this is exactly what we have in the water and in the sediments of the [Athabasca] river and in the delta.”* Kevin Timoney. [117]
- **Deformed fish have been found in nearby Lake Athabasca and drinking water has been contaminated. Internationally renowned water expert Dr. David Schindler, University of Alberta, states, “6-7% of the fish caught at Fort Chipewyan have skin or lip carcinomas.” Timoney states, “Mercury levels in the fish present a serious concern for human consumption”.** The commercial fishery of Fort Chipewyan (located on the northwestern tip of Lake Athabasca) is effectively dead. [118]
- A further independent study in 2009, done by Kevin Timoney and David Lee, Executive Director of Global Forest Watch Canada, confirmed that **current levels of pollution found in water, river and lake sediment, and in fish in the area affected by Oil Sands production presents human health concerns.** [119]



WHITEFISH WITH TUMOUR,
taken from Lake Athabasca,
downstream from the Oil Sands

BURBOT from Athabasca Delta
Photo: John Ulan, EPIC
Photography, Source: The Tyee



“The fish are hard to look at. One whitefish has a golfball-sized tumour bulging from its side. Another is simply missing part of its spine, its tail growing from a stumpy rear end. One has no snout.



Another is coloured in a lurid red instead of a healthy cream. All taken from Lake Athabasca, downstream from the oilsands in northern Alberta.”

Bob Weber, The Canadian Press [120]

A FISH WITH A TURMOUR, FOUND CLOSE TO FORT CHIPEWYAN

Photo: Jiri Rezac

Health concerns related to Oil Sands pollution were brought to public attention in 2006 when Dr. John O'Connor, Fort Chipewyan's fly-in doctor, found that abnormally high rates of cancers and immune diseases were occurring in the community and publicly called on Health Canada to investigate. Health Canada claimed Dr. O'Connor was spreading “undue alarm” and Alberta's Cancer Board repudiated him, even though its own review was not based on complete sets of data. After Timoney's reports, in 2009, the Cancer Board did a comprehensive study and concluded that, between 1995 and 2006, the overall number of confirmed cancer cases and the incidence of some specific cancers was higher than expected. The study did not address the issue of what relationship might exist between cancer risks in Fort Chipewyan and environmental exposures such as those related to oils sands operations. [121]

“We are seeing a terrifyingly high rate of cancer in Fort Chipewyan where I live. We are convinced that these cancers are linked to the tar sands development on our doorstep. It is shortening our lives. . . The blood of Fort Chipewyan people is on these companies' hands.”

George Poitras, former chief of the Mikisew Cree First Nation (MCFN). [121]

“The impacts of [intensifying resource] developments on Aboriginal Peoples living in the boreal forest region include the social disruption associated with the sudden influx of workers to relatively isolated communities that have been shielded from close contact with western lifestyles and values”, writes Monique Ross, Canadian Institute of Resource Law (CIRL), in a report on Aboriginal Peoples and Resource Development in Northern Alberta. [122]

As well, water-based access, by boat, is critical to practicing many aboriginal and Treaty rights, including hunting, trapping and fishing, along the lower Athabasca River.

- For example, there are few permanent roads in the Athabasca Cree First Nations (ACFN) and the Mikisew Cree First Nations (MCFN) territories and in spring, summer and fall – the primary seasons for hunting, fishing, and subsistence procurement – boat access is the only option for travel between Fort Chipewyan, (located 223 km north of Fort McMurry) and seasonal camps and villages, Indian Reserves, and core ACFN and MCFN territories along the Athabasca delta, the river itself, and its tributaries. At good water levels, a web of interconnected waterways exists that can be used to ‘go anywhere’ in the delta area and access large territories via adjoining waterways. Three rivers meet at Fort Chipewyan: the Athabasca, the Rocher, and Quatre Fourches. [123]



HAMLET OF FORT CHIPEWYAN

Photo: Mark S. Elliot, Source: Wikipedia

- A 2010 study conducted by the Firelight Group, with the ACFN and MCFN, concluded oil sands operations are removing large amounts of water from the Athabasca River and the withdrawals have negatively impacted the lives of those living downstream, creating shallow waters that are impassable in summer months. The water is also being contaminated from the oil sands operations. “Adverse effects are particularly evident where the preferred manner, or location, of exercising rights involves access to territories by boat, or where the right relies upon confidence in the quality, or safety, of foods or other resources procured on traditional lands influenced by industrial use.” [123]

One third of tar sands projects already underway are on aboriginal groups’ traditional territories. As Monique Ross (CIRL) notes, “[*Industrial*] impacts have deeply affected the traditional economy, and the very cultural integrity, of the affected Aboriginal communities. . . the health and integrity of the wildlife population and habitat must be maintained at such a level that activities of hunting, trapping and fishing remain viable.” [122]

First Nations versus the Oil Sands:

In the post-1995 land rush to secure oil sands leases, many First Nations quickly found their treaty land fenced in by tar sands mining operations. As Ian Urquhart, University of Alberta writes, “*In a very real sense, First Nations were presented with a fait accompli by the state – these lands, lands that may have mattered in order to pursue traditional practices, became nothing more than oil sands leases.*”

In the years following, monetary incentives from industry and the government, as well as the prospect of employment, were used to gain the support of many First Nations people for the Oil Sands industry. The vast majority of First Nations reserves and settlements in northern Alberta could not even claim a per capita average income level of 50% of the Alberta average, and many people were unemployed, so it is understandable, in the absence of other economic avenues for earning a living, that this did result in some commercial relationships with the oil sands sector. Accommodating the oil sands industry at that time (1997 to 2003) is possibly also linked to First Nations not possessing the requisite resources for legal opposition.

Corporate and government contributions came with the expectation that they should be used to adapt the ambitions of First Nations to the growth of the Oil Sands industry. For example: [124]

- In 2000, Ottawa contributed \$1.75 million to assist the Fort McKay First Nation’s interests in participating in the Athabasca Oil Sands Project. Then Indian and Northern Affairs Canada (INAC) Minister Nault linked this federal assistance to strong public support for the value of government efforts to promote First Nations’ self-sufficiency. [124]
- In 2003, the 3-year term Athabasca Tribal Council (ATC) All Parties Core Agreements was signed by 15 executives, representing the region’s oil sands, energy, and pulp and paper industries and the chiefs of the five First Nations in the ATC. Under this agreement, industry agreed to provide more than \$4 million to First Nations to assist them in efforts to continue to assemble the organizational capacity needed to address industrial activities in the northeast and to “create the capacity for each community to deal with Industry and the impacts of industrial development.” The federal government offered an additional \$1.2 million “to continue to support ATC’s role as a partner” in exploiting the oil sands. [125]

Treaties and Legal Action

More recently, the devastating effects on both wildlife and local indigenous peoples are becoming increasingly evident. The First Nations' maintenance of a healthy existence is being threatened as is the preservation of their traditional way of life. This, plus the pace and scale of development and the lack of consultation with local First Nations prior to development, has resulted in an emerging number of legal actions being taken by First Nations groups. The basis of these actions go back to treaties signed over 100 years ago.

- In 1876, 309,760 square kilometres of what is now central Alberta and Saskatchewan was surrendered to the Crown when Treaty 6 was signed between the Queen and the First Nations peoples of the area. The main peoples involved in the Treaty 6 signings were the Plain and Wood Cree, although there were also groups of Nakoda, Saulteaux, and Chipewyan. [126]
- In 1899, Treaty 8 was signed between the Queen and Cree, Beaver, Chipewyan, Dene, and Saulteaux Peoples, surrendering 840,000 square kilometres of land in what is now northern Alberta, northeastern British Columbia, northwestern Saskatchewan and the southwest portion of the Northwest Territories. [127]
- 40 First Nations groups in Alberta fall under these two treaties, many of them in the regions of Oils Sands development. **In both of these treaties the Crown promised that the First Nations would retain hunting, trapping, and fishing rights in perpetuity.**

"...We assured them that the treaty would not lead to any forced interference with their mode of life..." - David Laird, J.H. Ross, J.A.J. McKenna, Report of Commissioners for Treaty No. 8, September 22, 1899 [128]

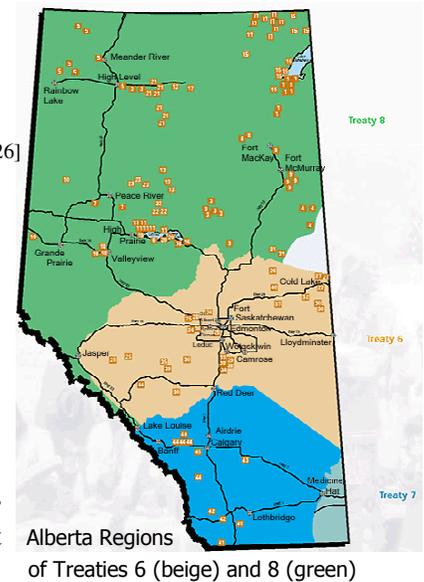
- The Constitution Act of 1982 recognized and affirmed "the existing aboriginal and treaty rights of the aboriginal peoples of Canada". Section 35 of the act protects aboriginal rights from federal and provincial action that could unilaterally extinguish aboriginal rights without any consultation whatsoever, and it protects aboriginal communities from legislative actions that could render their rights and practices meaningless by altering resources and territories to the point that the particular aboriginal and treaty rights could no longer be exercised.
"The way in which the treaty was obtained and is now being ignored by our political leaders must rank as one of the darkest chapters in Canadian History." Dr. David Schindler [129]
- The treaty rights were also affirmed by the United Nations Declaration on the Rights of Indigenous People. [129]
- Treaties 6 and 8 both contained a rider, which gave the government the right to exclude "tracts as may from time to time be required or taken up for settlement, mining, lumbering or other purposes". At the time, the Oils Sands and the extent to which their mining would compromise the First Nations' traditional way of life was unimaginable. In fact, oil and gas development were not included in the list of purposes, but constitute a major component of lands, which are 'taken up' for development today. [130]

In 2005, the MCFN won a ruling from the Federal Court of Appeal, overturning a winter road on the border of its reserve. The Supreme Court found that, because the 'taking up' adversely affected the First Nation's treaty right to hunt and trap, Parks Canada was required to consult with the Mikisew Cree before making its decision. As this had not been done, the Supreme Court set aside the Minister's approval of the winter road. This Court judgment set an important precedent for Treaty 8 First Nations in that it placed the onus on government to consult meaningfully with First Nations before making decisions that will have an impact upon their treaty rights.

"The Mikisew Cree judgment establishes that you can no longer talk about treaty rights in the abstract . . . The Supreme Court of Canada said the rights confirmed in treaties are backed up by the right to a meaningful level of preservation of the habitat that these animals require." Jack Woodward, author of *Aboriginal Law in Canada*. [131]

Other First Nations Legal Actions

- In 2007, the Woodland Cree First Nation (WCFN) filed an intervention with the Alberta Energy and Utilities Board with regard to Shell Canada's Carmon Creek Oil Sands project located near Peace River, Alberta. According to Shell's Environmental Impact Study, this Project may affect an area of 1352 square kilometers, located within the Traditional Territory of WCFN and very close to its main Reserve at Cadotte Lake. Neither Canada nor Alberta has bothered to consult with the WCFN about the project. WCFN's action also argues they should be consulted before any oilsands leases are sold on traditional lands. Chief Whitehead stated, *"Shell's existing oil sands facility, located less than 10km from our main Reserve, has already infringed our hunting, trapping and fishing rights, and it has harmed the water and air within our Traditional Territory and around our Reserves."* [132]



- In 2008, the Athabasca Chipewyan First Nation (ACFN) filed a legal action seeking a Judicial Review of the Government of Alberta's granting of certain Oil Sands tenures without consultation with the ACFN. The case was later rejected because it was filed more than six months after the leases were granted. Even though there was never any formal notice to ACFN, the Court ruled that this was not required as the information was posted to a government website to which they had access. At the time of writing, the ACFN is considering appealing to the Supreme Court of Canada. Between April 2008 and July 2010, the Alberta government has granted leases on 117,753 hectares of ACFN traditional lands. [133]
- The Beaver Lake Cree Nation (BLCN), located just south of Lac La Biche, filed a lawsuit against the Government of Alberta in 2008, alleging that, in granting certain tar sands tenures, the BLCN treaty rights were infringed upon. In the past 10 years, roughly 17,000 oilsands permits have been approved or are pending on BLCN traditional land. The BLCN say the "scale and scope" of the industrialization is ruining the "harvestable surplus" that was guaranteed them. The Co-operative Bank in England, through its corporate social responsibility program, has donated over \$400,000 to the tribe to help meet legal costs. This reflects the growing concern in other countries about the environmental degradation of the Oil Sands.

"Canada and Alberta have mounted an absolutely intensive opposition to this case . . . Alberta has its own department of Justice and they've also hired the largest law firm in Alberta to help them out", states Jack Woodward, whose firm is representing the case. "Our federal government has a legal and constitutional responsibility to protect the BLCN and all of the other Indian peoples in this country and they don't. They are fighting us tooth and nail."

However, Woodward is confident that the BLCN will win the lawsuit, and cites the fact that Treaty 6 guarantees sufficient preservation of habitat to maintain the First Nation's traditional way of life. He explains that the provision for mining in Treaty 6 will not inhibit the case because the mining of the Oil Sands affects such a large tract of land and as such is greatly reducing and detrimentally affecting the wildlife needed to fulfill this guarantee. *"The cumulative impact of the expansion of the Tar Sands absolutely is destructive to the exercise of treaty rights and therefore, it's unconstitutional."*

"It's getting increasingly hard to live off the land . . . This is our life, but it's increasingly hard for us to carry on. We used to be able to take a glass of water out of Beaver Lake. It didn't hurt us; it helped us. All the garbage is being dumped into the rivers and the lakes." Chief Al Lameman, BLCN [134]



CHIEF LAMEMAN

- In 2008, the Chipewyan Prairie Dene First Nation (CPDFN), filed legal action against the Alberta Government alleging a breach of Alberta's constitutional duty to consult with the First Nation on MEG Energy Corp.'s Christina Lake Regional Project, Phase 3 – planned to be located in the heart of CPDFN's Traditional Territory. The CPDFN seeks a ruling that the Government of Alberta has an obligation to conduct proper baseline studies, a cumulative effects study, and an environmental impact study with respect to the potential impacts of the tar sands tenure on the CPDFN's treaty and aboriginal rights. The CPDFN is located about 70 km south of Fort McMurray, an area rich in oilsands deposits. *"Nobody respects who we are," said Chief Vern Janvier. "There's no consideration for us and there never has been."* [135]
- In 2010, the Duncan First Nation (DFN) and Horse Lake First Nation (HLFN) successfully applied to the Supreme Court of Canada to intervene in the face of mounting tar sands extraction on the basis that their rights under Treaty 8 are being violated. The DFN and HLFN want the Court to direct governments and regulators to fully and effectively address the consultation rights of First Nations in the regulatory processes for the major oil sands infrastructure projects being proposed by Royal Dutch Shell, Trans Canada Pipelines, Enbridge, Bruce Nuclear Power and other corporations. [136]
- In 2010, the BLCN, the ACFN and the Enoch Cree Nation, launched court proceedings to force the federal government to uphold its legal duty under the Species at Risk Act (SARA) to protect the habitat of the woodland caribou in northeastern Alberta, now listed as a threatened species under SARA, from any further industrial development. The federal Minister of Environment is more than three years past a mandatory statutory deadline for preparing a recovery strategy for woodland caribou. [137]

"Without adequate water quality or quantity in the river system, we cannot access our important cultural, spiritual, and subsistence areas and we cannot sustain the health and well-being of our families on the traditional foods that we have always obtained from it... When we were children we still drank the water from the river channel flowing out from the Delta... The abundant fish, game and waterfowl of the Delta fed our families... Today, we will not allow our loved ones to drink the water from the river. The abundance of the past is now only a memory... As water levels continue to decline and water quality and health concerns continue to grow, we wonder what has happened to our Treaty Rights and the sharing agreement we entered into with the Crown so many years ago."

Chief Allan Adam, ACFN and Chief Roxanne Marcel, MCFN [138]

ENVIRONMENTAL AND HEALTH CONCERNS – LACK OF GOVERNMENT OVERSIGHT AND ACTION:

- A 2001 study by David Boyd, University of Victoria, found that Canada had one of the poorest environmental records of industrialized countries. For the 25 environmental indicators examined, Canada's overall ranking among the Organization for Economic and Co-operative Development (OECD) nations was a dismal 28th out of 29. [139]
- A 2010 study prepared for the David Suzuki Foundation by a research team at Simon Fraser University shows: **Canada's environmental record continues to be poor compared to other developed countries. Based on 28 environmental indicators, Canada's environmental performance ranks 24th out of 25 countries.** [140]
- The 2010 report also shows: **Canada's lackluster record is due to poor environmental policies.** It is not due to natural factors such as climate and geography. Instead, if Canadian environmental policies were comparable to the top three OECD countries, Canada's environmental rank would move from 24th to 1st in the OECD. [140]

Water pollution and conservation:

There is growing consensus that Canada does not have the abundant supplies of water it was once thought to possess. **In Canada, there is no national strategy to address urgent water issues, no federal leadership to conserve and protect our water, and Canada does not have legally enforceable drinking water standards. The Federal Water Policy is more than 30 years old and badly outdated.** [141]

- According to a 2009 report by the Pembina Institute, current water management practices cannot protect water in northern Alberta and the Northwest Territories from the impacts of Oil Sands development. [142]
- The federal government, in conjunction with provincial and territorial governments under the Canadian Council of Ministers of the Environment, developed the Canadian Water Quality Guidelines for use in the development of water quality objectives in certain locations. The guidelines are just that, guidelines; and are not mandatory or prescriptive. As well, the Athabasca River is not even listed on Environment Canada's Water Quality and Objectives website as having objectives established or under development. [143]
- **Despite 3 decades of increasing water withdrawals by an ever-expanding Oil Sands industry, neither the federal nor the provincial government has ever studied the effects of reduced flow rates on the Athabasca River and the 31 species of fish that populate it.** [144]
- When asked if his department investigates at all "the kinds of deformities in the fish and those kinds of things that the natives of Fort Chipewyan are talking about", Rob Renner, Minister of the Environment for Alberta, replied, "No, not directly. What we are doing is continuing what we believe is our responsibility to have ongoing monitoring of the quality of the water." He also stated, "Alberta is not about to close the door to further investment". [145]
- **A 2009 report from the Council of Canadian Academies decried Canada's ignorance of its groundwater, even though 10 million Canadians rely on drinking water that comes from beneath their feet. "The last comprehensive assessment of Canada's groundwater resources was published in 1967."** [146]

SUNCOR OIL EXTRACTION FACILITY ON BANKS OF ATHABASCA RIVER
Photograph by: Mark Ralston, AFP/Getty Images, source Canada.com



ATHABASCA RIVER RUNNING THROUGH ALBERTA OIL SANDS
Photo: Eamon Mac Mahon, Source: The Star

Noncompliance

The *Canadian Fisheries Act* states that "No person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water". [147]

In 2009 the Commissioner of Environment and Sustainable Development concluded that Environment Canada does not have a Fisheries Act compliance strategy for the industries and activities that must comply with the

Act's prohibition requirement against the deposit of harmful substances in water frequented by fish.

“Fisheries and Oceans Canada and Environment Canada cannot demonstrate that fish habitat is being adequately protected as the Fisheries Act requires.” [148]

- In April 2010, a coalition of environmental organizations and citizens filed a citizens’ submission with the Commission for Environmental Cooperation, the environmental side-body of the North American Free Trade Agreement (NAFTA). The submission alleges that the Canadian government is failing to enforce the anti-pollution provisions of the federal Fisheries Act by allowing the Oil Sands tailings ponds to leak contaminated materials into both surface waters and groundwater in the Athabasca watershed. [149]
- **Only two of nine Oil Sands operations reported they would comply with a new provincial law (April 2010) designed to limit increases in tailings. The seven remaining operations submitted plans that will not comply with these rules by the first target date in 2011. Some companies submitted plans suggesting they may not meet the rules for tailings management for over 40 years.** [150]

In June 2010, a Canadian government investigation into “the effects of oil sands development on water resources and the role the federal government can play in reducing risks as development evolves” was terminated without explanation.

- MPs on the Standing Committee on the Environment and Sustainable Development, who had traveled to Calgary, Edmonton, and Fort McMurray to hear testimony from expert witnesses, decided to destroy draft copies of the final report. [151]
- Francis Scarpaleggia, Liberal MP and member of the Environment Committee accused the Conservative government of blocking the release of an environmental report that highlights the negative impact of the oil sands on Canada’s freshwater supply. Scarpaleggia said the report contains research that suggests the oil sands are contaminating Canada’s freshwater resources, such as the Athabasca River watershed, with toxic substances. It also makes several recommendations to the government on how to improve water protection. [152]
- The timing of the Environment Committee aborting the Oil Sands investigation coincided with new questions being raised about the Harper government’s decision to exempt a primary toxic pollutant, found in Oil Sands tailings ponds, from a regulatory agenda. In a letter to the Environment and Health ministers, Matt Price, policy director at Environmental Defence wrote, "Naphthenic acids are one of the main pollutants responsible for the toxicity of oil sands tailings to aquatic organisms, and have been shown to harm liver, heart and brain function in mammals." Concentrations of naphthenic acids in tailings ponds reach concentrations 100 times greater than in the natural environment, yet the government has no water quality regulations for these substances. [153]



SUNCOR PROCESSING FACILITY AND TAILINGS PONDS
(ATHABASCA RIVER AT LEFT) Photo: David Dodge, Pembina Institute

Energy resources:

Canada has failed to exercise any fiscal accountability over its non-renewable oil wealth. The country has no sovereign fund and has saved no wealth to date.

- This is much to the consternation of the OECD, which concluded in a damning 2008 report that ‘other nations have shown much more restraint and foresight in managing their resource revenues to mitigate boom and bust cycles’. [154]

Canada does not have a strategic petroleum reserve.

- A 2008 report from Polaris Institute and Alberta’s Parkland Institute, warns that “Canada is recklessly unprepared for the next global oil crisis,” and that “despite its abundance of oil, Canada is the most vulnerable member of the International Energy Agency to short-term shocks.” Dr. Gordon Laxter, a political economist at the University of Alberta and author of the report, says, “The government is so concerned with exports and fear of taking on the oil industry in Alberta that they are not taking care of Canadians.” [155]
- Under the National Energy Board (NEB) Act’s criteria for issuance of licenses, the government should ensure “that the quantity of oil or gas to be exported does not exceed the surplus remaining after due allowance has been made for the reasonably foreseeable requirements for use in Canada”. Years ago, the NEB would not allow exports unless a 25-year supply remained available to meet Canadian needs. In the mid-1980s, the Mulroney government first reduced this surplus test to 15 years and then effectively did away with it altogether. [156]

Canada does not have a national energy strategy, which is currently being called for by the oil and gas industry, the renewable energy industry, the business community, and environmentalists.

- As well, the Canadian Senate's Energy, Environment and Natural Resources Committee supports the development of a Canadian energy strategy. [157]

Canada has no policies to enable large-scale renewable-energy adoption and has cut funding for renewable power development.

- According to Pembina Institute's analysis of Canadian and American budget documents, in 2010, the U.S. is set to outspend Canada nearly 18:1 per capita on renewables, and more than 8:1 per capita overall on clean energy programs and projects. [158]

Greenhouse gas emissions:

Canada's emissions in 2008 (734 million tonnes) were 24% higher than in 1990 and 30% higher than the country's KYOTO commitments (target of 558.4 Mt, 6% below 1990 levels by 2012). The Canadian government has predicted no net reduction in GHG emissions from federal action up to 2012. [159]

- When Stephen Harper became prime minister in 2006, he announced that Canada would not be able to fulfill its Kyoto Protocol commitment. He scrapped the Liberals pledge to spend \$10 billion over 7 years to help Canada cut its GHG emissions and, a senior environment department official reported that Harper also "scattered the 100 employees of the climate change secretariat and erased their database" when he came into office. The Harper government's first budget saw the elimination of fifteen climate-related programs. [160]
- Harper's message has consistently been that action on global warming cannot stand in the way of Canada's economic growth. He has maintained that position despite a 2009 paper (Pembina Institute and David Suzuki Foundation) that was sponsored by TD Bank, which concluded that meeting science based emission reduction targets (25% emissions reduction by 2020 based on 1990 levels) would not significantly harm the economy and would, in fact, allow it to grow by 23% over the decade (based on 2010 to 2020), or 2.09% per annum. [161]
- In both 2009 and 2010, the Canadian government refused to provide any new funds to the Canadian Foundation for Climate and Atmospheric Sciences, the most important funding body for university-based research on climate science in Canada. Funding everything from global climate models, to the melting of polar ice and frequency of Arctic storms, to droughts and water supply, the foundation will run out of cash early in 2011. W.R. Peltier, director of the Centre for Global Change Science, University of Toronto, said that will have a "devastating impact" on the quantity and quality of climate research in Canada at a time when the research is badly needed. Due to lack of funding and the perception that climate research is of peripheral policy concern to the federal government, Canada is losing many of its researchers, especially with the Obama administration set to pump \$18 billion into research in the U.S.
"The Government of Canada has cut virtually all programs aimed at funding climate science. I get the sense that they feel that science is a nuisance." Andrew Weaver, Professor Earth and Ocean Sciences, University of Victoria, and Canada Research Chair [162]
- As of 2007, the Canadian government no longer has an independent National Science Advisor. A group called the Science, Technology and Innovation Council, reporting to the Minister of Industry, has replaced that key role. Its 2008 annual report lists "energy production in the oil sands" and "resource production in the Arctic" as key priorities. Climate change adaptation is mentioned once. [163]
- **No federal government measures for carbon pricing have yet been adopted. Canada does not have a low carbon growth plan (LCGP). Canadian governments haven't yet agreed on an outline for a national approach to reducing greenhouse gases.** [164]
- The absence of federal leadership on climate change has led to a "patchwork" of regulatory initiatives at the provincial and regional levels. Canada has spent \$6 billion on carbon reduction programs, but has met none of its targets for 15 years. [165]
- **In November 2010, the Canadian Senate killed Canada's only climate change legislation, Bill C-311, the Climate Change Accountability Act, without even debating it.** This was an unprecedented move. Stephen Harper had ordered Conservative members of the Canadian Senate to "not to speak about the climate change bill, not to allow it to come up for a vote and to kill it when they could." [166]

Canada's standing on the world stage

Canada is the only country that signed the Copenhagen accord to have lowered its sights when submitting its emissions reduction pledge. In January 2010, then Canadian Environment Minister Jim Prentice announced a new, weaker target for Canada's greenhouse gas emissions - 17% below 2005 levels, by 2020.

The government's previous target was a 20% reduction below 2006 levels, by 2020. The new target for 2020 is 2.5% above 1990 levels, whereas the previous target was 3% below 1990 levels. [167]

- Canada's dismal record on climate change and minimal investments in green energy (Canadian business spending on Research and Development of about 1% of GDP has consistently ranked below the OECD average of 1.6% and is only about half of what the U.S. spends), reflect a growing dependence on oil revenue, oil volatility, and petroleum lobbyists. As a consequence, Canada now shares the same sort of unaccountability and lack of transparency that marks fellow petro-states such as Saudi Arabia. [168]
- According to German Watch and Climate Action Network Europe's 2010 Climate Change Performance Index, which evaluates and compares the climate protection performance of the 57 countries that together are responsible for more than 90% of global energy-related CO₂ emissions, Canada ranks 2nd last (only ahead of Saudi Arabia). [169]

Environmental assessment and monitoring:

While the U.S. requires many steps of environmental review before granting a lease, Alberta has leased out 84,000 sq km (an area the size of Scotland) to Oil Sands development with no environmental assessment, public input, or land-use planning. Alberta's tenure regime limits the government's ability to effectively manage development and land-use planning. [170]

"Oil sands development has proceeded on an ad hoc, project-by-project basis within a fiscal and environmental regulatory framework that is seriously out of date. Lacking a coherent and overall plan and strategy, there is only an ineffective, reactive, piecemeal approach to environmental issues such as water management." Chief Jim Boucher of the Fort McKay First Nation, located in the middle of four mining projects 75 km north of Fort McMurray [171]

A history of government inadequacies

- When Ralph Klein became the Premier of Alberta in 1992, he gutted the Energy Efficiency Branch, cut back the budgets of the environment and energy departments, and campaigned throughout Canada against Kyoto. In 1993, with the intention to downsize government under the banner of "efficiency", Alberta's energy sector regulations were thinned out. [172]
- In its 1994 annual report, Alberta's Energy Resources Conservation Board's (ERCB) comments on the deregulation and downsizing were: "Recent reductions and staffing at the ERCB meant that there were simply no longer adequate numbers of staff to sustain the historic model of thorough review of large numbers of detailed applications. . . The most likely future regulatory approach will require a significant transfer of responsibility to industry for ensuring that it understands and carries out regulatory requirements". The Oil Sands industry itself currently dominates pollution reporting and monitoring for both air and water in the Oil Sands region. [173]
- The multi-stakeholder, non-profit, CEMA was created in 2000 to manage the cumulative impact of Oil Sands development in the Wood Buffalo region. Yet there is still: no land use plan that protects wildlife and regional ecosystems; no lower limit on flows of the Lower Athabasca River below which Oil Sands water withdrawals would be prohibited; and no environmental management plan to maintain the integrity of watersheds. [174]
- **Canada has one of the worst records of pollution enforcement of any industrial nation. Its air quality objectives have not changed since the 1970's. A 2004 report from OECD cited Canada as having one of the worst records for air emissions, specifically particulate matter and ground level ozone.** [175]
- In the 2007 federal budget, the Harper government announced that, over the next two years, Ottawa would spend \$60-million to create a Major Projects Management Office with the mandate "to cut in half the average regulatory review period [for large natural resource projects] from four years to about two years." [176]
- A 2009 recommendation from CEMA, which includes Suncor and Shell, asking for a freeze until 2011 on sales of mineral rights in an area marked for conservation was rejected by the Alberta government. CEMA's members represent government agencies, environmental groups, aboriginal communities, and around 30 oil companies. [177]

Recent findings

- According to David Schindler, the most recent airborne monitoring in the oil sands, done by Alberta Oil Sands Environmental Research Program, was in 1978 and 1981. According to a peer review report, Alberta's Regional Aquatics Monitoring Program (RAMP) - the Alberta government's primary method of monitoring the environmental impacts of Oil Sands development on aquatic systems - is not in a position to measure and assess development-related change locally or in a cumulative way; few stations have been sampled consistently over time, consistently across components and using consistent methods; lacks an overall plan. [178]

- A 2009 study by David Schindler and his team, published in the Proceedings of the National Academy of Science states, “*More than 10 years of inconsistent sampling design, inadequate statistical power and monitoring-insensitive responses have missed major sources of PAC [polycyclic aromatic compounds] to the Athabasca watershed. Most importantly, RAMP’s claims that PAC concentrations are within baseline conditions and of natural origin have fostered the perception that high-intensity mining and processing have no serious environmental impacts. . .[RAMP] lacks scientific oversight. . .RAMP data are not publicly available, and the methods used. . .are not entirely transparent.*” [179]

Recent government strategy

- In June 2010, Bill C-9 was passed by the House of Commons (and the Senate in July 2010). This 904-page budget bill contains several non-budget measures, including major revisions to the federal assessment act. **The rules grant the Environment Minister power to reduce the scope of reviews and put many infrastructure projects on an exemption list.** (By rolling such measures into the budget bill, which is automatically a matter of confidence, the government effectively challenged the opposition to approve the bill or send the public to the polls in an election. In 2009, the Budget Implementation Bill was used to gut the Navigable Waters Protection Act). [180]
- Prior to Bill C-9 passing, Simon Dyer, Oil Sands Director for the Pembina Institute, stated, “Over the past several years the Government of Canada has been trying to dodge its responsibilities for environmental assessment of proposed oil sands developments. The measures included in Bill C-9 will grant the Environment Minister the legal discretion to turn a blind eye and ignore the environmental impacts of oil sands development.” [181]
- **In 2009, then Environment Minister Jim Prentice stated that, “ultimately, the only effective environmental policy is one that takes into account the competitiveness of the Canadian economy”.** [182]

RECLAMATION:

Oil sands mining companies are required to reclaim the land that has been disturbed during the mining process and the Canadian Association of Petroleum Producers claims that all oil sands developments will ultimately be reclaimed. However, **to-date, of the 686 sq km of land (68,600 hectares) disturbed by Oil Sands mining operations, only 1.04 sq km (0.2%) is currently government certified as reclaimed.** [183]

Reclamation certificates are only issued when long-term monitoring demonstrates the reclaimed land meets the objectives of equivalent land capability. As well, according to the Oil Sands Developers Group, industry is reluctant to seek certification under current regulations because reclaimed lands that have been certified revert to Crown ownership, thus operators must relinquish tenure on these lands so that they can be accessed by the public. [184]

Though some breakthroughs in reclamation have been made, they are small in comparison to the pace and scale of disturbance from oil sands mines. Oil Sands operations also work on long-term timeframes and currently there are no firm regulatory timelines for progressive reclamation to compel companies to reclaim more land more quickly. [185]

- In March 2008, the Alberta government issued its first reclamation certificate to Syncrude Canada Ltd. for the 104-hectare parcel of land known as Gateway Hill, approximately 35 km north of Fort McMurray. [186]
- Suncor is transforming its 220-hectare Tailings Pond 1 into mixed-wood forest and a small wetland. Unfortunately, Suncor is not permanently eliminating the contents of the Tar Island Pond but rather “reclaiming” the Tar Island Pond by transferring fluid tailings to other ponds and infilling the pond with coarse sand. [187]
- Syncrude Canada Ltd. reports that they have reclaimed about 4,600 hectares of the land disturbed by their mining operations and Suncor reports it has reclaimed 1,182 hectares of its disturbed land. [188]

Oil Sands mining operators report on their own reclamation efforts both in their annual “Conservation and Reclamation Reports” and in their Sustainability Reports. Because these numbers are self-reported and no specific reclamation standards exist for the Oil Sands, it is difficult to understand how companies define reclamation. There is limited data to accompany the company sustainability reports and company submissions to Government are not readily accessible to the public. [189]

Tailings lakes

According to the Pembina Institute, no tailings lakes have ever been successfully reclaimed and there is no demonstrated effective long-term way to deal with liquid tailings. More than four decades of mining have passed and the oil sands industry is still struggling to find tailings reclamation technology able to cope effectively with the vast amounts of mature fine tailings produced every year.

A proposed long-term solution to the tailings problem is for mining companies to dump toxic tailings waste into old mine pits and cap them with freshwater from the Athabasca River. Operators hope that the tailings layer and freshwater layer won't mix. End pit lakes (EPLs) will be a permanent feature of the reclaimed landscape, but it is not yet known if they will support a sustainable aquatic ecosystem. Modeling and relevant background studies have been the basis of research, but a fully realized EPL has yet to be constructed. At least 27 EPLs are planned for the Athabasca Boreal region within the next 60 years. These were approved in the absence of a single demonstrated EPL by any Oil Sands operator. [190]

In February 2009, the Alberta's Energy Resources Conservation Board (ERCB) approved Directive 74, an order that requires companies to reduce fine particles flowing into tailings ponds by 20, 30 and 50% over the subsequent three years. According to the Pembina Institute, the ERCB has since approved plans from three operators, but only Suncor met all the requirements. Plans from both Syncrude Canada and Imperial Oil have been approved, although neither met near-term targets. Imperial Oil's cleanup plan won't comply with Directive 74 rules until 2018. Shell's plan has not yet been approved. [191]

- In August 2010, Shell unveiled its new AFD (atmospheric fines drying) technology and opened its first demonstration project. The AFD method calls for a thickening agent to be mixed with the tailings to transform them into a solid substance. However, this technology is in its early stages and it is still not known if Shells tailings management plan submissions will meet the requirements of Directive 74. [192]



SYNCRUDE OIL SANDS MINING OPERATIONS IN ALBERTA PEATLANDS

BOREAL FOREST NEAR FORT McMURRAY AIRPORT Photos: David Dodge, Pembina Institute



Peatlands

The reclamation of peatlands (fens or bogs) in the Athabasca Boreal region has never been demonstrated.[193]

- Even officially reclaimed land will be permanently altered. Alberta's regulations do not require disturbed lands to be returned to their former condition, only to the concept of "equivalent land capability". **Since surface mining leaves no remnants of wetland to recover, industry has no ability to reclaim them.** Even Alberta Environment's 2005 Provincial Wetland Restoration/ Compensation Guide states that **it is almost impossible to fully replicate the complexity of a natural wetland ecosystem.** [194]

Peatlands perform many important ecological services, including water filtration and carbon capture.

- **These mossy lands contain 7 times more carbon than normal boreal forest soils. Because wetlands make up about 40% of the complex boreal forest ecosystems, the shift to a reclaimed landscape could have far reaching negative effects.** [195]
- Of the area changed by surface mining activities as of June 2009, wetlands comprised 52.4%, of the original pre-disturbance area, while upland forest comprised 46.3%, of the original pre-disturbance area. [196]

Although reclamation will sequester carbon from the atmosphere, it is unlikely to replace most of the lost biocarbon for thousands of years. Only a small portion of soil carbon can be recovered for areas where peatlands have been converted and reclaimed to upland. [197]

Reclamation costs and liabilities

The Government of Alberta requires that all oil sands operators post a security deposit to act as a financial mechanism to fund any unforeseen events that may arise during the life cycle of a Oil Sands mine - construction, operation, decommissioning, and reclamation, in the event an operator is unable or unwilling to pay for reclamation. However, **because of the lack of transparency about the true costs of reclamation, the public doesn't know whether or not the current security deposits are adequate.**

The security deposits are held in the Environmental Protection and Security Fund and are paid on individual mining projects. They can only be used to draw for the reclamation of the specific mine - security deposits from other mines cannot be used. [198]

The inadequacy of Alberta Environment's mine reclamation security program has been known for many years. The provincial government's own watchdog, the Alberta Auditor General, has raised concerns four times in the last eleven years, expressing concerns about:

- the government holding inadequate security to ensure that land destroyed by oil sands mines will eventually be reclaimed;
- inconsistencies in the application of the oil sands mine reclamation security program;
- the failure of oil sands operators to properly estimate reclamation costs; and
- the lack of government response to the Auditor General's concerns. [199]

Alberta Environment is supposed to ensure reclamation security estimates are accurate, but information about how estimates are calculated is not publicly available and Oil Sands companies are reluctant to provide public information on estimated or actual reclamation costs. **Albertans and Canadians are at risk of bearing the liability of costly clean up in the future.** [200]

- Alberta Environment has no formal policy to use accounting safeguards to verify the data submitted by mines. [200]
- Since long-term tailings reclamation has not yet been successfully demonstrated in the oil sands mineable region, the cost for achieving reclamation in the oil sands region is unknown. [201]
- In 2009 the total oil sands security in the Environmental Protection Security Fund was \$820 million for 68,574 hectares of disturbed land (including the 840 million cubic metres of MFT currently stored on the landscape) or only \$11,964 per hectare. In 2006 Syncrude spent a total of \$30.5 million on reclamation activities on 267 hectares or about \$114,000 per hectare. [202]
- **Based on the limited government and industry data available, the Pembina Institute conservatively estimated the cost of cleaning up all the land disturbed by the Oil Sands mining would be \$1.4 to \$3.7 billion, while the cost of cleaning up tailings would be \$8 to \$10 billion – or approximately \$220,000 to \$320,000 per hectare. This works out to a potential liability per Alberta taxpayer of \$4,300 to \$6,300.** [202]
- WWF has calculated that the full amount of security held, applied solely to addressing the tailings liability, would provide less than one dollar to remediate each cubic metre of MFT. The little information that is publicly available indicates operating costs for remediating MFT could reach almost \$5 per cubic metre depending upon the technology used. [203]

A June 2010 public opinion poll found that 96% of Albertans agree companies operating in the Oil Sands should be held liable for all environmental damages caused by their operations. [204]

History has proven reclamation to be a liability in other areas of Canada

- Twenty-five years of zinc and lead extraction has led to an estimated \$450 million in environmental liabilities at the Faro Mine in the Yukon Territory, one of 10,000 un-reclaimed or abandoned mines in Canada. The mining company that operated Faro Mine declared only \$93.8 million in liabilities shortly before going bankrupt in 1998. Nearby water sources contaminated with acid and heavy metals from the mine require continuous treatment. With 70 million tonnes of ore tailings, there is also the potential for a tailings dam failure. The estimated cost per hectare is \$180,000, but the government had only collected \$5,600 per hectare in security. The difference is being paid for by Canadian taxpayers. Cleanup is expected to take 40 years. [204]
- One hundred years of steel and coke production left more than a million tonnes of contaminated soil and sediment in Sydney on the eastern coast of Cape Breton Island, Nova Scotia. This prompted the Government of Canada to “undertake a 10-year, \$3.5 billion program to clean up contaminated sites for which the Government is responsible. And the Government of Canada will augment this with a \$500 million program of similar duration to do its part in the remediation of certain other sites, notably the Sydney tar ponds,” as announced in 2004. For comparison, the Sydney tar ponds cover an area of 31 hectares. Alberta Oil Sands total mineable area is 480,000 hectares, 15,000 times larger. [205]

In a letter to the diocese of St. Paul (23 parishes in central and northeastern Alberta), Bishop Luc Bouchard wrote: *“Sufficient revenue for full reclamation has to be assured and in place before development proceeds. At present, the monies allocated for this purpose do not appear to be at all realistic. . . The public should not be faced with a reclamation bill for the Athabasca oil sands as happened with Nova Scotia’s Sydney tar pond.”* [206]

IN SITU VS MINING:

Proponents of in situ (Latin for “in place”) development increasingly assert that it has considerably lower environmental impacts than mine-based production and are trying to distance it from the Oil Sands mining sector. However, in situ operations are not a low impact form of oil sands development. They have significant, cumulative and long-term environmental impacts. [207]

- A 2009 report in the journal *Environmental Research Letters* found that **when land fragmentation is considered, the in situ land area influence is greater than mining. Land disturbance is nearly double that of mining when direct and fragmentation disturbances are considered for the production facility and for oil sands-related natural gas production.** (In situ production requires substantially more natural gas than does mining.) [208]
- Surface mining, which accounted for 52% of bitumen production in Alberta in 2008, is only feasible for the shallow Oil Sands deposits found north of Fort McMurray. Over 80% of Alberta’s Oil Sands are too deep for mining and require “in situ” extraction techniques. The surface mineable area covers 4,800 sq km in the Oil Sands Region, while oil sands suitable for in situ extraction underlie 135,200 sq km. [209]
- Canadian Association of Petroleum Producers projects in situ production will likely surpass mining by 2017. [207]

Forest fragmentation and harm to wildlife

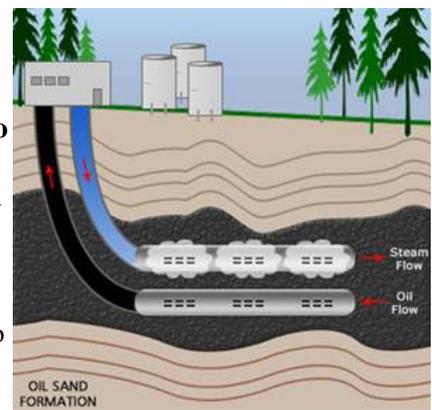
The land area already leased for in situ development (79,000 sq km in 2009) is already 16 times greater than the total mineable area (4,800 sq km). If in situ extraction is developed over the total available area, development could occupy an area 30 times larger than the oil sands mines. One of the biggest impacts of land use is the fragmentation of land. Therefore, surface area is less important than the linear distance within a given area. [210]

- The direct land disturbances of in situ operations, like seismic lines, roads, pipelines, power lines and well pads contribute to the reduced use of habitats adjacent to in situ operations through forest fragmentation. Steam Assisted Gravity Drainage (used for in situ recovery since 2001 and the choice technology for most new projects), would extirpate caribou, fish, bear, and moose over a region ranging from one to three million acres in size. [211]
- The 2008 report, *Danger in the Nursery*, states, “Tar sands drilling projects are projected to result in the loss of more forest-dependent bird habitat than strip-mining and could harm as many as 14.5 million breeding birds. . . . Numerous bird studies have shown that as habitats become fragmented, specific species are lost from isolated habitat patches.” [212]

Emissions comparisons

Oil sands in situ operations require more energy than oil sands mining to produce a barrel of bitumen. As a result, **in situ operations generate two to two and a half times as much greenhouse gas per barrel of bitumen as mining - excluding the emissions associated with bitumen upgrading - and four times as much as conventional oil, when burning natural gas.** [213]

- The production of synthetic crude oil through surface mining, including upgrading, is reported to result in emissions ranging from 62 to 164 kg of CO₂ equivalent emissions per barrel, while in situ techniques result in 99 to 176 kg of CO₂e emissions per barrel. (Average emissions per barrel for conventional crude oil production are 35.2 kg of CO₂e in Canada and 24.5 kg of CO₂e in the U.S.) [214]
- GHG emissions would increase if in situ mining utilized a dirtier energy source than natural gas. For example, in situ oil sands operations burning petroleum coke without any mitigation would produce 66% more greenhouse gas pollution than if the same operation were to burn natural gas. [215]
- Mining and in situ operations have comparable nitrogen oxides emission intensities. However, sulphur dioxide emission intensity is three times as high for the average in situ operation as for mining. [216]



Source: IPSA

Resource use comparisons

- It takes about 34 cubic metres of natural gas to produce one barrel of bitumen from in situ projects and an additional 11 to 14 cubic meters for upgrading. It takes about 20 cubic metres for integrated projects (oil sands projects that mine oil sand, extract and upgrade the bitumen into synthetic crude oil). So while in situ production may be less land intensive during the extraction phase, upstream natural gas use increases its land intensity. [217]
- An average of 2.1 barrels of water are used to produce each barrel of oil from mining and an average of 1.1 barrels of water per barrel of bitumen is used for in situ production. However in situ water intensity varies by project from 0.5 to almost 5 barrels of water per barrel of bitumen produced. [216]

A Natural Resources Canada 2007 report states, “The long-term impact on groundwater is still insufficiently understood, but is likely to be greatest for in situ operations”. [218]

LIVING AND WORKING CONDITIONS IN THE OIL SANDS REGION:

The population of Fort McMurray has grown at rate of over 8% a year. Housing is expensive and in short supply. The number of homeless people is growing. And the Parkland Institute reports that benefits are disproportionately going to the high income bracket. [219]

- According to Coldwell Banker's 2009 annual list on housing markets, Fort McMurray is Alberta's most expensive, with an average 2,200 sq ft 4-bedroom home costing \$638,000. According to Fort McMurray's Labour Market Information, in 2009, a bachelor suite rented for \$1,448 per month. [220]
- **The Oil Sands boom of high-paying jobs like driving one of Syncrude or Suncor's big trucks has not fared well for the rest of the community in Fort McMurray. With the Oil Sands-related population boom causing rental and housing costs to skyrocket and living costs to rise substantially, community members that work at jobs outside the industry, such as RCMP officers and school teachers, are having a very hard time.** [221]



FORT MCMURRAY Photo: David Dodge, Pembina Institute

- The growth of the economy and population in Fort McMurray has also put an enormous strain on public infrastructure, including housing, roads, bridges, schools, the airport, the water treatment plant, sewer system, recreational facilities, and hospitals. [222]
- In October 2009, Premier Stelmach announced cuts to the public services that Albertans rely on such as education, health care, and social services – because of a \$7 billion provincial deficit. [223]
- **Due to housing costs and shortages in Fort McMurray, there are Venezuelan and Phillipino and other immigrant families with 15 people in a one bedroom apartment. There are also 500 homeless people living in tents along the river, even in winter.** [224]

“Regions associated with oil sands development enjoy several economic benefits but these benefits are accompanied by costs to the social well-being of the communities. . . The negative effects [of rapid growth] include a shortage of affordable housing, increased regional traffic, increased pressures on government services such as health care and education systems, alteration to the traditional way of life, impacts on traditional lands, municipal infrastructure that lags behind population growth, drug and alcohol abuse, and increased dependence on non-profit social service providers.” The National Energy Board's 2006 report, *Canada's Oil Sands* [225]

Working conditions in the Alberta Oil Sands are not ideal. Work is often dangerous and shifts can be long, up to three weeks straight and often 12-hour days, before one week off. The polluted environment is often unhealthy and unpleasant, and there is a background sound of noise cannons, which fire every so often to scare the birds away from the tailings ponds. [226]

- Driving to and from the work site along Highway 63, originally built in the 70s to accommodate a mining community of 25,000, and most of which is a 2-lane highway, is both frustrating and dangerous. Thousands of logging trucks, subs, semi-trailers, buses, and tanker trucks traverse the road. Between 2001 and 2005, 1,011 collisions killed 25 people and injured 257. In 2007, this locally dubbed “Highway of Death” claimed 17 lives. [227]
- Many people working in the Oil Sands travel long distances from their homes, either commuting back and forth - away from their families while they are working, or relocating. Many are drawn by the lure of quick money, only to find out that though jobs may pay well, the cost of living offsets much or all of this benefit. [228]
- According to a report from the workplace health firm, Shepell.fgi, from 2006 to 2008, there was a 481% increase in Employee Assistance Programs access for alcohol abuse. Rod Phillips, CEO of Shepell.fgi, stated, **“Working in stressful jobs in remote locations, combined with distance or long periods of time away from family, is a prime cause for such problems as addiction. . . Oil and gas workers face socio-economic stressors involved in locating suitable resources to support family who accompany them to a new city, but have no social infrastructure to rely on”**. Cocaine abuse is four times the provincial average in Fort McMurray. [229]

“Everybody at this one rig, they wouldn't go to bed at night - they'd do coke and meth and ecstasy and then they'd show up to work. Everybody's all lit up on something.” Oil Sands Worker *“...what is going through the mind of an individual who might be high and driving his truck 140 clicks and passing other people on the highway?”* Researcher working on a 2010 study on mobile workers, in regards to workers going for drives as a release. [230]

Mobile Workers:

The non-permanent resident workforce represents the group that has experienced the highest population growth in the Regional Municipality of Wood Buffalo (RMWB). **At any given time, there are between 16,000 and 27,000 people employed as mobile workers in the Wood Buffalo Region.** They reside only temporarily in the region and have their permanent residences elsewhere.

In 2007, there were a total of 24,311 mobile workers, which constituted 26% of the RMWB population. The majority had not considered moving to Fort McMurray. **Approximately half were from other parts of Alberta (excluding the Wood Buffalo Region) and most of the other half were from other provinces in Canada, with Maritimers accounting for over half of the out-of-province workers** (22% from Newfoundland and Labrador). 3% came from outside of Canada. The number of mobile workers rose to 26,284 in 2008. Half of the mobile workers in the Wood Buffalo region are over 35 years of age, with the over-45s constituting the largest group; the majority are married and, on average, have two children. They are overwhelmingly non-aboriginal and male. [231]

- A 2007 study by the Athabasca Region Issues Working Group, provides strong evidence that the construction of Oil Sands facilities is executed with workers from outside the region. In early 2007, only 38 (3.5%) of a total of 1,120 persons surveyed were from Fort McMurray; all others had their permanent residence elsewhere. [232]

Three quarters (18,626 in 2007) of mobile workers stay in camps or lodges; others stay in rented dwellings, hotels, motels, or campsites in the region influencing cost and availability of housing. Work camps are remote clusters of modular trailers, some the size of small towns. [233]

- **According to a recent University of Alberta study, many mobile workers describe camp like prison. They swipe a card to enter, and swipe out to leave. Legions of low-paid security guards enforce every tiny rule. Grown men feel patronized, or like mere cogs in an oil-producing machine. They miss their families. For some, the oblivion of hard drugs or alcohol offers easy escape.** [234]



FORT MCMURRAY
CAMP HOUSING
AT SURMONT

Source: Energy Tomorrow @ Flickr

“You never think of a camp as home. They set it up in such a way that it is not that comfortable. There is a gym here if you want to work out. And there is a bar here if you want to drink. They tell you what to eat, when you’re going to eat it...when you have to be quiet, when you have to turn your TV off. It’s not a setting you’d expect for grown adults going to work. You don’t expect babysitters wearing fake cop uniforms...There’s lots of stupidity there but I am not sure if you put 11,000 strangers together in any environment that you wouldn’t see that.”

Oil Sands worker [235]

In a study by the Athabasca Regional Issues Working Group in 2007, when asked what the greatest single challenge is of working mobile in the Wood Buffalo region, 84% of respondents indicated that separation from family and friends constitutes the greatest challenge. [236]

- The marriages of mobile workers are also put at risk. Oil worker, Blair Ghent, reported:
“Anybody who works in the oil patch, it’s hard on the family. Lots of divorces. Three or four years ago we were working just outside Calgary, and of maybe 50 guys I think I was the only one left married.” [237]

A recent study on the Social Impacts of Resource Development in Fort McMurray, concluded that organization of work in the oil economy dominates people’s identities and possibilities for community involvement in Fort McMurray; the cost and instability of housing creates vulnerabilities and limited choices for many; even long-term residents feel vulnerable; and where change is so ubiquitous and work pressures are high, individuals’ social worlds and identities seem to get reduced. [238]

- Within any one year and over time, mobile workers in the Wood Buffalo region are employed in different regions and in different industries, including heavy industrial, commercial, residential construction and other industries. [239]
- Once their shift is over, they are not only tired, but transportation from camp to town limits their ability to participate in community recreation activities. [239]
- Many mobile workers struggle. They're haunted by alienation, addiction and feelings of impotent frustration. For some, the oblivion of hard drugs or alcohol offers easy escape. [240]

In addition to the stress on mobile workers and their families, the number of airline flights involved with a large portion of mobile workers consistently flying to and from work in the Oil Sands incurs a substantial amount of greenhouse gas emissions that are not normally included in estimates of Oil Sands-related emissions.

- There are currently 10 airlines that fly into Fort McMurray. Between 2005 and 2007, passenger traffic between the Halifax and Edmonton airports increased by 250%. Between mid-2006 and mid-2008, Air Canada and WestJet added four new weekly flights from St. John's to Fort McMurray, estimating the grand total of those regularly traveling to Alberta each year at 51,000. Air Canada called its daily flight between the two cities, the 'Newfoundland Express'. [241]
- In 2007, annual commercial travelers were up 36% from the previous year and it was estimated by the Municipality of Wood Buffalo, in a May 2008 report, that this will easily top 500,000 to 600,000. [241]

A large percentage of mobile worker drive substantial distances from their place of residence to the Oil Sands region in private vehicles, which as well adds to emissions related to Oil Sands development. [242]



HIGHWAY 63

Source: CBC NEWS



A FLARE FROM A OIL SANDS PROCESSING PLANT

Source: gofrm.com



SUNCOR TRUCK TIRES

Source: Pembina Institute

Temporary Foreign Workers:

Canada has increasingly relied on temporary foreign workers (TFWs), in particular at boom times, to develop its oil fields. Lower pay and other exploitation of these workers is common.

- In just one 3-month period in 2008, the Alberta government handled 800 complaints of abuse of guest workers. [243]
- Government officials found 74% of employers of TFWs inspected by the province of Alberta in 2009 had violated employment standards and the province's labour code. [243]

The Alberta government is currently the party most actively involved in international recruitment. As of September 2010, Alberta had more than 60,000 TFWs. [244]

- TFWs are from the Philippines, the U.S., the U.K., Mexico, Australia, India, China, Japan and other countries. [244]
- Alberta Human Resources and Employment forecasts Alberta's labour market to grow by 400,000 jobs by 2016, with a potential labour shortage as high as 109,000 people. According to the Alberta Federation of Labour (AFL), this is mainly due to the uncontrolled, rapid pace of development of the Oil Sands, which accounted for roughly 60% of the total value of all construction projects in the province. (The goal in 1995 was to produce a million barrels of oil per day by 2020.) [245]

"It would be reasonable to say that without the oil sands projects, Alberta would not be facing a labour force 'crisis' at all. . . the government could have simply regulated the development of the oils sands to schedule construction over a more reasonable time period – guaranteeing a longer-term and more stable demand for the various construction trades." AFL

- Many of the labour shortage jobs will likely be filled by TFWs. According to Yessy Byl, TFW Advocate:

"It's a totally horrendous situation. We need them desperately, but once they come here, they have no rights. . . [The Temporary Foreign Workers Program (TFWP)] has created a sub-class of workers with fewer rights than others in this country. It has incited more racism as well, not just from exploitative employers, but from Canadians generally."

"There are presently more TFWs entering the province each year than there are permanent immigrants. The entire strategy of the government has shifted away from bringing people to Alberta to allow them to have the full rights of citizenship and become members of our communities. They've now shifted it to say we want a revolving door of cattle to do a bunch of work and ship them back home again. [The oil companies] have found that if you increase supply by bringing in a pool of workers from outside the country who are prepared to work for less and without benefits - you artificially suppress wages."

Jason Foster, director of Policy Analysis for the AFL [246]

Exploitation of Temporary Foreign Workers

According to the Auditor General of Canada (2009), TFWs, especially those in low-skill placements, are at risk of abuse due to economic dependence, language isolation, and limited comprehension of their rights, and may be reluctant to raise concerns regarding their treatment or workplace safety, and may be willing to endure poor working conditions in order to secure their employer's support.

Because guest workers are dependent on their employers for their status in Canada, they are, by definition, vulnerable to abuse and poor treatment, says Professor Naomi Alboim, School of Policy Studies, Queen's University. The visitors say repeatedly they would never complain for fear of losing their jobs and their status. If TFWs lose their jobs, they are left with no income, no right to stay in Canada, and often a huge debt. [247]

- **Recruiters or labour brokers, who perform recruitment services for which they charge employers a fee, often exploit TFWs by illegally charging large placement fees to them as well. These fees range from \$3,000 to \$20,000. Recruiters also often mislead TFWs by understating the cost of living and as to what is covered and what isn't. As well, TFWs (particularly low skill workers) are often not aware of the temporariness of their contracts, mostly because recruiters create false hope of using this option to immigrate.** [248]
- Many temporary migrants mortgage their homes or borrow money to pay the fees so they can come to a job in Canada that may pay only \$10 an hour. If the recruiter arranged financing for the worker, a portion of the worker's wage is deducted to pay off the debt. [248]
- Though the practice of charging TFWs fees is illegal in Alberta, most of it is done from elsewhere and the government has failed to prosecute any of these recruiters. [249]
- When an employer brings in a worker, it's also the employer's responsibility to find the employee housing. Foster (AFL) states, *"If you are an employer and you can hire a worker where you can get half of the wages back on rent, that's a bonus...There are guys that come here work here for six months, then go home without having earned a penny."* [250]
- In Alberta, a TFW receives a work permit for one employer, for one job, in one specific location. Not only are workers tied to an employer, they are tied to a specific wage, in a specific post, in a specific location. [251]
- The tethering of TFWs to a particular job and a particular employer is inherently problematic as it makes migrant workers vulnerable to abuse and places them in a situation with limited agency. To obtain another job, workers must get a new Labour Market Opinion (LMO), which can take up to six months. Rather than waiting, with no incoming wage, many workers work underground for less pay or go home. [251]

Criticisms of the government's Temporary Foreign Workers Program

- The 2009 AFL report *Entrenching Exploitation* concludes that government responses to address exploitation are more designed to allay public opinion than to truly alleviate the exploitation of foreign workers and that the TFWP will lead to the creation of a permanent underclass of foreign workers who are marginalized from society. *"The purpose of this new class of workers is to artificially suppress wages and working conditions in certain low-wage sectors that become dependent upon foreign workers, sparking greater racial tensions and entrenching exploitation."* [252]

"The Government of Alberta should be doing more in terms of protecting TFWs . . . Alberta's TFW program does not meet the theoretical international best practices approach. . . At present, the terms utilized and the approaches taken in Alberta suggest that TFWs are viewed as stocks that can be brought in or out as required."

A 2009 research paper from the University of Sussex [253]

- New 2009 regulations for Temporary Worker programs restrict TFWs' eligibility for work permits to 4 years, followed by a period of 6 years during which they will not be allowed to work in Canada. This change is presented as a way to confirm the temporary nature of the TFWP. Only some TFWs whose skills are deemed "high" may have access to permanent residency. [254]
- The University of Sussex paper also questions, "if the Government of Alberta is acting in the best interests of all Albertans, or in the interests of employers?" [253]
- The 2009 AFL report also concludes, *"The rapid expansion and occupational shift of the TFWP has been done solely at the behest of employers clamouring for a quick fix to labour problems and . . . without consideration of consequences and with little regard for the well being of foreign workers. . . The TFWP, in its new form, is rapidly becoming an institutionalized part of Canada's and Alberta's labour force strategy."* [252]

It is estimated that 70,000 transient, temporary, or mobile workers are living in the Wood Buffalo Region. [255]

VIABLE ALTERNATIVES:

Alternate jobs

Expansion of the renewable energy industry would create jobs that could replace those lost if the Oil Sands were phased out and, at the same time, would address the global warming crisis.

- **According to analysts from the Center for American Progress, relative to spending on fossil fuels, clean-energy investments create 2.6 times more jobs for people with college degrees or above, 3 times more jobs for people with some college, and 3.6 times more jobs for people with high school degrees or less.** [256]
- Clean technology development and commercialization is a rapidly growing industry and is becoming a mainstream investment category. Canada is getting left behind in the emerging clean energy economy. Within the next decade, clean energy could grow to become one of the world's largest industrial sectors. Yet, Canada is not a player in the clean energy field, and has invested less of its stimulus spending in clean energy than Saudi Arabia, China, Australia, France or the United States. [257]
- According to Canada's National Round Table on the Environment and the Economy (NTREE), research has shown that every \$100 million of venture capital invested in cleantech could result in 2700 direct jobs, as well as additional revenues and other indirect employment opportunities. [257]
- **The Canadian government emphasizes that it is harmonizing its energy and climate policies with the United States. Yet, when it comes to investing in clean energy jobs, Canada does not even come close to matching U.S. efforts. As a May 2010 report, *Falling Behind: Canada's Lost Clean Energy Jobs*, shows, if Canada were matching U.S. investment in clean energy on a per person basis, an additional \$11 billion would have been earmarked by the Canadian government for clean energy. If Canada's spending matched U.S. investment in renewable energy alone, an additional estimated 66,000 jobs would have been created.** (The actual job gap is much larger once energy efficiency and transportation investment are taken into account.) [258]
- The clean-energy sector produces more jobs per dollar than the fossil fuels industry because a larger share of clean-energy expenditures goes to manufacturing, installation, and maintenance—far more labour intensive than the extraction and transportation sectors that comprise most fossil fuel jobs. [259]
- Whereas the Oil Sands employs many mobile workers as well as those who have relocated to work there, renewable energy projects have the potential of providing local employment through the deployment of local and sustainable energy technologies. [260]

"If there were enough jobs here that paid a living wage, no one would leave. It wouldn't be worth it." Christie Ghent of Nova Scotia, wife of a mobile Oil Sands worker.



Source: Wind Energy Planning

Alternate energy

An August 2010 Greenpeace report projects that low-impact renewable energy can supply 96% of electricity and 92% of our total heating needs by 2050 and that Canadians would save about \$135 per person a year or \$5.3 billion on average on their energy bills over the next 40 years, if we use less energy and switch away from increasingly costly fossil fuels. [261]

- According to the August 2010 Greenpeace report, the market for Oil Sands oil could be eliminated through a global scenario of investments in public transit, more efficient vehicles and a rapid shift to electric vehicles that would reduce the world's demand for oil by 25% by 2030 and 66% by 2050. [261]
- Wind power is one of the fastest-growing sources of energy in the world. This industry generates billions of dollars in revenue. Canada is lagging far behind many countries already reaping the economic and environmental benefits of wind power. With thousands of kilometers of shoreline along lakes and oceans, there is tremendous potential for wind power in Canada. **In an average year, a single wind turbine (1.8 MW) will produce 6,000 MWh of electricity, enough power for more than 750 Canadian homes.** This is equivalent to taking 1,260 cars off the road and would reduce GHG emissions by 6,000 tonnes annually. [262]
- According to a 2008 detailed study from Stanford University, the renewable resources available to power the planet are staggering . . . Sufficient clean natural resources (*e.g.*, wind, sunlight, hot water, ocean energy, gravitational energy) exists to power all energy for the world. **Globally-available wind power over land is five times the world's total power production and 20 times the world's electric power production. The sun's rays deliver to our globe daily 15,000 times more energy than the daily consumption of nuclear and fossil energy.** [263]

For Canada to not invest at least the dollars slated for CCS, oil subsidies and tax incentives to renewable energy research and initiatives and promoting a green economy, and join the International Renewable Energy Association

to connect globally with renewable energy development, is to take a step backwards environmentally and economically. Canada currently invests 18 times less per capita on renewable energy than the U.S.

In its first *Climate Prosperity* report, NTREE states: *The challenge before us is not just about coping with climate change, but prospering through it. . . Competitive advantage in the future requires competitive advance in low-carbon performance. Every country in the world will feel the effects of the low-carbon transition. How they position themselves to compete in terms of their domestic emissions and energy use, investment, innovation, skills, and policies will have lasting effects on their economic viability.* [264]

"If Canada stays dirty, you are going to have real problems down the road. Ask your PM if, in his studies of economics, he studied the histories of economic revolutions. They create jobs and stimulate economic activity. To claim acting to reduce GHGs will lose jobs is to have it exactly backwards. Failing to act, losing out on the green race to new technology risks jobs, risks investments, risks access to markets - if you stay dirty, you run huge risks."

Sir Nicholas Stern on Canadian Prime Minister Stephen Harper's claim that meeting necessary GHG reduction targets will cost "millions of jobs", Climate Change Conference, Cancun, December 2010

CANADA'S COMMITMENTS TO YOUTH AND FUTURE GENERATIONS:

- **The UN Framework Convention on Climate Change (UNFCCC) provides the basis for global action to "protect the climate system for the benefit of present and future generations of humankind"**. Stated principles and commitments include: taking precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects, and promoting sustainable development. It also directs that developed countries and other Annex 1 Parties "commit themselves specifically as provided for in the following: **Each of these Parties shall adopt national policies and take corresponding measures on the mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases and protecting and enhancing its greenhouse gas sinks and reservoirs. Canada is an Annex 1 Party in the UNFCCC.** [265]
- **The UN Educational, Scientific and Cultural Organization (UNESCO) states: "Present generations have the responsibility to bequeath to future generations an Earth which will not one day be irreversibly damaged by human activity. . . [and] should take into account possible consequences for future generations of major projects before these are carried out. . . Each generation inheriting the Earth temporarily should take care to use natural resources reasonably and ensure that life is not prejudiced by harmful modifications of the ecosystems and that scientific and technological progress in all fields does not harm life on Earth."** **Canada is a member of UNESCO.** [266]
- In promoting the development of the Alberta Oil Sands and killing bills and actions to mitigate climate change, the Conservative government is not taking consequences for future generations into account.

The single-minded determination to extract Oil Sands oil began back in the 1950s, when hundreds of scientists, geologists, engineers, politicians, and businessmen in both Canada and the United States seriously studied the possibility of inserting atomic bombs to 'boil the oil out of the sands', discounting both the possibility that the radioactivity could escape into the atmosphere, and the potential devastation of the Native population and the natural environment where they lived.



Cree Children
Source: David Suzuki's Notebook, Facebook



Mikisew Cree First Nation live in Fort Chipewyan downstream from the Oil Sands



Source: Elan Films

Tom Wright, then-exploration geologist with Richfield Oil Company, recalled, *"Nobody gave them any thought."* [267]

PART 2: PIPELINES, CCS, AND POLITICS

PIPELINES – EXISTING (major, export):

According to Alberta's Oil Sands Discovery Centre Fact Sheet, approximately 700,000 km of pipelines transport virtually all of Canada's crude oil and natural gas production to consumers in Canada and the United States. If laid end to end, there are enough pipelines to circle the equator more than 17 times. Of this, 580,000 km are in Canada (CEPA 2007), with 293,700 km in Alberta alone. [268]

- According to the Canadian Association of Petroleum Producers (CAPP), at the end of 2009 there were three major pipelines that directly connected to the Canadian supply hubs at Edmonton and Hardisty, Alberta: Enbridge Mainline, Kinder Morgan Trans Mountain, and Kinder Morgan Express, with a total annual capacity of 2,448,000 barrels per day (bpd). [269]
- **CAPP figures show total Western Canada oil production for 2009 at 2,454,000 bpd, with 55% coming from the Oil Sands.** [270]
- In addition to the existing massive pipeline network (above), TransCanada Corp. and Enbridge Inc. have recently completed two new pipelines, named Keystone I and Alberta Clipper (operational in July and October 2010 respectively). Together they have room to carry 885,000 bpd (Keystone 435,000 and Clipper 450,000). The completion of Keystone II in 2011, adding 155,000 bpd capacity, will increase total throughput capacity for these two pipelines to 1,040,000 bpd. [271]
- **With the 2010 Keystone/Clipper additions, CAPP figures show 2010 pipeline capacity from western Canada as 3,333,000 bpd (1,814,000 heavy crude and 1,519,000 light crude).** [272]
- The Alberta Clipper pipeline can be further expanded to add another 350,000 bpd, bringing the total of these two new pipelines to 1,390,000 bpd – a new capacity almost equal to the entire current output of the Oil Sands. [273]
- According to CAPP, the timing of the Keystone/Clipper expansions and the approved projects going into service (see major expansions below) “will mean that excess pipeline capacity out of the [Western Canada Sedimentary] basin will exist until around 2022, when growth in crude oil supply is expected to reach over 4 million bpd”. [274]

The large oil pipelines that criss-cross the continent from Alberta to the Midwestern United States are large consumers of energy.

- According to Enbridge's own data, in 2008 its Liquids Pipelines Division used 6,846,673 gigajoules (this figure represents Canadian based pipelines only) of electricity to pump, ship and store hydrocarbons. This amount of electricity is the energy equivalent of 41,080,038 barrels of oil. [275]

Diluent:

Oil Sands crude is exported as either raw bitumen ('bitumen blend') or upgraded light synthetic crude oil. For the former, diluents are blended with the heavy bitumen to move the material through the pipelines. Diluents are light hydrocarbons that are used to reduce the viscosity of heavy oils, such as bitumen-based crude oil. [276]

Currently the main source of diluent is natural gas condensate that is produced in western Canada. (As natural gas comes to the surface, pressure is released and temperatures are lowered, and some of the gas content naturally condenses into a light oil called condensate.) Upgraded light crude oil can also be used as diluent. Blending with condensate (dilbit) requires a 70:30 bitumen to condensate ratio, while blending with light crude (synbit) requires an approximately 50:50 ratio. [277]

- **Natural gas condensates are rapidly becoming scarce due to depletion of natural gas reserves and the needs of growing bitumen production are exceeding the western Canada diluent supply. An average of over 60,000 bpd of diluent were imported into Alberta by rail in 2009.** [278]
- Enbridge has recently added the Southern Lights pipeline, which is to be in service July 2010. It will transport 180,000 bpd of diluent from Midwest U.S. refineries and supply centers to the Oil Sands and heavy crude oil production in Western Canada. It is expandable to 400,000 bpd. [279]
- There is an additional plan for the U.S. Chicap Pipeline (U.S. Gulf Coast to Chicago) to connect to the Southern Lights Pipeline. Ultimate capacity on the pipeline is estimated to be 320,000 bpd in batched diluent and light crude oil, with about 50% initially available in 2010. [279]
- Access to a reliable supply of diluents from U.S. refining centers will, in turn, facilitate increased production of growing supplies of crude oil for delivery to the U.S. from Canada.

Crude oil pipelines – major proposed expansions:

TransCanada Corp.’s Keystone Gulf Expansion project, Keystone XL

The Keystone Gulf Expansion Project, Keystone XL, to be completed in 2013, would initially increase the Keystone pipeline capacity by an additional 700,000 bpd – running from Hardisty, Alberta to Cushing, Oklahoma and Houston, Texas. If warranted, additional pumping capacity would increase the average throughput to 900,000 bpd, with the additional 200,000 bpd transported to delivery points on the U.S. Gulf Coast (Louisiana). According to CAPP, the pipeline could be further expanded to 1.5 million bpd. Canada’s National Energy Board has already approved the Canadian section of this pipeline expansion. Applications for U.S. regulatory approval are underway. [280]

Opposition to Keystone XL

- In June 2010, a coalition of U.S. congressmen, in a letter to the Secretary of State, Hillary Clinton, and signed by 50 representatives, expressed opposition to the \$12-billion Keystone XL pipeline expansion, insisting that the “tarsands oil pipeline” needs more study. “This pipeline would deliver up to 900,000 barrels per day of tarsands oil from Alberta, Canada, over 2,000 miles to refineries on the U.S. Gulf Coast, more than doubling U.S. consumption of tarsands oil.” [281]
- In July 2010, U.S. House Member and Chairman of the Committee on Energy and Commerce, Henry A. Waxman, wrote a public letter to Hillary Clinton expressing strong opposition to the Keystone XL, *“This pipeline is a multi-billion dollar investment to expand our reliance on the dirtiest source of transportation fuel currently available. . . I am also concerned that the State Department has failed to analyze the most significant environmental impacts of this decision, as required by law, and is conducting the permitting process in a manner that lacks transparency and limits the ability of other relevant agencies to participate.”* [282]
- Waxman is also concerned that the cumulative effect of the Keystone and Alberta Clipper 2010/11 pipeline additions and the proposed Keystone XL pipeline would “increase tar sands imports to over 3 million barrels per day. To process this large increase in tar sands imports, U.S. refineries will invest billions of dollars more in refinery upgrades. . . The combined effect of the three tar sands pipelines would be to erase roughly two-thirds of the global warming pollution reductions that the Administration’s historic motor vehicle standards would achieve in 2020.” [282]
- In July 2010, the U.S. Environmental Protection Agency (EPA) asserted that the State Department’s draft Environmental Impact Statement on the Keystone XL tar sands pipeline “does not fully identify and address the potential for disproportionately high and adverse human health and environmental effects on minority, low-income and Tribal populations.” The EPA also raised serious concerns about the threats tar sands pose to the health and safety of American communities. [283]
- The Communications, Energy and Paperworkers Union of Canada is concerned that the Keystone XL pipeline “means the loss of tens of thousands of jobs in the Canadian oil upgrading and refining sector that either exist now, or that would have been created by projects that are likely to be cancelled as a result of the dramatic expansion of oil export pipeline capacity to upgraders and refineries in the U.S.” [284]

Adding up the figures: 2,458,000 bpd pipeline capacity in 2009 plus 1,040,000 expandable to 1,391,000 bpd added in 2010/2011, means a crude oil pipeline capacity of 3,848,000 bpd is essentially already in place. Add in Keystone XL with 700,000 bpd, expandable to 1.5 million bpd, and the expandable capacity will jump to 5,348,000 bpd – more than doubling the pipeline capacity of 2009 – billions of dollars of investments, locking Canada further into Oil Sands growth.



Source: Pipeline International
PIPELINE CONSTRUCTION IN ALBERTA



Source: Plains Justice
KEYSTONE PIPELINE NEAR YANSTON, SD



Source: Oil and Gas Journal
TRANSCANADA PIPELINE LTD. CONSTRUCTION

Enbridge's Northern Gateway Project proposal

The Polaris Institute reported that oil companies have already built an overcapacity of pipelines to bring oil to the Midwest United States, where demand is less than originally thought. They are now looking to Asian markets and the U.S. West Coast as the next frontier for selling Canada's oil. [285]

In May 2010, Enbridge filed an application with the National Energy Board to build a 1,170 km long, 30 metres wide 'Northern Gateway' Pipeline (estimated cost \$5.5 billion) from near Edmonton (Bruderheim) to Kitimat, B.C., a small industrial and forestry town nestled in the Coastal Mountains at the mouth of the Kitimat River. [286]

- The Gateway Project would see the development of parallel pipelines with pumping stations, projected to carry an average of 525,000 bpd of crude oil to Kitimat and 193,000 bpd of imported condensate to Bruderheim. [286]
- **The Northern Gateway pipelines would cross 785 watercourses (of which around 80 have high fisheries sensitivities or constructability issues), including the headwaters of the Fraser and Skeena, 50 First Nations territories, timbered plateaus, wetland habitats, and the coastal mountain range.** [287]

The Gateway Project also includes the building of a supertanker port in Kitimat. According to Enbridge's proposal, during operations "between 190 and 250 oil and condensate tankers will call on the Kitimat Terminal each year.

On average, this will likely comprise 50 VLCCs [very large crude carriers-200,000 to 320,000 dead-weight tons (DWT)], 120 Suezmax tankers [120,000 to 200,000 DWT], and 50 Aframax tankers [80,000 to 120,000 DWT]". [288]

- The tankers would travel north and south out of Queen Charlotte Sound and Hecate Strait, through important fishing areas, critical whale habitat, and the heart of the Great Bear Rainforest, to markets in Asia and the U.S. [289]
- There are major concerns that the Northern Gateway pipeline construction and ruptures would: affect the health of communities along the route of the pipeline, affect fish abundance and habitat, poison entire food chains of plant life, fish, bird, and wildlife populations and, in turn, affect the livelihoods and survival of entire communities that depend on hunting and/or fishing for sustenance. [290]
- There are also major concerns that an oil tanker spill on the north or central B.C. coast would be catastrophic to the communities, marine life including B.C. salmon production, fisheries, and coastal economy. [291]

Kinder Morgan's Trans Mountain Pipeline proposed expansion

Kinder Morgan Canada's Trans Mountain Pipeline, running from Haines, Alberta to Westridge in north Burnaby, B.C., has been in operation for over 50 years and has been carrying Oil Sands crude, to be loaded onto oil tankers, for much of that time. It is currently the only pipeline route to markets off the West Coast and also transports crude to a pipeline that provides delivery to refineries in Washington State. [292]

Increased Oil Sands production and emerging West Coast and Asian markets are driving a steep rise in the number of oil tankers leaving Westridge terminal and plying B.C.'s coast. [293]

- In 2008, as the first stage of Kinder Morgan's Trans Mountain Expansion (TMX) project, the 158 km Anchor Loop project, running through Jasper National Park and Mount Robson Provincial Park, was completed, adding 40,000 bpd to increase capacity to 300,000 bpd. **TMX project plans include boosting capacity of Trans Mountain to 380,000 bpd in 2015 (TMX2) and to a potential 700,000 bpd by 2016 (TMX3). TMX3 includes a new line to the Washington State refineries and a second berth at the Westridge dock.** [294]
- Nearly 3 years ago, Kinder Morgan dredged the waters around its Burnaby terminal to allow passage for Aframax vessels, which the port of Vancouver now allows. The Port is now looking at the viability of further dredging to allow for bigger Suezmax tankers (which will carry approximately one million barrels) in the future. [295]
- According to Kinder Morgan, in 2008, their company loaded 42 tankers and in 2009, they loaded 65 tankers, for shipment through Vancouver. According to Port of Metro Vancouver figures, in 2009, crude oil shipments more than tripled from 2005 and nearly doubled from 2008 to 3,916,000 metric tonnes. **Planned pipeline expansions could see crude oil traffic leaving the port of Vancouver increase to well over 100 vessels per year.** [296]
- Tankers exiting the Westridge Terminal in Burnaby must pass through the narrow gap under the CN Railway bridge at the Second Narrows (given a high hazard rating by the Canadian Coast Guard), only at high slack water during daylight hours, then make their way past downtown Vancouver and Stanley Park. **After exiting the busy port of Vancouver and crossing George Strait, tankers must navigate the narrow channels through the Southern Gulf Islands, and the strong tidal currents of Haro Strait and Race Rocks.** [297]

Kinder Morgan also has a subsequent proposal to expand its existing 1,150-kilometre Trans Mountain Pipeline to add a northern leg to Kitimat and increase Trans Mountain's capacity by another 400,000 bpd (bringing its total capacity up to 1.1 million bpd), which they feel is a "better way to go" than Enbridge's Northern Gateway project. (The northern spur from Valemont to Kitimat would be 769 km and would pass by the city of Prince George.) [298]

PIPELINES AND OIL TANKERS – ENVIRONMENTAL IMPACTS:

Oil spills and leaks can be a major source of water contamination in streams, rivers, lakes and ocean environments. Land based oil spills carry the potential to contaminate drinking water through direct spills in rivers and streams, which will cause leaching and contamination to groundwater. Contamination from oil spills on fish and wildlife also pose serious health risks to humans. [299]

- Hydrocarbons dissolved in water have an immediate toxic effect on aquatic organisms, and juvenile fish are more vulnerable than adults. [300]
- Crude oil contains polycyclic aromatic hydrocarbons (PAHs), which are very difficult to clean up, and last for years in the sediment and marine environment. Condensate also contains persistent PAHs, although the impacts of condensate spills are less known. [301]
- Marine species constantly exposed to PAHs can exhibit developmental problems, susceptibility to disease, and abnormal reproductive cycles. [302]
- Impacts on salmon and other fish species exposed to oil and other petroleum products include lethal and sublethal effects on growth, gene expression and defects in cardiac function, edema, spinal curvature and reduction in the size of the jaw and other craniofacial structures. PAHs are the most toxic components for fish and invertebrates. [303]



KEYSTONE PIPELINE WATER CROSSING IN THE MIDWEST Source: North American Pipelines

Environmental impacts specific to pipelines:

Pipeline construction and operation can cause damage to soils, surface and groundwater, air quality, vegetation, wildlife, and fish populations. Pipeline spills can lead to direct loss of various species as a result of contaminated food intake, reduced respiratory functions, or ingestion of oily water. [304]

In salmon bearing streams, the most significant impacts of pipeline construction and operation would occur during construction at stream crossings, where increased sedimentation can cause adverse impacts ranging from increased mortality to changes in salmon behavior. [305]

“[Enbridge pipeline projects have] involved massive amounts of soil disturbance (trench-digging), excavation through hundreds of miles of wetlands, hundreds of stream crossings, clear-cutting of forests, and more. Trees are not allowed to regenerate above the pipes, meaning many forested areas, including wooded wetlands, are permanently stripped of forest cover and habitat....Pipeline construction is inherently messy and compliance with environmental permit conditions is often poor.”

Erin O’Brien, Wetland Policy Director of the Wisconsin Wetlands Association, who has observed Enbridge’s pipeline construction process in Wisconsin [306]

Indirect environmental impacts

The environmental impact of additional oil and gas pipelines is not limited to the construction of the pipelines. Transporting oil to new markets also enables greater expansion of Oil Sands projects, which, in turn, permits the continuation of the severe environmental and social impacts that result from increased production in the Oil Sands.

- For example, the Pembina Institute estimates that the proposed Northern Gateway pipeline capacity would result in the production of an additional 367,500 barrels of oil each day and that related Oil Sands production would: produce an estimated 6.5 megatonnes of greenhouse gas emission annually (equivalent to putting 1.6 million more cars on the road); produce 25 million barrels (3.8 trillion litres) of toxic tailings; disturb 11.5 sq km of forest (an area nearly three times the size of Stanley Park); consume the amount of natural gas used by 1.3 million households in Canada each year; use the amount of water consumed annually by a city of 250,000. [307]

Pipeline failure statistics

Because of corrosion and stress on pipelines the National Energy Board has found that large diameter oil pipelines fail after 28 years on average. [308]

A 1,000 km section of liquid pipeline would be expected to experience a rupture every 16 years. (No ruptures were recorded in pipelines that had operated for less than 12 years.) [309]

- In Alberta, the oil and gas industry averaged 762 pipeline failures per year between 1990 and 2005 for a total of 12,191 failures. 6% of these (758) were ruptures and 94% (11,433) were leaks. 96% released less than 100,000 litres of liquid, 3.5% were between 100,000 and 1,000,000 litres, and 0.5% were over 1,000,000 litres. [309]

Major pipeline failures and ruptures

Burnaby, British Columbia – Kinder Morgan

- In 2007, a 24-inch Kinder Morgan pipeline in Burnaby was ruptured, resulting in a 30-metre geyser of oil spraying oil into the air and covering the surrounding area with oil, spraying oil across 50 homes and spilling it into Burrard Inlet. About 234,000 litres of oil was spilled and approximately 1,200 metres of shoreline were affected. In 2009, 200,000 litres of crude oil spilled from one of Kinder Morgan's storage tanks. The oil was captured by a containment bay surrounding the tank before it escaped into the environment. [310]

Alberta – Plains Midstream Canada

- In 2011, a break in Plains Midstream Canada's 44-year-old Rainbow pipeline, 100 km northeast of Peace River, Alberta, leaked 4.5 million litres of crude oil, the largest pipeline spill in the province since 1975. Members of the Lubicon Cree Nation community of Little Buffalo, 30 km away, experienced nausea, burning eyes, and headaches. News of the spill was not released until after the May 2, 2011 Canadian election, 4 days after the spill occurred. [311]

Major Enbridge oil pipeline spills since 1999

- Between 1999 and 2008, across all of Enbridge's operations there were 610 spills that released close to 132,000 barrels (21 million litres) of hydrocarbons into the environment. This amounts to approximately half of the oil that spilled from the oil tanker Exxon Valdez in 1989. [312]



ENBRIDGE CONTROLLED BURN Source: The Tyee
Photo: U.S. National Transportation Safety Board

- In January 2001, Enbridge's Energy Transportation North Pipeline leaked 23,900 barrels of crude oil (3.8 million litres) into a slough near Hardisty, Alberta. The Transportation Safety Board of Canada noted that the site of the leak on the aging pipeline had been identified a "high priority location" just four months earlier. [313]
- In July 2002, a 34-inch diameter steel pipeline ruptured in a marsh west of Cohasset, Minnesota. A plume of smoke extending one mile high was the result of the company setting the oil on fire to prevent the 6,000 barrels (950,000 litres) of crude oil from reaching the Mississippi River. The U.S. National Transportation Safety Board blamed the rupture on "inadequate" loading of the pipe for transportation". [314]

- **Major Enbridge spills 2003 to 2010:**

In January 2003, a leak released at least 380,000 litres of oil into the Nemadji River, a tributary of Lake Superior.

In February 2007, workers ruptured a Wisconsin pipeline, releasing 300,000 litres of oil.

In April 2007, a pipeline rupture attributed to corrosion, near Glenavon, Saskatchewan, released 990,000 litres of oil.

In January and February 2007, 675,000 litres spilled in two separate incidents in Clark and Rusk Counties, Wisconsin. One pipeline cracked open and couldn't be shut off until an operator in Canada shut down the line.

In November 2007, a 34-inch Enbridge pipeline carrying bitumen to U.S. Midwest markets exploded, killing two workers near Clearbrook, Minnesota. The pipe had leaked two weeks prior to the explosion and was being repaired. The Pipeline and Hazardous Materials Safety Administration fined the company \$2 million for exceeding pressure in its pipeline and for failing to follow safety procedures. [315]



Flames and smoke rise above Enbridge's oil pipeline fire that killed two workers Photo: Eric Hylden/Grand Forks Herald/Associated Press



- In July 2010, in southwestern Michigan, the Chicago to Sarnia portion of Enbridge's 190,000 bpd Lakehead pipeline system, leaked over 3 million litres of crude oil into a fast-moving creek that flows into the Kalamazoo River, which, in turn, empties into Lake Michigan. More than 50 families close to the river were evacuated from their homes because of elevated benzene levels in the air and another 200 homes were told to avoid drinking well water. Oil-covered Canada Geese along the banks of the river and dead fish floating in the oily water were victims. The spill extended at least 40 km along the banks of the Kalamazoo River and toward the Great Lakes. [316]

VICTIMS OF THE MICHIGAN PIPELINE SPILL: OIL SOAKED CANADIAN GEESE

1. Source: The Star; 2. Photo: Tod Heywood, The Minnesota Independent;
OIL SOAKED RIVER OTTER, Source: LA Times

Enbridge pipeline spills' aftermaths

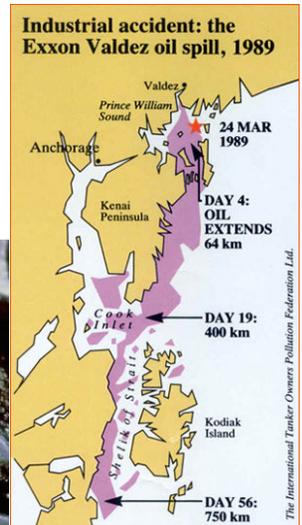
- In May 2008 Alberta's energy regulator delivered a "high risk enforcement action" against Enbridge for using "valves, flanges and fittings" on its Midstream pipeline that were not suitable for maximum operating pressure. No fines were levied. [317]
- In January 2009 Enbridge agreed to pay a fine of \$1 million to the government of Wisconsin after it committed more than 500 violations of the state's wetland and waterway protection regulations while constructing the \$2 billion Southern Access pipeline to export 400,000 barrels of bitumen from Alberta to Chicago. Attorney General J. B. Van Hollen said "the incidents of violation were numerous and widespread and resulted in impacts to the streams and wetlands throughout the various watersheds." Enbridge blamed the problems on "bad" weather. [317]
- Following the July 2010 Enbridge spill in Michigan, the Calgary-based company admitted the aging Line 6B had been subject to more than 100 repairs during the preceding year. Earlier in July 2010, Enbridge Energy Partners had informed the U.S. Department of Transportation that the 41-year-old pipe likely was corroded and needed replacing. The Lakehead System is the US portion of Enbridge's primary transport line for crude oil from Western Canada to the US, serving all the major refining centers in the Great Lakes, Midwest US, and Ontario, Canada. [318]

Enbridge's Northern Gateway Project Application states, "Some chronic toxicity associated with any hydrocarbons might remain after cleanup because PAH levels in sediment may remain above applicable guidelines for the protection of aquatic life until biodegradation has reduced the levels. Most wildlife groups would be affected to some degree by habitat loss, particularly those species with low mobility and small home ranges." [319]

Environmental impacts specific to oil tankers:

Oil spills from tankers can have numerous adverse effects including shoreline contamination, catastrophic species loss, ocean sediment contamination, water quality deterioration, commercial fishing industry closures, and, in many areas, impacts on tourism and traditional Aboriginal culture. [320]

- Recent studies have indicated that oil-spill impacts can endure for longer than previously anticipated, causing extended population reductions and postponed recovery in many species for decades. [320]
- When the Exxon Valdez ran aground in Prince William Sound, Alaska, it spilled 37,000 tonnes (41 million litres) of oil and polluted over 2,000 km of coastline. Only 3% of the oil was recovered. An estimated 2,800 sea otters, 250,000 birds, 1.9 million salmon, and 12.9 billion herring were killed. A 2003 study found lingering effects on local marine life 14 years after the spill. [321]



EXXON VALDEZ OIL SPILL VICTIMS 1. Source: Youth against climate change; 2,3. Source: Prince William Soundkeeper, Courtesy Exxon Valdez Oil Spill Trust Council

Oil spill statistics

Increased oil tanker traffic coming out of Burrard Inlet could be more dangerous than new tanker traffic from the proposed Northern Gateway pipeline. According to marine experts, oil spill risks increase with the number of shipments, rather than the size of tankers. The Burnaby terminal and Burrard Inlet cannot handle larger vessels, which results in more tanker traffic. One transit of a 300,000 DWT tanker going out of Kitimat could be of less risk than three 100,000 DWT tankers currently going out of Burnaby. [322]

- According to Living Oceans Society, based on the amount of oil the Enbridge project would be transporting and world wide oil tanker spill statistics, **a spill of 1,000 barrels (150,000 litres) or greater is predicted to occur once every 4 years. A spill of 10,000 barrels (1.6 million litres) or greater could be expected to occur once every 9 years.** [323]
- According to the International Tanker Owners Pollution Federation the average number of major spills, greater than 700 tonnes (800,000 litres), from 2000 to 2009, was 3.3 per year and the average number of medium-sized spills, 7-700 tonnes for the same period was 14 per year. Their handbook also states that at sea, even with modern technology, recovering 10-15% of the oil spilled from major tanker accidents is considered successful. This group has also tracked 444 spills greater than 700 tonnes between 1970 and 2009 as well as 9,078 smaller spills. [324]

Oil spill cleanup

The pipeline company is not responsible for the oil once it leaves the terminal and therefore has no legal obligation to clean up a spill. According to Jennifer Lash, executive director of the Living Oceans Society, the owner of the tanker is liable for the costs of oil recovery, cleanup and compensation for environmental damage - but only to the limit of the owner's liability insurance. The Marine Liability Act also limits liability for oil spills to between about US\$38 million and US\$76.5 million, depending upon the size of the ship. [325]



AFRAMAX FREIGHTER APPROACHING RAILWAY BRIDGE AT SECOND NARROWS Source: BCWaters.org

- There are additional funds for oil spill cleanup, up to \$1.4 billion per incident, available through international marine organizations, but Lash said Living Oceans is concerned that **Canadian taxpayers could end up digging money out of their own pockets if those third party funds are exhausted.** The 1989 Exxon Valdez spill in Alaska led to \$3.5 billion in clean-up costs and \$5 billion in legal and financial settlements. [325]
- According to Stafford Reid, a member of a committee that advises the federal government on issues involving oil spill response efficiency on the Pacific Coast, Canadian federal standards, written in 1995, are not high enough to minimize risks - or impacts in the event of an actual spill. *"[Federal standards] are very, very lean when it comes to shoreline cleanup, oil waste management, wildlife response."* [326]
- Reid has also stated that the other threat not addressed in Canadian federal regulation is managing a distressed vessel before it can founder, sink or get grounded and break up - and siphoning all the oil out of it before a potentially minor incident degrades into a disaster. And, in regards to paying for cleanup: *"Canada does not have a national resource damage assessment policy and process."* [326]
- According to the office of the Auditor General of Canada, a public review panel recommended 20 years ago that the federal government establish a national regime to deal with ship-source chemical spills. Such a regime is not yet in place, and none is expected before 2013. [326]
- In the spring of 2010 then B.C.'s Environment Minister, Barry Penner, said that the province has a continuing concern about the lack of coordination and communication between the Canadian Coast Guard and other agencies that would respond in the event of a spill, and that he and officials in his ministry have raised the issue several times with the federal government - so far without success. Jennifer Lash stated: *"What we need is a much better coordinated, single strategy with all agencies from the different levels working very well together in partnership with first nations and environmental groups."* [326]

EXPORT TO THE UNITED STATES:

Oil Sands production is not providing Canada with foreign oil independence. A large percentage of Oil Sands crude oil is exported to the U.S. and Canada is still buying oil from the Middle East and from North Sea countries. (In 2008 crude oil imports represented 47% of total Canadian refinery feedstock, 59% coming from OPEC countries.) [327]

Canada's Oil Sands are the single largest source of the U.S.'s imported oil. Development of the oil sands has made Canada the number one foreign supplier of oil to the United States. **Under a high projected growth scenario for the oil sands, Canada could account for over 35% of US oil imports by 2035, according to IHS CERA.** [328]

- Article 605 of NAFTA prohibits the Canadian government from imposing (under normal conditions) any restriction that causes U.S. imports of Canadian energy to fall. It states that **Canada, in the event it decides to reduce its production for reasons of, for example, environment protection, conservation or national security, must maintain the exact percentage of exports to the United States that prevailed over the previous three years . . . even if this means that Canadians will not have enough for their own domestic needs.** [329]
- The Oil Sands create tens of thousands of jobs in the U.S. Even if the Oil Sands were environmentally sound, much of the raw bitumen or heavy crude that is produced from the Oil Sands is sent to the U.S. to be refined, thus exporting thousands of refining jobs rather than keeping them in Canada. According to CAPP figures, in 2009, from the Oil Sands, 970,000 bpd was exported as Bitumen Blend (includes diluent) and only 653,000 bpd was exported as Upgraded Light (Synthetic) crude. [330]
- While much of the bitumen is currently upgraded into synthetic crude, firms have shelved plans for more upgraders in Alberta, choosing instead to send the new supplies of raw bitumen straight to U.S. upgraders and refineries. And energy companies are in the process of spending about US\$31 billion to build, re-tool or expand at least 10 refineries in the U.S. for upgrading and refining raw bitumen from the Oil Sands. The combined capacity of these refineries will be about 2.8 million bpd. [331]

CARBON CAPTURE AND STORAGE AND POLITICAL GREENWASHING:

What is carbon capture and storage (CCS)?

Carbon capture and storage (CCS) is an integrated process, made up of three distinct parts: carbon capture, transport, and storage (including measurement, monitoring and verification). Capture technology aims to produce a concentrated stream of CO₂ that can be compressed, transported (likely via pipeline), and stored. The vast majority of CO₂ storage is expected to occur in geological sites on land, or below the seabed. A good storage site is typically more than 800 metres below the surface so that CO₂ can be injected and stored as a liquid. [332]

Porous rock formations or deep saline formations offer the best storage mediums for CO₂, with deep saline aquifers, which are widely distributed globally, providing the greatest volumetric potential for storage. This includes sub-sea reservoirs. An aquifer is a layer of sedimentary rocks, usually sandstone and carbonate, saturated with saline (non-potable water) from which water can be produced or into which fluids can be injected. [333]

- Saline aquifers run deep under all 68 Canadian sedimentary basins. Depleted or nearly depleted oil and gas fields, as well as deep coal seams, provide potential for enhanced oil and gas recovery. (By pumping CO₂ into an oil reservoir, previously unrecoverable oil is pushed up to where the oil can be reached.) [333]
- Today, three types of CCS technologies exist:
 - 1) oxyfuel – burning the fuel in pure oxygen instead of air to produce a CO₂-rich stream;
 - 2) post-combustion, the most well developed method – using various forms of chemistry – in the form of amine or ammonia scrubbers, special membranes or ionic liquids – to pull CO₂ out of a more mixed set of exhaust gases;
 - 3) pre-combustion – gasification, in which liquid or solid fuels are first turned into a synthesis gas (“syngas”) stream, consisting mainly of carbon monoxide and hydrogen; carbon monoxide in the syngas is converted into CO₂ and removed prior to combustion using solvent. [334]

CCS in the Oil Sands

A 2009 WWF report on *CCS in the Alberta Oil Sands* states, “*In its application to oil sands developments, CCS has limited potential to reduce upstream emissions to levels comparable with the average for conventional oil. . . Optimistic industry estimates for CCS have suggested that overall reductions from upstream operations could be in the 10 to 30% range at the best process locations by 2020 and in the 30 to 50% range industry wide by 2050.*” [335]

- The WWF report concludes, “Maximum reductions achievable using CCS would therefore be insufficient to meet emerging low carbon fuel standards, such as those in the European Union and California, even by 2050 . . . or enable Canada to meet its international climate change commitments.” [335]
- Ceres reports that only the upgrading and hydrogen processing elements of oil sands production yield high-CO₂ waste streams that lend themselves to ready capture, and that pipelines would have to be built (extending up to 1,000 miles) to transport the captured CO₂ to geographically suitable regions. [336]

Canadians are given the impression that CCS is a silver bullet that is just around the corner for the Oil Sands. CCS is being used to create a false sense of security about the relationship between climate change and Oil Sands development. Through various government reports and studies, the governments of Canada and Alberta know the limitations of CCS in its application to the Oil Sands.

- A 2008 report, *Canada’s Fossil Energy Future*, based on the findings of a joint Canada and Alberta task force on CCS, states, “*Oil sands operations are very diverse (both geographically and technically) and only a small portion of the carbon dioxide streams are currently amenable for carbon capture and storage.*” [337]
- CBC obtained internal federal briefing notes state:
“*Only a small percentage of emitted CO₂ is ‘capturable’ since most emissions aren’t pure enough. Only limited near-term opportunities exist in the oil sands and they largely relate to upgrader facilities.*” [338]
- In March 2010, Graham Thomson, author of *Burying Carbon Dioxide in Underground Saline Aquifers*, told the Standing Committee on the Environment and Sustainable Development that, “Carbon capture is best done at a plant that is a large, single-source emitter, like a coal-fired plant. . . When it comes to the actual extraction process on the ground in the Athabasca oil sands, it seems very doubtful at this point that they can use carbon capture, because, for example, in the mining of the oil sands, most emissions there come from things like the giant trucks they use to haul the tar sands. Also, when it comes to in situ development, it means burning a lot of natural gas, and the natural gas effluent stream is very expensive to capture the CO₂.” [339]
- Thomson also stated, “Oil sands companies have backed away from CCS, realizing the technology will likely not help the industry reduce CO₂ pollution because the oil sands have too many diffuse emission sources. [339]

According to the Pembina Institute, spending 1.6 billion dollars to replace old refrigerators with high-efficiency ones in the average Canadian home brings higher emissions reductions than CCS in the Oil Sands ever will. [340]

CCS and greenhouse gas emissions reduction

A 2009 study by the Co-operative Financial Services and WWF-UK found that even on the assumption of a constrained growth forecast for Oil Sands developments and the aggressive deployment of CCS, rather than what is likely, **projected upstream emissions from the Oil Sands alone are set to exceed the whole of Canada's 2050 carbon budget**, were it to meet the IPCC 2007 recommended GHG reduction target of 80% below 1990 levels by 2050.

Estimates from a June 2010 study project **only an 11% cumulative reduction of CO₂ emissions by 2050**, based on avoided emissions from CCS on coal 2010-2050, indicating that, even aside from the Oil Sands, CCS cannot deliver significant reductions in time to play a meaningful role in the effort to keep the global temperature increase below 2°C. This signifies CCS cannot be successfully utilized as a "bridging technology" between fossil fuels and renewables. [341]

- Even relating CCS to coal plants, Howard Herzog, respected carbon capture research engineer at the Massachusetts Institute of Technology (MIT), estimates that the first new CCS coal plant in the U.S. won't be completed before 2015. "We may have by 2020 a handful, maybe even close to 10," he says. "If your goal is 80% cuts [in CO₂ emissions] by 2050, then it's not big enough." [342]
- Federal and provincial governments have committed upwards of \$3.5 billion in public funding for CCS, even though it is still an unproven technology, which, even if it proved feasible for the Oil Sands, would directly benefit the high profit fossil fuel industry. Meanwhile the government has cut funding to the development of carbon-free technologies such as wind and solar, and its 2010 budget contains no funding for Canada's Copenhagen Accord commitment (\$300 million) to help developing countries tackle climate change and adapt to its impacts. [343]
- The Integrated CO₂ Network, an alliance of 15 of Canada's major GHG emitters (Canada's major oil companies and some other energy related businesses), says CCS would reduce Oil Sands mining and upgrading emissions by 10 to 30% and Canada's CO₂ emissions by 2.6%. However, according to environmentalists, the effort would fail to capture the carbon equivalent of projected emissions from even one large Oil Sands company like Suncor. [344]

Even if CCS could be sufficiently applied to the Oil Sands, further refining at other locations would continue to produce additional downstream emissions, as would burning the resulting fuel in vehicles. And CCS cannot mitigate the negative impacts and carbon loss of the Oil Sands' depletion of the boreal forest.

Carbon Capture and Storage – Resource implications:

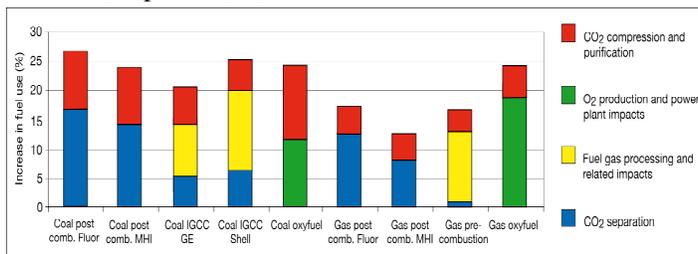
- Capturing and storing carbon uses a lot of energy, anywhere from 10-40% of a power station's capacity. For example, Ray Miller, Superintendent of Utilities at the University of Cincinnati reported in September 2010, "A recent study here in the Midwest for a first installation on an existing 600 MW coal plant would require 200 MW of the plant's power to liquefy and pump the CO₂ over 8000 feet under a rock layer". Even an energy penalty of just 20% would require the construction of an extra power station for every four built. [345]
- An August 2009 report for Australia's National Water Commission noted, "Coal fired power plants incorporating CCS could be one-quarter to one-third more water intensive [than conventional plants]." In June 2010, the U.S. Department of Energy estimated that "post-combustion carbon capture technology could almost double water consumption at a coal plant, while pre-combustion capture could increase water use by 73%". This will worsen water shortages, already aggravated by climate change. [346]

According to Greenpeace, overall, wide-scale adoption of CCS is expected to erase the efficiency gains of the last 50 years, and increase resource consumption by one third. [345]

Carbon capture and Storage – Cost implications:

CCS is energy intensive and costly. Ceres has projected that initial costs of CCS for Oil Sands range from \$70-150 per tonne of CO₂ sequestered. A study by the National Energy Technology Laboratory found that the cost of electricity could increase by 70 to 100%. [347]

- The U.S. Department of Energy estimated in 2007 that a new power plant burning pulverized coal and equipped with amine scrubbers to capture 90% of the CO₂ would make electricity at a cost of more than \$114 per megawatt-hour, compared to just \$63 per megawatt-hour without CO₂ capture. [348]
- The Alberta CCS Development Council's final report estimated that an investment of between \$1 to \$3 billion per year from the governments of Alberta and Canada will be required to promote further CCS projects after the first wave of demonstration plants. According to Andrew Leach, University of Alberta, even if it were proven CCS could be done safely at large scale, in Alberta alone it could be \$14 billion a year by 2050. [349]



Percentage increase in fuel user per kWh of electricity due to CO₂ capture

Source: The Oil Drum (Original source data: Davison,2005;IEA GHG,2004,2003,2000b;Dillon et al,2005)

The cost of applying CCS to oil sands developments is very high and does not compare favourably with capturing emissions from highly concentrated sources such as coal-fired power stations. [350]

- In March 2009, the Alberta Carbon Capture and Storage Development council (joint industry-government) published its final report, *Accelerating CCS implementation in Alberta*. **The overall estimated capture costs for the year 2020 ranges from: \$60 to \$150 per tonne of CO₂ for coal fired power stations and oil refining/upgrading; \$110 to \$240 per tonne of CO₂ for oil sands upgrading; and \$200 to \$290 per tonne of CO₂ for Steam Assisted Gravity Drainage (SAGD) and gas fired sources.** CCS could raise production prices to the point that the Oil Sands can't compete on the market. [351]
- **In April 2009, the high costs related to CCS in the Oil Sands prompted eight Oil Sands companies to abandon their bids for a share of \$2 billion in provincial government subsidization for CCS demonstration.** These included many of Alberta's largest companies, such as Suncor and Syncrude, who have chosen to hold off on further plans for carbon capture and storage projects. High costs and the belief that CCS money can be better used for coal-fired plants and larger, more concentrated sources of emissions were amongst the reasons cited for the recent decisions. [352]

"Politicians are making promises for the technology that scientists and the energy companies don't know they can keep," Graham Thomson, author of *Burying Carbon Dioxide in Underground Saline Aquifers*. [353]

Another cost factor is the expense of transporting CO₂ over long distances (greater than 100 km) for storage. The Integrated CO₂ Network is exploring the viability of developing a CO₂ pipeline network in Alberta that would spread into western Canada and eventually to other parts of Canada and the U.S. The initial cost of a proposed 400 km section of pipeline was estimated at \$1.5 billion, but was later revised to \$5 billion (including the costs of capturing the carbon). [354]

Carbon pricing

- Even for applications amenable to CCS, a hefty carbon pricing mechanism to offset the costs of CCS will be necessary to drive its large-scale development and deployment and make it commercially viable. (Norway introduced a carbon tax of approximately \$55 per tonne in 1991, which motivated Norway's Statoil offshore oil and gas company to pioneer the world's first commercial-scale carbon capture and storage operation.) [355]
- The Alberta Government's current carbon offset system supports a floor price of CO₂ of \$15/tonne, well below the best cost estimates for carbon capture of between \$60 and \$250/tonne. According to the Pembina Institute, for carbon capture and storage (CCS) to be implemented on a large scale in the oil sands, federal and/or provincial governments would have to put a price on emissions about five times higher than they have proposed to date. [356]
- Even with carbon pricing, the technology cost and business risk may still be too great to see high market penetration of CCS technology in the next few decades. Even Oil-giant Shell *"doesn't foresee CCS being in widespread use until 2050"*. [357]

Carbon Capture and Storage – Storage implications – capacity:

- MIT's 2007 study on *The Future of Coal* notes: *"Most efforts to quantify capacity either regionally or globally are based on vastly simplifying assumptions about the overall rock volume in a sedimentary basin or set of basins."* [358]
- The World Resources Institute says that when evaluating how much land would be needed to store CO₂, land capacity can only be estimated with site-specific geological information, as not all land has equal CCS potential. (The 1 megatonne (Mt) of CO₂ a year that Norway's Sleipner project has buried below the North Sea seabed is only about 25% of the CO₂ output from a full-size power plant.) [359]

Dr. Stefan Bachu, a scientist with the Alberta Research Council and a world authority on CCS, warns that we might not have as much usable sequestration space as we first thought.

- A 2007 study at the Lawrence Berkeley National Laboratory pointed out that if one large point source, such as a coal-fired plant, wanted to put all its emissions into a single formation, "a significant pressure buildup will be produced, which can severely limit CO₂ storage capacity, because overpressure and geomechanical damage need to be avoided." [360]
- A November 2009 research paper from American academics at Houston University questions the value of CCS in relation to the amount of CO₂ that the land can hold: *"Our calculations suggest that the volume of liquid or supercritical CO₂ (CO₂ that is in a fluid state while being at or above its critical temperature and pressure) to be disposed cannot exceed more than about 1% of pore space. This will require from 5 to 20 times more underground reservoir volume than has been envisioned by many, and it renders geologic sequestration of CO₂ a profoundly non-feasible option for the management of CO₂ emissions."* [361]

Carbon Capture and Storage – Storage implications – leakage:

According to CCS expert Dr. David Keith, University of Calgary:

“It seems unlikely that large-scale injection of CO₂ can proceed without at least some leakage.” [362]

According to Bonnie Lovelace, Water Protection Bureau of Montana, “Carbon dioxide becomes problematic when we take it in a polluted form, pressurize it and try to store it in the ground where it may move where we don’t want it, mix with water or mobilize metals. . . The possible pollutants increase as types of processes are added to the universe of those capturing the emissions. . . Once underground, the carbon dioxide and companion pollutants may:

- 1) work their way to the surface where pressure loss will return it to a gaseous and deadly state,
 - 2) move with groundwater as a pollution plume, and
 - 3) interact with the geological body and mobilize more pollutants.” [363]
- Greenpeace reports, “Captured CO₂ often contains various by-products of combustion processes such as nitrogen oxides and sulphur dioxide (SO₂) as well as trace heavy metals including lead, mercury and cadmium. Co-storage of CO₂ with SO₂ increases the risk of leakage due to its chemical properties. In contact with water, SO₂ forms the highly corrosive sulphuric acid that more readily dissolves materials, such as the cement used to seal wells.” [364]
 - According to Graham Thomson, the process of burying vast amounts of carbon underground for 1,000 years or longer will build up pressure in saline formations that could fracture seals or overlying rock caps. And there is the possibility that an unmapped or forgotten well will allow the CO₂ to escape directly to the surface. [365]

Risks to groundwater

Additions to any brew may include elements already underground such as arsenic or lead that could be leached out of the rock by the acids formed by water reacting with the CO₂ or SO₂, according to Dr. Sally Benson, Executive Director, Global Climate Change and Energy Project, Stanford University.

“The biggest risk of storage and saline aquifers is potential impacts to groundwater.” [366]

- Over several decades a large-scale injection operation could impact an area of thousands of square kilometres. [366]
- The American Water Works Association (AWWA) says that large-scale CCS projects could endanger underground sources of drinking water, not just through leaks, but also through displacement of saline. The pressurized carbon dioxide plume injected over years into a saline aquifer would force salt water from the aquifer into underground sources of drinking water. [367]

More than 10 million Canadians depend on aquifers as a source of their drinking water yet the Canadian government is 20 years away from mapping the country’s groundwater system.

- According to the Council of Canadian Academies, combining an aggressive CCS regime with our lack of knowledge about groundwater could spell disaster. “Potential groundwater risks include the gradual migration of CO₂ into shallow aquifers and resulting changes in the groundwater chemistry and overall water quality, as well as the displacement of deeper native brine and the triggering of changes in shallow groundwater-flow regimes.” [368]

In areas running short of water, there might be competition between those who want to use a saline aquifer as a source of drinking water and those who want to use it to sequester CO₂.

- In a global-warming world that is running short of fresh water, we may be forced to turn to some of the saline aquifers as sources of drinking water, according to Don Broussard of the AWWA. *“In several communities across the country, waters that were previously considered to be unusable . . . are now being used as drinking water sources. As desalination technology improves, even more saline water may be used in the future.”* [369]

Potential dangers of CO₂ leakage

Buried CO₂ may leak out slowly or have a more disastrous large-scale potential leak due to earthquakes or other geological events, or wars. A big enough leak into the atmosphere could prove immediately fatal to living organisms, including humans, in large enough concentrations. [370]

“Adverse health effects caused by high levels of CO₂ can range from minor, reversible effects to mortality, depending on the concentration of CO₂ and the length of the exposure.”

The U.S. Environmental Protection Agency [371]

Tree kill zone from naturally occurring CO₂ seepage from oil
– Mammoth Mountain Volcano, California Source: whatsupwiththat.com



Exposure to concentrations of CO₂ above 17% will result in “loss of controlled and purposeful activity, unconsciousness, convulsions, coma, and death within one minute of initial inhalation.” [372]

There is also the very real possibility that the pressure from massive amounts of supercritical CO₂ injected underground will cause seismic activity. According to Calgary-based geologist Jack Century, man-made mini-earthquakes occur not just in areas noted for geologic faults. *"It isn't just earthquakes that are a problem but it's when you start injecting fluids into the earth and you don't know what you're doing, you can start small seismic events . . . and they can cause fractures, and the fractures themselves can interfere with the reservoir and violate the integrity of the reservoir and cause leakage."* In a report on CCS, the IPCC concurs, *"Pressure build-up caused by CO₂ injection could trigger small seismic events"*. [373]

Carbon Capture and Storage – Storage implications – scale:

The scale of CCS required to make a major difference in global greenhouse gas concentrations is massive.

- For example, sequestering one gigatonne of carbon per year (nearly four gigatonnes of carbon dioxide) requires injection of about 50 million barrels per day of supercritical CO₂ from about 600 1000 MW coal plants." [374]
- The International Energy Agency estimates that for CCS to deliver any meaningful climate mitigation effects by 2050, 6000 projects each injecting a million tonnes of CO₂ per year into the ground would be required. At the moment, it is not clear that it will be technically feasible to capture and bury this much carbon, i.e. whether there are enough storage sites, or that they will be located close enough to power plants. [375]
- **By one estimate the United States would have to construct 300,000 injection wells at a cost of \$3 trillion by 2030 just to keep emissions at 2005 levels.** University of Manitoba energy expert, Vaclav Smil, has calculated that we will have to construct CO₂ infrastructure just over twice the size of the world's crude oil industry just to bury 25% of the world's 2005 emissions. [376]
- According to Vaclav Smil, *"Carbon sequestration is irresponsibly portrayed as an imminently useful option for solving the challenge [of global warming]. . . Sequestering a mere 1/10 of today's global CO₂ emissions (< 3 Gt CO₂) would call for putting in place an industry that would have to force underground every year the volume of compressed gas larger than or (with higher compression) equal to the volume of crude oil extracted globally by the petroleum industry whose infrastructures and capacities have been put in place over a century of development. . . such a technical feat could not be accomplished within a single generation."* [377]
- Howard Herzog, MIT, stated in March 2009, "We have yet to build a large-scale (> 1 Mt CO₂/year) power plant demonstration. "Is it reasonable to expect to build hundreds of power plants with CCS by 2050 when we are having so much trouble building just one today?" [378]

Carbon Capture and Storage – Liability and climate change:

Large-scale applications of CCS pose significant liability risks.

- Risks include negative health effects and potential threats to human safety, damage to ecosystems, groundwater contamination including pollution of drinking water, and increased greenhouse gas emissions resulting from leakage. . . Significant questions as to ownership and who is liable remain unanswered. *Canada's Fossil Energy Future* report states, *"liability will transfer to relevant government jurisdictions once a project moves to the post-abandonment phase."* [379]
- Industry views liability as a barrier to wider deployment of CCS and is unwilling to fully invest in CCS without a framework that protects it from long-term liability. [379]

Seepage of carbon dioxide from long-term CCS projects could lead to delayed global warming contributions, unless the gas can be tightly controlled and held to a seepage rate of 1% every 1,000 years, according to research published in July 2010 in *Nature Geoscience*. [380]

- The delayed warming resulting from escapes of gas would occur gradually for hundreds of years, but could be problematic and expensive for future generations who would have to figure out how to recapture the CO₂ from the atmosphere. [380]
- The issue of trying to store millions of tonnes of highly pressurized carbon dioxide in old oil fields that are punctured by old oil wells, called the pincushion effect, could create leaks of CO₂ into groundwater or into the atmosphere. The latter, even in small amounts over time, could undo any climate change good done by sequestration in the first place. [381]
- According to Greenpeace, **continuous leakage, even at rates as low as 1%, could negate climate mitigation efforts.** However, Dr. Bachu (Alberta Research Council) says leaks are possible but, as one of the authors of the IPCC report on CCS, he confidently believes 99% of the CO₂ that is sequestered will stay in place. Even having a 1% leak with CCS, adds Bachu, is much better than what we have now: unchecked emissions of greenhouse gases. [382]

CCS - Enhanced Oil Recovery (EOR):

EOR is not the same as CCS. EOR is employed over a relatively short term (decades) to recover oil from a depleted field. About two-thirds of the injected CO₂ returns with the oil or gas to the surface while a steady pressure is maintained in the formation. EOR is not concerned with storing carbon dioxide indefinitely or even with keeping track of where the CO₂ ends up after the EOR process is completed. [383]

- According to MIT's 2007 study, "Regulations differ, the capacity of EOR projects is inadequate for large-scale deployment, the geological formation has been disrupted by production, and EOR projects are usually not well instrumented." [384]
- Using captured carbon for EOR rather than sequestering could actually result in an increase in net atmospheric carbon emissions because of improved recovery of fossil fuels. This is potentially significant, as the ACCSDC has estimated that EOR could effectively double Alberta's recoverable conventional oil reserves. The emissions resulting from the production and normal use of this oil would be greater than the amount of carbon sequestered underground from CCS operations. [385]
- **Author Sam Gomersall, a director at CO₂DeepStore, estimates generating the equivalent amount of energy through EOR results in five times more emissions than energy produced from a coal-fired plant with CCS (750g/kWh vs. 150g/kWh).**

"[EOR] is not a viable CO₂ abatement technology and will result in increased emissions." [386]

The message from Royal Dutch Shell's Canadian unit in January 2010 was that those counting on CCS as a destination in the fight against climate change had best buckle in for a long journey. Rob Seeley, Shell Canada's general manager of sustainable development said that moving to the next phase of using CO₂ for EOR is still a fairly new and evolving industry in Alberta. He suggested that even when EOR projects come onstream they would initially consume only small volumes of CO₂. He also noted that several large CCS projects could come onstream about the same time, generating more volumes of CO₂ than could be used for EOR projects. [387]

"Using CCS to recover more oil arguably makes sense economically, but calling enhanced oil recovery pure "carbon sequestration" in the context of massively reducing global emissions is, environmentally speaking, an exaggeration". Graham Thomson [388]

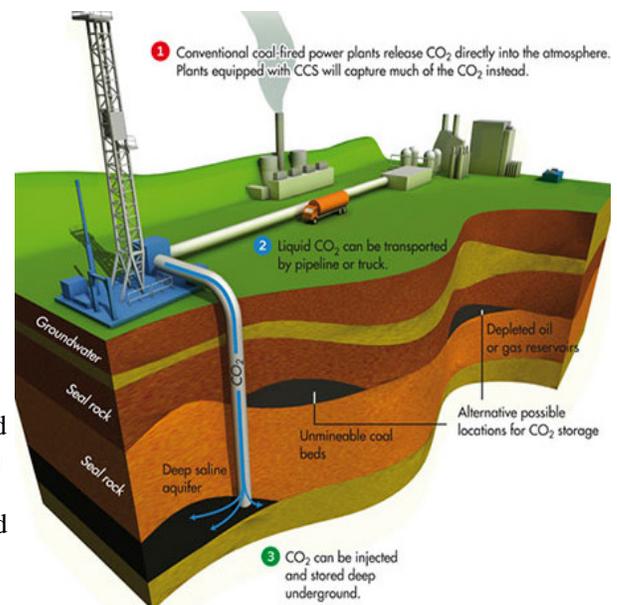
CCS-related projects:

Existing commercial-scale CCS projects

According to the International Energy Agency, in 2009, there were five fully integrated, commercial-scale CCS projects in operation and a number of other projects in planning stages across the world. In 2009, over 5 Mt CO₂/year was being stored from these five plants. [389]

- The Sleipner (1 Mt/year) and Snøhvit (0.7 Mt/year) projects in Norway, and the In Salah (1.2 Mt/year) project in Algeria involve CCS where the CO₂ content of the extracted natural gas is too high. To achieve commercial-grade quality natural gas, the CO₂ is stripped, collected and stored securely in underground geological formations. [389]
- The Rangely project, in Wyoming, also uses CO₂ from a natural gas processing plant, but uses the CO₂ for enhanced oil recovery (EOR) and storage at the Rangely field in Colorado. [389]
- The Weyburn-Midale project involves the capture of CO₂ from a coal-based synfuels plant in North Dakota. The captured CO₂ is compressed and sent via pipeline to an oil field in Weyburn, Saskatchewan, where it is used Enhanced Oil Recovery (EOR) as well as storage. [389]

The U.S. Department of Energy (DOE) (2010), reports 8 active and 184 proposed (planning and development or recently proposed) CCS projects worldwide with projects located in 20 countries across five continents. The 192 projects globally include 38 capture, 46 storage, and 108 for capture and storage. In addition to the above projects, the DOE's and the National Mining Association's list of active, demonstration projects include 1 other large project and 3 smaller ones: K12B (0.2 Mt/year, storage in depleted natural gas reservoirs) in the Netherlands; Zama Field (0.067 Mt, evaluation for CO₂ sequestration) in Alberta; Mountain CCS Project (30-235 MW, sequestration via pipeline) in West Virginia; and SECARB Cranfield oil field (1.5 Mt/year-EOR, 0.1 to 0.25-sequestration) in Mississippi. [390]



Proposed CCS-related projects in Alberta

The federal government has allocated \$1 billion for CCS related research and development and the Alberta government has allocated \$2 billion to funding CCS. [391]

The proposal outlined in the 2009 Alberta Carbon Capture and Storage Development council (ACCSDC) report calls for the introduction of a CCS requirement for some new operations in the 2015 to 2020 period, and full commercial deployment post 2025. [392]

The Alberta government has announced letters of intent for four CCS-related projects, most of which involve using the captured CO₂ for EOR. Two are specific to the Oil Sands, one in the electricity sector, and one in situ coal gasification project. There is no guarantee all these projects will go ahead, and if they do, the target date to start sequestration is 2015. [393]

- Shell's Quest Project would capture and store one million tonnes of CO₂ per year from the Shell Scotford Upgrader, located about 40 km northeast of Edmonton. It would then be transported by an 84-km pipeline to injection wells north of Shell Scotford and stored approximately 2,300 metres underground in a deep geological formation. The CO₂ could also be used in EOR. [394]
- Enhance Energy's Alberta Carbon Trunk Line (ACTL) would be a 240-kilometre pipeline that would capture CO₂ from a bitumen upgrader and fertilizer plant and the captured CO₂ would be transported to depleting convention oilfields for use in EOR. Construction is scheduled to begin in 2011. [395]
- The Pioneer project, headed by TransAlta, project will take place at the Keephills 3 coal-fired power plant (450 MW), west of Edmonton and currently under construction. The CO₂ (1 Mt/year) will either be injected about 2,600 to 2,800 metres below the earth's surface for permanent storage or used for EOR. [396]
- Swan Hills Synfuels will use an in-situ coal gasification process to access deep coal seams to convert the coal to synthetic gas (syngas) that will be processed in a conventional gas plant to remove CO₂ as a byproduct stream. The syngas will then be pipelined to a combined cycle power generation station to product low emission electricity. [397]

A major barrier to using captured carbon from the Oil Sands for EOR would be the need for a dedicated CO₂ pipeline to transport CO₂ from the Oil Sands projects to the light oil pools in central Alberta. Developing CO₂ pipelines to an appropriate storage area would be a similar challenge for direct storage of captured carbon. [398]

POLITICAL AND ECONOMIC ISSUES:

Oil Sands Investments

As the world's largest energy project, the Oil Sands has attracted investment from almost every major domestic and international oil company, totaling \$200 billion in committed funds for current and proposed projects. From 2009 through 2019, the ERCB expects nominal investment expenditures related to oil sands (surface mining, upgrading, in situ, and support services) to total \$148 billion. [399]

However, oil sands production is the most expensive oil production in the world, currently requiring minimum oil prices of \$70-75, and possibly approaching \$100, a barrel to turn a profit. CERI, in its 2009 to 2043 forecast for the Oil Sands, expects production to grow to 5-6 million bpd by the 2030s to 2040s and calculates the oil price required to facilitate this level of production to be \$119 to \$134 per barrel. But if global oil prices get too high, it will likely reduce global oil demand, exert a deflating effect on the economy, and shift markets in favour of alternative fuels. Over the last four years, agencies such as OPEC and the IEA have progressively reduced oil demand forecasts for the 2020-2030s. [400]

Oil Sands Royalties:

- Between 1995 and 2004, Oil Sands production increased 133% while government royalties decreased 30%. [401]
- Alberta's royalty rates on new Oil Sands projects are among the lowest in the world, which means the province makes much less from its Oil Sands oil than do, for example, Norway and Alaska. The result is that Alberta's Heritage Fund is approximately US\$14 billion (March 2010), while Alaska's Permanent Fund is US\$33.3 billion (June 2010) and Norway's Oil Fund is worth US\$380 billion (2009). On a per-capita basis, this works out to - Alberta's fund: US\$3,768; Alaska's fund: US\$47,570; Norway's fund: US\$791,650. [402]
- The Alberta government's special royalty of only 1% on gross revenues from Oil Sands projects until they recover all their capital costs/investments (payout) and 25% royalty on their net earnings after payout, changed in 2009 to 1% at \$55/barrel up to 9% at \$120/barrel before payout, and 25% at \$55/barrel up to 40% at \$120/barrel after payout. The province also permits corporations to deduct royalties for federal corporate income tax purposes. [403]
- KAIROS reported in their 2008 research paper, *Pumped Up*, that with the decline in conventional oil and gas revenues, overall Alberta royalty revenues are down, and even after the proposed royalty changes, government royalty revenues are likely to be about \$900 million less in 2010 than they were in 2006. [404]

Fossil-fuel subsidies:

According to a November 2010 report from the International Institute for Sustainable Development (IISD), Canadian federal and provincial governments provided \$2.84 billion to support oil production in 2008. This aid was received regardless of the companies' profits or growth.

The federal government's share was \$1.38 billion. Of this \$840 million came in the form of special tax breaks. Within the provincial governments, Alberta was estimated at \$1.06 billion, Saskatchewan at \$327 million and Newfoundland & Labrador at \$83 million. A total of 63 subsidy programs were identified.

In most cases, the subsidies were intended to increase exploration and development through a mix of tax breaks and royalty reductions. These tax breaks go to some of the richest companies in the country and are increasingly recognized as unnecessary and obsolete. The study forecasts that scaling up current subsidies to future production would double the cost of subsidies to governments by 2020. [405]

- According to a 2005 report for Climate Action Network, Canadian oil and gas companies (including the Oil Sands) benefited from a federal subsidy of \$1.085 billion in 1996. That amount had increased 33% to \$1.4 billion by 2002. Total expenditure over the 1996 to 2002 period was \$8.3 billion. [406]
- Since 1996, the federal Accelerated Capital Cost Allowance (ACCA) has applied to both surface and underground mining in the Oil Sands. It allows individual Oil Sands projects to write off all of their capital costs before they start to pay income tax. [407]
- **The 2007 budget announced a gradual phase out of the ACCA for Oil Sands projects, starting in 2011. However, any major project that began construction prior to budget day will be grandfathered and the companies' capital spending will still qualify for accelerated write-offs. For projects started after March 18, 2007 the phase out is set to occur between 2011 and 2015 when the preferential ACCA (100%) will be brought into line with the 25% level currently applicable to conventional oil and gas.** [408]
- **Eleven oil sands projects currently under construction will receive the full 100% ACCA under grandfathering clauses. A further 45 planned projects will receive substantial capital cost allowances because they will be completed before 2015. As a result, over 90% of Oil Sands projects currently announced will receive substantial subsidies.** [409]
- If Oil Sands operators invest in new areas like carbon capture and storage (CCS), the Conservative government has committed itself to identify additional areas where an ACCA can help. [410]
- The Harper government is also providing direct subsidies to the fossil fuel industry in the form of support for CCS projects. In its March 2010 budget, it was noted that the Harper government has "announced over \$800 million" in subsidies for carbon capture and storage projects, under two programs, the Clean Energy Fund, and the ecoENERGY Technology Initiative. [411]
- According to Greenpeace, subsidies have already been provided under the Clean Energy Fund for three CCS projects (\$120 million for the Shell Quest CCS project; \$315.8 million for the TransAlta Keephills CCS project; \$30 million for the Alberta Carbon Trunk Line project) and, as part of its Economic Action Plan, the Harper Government has also conducted a consultation on the tax treatment of CCS assets, and thus seems to be moving backwards on his G20 commitment (see pages 61,62 in this report) by supporting a new fossil subsidy through a favourable tax treatment for CCS. [411]
- In addition to the government's support for oil and gas activities domestically, it also finances fossil fuel production internationally through Export Development Canada (EDC), the Canadian International Development Agency (CIDA), and multilateral agencies such as the World Bank. [412]
- In the first six months of 2007, Export Development Canada supported transactions in the oil and gas sector valued at \$6.8 billion. Business transactions it supported for alternative fuels were worth \$5 million, and only \$2 million went to renewable energy. [413]

The oil and gas industry is the most profitable of all Canadian industries. In the 2nd quarter of 2010, Suncor's profits were \$480 million and Canadian Oil Sands Trust's were \$237 million. In 2006, Canadian companies engaged in oil and gas extraction earned \$31.1 billion in profits, more than double the \$14.7 billion they earned in 2002. Their 2002 profits already represented a healthy 16% return on equity, which was bolstered by \$1.4 billion worth of subsidies from the federal government – the equivalent of one out of every 10 dollars of profits. [414]

Companies with Oil Sands investments have combined annual revenues over \$1.2 trillion. Of these revenues, more than \$1.1 trillion belong to foreign-owned companies. For example, US-owned ExxonMobil, with investments in the Syncrude development, brings in almost \$320 billion annually. [415]

Repercussions of fossil fuel subsidies

A November 2010 report, *Fueling the Problem*, from Climate Action Network (CAN) states:

“Globally — artificially low costs of fossil fuels have been shown to encourage wasteful consumption, distort energy markets, and allow for increased greenhouse gas pollution, thereby fueling the climate crisis. Subsidizing oil extraction also makes investments in oil more attractive compared to lower carbon, lower risk alternatives, thereby increasing the lock-in of economies into fossil fuels.” [416]

- The 2010 IISD report indicates that national emissions will be about 2% higher in 2020 with the subsidies. In Alberta, the likely increase in provincial emissions attributable to the subsidies is about 5% more than if the subsidies were removed, while subsidies are adding 6 to 7% more to Oil sands production resulting in 12% more emissions than they otherwise would be if this sector was not subsidized. [417]



OIL SANDS MINING Source: The Bottom Line

- **By subsidizing fossil fuel producing companies the government is encouraging faster production and facilitating the rapid expansion of large fossil fuel projects such as the Alberta Oil Sands.** [416]
- While the increased economic activity due to the subsidies does increase corporate taxes and royalties paid, labour taxes are likely lower due to the spending in the capital-intensive oil sector. More significantly, major subsidy outlays are relatively large, as is the risk of a growing subsidy obligation on governments. Scaling up current subsidies to future production could more than double the subsidy as a share of government expenditures by 2020. Since tax and royalty increases are more than offset by the subsidies paid, government balances are worse off with the subsidies. [417]

While the economy does expand with the oil subsidies in place, most of this happens in the capital-intensive-oil sector. The impacts on total employment are therefore negligible. [417]

“[Fossil fuel] subsidies have several key impacts: they lock economies into longer-term reliance on fossil fuels; they exacerbate greenhouse gas emissions by, in part, supporting inefficient energy uses; they contribute to other forms of environmental pollution and land degradation; and they reduce investments available for cleaner energies, healthcare and education.” Achim Steiner, United Nations Under-Secretary General and UNEP Executive Director [418]

“If you don’t want more of something, then don’t subsidize it. On our finite globe, we don’t want more fossil fuels, so we must stop subsidizing them. . . Removing fossil-fuel subsidies will enhance the market for new energy solutions by making them more competitive, spurring innovation and development.” J.M. Figueres, former President of Costa Rica [419]

Benefits of phasing out fossil fuel subsidies

Phasing out fossil subsidies is extremely important, since it has the potential to free up funds to promote renewable energy and efficiency/conservation; develop green economies; support national programs to fight climate change; and provide climate financing for the developing world. [420]

The IEA and the OECD modeling, even using incomplete data, estimated that **phasing out fossil-fuel consumption subsidies would reduce greenhouse-gas emissions 10% globally by 2050** relative to a business-as-usual scenario. [421] Less than 2% of all subsidies are currently spent to provide credit support or for environmental costs. [422]

Canadian government’s vs global commitments on phasing out fossil fuel subsidies

The G-20 and the Asia-Pacific Economic Cooperation (APEC) have recently made commitments to phase out inefficient fossil-fuel subsidies that encourage wasteful consumption. [423]

- The Leaders' Declaration from APEC’s 17th Economic Leaders' Meeting, released in November 2009, included a commitment to *“rationalize and phase out over the medium term fossil-fuel subsidies that encourage wasteful consumption, while recognising the importance of providing those in need with essential energy services.”* [424]
- The G-20 announced their own commitment to phase out and rationalize fossil-fuel subsidies at their Pittsburgh September 2009 Summit, arguing that *“Inefficient fossil fuel subsidies encourage wasteful consumption, distorts markets, impede investment in clean energy sources and undermine efforts to deal with climate change”* . . . all G20 leaders committed to: *“phase out over the medium term inefficient fossil fuel subsidies that encourage wasteful consumption.”* [425]

The OECD and the IEA, organizations established by industrialized nations to provide advice on economic and energy policy, have also called for an end to fossil fuel subsidies. [426]

At the June 2010 G20 meeting in Toronto, countries' plans for fossil fuel tax breaks and subsidies phase-out were to be captured in an Annex of the final leaders' statements coming out of the G20. Instead of releasing this Annex on the last day, as expected, Canada refused to make it public. The Annex was officially released three months later. [427]

- In the text that Canada submitted to the Annex, **the federal government tried to take credit for its initiatives from 1989, 2003 and 2007, but it proposed no new plans for reducing the remaining subsidies.** This refusal to phase out tax breaks was against the advice of top officials, including Canada's Deputy Minister of Finance, Michael Horgan, and then Minister of the Environment, Jim Prentice. [428]
- In a leaked secret memo, Michael Horgan argued that there is no financial justification for continuing subsidies for fossil fuel companies: "These measures were historically premised on factors such as exploration risk, spillover benefits of exploration to third parties (similar to R&D), large capital requirements, price volatility, and a desire to be competitive. Today, however, it is not clear that these factors are unique to the sector or merit preferential treatment." [429]
- The 1989 and 2003 initiatives refer to "earned depletion" and "resource allowance" tax subsidies. However, the overall oil and gas sector tax rate has actually decreased relative to the 2001-02 level, and five major tax subsidies identified in a 2005 report for Climate Action Network still remain in place: Canadian Exploration Expense, Canadian Development Expense, Canadian Oil and Gas Property Expense, Atlantic Investment Tax Credit, and Scientific Research and Experimental Development Tax Credit. [430]
- Since their 2007 announcement to phase out the ACCA starting in 2011, the Canadian government has taken no additional action to reduce, phase out or eliminate other fossil fuel tax breaks or subsidies. [431]

Politics behind subsidies

The 2010 Climate Action Network report suggests that Prime Minister Harper is to blame for policies that favour oil and gas companies:

"It's no secret that Prime Minister Harper meets frequently with oil and gas companies operating in Canada, many of which make billions of dollars per year extracting dirty oil from the Tar Sands." [431]

Another 2010 IISD paper argues that the failure to fully reform subsidies lies in a failure to appreciate the politics behind such policies:

"Channelling resources to interest groups can be a tool to promote government survival, such as by influencing voting decisions or donations to political campaigns. Once subsidies have been created, the groups who benefit are usually well organized and poised to block reform."

David Victor, International Law, UC San Diego, author of *The Politics of Fossil-Fuel Subsidies* [432]

The actions of the Canadian government on fossil-fuel subsidies mirrors their actions on biofuel subsidies. In the three-year period ending 2008, total transfers to biofuels approached \$1 billion. The subsidies accounted for 20 to 70% of the retail market prices for the biofuels. Canadian government subsidies for biofuels have introduced market distortions that make it difficult for other more cost effective and sustainable energy alternatives to enter the market.

Considering corn-based or wheat-based ethanol contributes little to negative net benefit towards GHG emissions and biofuel subsidies provide little net increase in income to most farmers, biofuel subsidies



OPEN PIT MINING

Photo: John Woods, Greenpeace Source: Huffington Post

would be better spend on real alternate energy alternatives and, along with the government's fossil-fuel subsidies, would provide significant funding for such if both subsidies were redirected. [433]

The National Table on the Economy and the Environment's first *Climate Prosperity* 2010 report concludes, *"Canada will face unique challenges competing in a global low-carbon economy based on our current profile . . . Action now to build capacity for trade and investment in a carbon-constrained market will propel us forward to be leaders in providing the skills, technologies, financing mechanisms, and goods and services that will only grow in demand."* [434]

A SAMPLING OF POLITICAL, ECONOMIC, AND INDUSTRY INFLUENCES:

Oil Sands Oil

- The Security and Prosperity Partnership (SPP) initiated by Prime Minister Paul Martin, President George W. Bush and Mexican President Vicente Fox in March 2005 aims at deep continental energy integration. (The SPP is largely a product of lobbying by the Canadian Council of Chief Executives, which represents the 150 largest corporations in Canada, many of them U.S. owned) **An SPP-sponsored workshop in 2006 called for the rapid expansion of Tar Sands production from one million barrels a day to five million barrels a day by 2030. Radio-Canada reported that Canadian officials at the workshop promised to streamline environmental approvals to facilitate Tar Sands expansion.** [435]
- In 2007, Heather Kennedy was appointed as Assistant Deputy Minister of the Oil Sands Sustainable Development Secretariat within the Government of Alberta for a two-year secondment, which was later extended to three years. In 2008, Kennedy was appointed chair of the new Regional Advisory Council, which is to provide advice to the government on the development of a land-use plan for the Athabasca region. Kennedy has worked at Suncor since 1996 in project management and senior operations roles in bitumen production and the extraction plant. With Suncor paying her salary and the government reimbursing the company, she technically still worked for Suncor, yet the Alberta government does not seem to view this as a conflict of interest. [436]
- Early in 2009, Alberta's envoy to Washington, Gary Mar, visited several state governors and lobbied vigorously on Capitol Hill with the message that Alberta oil brings big money to local economies. **In April 2009, Alberta hired a team of well-connected consultants, earning \$40,000 a month, to improve the province's image in Washington ahead of climate change talks.** [437]
- In July 2010, in defense of the U.S. concerns over expanding imports of the Oil Sands, **Alberta's public affairs bureau budget paid US\$55,000 for a letter from Alberta's premier defending Canada's oil sands, to appear as a half-page ad in the Washington Post. Stelmach's ad opens with, "A good neighbour lends you a cup of sugar. A great neighbour supplies you with 1.4 million barrels of oil per day."** [438]

Not only has Oil Sands production heavily influenced the Canadian government's lack of action on global warming, and not only has Canada undermined progress in global negotiations on climate change, the Canadian government has also been crossing boundaries in attempts to stifle other countries' efforts to support cleaner fuels:

- In 2007, the U.S. *Energy Independence and Security (Energy Act)* was signed into law. Section 526 of this act prohibits U.S. Federal agencies from entering into any contract for the procurement of an alternative or synthetic fuel, including fuel produced from non-conventional petroleum sources, unless the contract specifies that the lifecycle greenhouse gas emissions associated with such fuel are less than or equal to emissions from conventional petroleum sources. [439]
- In 2008, then-American ambassador Michael Wilson wrote to the U.S. Secretary of Defense, arguing, *"Canada would not want to see an expansive interpretation of Section 526, which would then include commercially-available fuel made in part from oil derived from Canadian oil sands."* [440]
- In April 2009, when California was considering adoption of a low carbon fuel standard (LCFS), Canada's then Natural Resources minister Lisa Raitt wrote to then Governor Arnold Schwarzenegger, *"We are concerned that the proposed LCFS regulation could lead to unfavourable treatment of Canadian crude oil. . . In addition, we believe that the principle of favouring certain sources of crude oil is not practical. . . could be perceived as creating an unfair trade barrier between our two countries."* California's LGFS was approved in January 2010. (The policy's goal is to reduce the carbon intensity of California's transportation fuels by at least 10% by 2020.) [441]
- The Government of Canada had intervened formally at least five times in the LCFS decision-making process, starting with a letter from Ambassador Wilson to the chair of the California Air Resources Board (CARB) in November 2008. CAPP also lobbied heavily against California's LCFS and Alberta's Premier, Ed Stelmach, spoke out against it as well. In a January 2008 speech in Washington, he stated, *"There are ongoing attempts in some quarters of this country to slow down or even stop oil sands development. . . they could serve to jeopardize this country's energy security at a time when Asian markets are clamoring for oil. Look at climate change initiatives like California's Low Carbon Fuel Standard, for example."* [442]
- Also, given that significant amounts of oil from the Oil Sands is refined in the U.S., in February 2010, the U.S. National Petrochemical and Refiners Association filed a lawsuit against the LCFS, citing the policy's effect of "discouraging the use of Canadian crude oil." [443]

- In 2009, the European Union passed its final version of the Fuel Quality Directive in which fuel suppliers are required to make a mandatory 6% emissions reduction by 2020, compared to a 2010 baseline. In January 2010, Canada's Ambassador to the EU, Ross Hornby, sent a letter to the Director General of the EU's Environment Directorate, arguing that the fuel quality proposal would create "a large administrative burden and prohibitive costs." The Canadian government has also been pushing for the EU to assign a single value for GHG intensity for all oil-based fuel entering the EU, rather than tracking their different carbon footprints. (Hornby also sent a separate letter to question the EU's biofuels accounting methodology - unlike Canada, the EU plans to account for both the indirect and direct effects on land use that biofuel production creates. Like his Oil Sands letter, the biofuels letter states that the EU's environmental proposals "could potentially distort trade between Canada and the EU.") [444]
- A 2009 briefing note prepared for the Minister of Natural Resources (NR), opens with the statement that: "...*there have been a number of well-orchestrated media campaigns, restrictive legislative and regulatory proposals that associate oil sands with 'dirty oil.'* There is a need to ensure the Government is more proactive in providing accurate and factual information to address those views." The note refers to Section 526 and California's LCFS as "political lobbying." But despite this dismissal of other jurisdictions' efforts to support cleaner fuels, the note acknowledges that oil sands production is "energy and water intensive," has "higher GHG emissions," and creates "large tailings ponds which sit permanently on the landscape without appropriate treatments." [445]
- The NR briefing note also states that NR Canada is developing "a work program for an oil sands engagement strategy" and that oil sands industry representatives are "pleased that this process is underway at Natural Resources Canada." It also reports that government officials have already met with CAPP to talk about public engagement, which the department views as "an opportunity for further coordination with industry and other stakeholders." [445]

Other influences come from climate change deniers, shipping companies, and banking institutions:

- Prime Minister Harper is the son of an Imperial Oil executive and close friend of one of the founders of Friends of Science, a pro-oil, anti-climate lobby group whose right-wing political and economic theories have influenced the thinking of Harper and his Conservative Party. Harper has appointed three climate change deniers to the boards of the National Sciences and Engineering Research Council and the Canadian Foundation for Innovation. [446]
- Braemar Shipping Services reported early in 2010 that while global demand for crude oil products dropped in 2009, the deadweight tonnage of the total VLCC, Suezmax, and Aframax (and MR and LR1) vessels increased substantially. While outlook for global oil consumption has forecast a growth of 1.2 million bpd in 2010 and 1.6 million bpd in 2011, the scheduled deliveries of new ships in the above categories represent, on average, close to 30% of the existing tonnage in the market. Unutilized tankers represent a large cost - a freight rate for a Suezmax oil tanker can be over US\$20,000 per day - and another catalyst in the drive for more crude oil production. [447]
- Many of Canada's major banks are substantial investors in the Oil Sands, either directly or through pipeline companies. The Royal Bank of Canada is the largest financier of the Alberta Oil Sands and is a major shareholder of Enbridge. Other major funders of both the Oil Sands and Enbridge are: BMO, CIBC, Scotia Bank, and Toronto Dominion Bank, while HSBC and ING help fund Oil Sands projects. The CEO of Enbridge sits on the board of CIBC and the CEO of TransCanada Pipelines sits on the board of BMO. [448]

Greenhouse gas emissions

- Briefing documents prepared in 2009 by the Department of Foreign Affairs underscore Canada's international strategy as a carbon bully. The documents propose that Canada try to split members of the EU on their GHG commitments, backpedal on reduction targets, and tie any assistance to developing nations to binding GHG targets. The documents also highlight Canada's appallingly low-level targets, compared to European commitments to reduce emissions by 20 to 30% from 1990 levels by 2020. [449]
- Climate Action Network and the Tar Sands Group stated in a 2009 report, "*Canada is the only country in the world to ratify a Kyoto Protocol target and then simply walk away from it . . . while embarking on a massive increase in global warming pollution - up more than 26% since 1990 [in 2007] at a time when Canada was supposed to be reducing emissions by 6%. . . The reason for the disconnect between Canada's positive historical reputation and its current poor performance is the Tar Sands.*" [450]

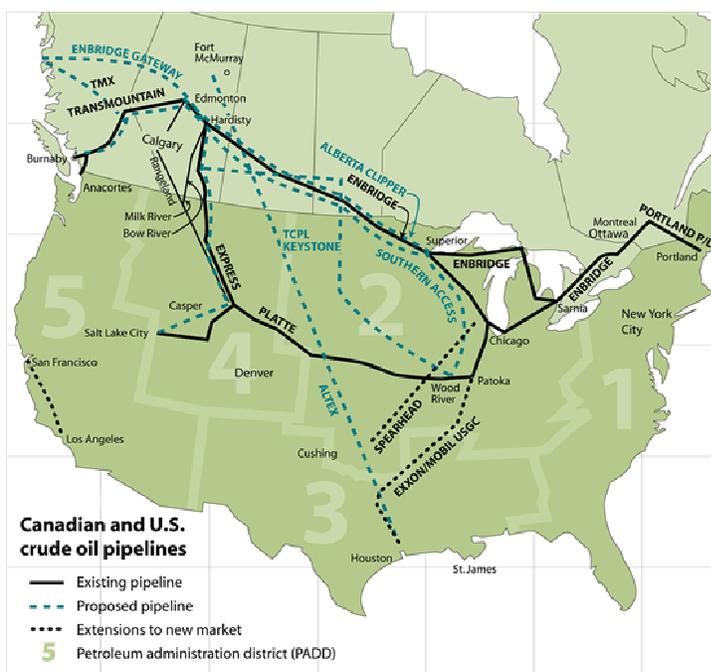
With all the foreign ownership and multinational interests that are tied into the Oil Sands, including 'big money' investments beyond the Oil Sands itself in, for example, pipeline and tanker companies, and upgrading facilities in the U.S., the implications of shutting down Oil Sands projects are vast. These implications include responsibility for reclamation and liabilities related to existing development. However, the losses of companies that have invested in the Oil Sands would be far less than the losses of current and future generations faced with the disastrous results of environmental devastation and global warming if Oil Sands production and development is not phased out, or at the least, halted from further development. For most of these companies, their Oil Sands investments represent only a minor percentage of their overall enterprise (see page 60).

Lobbying:

Examples of industry influences inside Canada

The battle over climate change in Canada largely pits environmental groups against a powerful coalition of energy companies, along with academic climate-change skeptics who support the Harper Conservatives. **An analysis by the International Consortium of Investigative Journalist (ICIJ) found that the lobbyists hired by these groups are among the largest special interest groups on Parliament Hill and lobby not only to shape legislation in industry's favour, but also to ensure that those industries benefit from the billions of dollars in government grants being issued for clean energy and emissions-reduction projects.** [451]

- **Combined, oil and gas producers and other major producers of fossil fuels, have employed about 465 lobbyists since 1996.** According to Stéphane Dion, who was the Environment Minister from 2004 to 2006, "It's almost daily. They say, 'What can we do? There is no technology possible [for emission cuts]. Can you exempt us? Please.' This kind of pressure [is] always, everywhere." [451]
- **Federal lobbyist records show that corporate oil executives have frequent access to the highest officials in Ottawa. From July 2008 to August 2009, for instance, Richard George, president of Suncor Energy, listed 48 meetings between senior government officials and Suncor executives, including seven meetings with the Environment Minister, eight with the Minister of Natural Resources, and one with the Prime Minister.** [451]
- **Including Suncor's own in-house lobbyists, there have been 56 lobbyists registered to lobby for Suncor since 1997. According to the federal lobby registry, Suncor has 12 active in-house lobbyists that spend more than 20% of their time lobbying Ottawa. Suncor also retains six registered consulting lobbyists to represent its interests in climate change issues in Ottawa, four of whom have previously worked as senior policy advisors to the government.** [452]
- While CAPP employs Ottawa-based Global Public Affairs and its eight lobbyists, it also has registered 42 of its own employees as federal lobbyists. Of the total 51 active lobbyists registered by CAPP, 17 previously worked for the government, including one who was a senior aide to Stephen Harper when he was leader of the opposition. [451]
- Federal lobbyist records show that CAPP has enjoyed access to the highest officials in the Canadian federal bureaucracy. For example, CAPP president David Collyer, a former director of the National Energy Board, met 95 times between August 2008 and October 2009 with some of Canada's top civil servants and politicians involved in the energy and climate change files, including meetings with Canada's chief climate change negotiator, the ministers for the Environment and National Resources Canada, their deputies, and the clerk of the Privy Council. [451]
- Mark Rudolph, a 20-year veteran lobbyist who represents Suncor Energy Inc. and Shell Canada Ltd., and who worked as chief of staff to the federal minister of the environment from 1983 to 1984, said some oil companies, including Suncor, have come to accept the science of climate change. However CAPP has lobbied heavily to undermine climate change legislation. [451]



Source: Gulf Port Energy Corporation, 2008

- Rudolph also said that Alberta, in effect, represents the single most powerful lobby in Ottawa, "The [Alberta] government ... takes somewhat of the same point of view as the denialist companies ... And they basically say to the feds – 'back off. This is our domain. Don't bother us.'" [451]

The ICIJ analysis also found that 1,570 climate change lobbyists have pounded the halls of Parliament since 1996. Their client list has steadily increased since that year from just 13 to 109. [451]

Dale Marshall of the David Suzuki Foundation said that while the foundation's members have had "reasonably good access" to Canada's climate change negotiator during U.N. climate change talks, "*the last time an environmental group met with Harper was when he was leader of the opposition.*" [451]

Examples of industry influences outside Canada

- In 2009, the Centre for North American Energy Security was one of the groups that successfully lobbied for the removal of a low carbon fuel standard (LCFS) in the U.S. House Waxman-Markey climate bill. (It's also unlikely the LCFS will be resurrected as part of the U.S. Senate Kerry-Lieberman climate bill.) Tom Corcoran, executive director of the group, said, "*There is a desire to reduce the amount of fossil fuels here in the United States. We exist to persuade the government not to do that, and so far with the Congress I think we've been successful.*" [452]
- Members of the Centre for North American Energy Security, include fossil fuel heavyweights such as Exxon Mobil, who has spent nearly \$60 million lobbying the U.S. government since 2008, and ConocoPhillips, who spent about \$33 million during the same period for the same purpose. [452]
- British Petroleum (BP) and Exxon Mobile are joint venture partners with Enbridge. Enbridge holds membership in lobbying coalitions seeking to lower current environmental laws and regulations. [453]
- In regards to Section 526, ConocoPhillips, an oil company that reported \$5 million in lobbying expenses for just three months of 2010, continues to lobby against the provision. The American Petroleum Institute had eight lobbyists registered to work on S. 526 in 2009. By April 2009, the Government of Alberta had hired its own Washington lobbyists. The contracts for both consultants specify that they will "provide advice for dealing with initiatives that could impact our interests (e.g. the next Section 526)." According to lobbying disclosure records, just one of the two lobbyists — former Michigan governor James Blanchard, along with others at his firm — participated in over 80 interactions with U.S. officials and politicians in the year beginning March 1, 2009, on behalf of the Government of Alberta. In exchange, he billed for over \$300,000 in fees. [454]

A sampling of the historical influence of the United States:

- In March 1960, at a hearing of the Atomic Energy Committee, Project Oil Sands got the stamp of approval from the U.S. Congress. A cheap method of releasing the oil from the sands would mean a secure energy supply for the American military and industry for centuries to come. [455]
- In 1981, the U.S. Treasury instructed the World Bank to play a leading role in the "expansion and diversification of global energy supplies to enhance security of supplies and reduce OPEC market power over oil prices." [456]
- Between 1992 and 2004, the World Bank approved US\$11 billion in financing for 128 fossil fuel extraction projects in 45 countries, projects that will ultimately lead to over 43 billion tonnes of CO₂ emissions. World Bank financing for fossil fuels outpaced financing for renewable energy and energy efficiency by a ratio of 17 to 1. Some of the biggest beneficiaries were transnational corporations including Halliburton, Chevron/Texaco, and Exxon/Mobil. [456]
- In a May 2001 report based upon information from the U.S. National Petroleum Council policy development group that reported to the U.S. Cabinet, one fundamental recommendation was that "*[The] President make energy security a priority of our trade and foreign policy. . . Estimates of Canada's recoverable heavy oil sands reserves are substantial, and new technologies are being deployed to develop their potential . . . Their continued development can be a pillar of sustained North American energy and economic security.*" [457]
- In 2005, the U.S. Energy Policy Act called for a continental plan that will make North America energy self-sufficient by 2025. In a section entitled "Use of Fuel to Meet Department of Defense Needs," the act states that **the Secretary of Defense shall develop a strategy to use fuel produced, in whole or in part, from coal, oil shale, and tar sands that are extracted by either mining or in-situ methods and refined or otherwise processed in the United States in order to assist in meeting the fuel requirements of the Department of Defense when the Secretary determines that it is in the national interest.** [458]
- Another section of the U.S. Energy Policy Act states, "*The Task Force shall make recommendations with respect to initiating a partnership with the Province of Alberta, [not Canada] for purposes of sharing information relating to the development and production of oil from Tar Sands*". [459]
- Immediately after the election of Stephen Harper's Conservatives in January 2006, Canadian government officials with Natural Resources Canada traveled to Houston to meet with U.S. oil executives and officials from the U.S. energy secretary's [Samuel Bodman] department to discuss ramping up Tar Sands production. [459]
- In February 2006, U.S. president George W. Bush announced that the Nation's dependence on oil from the Middle East would soon end, with the eventuality that 75% of its imports will come from Alberta's oil sands. [460]
- In March 2006, at the Canadian embassy in Washington, the U.S. energy secretary said that since Americans consume about 8 billion barrels of oil a year, or about one-third of the world's production, Canada's oil sands represent "a big fraction of it, so it will be very important. *We certainly are very anxious that the oils sands development be as swift as possible.*" Bodman later told energy executives in Alberta that the U.S. was committed to reducing its overseas oil imports and "no single thing can do more to help us reach that goal than realizing the potential of the oil sands in Alberta." [461]

Foreign Investment – China’s Investments in the Oil Sands:

There is a growing trend in Alberta’s Oil Sands for companies and projects to welcome overseas investment to fund major developments in preference to traditional domestic and U.S. sources. It has already attracted investors from the United States, Japan, Norway, France, South Korea, the Netherlands, and Thailand, and India is demonstrating interest in getting involved. Chinese sovereign wealth funds and state-run companies have become large-scale investors, which is seen in Canada as a useful counter to the possibility of a waning demand for Oil Sands oil from the U.S., its biggest customer. [462]

- In 2005, China made its first investments in the Oil Sands with state-owned China National Offshore Drilling Corporation, purchasing a 17% stake (\$105 million) in privately held MEG Energy Ltd., which could eventually pump up to 210,000 bpd. Sinopec, China’s second-largest oil producer and top refiner, purchased a 40% interest (\$122 Million) in the Northern Lights oil project which has a production capacity of 5 million tonnes a year. [462]
- In 2009, state-owned PetroChina agreed to buy 60% of two undeveloped projects (\$1.9 billion) held by Athabasca Oil Sands Corp. that have been independently assessed to contain approximately 5 billion barrels of oil and could eventually produce as much as 500,000 bpd. Sinopec acquired an additional 10% stake in the Northern Lights oil sands project. [462]
- In 2010, Sinopec agreed to buy the ConcocoPhillips’ 9.03% stake in Syncrude Canada Ltd, the largest oil sands project, for \$4.65 billion. China Investment Corp., a state-owned sovereign wealth fund, paid \$817 million for a 45% interest in Penn West’s 237,000 net acre Peace River oil sands project and \$435 million for a 5% equity stake in the trust itself. [463]
- Prime Minister Stephen Harper recently said, "Expect more Chinese investment in the resource and energy sectors ... there will definitely be more." [464]

A SAMPLING OF UNHEEDED WARNINGS AND RECOMMENDATIONS FROM GOVERNMENT REPORTS:

Historical recommendations

- In 1972, Alberta’s Conservation and Utilization Committee (senior servants with some 20 government departments) released its 80-page confidential draft document, the *‘Fort McMurray Athabasca Tar Sands Development Strategy’*. **They advise the government to take control of “the historical trend of ever increasing foreign control of nonrenewable resources development in Canada.”** [465]
- In 1973, a series of reports for the Alberta Department of the Environment, *An Environmental Study of the Athabasca Tar Sands*, **described growing waste ponds as “the most imminent environmental constraint” to the industry because of the threat of dike failure, seepage and groundwater pollution.** The reports also concluded that unless preventative measures are discovered and implemented, **“the environmental effects of eventual multi-plant operations over the extent of the Athabasca tar sands could be enormous.”** [466]
- In 1974, Environment Canada released a report extremely critical of Syncrude’s Environmental Impact Assessment of its Tar Sands development plan. Then Environment Minister Jeanne Sauve stated the company “has failed to appreciate the real scope of environmental concerns and has also failed to address the question of environmental protection in either a realistic or adequate manner . . . [The company’s documentation is] **deficient in detailed information in many areas of environmental concern and we believe there is a likelihood for major environmental damage.**” [467]
- The Energy Efficiency Board of the Alberta government’s Department of Energy’s report, *A Discussion Paper on Reducing CO₂ Emissions in Alberta, 1988-2005*, recognized that **global warming is a threat to life on earth and is caused by the increasing accumulation of “carbon dioxide, methane, Oxides of nitrogen and Chlorofluorocarbons.”** The paper predicted a substantial rise from Alberta’s then 22% of CO₂ emissions in Canada and outlined a strategy, with about 300 energy conservation measures, for reducing the province’s GHG emission by 20% below 1988 levels by 2005. It was filed away in 1990 when Ralph Klein was Environment Minister. [468]
- The House of Commons’ Standing Committee on the Environment’s 1991 report, *The Risks of Irreversible Climate Change* focused on the premises: **global warming has been proven scientifically; it is an inevitable and continuing consequence of past and present patterns of human activity; and it presents a severe threat to both Canada and the planet as a whole.** The report presented a strategy for the 1990s to achieve targets for emission reduction and consider what has to be done to stabilize GHG emissions at a sustainable level by 2050. [469]
- A 2003 peer reviewed Environment Canada study *“indicated that we did see both hydrocarbon exposure in natural fish populations and elevated stress activities in these fish” – related to areas near the oil sands.* [470]

- In August 2007, then Liberal leader, Stéphane Dion, wrote an open letter to Prime Minister Harper on the occasion of the Environment Canada report on the Kyoto Protocol Implementation Act, saying that **GHG emissions from the Oil Sands are expected to reach 126 Mt of CO₂e by 2015 - a figure larger than all the emission reductions expected under Harper government initiatives.** [471]
- In a 2008 report, Health Canada warned, *“the economic costs of extreme events in this country are rapidly increasing, as is the number of people affected by natural disasters. . . Such events and other climate-related hazards (e.g. smog, food-, water-, vector- and rodent-borne diseases) continue to pose significant short- and long-term risks to the health and well being of Canadians and their communities. Both adaptation and GHG mitigation actions need to be employed to address climate change impacts.”* [472]

Recommendations from Natural Resources Canada

- In 2007, the Standing Committee on Natural Resources, in its *Oil Sands* report, made several recommendations including that the federal government:
 - conduct a full and detailed assessment of the socio-economic and environmental impacts of oil sands activities;
 - employ existing legislation such as the Canadian Environmental Protection Act and the Canadian Environmental Assessment Act in a more comprehensive way to address environmental concerns such as trans-boundary air pollution, greenhouse gas emissions, and harm to waterways and fisheries;
 - take necessary measures to improve living conditions for the aboriginal communities whose way of life has been impacted by extensive oil production on their traditional lands. [473]
- The 2007 Natural Resources Committee also stated that it is *“concerned that the public sector has borne too great a proportion of oil sands research and development in comparison to the private sector”* and recommended that *“the federal government, specifically the Department of Natural Resources, base all of its actions in the area of oil sands development on sustainable development and polluter pays principles”*. [474]
- The 2007 Committee called for **“hard emissions caps for the oil sands for 2008 to 2012, 2020 and 2050, based on absolute levels and not based on intensity”**; and for **any future expansion of oil sands development to be done in a way that does not jeopardize Canada’s international Kyoto obligations on GHG emissions and climate change.** [475]
- The 2007 Natural Resources report concluded, **“Mounting environmental and social costs associated with oil sands activities in particular make it increasingly clear that it would be irresponsible to continue on a 'business-as-usual' course; a business-as-usual approach. . .is not sustainable; [and] it is time to begin the transition to a clean energy future”**. It recommended that the federal government shift its research focus to emerging renewable and sustainable technologies. [476]
- Another Natural Resources Canada’s 2007 report stated, **“Impacts of changing climate on many physical and biological systems, such as ice and snow cover, river, lake and sea levels, and plant and animal distributions, are unequivocal.”** The report recognized that increases in the occurrence of heat waves, forest fires, storm-surge flooding, coastal erosion and other climate-related hazards, as well as other environmental, social and economic issues, such as the unprecedented outbreak of mountain pine beetle in British Columbia, encompassing over 9.2 million hectares of forest in 2007, are related to climate change. [477]
- A 2009 report commissioned by Natural Resources Canada and issued by the Council of Canadian Academies points out that **groundwater use in the oil sands region is unsustainable.** With production growth and an increased strain on groundwater, the potential for accidents leading to the contamination of one of the largest aquifers (which many in situ projects sit below) is very high. Over 90% of rural Albertans rely on groundwater resources. [478]
- The 2009 Natural Resources report also states, **“sustainable management of groundwater also depends on governance that is less fragmented than is the case today”**. [479]



OPTI NEXEN LONG LAKE SAGD SITE

Photo: David Dodge, Pembina

Recent studies and recommendations

- Environment Canada’s website on Groundwater Contamination warns that the most practical solution is to prevent contamination in the first place. **“Several studies have documented the migration of contaminants from disposal or spill sites to nearby lakes and rivers as this groundwater passes through the hydrologic cycle, but the processes are not as yet well understood. In Canada, pollution of surface water by groundwater is probably at least as serious as the contamination of groundwater supplies.”** [480]

- Water expert, David Schindler, and his team published their first peer-reviewed paper in 2009, which concluded that **“the oilsands industry is a far greater source of contamination than previously realized”**. The study also “confirms the serious defects of the RAMP” (the joint government-industry Regional Aquatic Monitoring Program) and that it “missed major sources of PAC to the Athabasca watershed”. Schindler told CBC News: *“The current RAMP program is like they threw the rulebook away. They violate every rule of how to run a good long-term monitoring program, so of course they can’t detect anything.”* [481]



AN EFFLUENT PUMP DUMPS MINE TAILINGS AT ONE OF SYNCRUDE’S TAILINGS POND SITES

Photo: Garth Lenz, Source: Tar Sands Tour



SYNCRUDE’S PROCESSING PLANT

(Times/UK) Source: Civilianism.com

- In another study, released in July 2010, Schindler and his team concluded, “Contrary to claims made by industry and government in the popular press, **the oil sands industry substantially increases loadings of toxic PPE [the 13 elements considered priority pollutants under the US EPA’s Clean Water Act] to the AR [Athabasca River] and its tributaries via air and water pathways.** This increase confirms the serious defects of RAMP, which has not detected such patterns in the AR watershed. . . A robust monitoring program to measure exposure and health of fish, wildlife, and humans should be implemented in the region affected by oil sands development.” [482]
- In March 2010, David Schindler told the Standing Committee on the Environment and Sustainable Development that **all 13 PPE were higher within a 50-kilometre radius of the upgraders on the river and that: “Oilsands companies should be charged under the Fisheries Act. Clearly they’re discharging deleterious substances into fish-bearing waters.”** [483]
- In December 2010, The Royal Society of Canada released a report on Canada’s Oil Sands Industry. Though the report discounted some Oil Sands-related concerns, listed deficiencies include:
 - Reclamation is not keeping pace with the rate of land disturbance . . . Reclamation and management options for wet landscapes derived from tailing ponds . . . are not adequately demonstrated. . . Current practices for obtaining financial security for reclamation liability leave Albertans vulnerable to major financial risks;
 - More monitoring focused on human contamination exposures is needed to address First Nations and community concerns;
 - There is population level evidence that residents of the Regional Municipality of Wood Buffalo experience a range of health indicators, consistent with ‘boom town’ impacts and community infrastructure deficits;
 - There are valid concerns about the current Regional Aquatics Monitoring Program (RAMP) that must be addressed;
 - The regional cumulative impact on groundwater quantity and quality has not been addressed;
 - The rate of improvement [for tailings management] has not prevented a growing inventory of tailings ponds. . . Control of Nox emissions and regional acidification potential remain valid concerns;
 - Increasing GHG emissions from growing bitumen production creates a major challenge for Canada to meet our international commitments for overall GHG emission reduction that current technology options do not resolve;
 - The EIA [environmental impact assessment] process relied upon by decision-makers to determine whether proposed projects are in the public interest has serious deficiencies in relation to international best practice. Environmental data access for cumulative impact assessment needs to improve. [484]

- The Oilsands Advisory Panel, appointed by former federal environment minister Jim Prentice, made its findings public in Ottawa in December 2010. The panel found that **oilsands monitoring was fragmented and inconsistent, with no links between data on water quality – including groundwater – and air quality, and lacked the scientific rigour needed for good decision-making.**

The panel's chair, Elizabeth Dowdeswell, said that researchers were making reams of data, but the panel found it could not be used with any confidence and there is no reliable longitudinal data that would give a solid understanding of the environmental impact of the oil sands. Different organizations don't share information and the major monitoring body, set up by industry, isn't scientifically credible. *"There is clearly a lack of leadership and co-ordination. . . There is no holistic and comprehensive system. There is no system."* The panel underlined a critical need for a new governance structure including an inter-jurisdictional steering committee, an external scientific advisory committee and sufficient resources to follow through. [485]

- **Canada's 2010 National Inventory Report states,** "Evidence indicates that in order to achieve success with a program of emission reductions the continued reduction in the emission intensity of Canada's economy over time will be required and it must occur at a pace that counteracts the country's continued population and economic growth. . . further significant reductions in fossil fuel energy consumption will have to take place. . . more significant actions must be in place before the historical record will show the steep and continued emission reductions required to achieve Canada's current target." [486]

Scott Vaughan, The Commissioner of the Environment and Sustainable Development, Office of the Auditor General of Canada, tabled a report in the House of Commons in December 2010, which highlights several areas where the federal government is not doing what it said it would do to protect the environment and move toward sustainable development. *"There is little in our findings to offset a discouraging picture, as most suggest underlying problems in how these federal programs are being managed. . . The two fundamental problems we identified are a lack of effective and sustained leadership, especially when responsibilities are shared, and inadequate information."* The audit looked at: monitoring water resources, adapting to climate impacts, and oil spills from ships. It found: [487]

- **Environment Canada is not adequately monitoring the quality and quantity of Canada's surface water resources;** has not fully defined its water monitoring responsibilities; is not monitoring water quality on most federal lands and does not know what monitoring, if any, is being done by other federal departments; has not located its monitoring stations based on an assessment of risks to water quality and quantity; cannot assure users that its water quality data is fit for their intended uses; does not validate the data collected through the water quality monitoring program; and monitoring networks have not been adjusted to respond to industrial development, climate change and population growth in certain regions - for example, the Department has only one long-term water quality monitoring station in the Athabasca River, and this station was not designed to monitor pollutants related to oil sands development. Vaughan stated, *"Environment Canada should update its assessment of the threats facing Canada's water resources, from climate change to impacts on human health, so that it can manage its network to understand and respond to the greatest threats."* [488]
- **The government has not established clear priorities for addressing the need to adapt to a changing climate. . .** there is still no federal adaptation policy, strategy, or action plan in place. Departments therefore lack the necessary central direction for prioritizing and coordinating their efforts to develop more effective and efficient ways of managing climate change risks. . . Funding for adaptation programs under the Clean Air Agenda is scheduled to end in March 2011, and there is no plan in place to address ongoing needs after that date. [489]
- **The government isn't ready to respond to a major oil spill in Canadian waters.** Canada lacks a formal framework with clearly defined roles and responsibilities for responding to chemical spills. Knowledge of risks in Canada to spills from ships is not complete or up to date nor are the emergency management plans of the Canadian Coast Guard and Environment Canada. There is currently no process for providing assurance that the federal component of the oil spill response system is ready to respond effectively. The Coast Guard is unable to determine how much oil spill response equipment it should have and whether it has appropriate capacity to address the risks, and there are limitations with their system for tracking oil spills and other marine pollution incidents. [490]

In 2010, Canada's National Round Table on the Environment and the Economy (NTREE) also put forward assessments and recommendations relating to Canada's water and climate change:

- A 2010 study, *Changing Currents*, from Canada's National Round Table on the Environment and the Economy, NTREE, reported that natural resource industries account for about 84% of Canada's gross water use. **"Canada's apparent water abundance masks a looming scarcity challenge for our important natural resource sectors and for certain regions of our country."** The report suggests that **the federal government should coordinate a national approach to better manage use and consumption** while researching all of the risks. [491]

- In the first of its *Climate Prosperity* reports (2010), NTREE states:
“Where future climate regimes will increase demand for low-carbon goods and decrease demand for carbon-intensive ones, net carbon exporting countries will face new competitive risks and disadvantages in a low-carbon world. . . There could also be higher economic costs associated with participating in a global climate mitigation regime for those nations that maintain a large share of their exports in carbon-intensive production.” [492]
- NTREE’s *Climate Prosperity* overview states:
“Portrayal of the climate change challenge is dominated by attention on the economic costs of carbon mitigation. This ignores an important part of the balance sheet: the economic risks of global failure to prevent significant climate impacts, and the investments needed to effectively adapt to current and projected climate impacts. . . Reducing primary energy demand and shifting production from fossil-fuel-generated energy to more low-emission sources will be necessary to achieve deep emission reduction targets.” [493]
- NTREE’s *Climate Prosperity* report also states, **“For Canada, the inescapable conclusion is that when it comes to low-carbon performance, we need to do better. Our competitors, save for the United States at this stage, are all investing more and preparing their economies for the low-carbon transition. Low-carbon policies and plans are only just being contemplated and implemented in this country, federally and provincially. Canada’s rankings reinforce current perceptions and past investments and commitments.”** [494]

PART 3: GLOBAL WARMING AND GROWING CONCERN

GLOBAL WARMING AND MITIGATION:

Canada’s low carbon performance compared to other industrialized countries:

Indicating that the current government has little intention of moving aggressively ahead on renewable energy sources, *Canada’s 2008 Fossil Energy Future: Carbon Capture and Storage* report states, “petroleum resources are expected to dominate Canada’s energy supply needs for the next several decades”. [495]

- **Canada ranks second highest in G8 countries for its share of low-carbon electricity, attributed in major part to its large hydroelectric generating capacity. Yet, with all its ‘green’ potential, Canada ranks sixth when it comes to emissions and energy and overall low-carbon performance. It ranks lowest in carbon emissions embodied in exports and seventh in carbon productivity (amount of GDP per CO₂ equivalent emissions), marginally behind the U.S.** [496]
- Canada’s poor performance is particularly highlighted when compared with the example the United Kingdom has set – a country with almost no hydroelectric (2.5% in 1990). **While Canada’s emissions in 2008 were 24% higher than in 1990, the UK has already reduced its emissions by 19.4% without emissions trading and 22% including emission trading, below 1990 levels.** It is also on track to reach a 25% reduction by 2012, has a target of 34% reduction by 2020, and is considering moving to a 42% reduction by 2020. [497]
- Other examples of substantial accomplishments and commitments in GHG reductions:
 - Germany, which in 2008, had reduced its emissions by 22% from 1990 levels and has pledged a 40% reduction below 1990 levels by 2020;
 - Scotland, which will get 80% of its electricity from renewables by 2020, 100% by 2025, and will become a net exporter of “clean, green energy”; and,
 - as per 2010 Copenhagen Accord commitments, the European Union, which has confirmed its commitment to cut emissions 20% from 1990 levels by 2020 and raise its target to 30% if other large emitters set similar targets; Japan, Norway, Brazil, which have committed to 25%, 30-40%, and 39% GHG reductions, respectively, by 2020, based on 1990 levels. [498]
- Even though China is continuing to invest in fossil fuels, it is also taking a lead on renewables. In 2009, it spent \$34.6 billion on renewable energy projects, became the world’s largest manufacturer of wind turbines and solar photovoltaic (PV) cells, achieved a 15.6% drop in energy intensity, and set a feed-in tariff for new onshore wind power plans of 7 to 9 cents per kilowatt-hour. In 2010, it committed \$44 billion through 2012, to increase to \$88 billion through 2020, to build ultrahigh-voltage transmissions lines (smart grid). It has committed another \$738 billion over the next 10 years to alternate energy development, has set aggressive targets to increase non-fossil fuel energy, including renewables, to 15% of primary energy consumption by 2020 and to cut carbon emissions per unit of GDP by 40-45% below 2005 levels by 2020, and is revising its national building energy standards to mandate reducing new building energy use by 65% (previously 50%). [499]

- Other examples in substantial accomplishments in renewables:
 - Denmark increased its reliance on wind power from 3% of its total electricity supply up to 19.7% between 1991 and 2007. That, along with other measures, reduced emissions from electricity production by 30% over the same period, while the country's GDP grew by 45%. [500]
 - Germany has become a world leader in research and manufacturing of solar photovoltaic cells and wind turbines. Germany has integrated almost 15% of its power from renewable energy sources (wind, solar, biomass, farm biogas and small hydro) at a cost of less than \$4/month per household. And while Germans pay more per kWh of electricity than Canadians, by using energy more efficiently, a typical German household pays less per month than its Canadian counterpart. [501]
 - The production of wind, solar (including solar thermal), and/or geothermal power is expanding at a breakneck pace in many states in the U.S., some with planned projections to produce excess energy to export. According to an independent study by GTM Research, U.S. solar installations created \$3.6 billion in direct value to the global economy in 2009. Of that, nearly 74%, or \$2.6 billion, directly benefited the U.S. economy. The U.S. was a net exporter of solar energy products in 2009. [502]
 - In 2010, Texas increased its reliance on wind power to about 19% of the electricity on the state's main grid. Texas's plans are to have 45,000 megawatts of wind-generating capacity (think 45 coal-fired power plants), which will more than satisfy the residential needs of the state's 24 million people and enable Texas to feed electricity to nearby states. [503]

In 2010, Pembina's analysis found an 18:1 per capita ratio for stimulus spending between the U.S. and Canada on renewable energy programs. **Overall, the U.S. plans to spend US\$26.7 billion on green programs including renewable energy, efficiency, technology development, and public transit, compared to C\$357 million in Canadian spending in 2010.**



SOLAR 'TREE' IN GLEISDORF

Source: Solar Artworks

The U.S. proposes to eliminate 12 fossil fuel subsidies worth \$12 billion in 2011, as a step towards fulfilling G20 commitments. No similar initiatives were in Canada's 2010 budget.

In Austria, one out of every seven homeowners now uses solar to heat their hot water. The village of Gleisdorf in southern Austria - population 35,000 - has a greater installed capacity for solar heating than all of Canada. [504]



HIMIN SOLAR ENERGY GROUP POWER PLANT IN CHINA

Photo: TradeVV, Source: CalFinder

Global warming:

The increasing exploitation of Canada's Oil Sands amounts to a massive investment - locking in a high carbon North American transportation system at the same time that Canada and the rest of the world need to urgently tackle climate change. There can be no energy security, or indeed any kind of lasting security, without a stable climate. It is important to consider the implications and impending dangers of the global warming track that the world is currently on so as to be able to weigh these against the benefits of oil sands development and the continuation of the minimal climate change commitments and renewable energy policies that the Canadian government is perpetuating.

- As stated in a 2010 University of Calgary paper, **"Emissions from oil sands continue to grow, yet in order to stabilize atmospheric carbon, (all) emissions will need to be reduced to near zero. . . we cannot keep pulling carbon from the ground and pumping it into the atmosphere if we want a stable climate."** [505]
- "For every five years of inaction, it requires an extra gigatonne of reductions," says Gardiner Hill, manager of technology and engineering for CCS at BP's alternative energy arm. [506]
- **According to a 2008 WWF report, if all 1.1 trillion barrels of probably extractable Canadian and U.S. unconventional oils (two greatest potential sources are from oil sands and oil shale) were exploited within the next century, it would result in wheel-to-well emissions of 980 Gt CO₂, (183 Gt CO₂ from the Oil Sands and 797 Gt CO₂ from U.S. shale oils) equating to an estimated increase in atmospheric CO₂ levels of between 49 and 65 parts per million (ppm). Such a catastrophic exercise would likely tip CO₂ levels beyond the climate stabilization threshold of 450 ppm CO₂e, widely accepted as the level we must not exceed to stay below 2 degrees C of global warming.** [507]

- “We now know what matters in policy framework is not the emissions in any individual year, but the cumulative emissions,” says Canadian Climatologist Andrew Weaver. **“If we consider carbon dioxide alone, then from 2010 onwards we can emit 68 gigatonnes of CO₂ [in total] to stay within only a 1 in 10 chance of breaking 2 degrees C. We are currently emitting more than 10 Gt CO₂ per year.”** If we take longer than the 7 years this implies to reach zero emissions, our odds of breaking the 2 degree C global warming threshold increase. And this doesn’t account for the other greenhouse gases, nor is there certainty that the 2 degree C maximum warming limit is sufficient. [508]
- **James Hansen says warming has brought us to the “precipice of a great tipping point”. If we go over the edge, it will be a transition to “a different planet”, an environment far outside the range that has been experienced by humanity. There will be “no return within the lifetime of any generation that can be imagined, and the trip will exterminate a large fraction of species on the planet”.** [509]

Note: In 2007, Environment Canada adopted a new media relations policy requiring the department’s scientists, or “subject matter” experts, to refer all media requests to Media Relations at Environment Canada’s national headquarters, thus reducing the media’s access to, and coverage of, the department’s scientists, which includes those researching climate change. This policy means Canadian scientists require permission from the Prime Minister’s communications office to comment on their own studies made public in scientific journals and reports. If permission is granted, it requires written questions submitted in advance and often replies by scientists have to go through a vetting process. Media coverage of Environment Canada scientists with respect to climate change has declined by more than three-quarters since before the new policy was instituted. [510]

Lack of action on mitigation is setting the world on a path to surpass 2°C of warming

- According to the IEA (2010), as carbon dioxide emissions rise 21% to 35 billion tonnes, **global temperatures are projected to rise to 3.5°C over the next 25 years**, meaning that governments worldwide will have failed in their pledge to hold global temperature at 2°C. The Canadian government has been implicit in encouraging and ensuring the success of this failure. [511]
- The Intergovernmental Panel on Climate Change’s 2007 Fourth Assessment Report gave a warming range of 1.6 to 6.9°C to 2100, with a center range of projected global warming of approximately 4°C. In 2009, “4 degrees and beyond” was the focus of an International Climate Conference at Oxford, which brought together leading scientists. A paper from the conference found that the IPCC’s high-growth, fossil-fuels-intensive scenario “would lead to a warming of 4°C relative to pre-industrial during the 2070s. If carbon-cycle feedbacks are stronger. . . then 4°C could be reached by the early 2060s in projections that are consistent with the IPCC’s ‘likely range’”. [512]
- At the end of the “4 degrees and beyond” conference, **Met Office projections revealed that the lack of action in the intervening 17 years – in which emissions of climate changing gases such as carbon dioxide have soared – has set the world on a path toward potential 4°C rises as early as 2060, and 6°C rises by the end of the century - unless we stop pumping greenhouse gases into the atmosphere the way we do now.** Temperature rises caused by GHG emissions are expected to trigger dangerous feedback loops, which will release ever-increasing amounts of greenhouse gases. [513]

“Climate change is a story of public relations and the most widespread mis-information campaign. . . This is a story about greed and irresponsibility on an epic scale, deception and widespread media manipulation.”

James Hoggan, PR executive and author of the book *Climate Cover-Up* [514]

A 4-degree warmer world

Climate change is already forcing people to migrate. Sea level rise is driving an exodus from Tuvalu, Kiribati, Papua New Guinea and the low-lying Carteret Islands, while water stress is forcing people in Mauritania, Sudan, Ghana and Kenya to migrate. Melting permafrost is pushing people out of parts of Alaska and floods are forcing others out of the delta regions of Bangladesh and Vietnam.

The high number of weather-related natural catastrophes and record temperatures both globally and in different regions of the world provide further indications of advancing climate change, says Munich Re, the world’s top reinsurer. The Haiti earthquake and floods in Pakistan and China helped make 2010 an exceptional year for natural disasters, killing 295,000 and costing 130 billion dollars. A total of 950 natural disasters were recorded in 2010 while the average number of events over the past 10 years was 785.

Phytoplankton, which absorb vast quantities of carbon dioxide, are already finding it harder to live in the more stratified layers of the warmer ocean. Since 2000, when the sea surface temperatures began to rise more noticeably, the photosynthetic productivity of phytoplankton have decreased in some ocean regions by 30% [515]

If political leaders fail to agree to a method of stopping current rates of global warming, what could our world look like by the mid- to late-2000s? The February 2011 report, 4 degrees hotter, brings together data from a number of studies:

- The world would be warmer than during any part of the period in which modern humans evolved, and the rate of climate change would be faster than any previously experienced by humans.

- The world's sixth mass extinction would be in full swing. Isotherms (temperature bands) would be shifting towards the poles at a pace beyond the capacity of most ecosystems to keep up. If the rate should exceed 0.4°C per decade, most ecosystems would be quickly destroyed, opportunistic species will dominate, and the breakdown of biological material will lead to even greater emissions of CO₂.
- An average global increase of 4°C translates to a rise of up to 15°C at the North Pole. Carbon stored in Arctic permafrost is double the amount of carbon in the atmosphere. *4 degrees hotter* reports that “a 3°C increase in global temperature is probably more than enough to detonate the permafrost time bomb”, which would drive temperatures significantly higher. A 2011 study by NOAA and the National Snow and Ice Data Centre predicts the permafrost carbon feedback will change the Arctic from a carbon sink to a source after the mid-2020s and is strong enough to cancel 42-88% of the total global land sink. As well, in 2010 it was reported that the subsea permafrost in the East Siberian Arctic Shelf, is showing signs of destabilization. The thaw and decay of permafrost carbon is irreversible.
- Studies suggest 2-4°C of warming would trigger the permanent break-up of the Greenland ice sheet. Sea levels will rise twice as fast as official estimates predict, up to 2 metres by 2100. While ice sheets take considerable time to lose mass, and the rise to 2100 may be only 1–2 metres, the world would be on the way to increasingly higher sea levels. A rise of one metre would put at risk over 136 port cities with present-day populations greater than 1 million.
- Climate change, deforestation and fires spreading from degraded land into pristine forest will conspire to destroy over 83% of the Amazon rainforest by 2100.
- A 4°C rise would turn swaths of southern Europe to desert.
- In Australia, a study of the probability of forest fires suggests that the number of "extreme fire danger days" will treble by 2050. Says David Karoly of the University of Melbourne, *"We are unleashing hell on Australia."*
- Half of the world would be uninhabitable. Professor Hans Joachim Schellnhuber, director of the Potsdam Institute, and one of Europe's most eminent climate scientists, stated “. . . carrying capacity estimates [are] below 1 billion people.” Professor Kevin Anderson, director of the Tyndall Centre for Climate Change, believes only around 10% of the planet's population – around half a billion people – will survive if global temperatures rise by 4°C. While the loss will be exponential and bunch towards the end of the century, on average that is a million human global warming deaths every week, every year for the next 90 years. The security implications involved are immense.
- Ocean acidification would have rendered many calcium-shelled organisms, such as coral and many at the base of the ocean food chain, artifacts of history. Ocean ecosystems and food chains would collapse.
- Anders Levermann's simulations (Potsdam University in Germany) suggest that in a 4°C world there will be a mix of extremely wet monsoon seasons and extremely dry ones, making it hard for farmers to plan what to grow. Worse, the fine aerosol particles released into the atmosphere by burning fossil fuels could put a complete stop to the monsoon rains in central southern China and northern India.

It doesn't have to be this way. If politicians agree to cut emissions by 3% every year, the world can limit temperature rise to a 'safe' 2°C, says the Met Office. [516]

Adaptation vs mitigation

There is a pervasive assumption that our species can adapt to whatever is thrown at us by climate change. But Professor Neil Adger, a Tyndall Centre climate change adaptation expert states:

“...that is a dangerous mindset to be in. Thinking through the implications of 4°C of warming shows that the impacts are so significant that the only real adaptation strategy is to avoid that at all cost because of the pain and suffering that is going to cost... There is no science on how we are going to adapt to 4°C warming. It is actually pretty alarming.” [517]

In his 2010 book, *Requiem for a Species*, Clive Hamilton writes:

“From the outset of the global warming debate some have argued that as much emphasis should be placed on adapting to climate change as on mitigating it. . . Underlying the discussion is an unspoken belief that one way or another we (in rich countries) will be able to adapt in a way that broadly preserves our way of life because global warming will change things slowly, predictably and manageably. Wealthy countries can easily afford to build flood defences to shield roads and shopping centres from storm surges, and we can ‘climate proof’ homes against the effects of frequent heatwaves. Yet if our belief in our ability to stabilise the Earth's climate is misconceived then so is our belief in our ability to adapt easily to climate change. If instead of a smooth transition to a new, albeit less pleasant, climate warming sets off a runaway process, adaptation will be a never-ending labour.” [518]

Events such as New Orleans after cyclone Katrina should disavow the notion that adaptation (rebuilding the city) is more economical than mitigation (strengthening the storm defences before the event). And it won't take too long to figure out that building a new energy system is cheaper than constantly rebuilding lives and buildings and infrastructure and agriculture when “1-in-a-100 year” extreme heatwaves, droughts, fires, floods and cyclones become regular events on the hotter planet calendar. [519]

GROWING CONCERN ABOUT THE OIL SANDS AND CLIMATE CHANGE:

- Contrary to Canada's Environment Minister, Peter Kent's February 2011 statement that "all Canadians are proud of the Canadian oil sands as a natural resource", a **2009 poll showed that 52% of Canadians want oil sands development slowed and investments directed toward the development of green energy** and a 2010 poll showed that basically half of Canadians feel that **"while there is a need for energy in Canada, it does not outweigh the environmental risks with this development."** [520]
- Even though Canada's emission reduction targets are weak in a global and science-based context, Peter Kent recently recounted praise of Canada's emission reduction targets, saying, "our government has made clear commitments to be a world leader in clean electricity generation and to reduce greenhouse gas emissions by 17% below 2005 levels by 2020". Yet even as early as 2008, polling showed that **83% of respondents want Canada to "commit to strong action on global warming without waiting for other countries." 78% also agreed that "Canada's global warming targets should be based on what leading scientists say is needed to avoid serious harm to people and the environment, even if meeting these targets entail some cost to the economy."** (Canadian targets translate to 3% above 1990 levels, science-based targets are at least 25% below 1990 levels.) [521]
- In a November 2010 poll:
 - 83% of Canadians agreed: "The Canadian government should invest in green jobs and have transition programs for workers and communities negatively affected by a shift away from reliance on fossil fuels."
 - 87% of Canadians agreed: "The root cause of climate change is too much focus on economic growth and consumerism. We need to have an economy that is in harmony with nature, which recognizes and respects the planet."
 - 85% of Canadians agreed: "Industrialized countries which have historically produced the most greenhouse gas emissions, should be the most responsible for reducing current emissions." [522]
- In a bold move to slow climate change, in 2010, city council members in Bellingham, Washington vowed to find lower carbon alternatives to Tar Sands and other fuels, and decrease overall fossil fuel consumption. [523]
- Whole Foods Market, a U.S.-based grocery chain that caters to high-end, health conscious consumers, recently moved to stop using any fuel sourced from Alberta Oil Sands in its supply chain. Walgreens, a 7,500-store drugstore chain, plans to switch suppliers that provide fuel for the company's delivery trucks to avoid those that may have Oil Sands oil sourcing. The Gap, Levi Strauss and Timberland have told companies that transport their goods that they will give their business first to those that avoid using Oil Sands fuels. [524]
- A group of ethical investors, led by the Co-operative Group, has boycotted companies working on Oil Sands exploitation and is increasing pressure on other investors to do likewise. [525]

Canadians deserve an honest debate about the Oil Sands and climate change:

If the government clings to the notion that promoting and enduring environmental devastation is needed to grow the economy, then let them at least be forthright about the viability of 'cleaning up the Oil Sands' and Canada's lack of action on global warming mitigation.

A 2010 paper by Joule Bergerson and David Keith explains, "Because the emissions impacts of technologies depend so strongly on project-specific decisions, we should not expect emissions performance to improve automatically with accelerated technical innovation. Policies that discourage emissions will be required along with innovation in order to drive substantial adoption of low-emissions technology. . . even a technology that could reduce the extraction emissions to near zero would be considered incremental because 60-80% of the emissions are still going to occur if the bitumen is eventually combusted in a vehicle.

"The environmental impacts of CO₂ emissions are the same wherever they occur, **so seen through the lens of environmental cost-benefit analysis it makes little sense to devote major resources to reducing oil sands process emissions.** Resources might be better spent on the long-run task of developing technologies that can decarbonize the transportation sector by moving it away from oil as a primary fuel." [526]

Even from an economic viewpoint, Oil Sands development and delay in climate change policy action, could prove to be high risk in the long run. Additionally, focusing on fossil fuel production instead of renewables, could leave Canada well behind other countries in low-carbon economic markets in the near future.

- A 2010 report released by Ceres, a coalition of investors, environmental and public interest organizations that studies challenges to sustainability, states, "The risks for companies involved in developing Canada's oil sands . . . are arguably greater than those in the Gulf of Mexico. Most of these risks are related to the energy- and water-intensive nature of oil sands production, risks that will only increase as the industry seeks to double or even triple production in a world that is increasingly becoming water- and carbon-constrained." [527]

- In February 2011, research released by Mercer and a group of leading global investors found that **continued delay in climate change policy action and lack of international coordination could cost institutional investors trillions of dollars over the coming decades** and that climate change could contribute as much as 10% to portfolio risk over the next 20 years. **The cost of impacts on the physical environment, health and food security could be in the range of \$2 trillion to \$4 trillion by 2030**, with costs rising the greater the delay and the less well-coordinated the policy response. “There will be no long-term winners from a delayed response.” The research also found:
 - Investment opportunities in low carbon technology could be as high as \$5 trillion by 2030 and that the EU and China/East Asia are set to lead investment in low carbon technology and efficiency improvements over the coming decades.
 - **The future cost of carbon emissions increases the longer the policy delay and the less well-anticipated and coordinated the policy action is.** Policy measures could increase the cost of carbon emissions by as much as \$8 trillion cumulatively, by 2030.
 - Economically realized costs of climate change may reflect only a fraction of total costs incurred, particularly in developing countries, since property insurance, for example, is much more extensive in the industrialized world. Losses in the former may be uncompensated but nevertheless real. (Costs incurred from the Pakistani flood damage in 2010 were calculated to be up to \$43 billion.)

The findings also undermine the notion of a conflict between 'green' investing ' and acting in beneficiaries long-term financial interests.

“That climate change poses significant financial and economic risks has only been accentuated by the tens of billions of dollars in losses due to recent climate related natural disasters such as the floods in Australia and Pakistan and the wildfires in Russia.” Rachel Kyte, Vice President, International Finance Corporation [528]

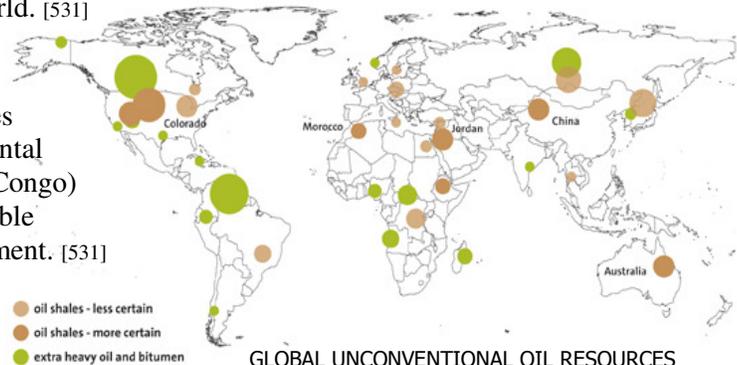
The financial costs of damages from increasing severe weather events may soon loom large in comparison to profits from the Oil Sands industry. And, because the boreal forest’s ecosystem and carbon storage services are globally important in mitigating climate change they ethically do not belong to just Alberta or Canada. Enforcing adequate protection measures for the boreal forest is a responsibility that Canadians owe to the world and future generations.

Further exploitation of unconventional fossil fuel:

Fossil fuels are the biggest source of greenhouse gas emissions. Instead of leading the way on the path to eliminate the use of fossil fuels, Canada is leading the way down the road of exploiting unconventional reserves and the use of the most GHG intensive fossil fuels. [529]

huge unconventional fuel reserves - extra heavy crude, oil sands and oil shale - lie untapped across the globe. Canada is currently the only major centre of production. However, according to a September 2010 report from Friends of the Earth, new deposits of oil sands and other unconventional oil have been discovered or are already being exploited in countries such as Venezuela, Madagascar, Congo-Brazzaville, Russia, Jordan, Nigeria and Angola. Further exploitation of unconventional fossil fuel would be making a mockery of climate protection. [530] Therefore, Oil sands development in Canada constitutes a huge threat to climate protection and to the shift to a low-carbon economy that is the basis of future sustainable development globally, which will only intensify if oil sands investment expands to other areas of the world. [531]

- Expanding investment in oil sands and other dirtier forms of oil production to non-OECD countries - and in particular to countries that may have weaker political and environmental governance frameworks (eg. The Republic of Congo) - means a greater concomitant risk of irreversible damage to local communities and the environment. [531]
- Global expansion of unconventional oil will hasten potentially catastrophic climate change and is unlikely to contribute to poverty reduction and good governance in the producer countries, nor will it enhance the energy security of the producer states or importing regions such as the EU. [532]
- In places like Madagascar and the Congo, it is unclear whether any environmental and social issues relating to oil sands development will be dealt with in a transparent manner. [533]



Source: *Modified from Oil Shales of the World: Their Origin, Occurrence, and Exploitation* by Paul L. Russell and UNITAR Heavy Oil & Oil Sands database [536]

- Environmental degradation from exploitation of unconventional fuel is exemplified in Jordan, where one possible source of water will be the proposed Red Sea-Dead Sea Canal, which could cause damage to coral reefs in the Red Sea and potential wider impacts on the ecosystem of the Jordan valley. [534]

Under the IEA's "reference" scenario global oil demand is set to increase such that, by 2030, "the equivalent of almost six times the current capacity of Saudi Arabia" would be needed in extra supply. With production from existing conventional oil fields predicted to decline by 50% by 2020, the IEA predicts this supply gap will be met by greater demand for both coal and "unconventional" oil, with the latter providing around 11% of total oil output by 2030. According to a November 2010 report by Communities for a Better Environment, processing heavy oil/bitumen blends at 2009 world refining capacity could increase annual CO₂ emissions by 1.6 - 3.7 gigatonnes and total petroleum fuel cycle emissions by 14 - 33%, while extraction emissions would add to these percentages. [535]

The possibility of exploiting unconventional fossil fuels is providing an alternative to addressing the need to convert to other forms of energy supply and is providing a means of perpetuating the empire of fossil fuel moguls, who seem more concerned with monetary gains than with the quality of life and the very existence of the next generation. World leaders are already failing to curb fossil fuel demand. This trend risks "tipping the world over the brink in terms of climate change," the Friends of the Earth report claimed. [536]

"The total amount of carbon in the oilsands resource—one of the largest hydrocarbon deposits on the planet—is roughly 200 gigatons of carbon. This is a huge amount of carbon. It is just under two thirds of the total amount of carbon emitted by fossil fuel combustion in human history. The oilsands resource alone is almost a third of the amount of atmospheric "head room" we have left before we hit 1000 gigatons of cumulative carbon emissions, a value widely seen threshold where the risks of dangerous climate change become substantial. Large-scale development of oil sands and similar heavy oil resources around the world builds an industrial inertia towards development of these resources, and in that context the development of oil sands constitutes a growing global threat." David Keith, Canadian Research Chair in Energy and the Environment, University of Calgary [537]

CLOSING COMMENTS:

Canadians have the ingenuity and talent to be leaders in the switch to renewable energy and low carbon output, but the Canadian government is not supporting this kind of innovation. Fatih Birol, the chief economist for the Paris-based International Energy Agency (IEA) says, if governments remove subsidies for fossil fuels and increase investments in renewable energy to make them cost competitive, then the Copenhagen Accord agreement to keep temperature rise to less than 2°C can still be upheld.

The IEA projects global energy demand to surge 36% over the next 25 years. To keep temperatures from rising more than 2°C, the share of renewables among total energy use must reach to 38% by 2035, governments must end their subsidies on fossil fuels, and global demand for coal, oil, and gas must plateau before 2020. And the longer the world waits to tackle the issue the more expensive it will become.

According to Dr. Viroi, *"Renewable energies need substantial subsidies from governments. The important task [for governments] is to decide whether they will support energy renewables in the future. It could be bad news for energy security and climate change if they don't."* [538]

Canadian governments and the oil sands industry argue in favour of further Alberta Oil Sands development, saying that on a global basis the GHG emissions and the environmental destruction of the Oil Sands are small. However, what this development represents is huge. The Alberta Oil Sands are impeding the enforcement of adequate environmental policies and emissions reduction within Canada and adversely influencing Canada's role in global climate change initiatives. They are also setting the stage for further exploitation of unconventional fossil fuels on a worldwide scale. Instead of reducing emissions, increases in the extraction and processing of unconventional fuels would lead to a substantive increase in GHG emissions from fossil fuels.

The potential for increased exploitation of unconventional fuels is also providing a means for global governments and industry to perpetuate the heavy use of fossil fuels rather than seriously tackling the necessary conversion to renewable energy, low carbon transportation and energy supplies, and reductions in energy use. Given the projected repercussions of climate change based on current emissions reduction commitments, only short-term thinking and maintaining local pollution, global warming, and loss of habitat as 'externalities' allow the ever-expanding Alberta Oil Sands project to continue.

"It is clear that our collective survival depends on the most radical mitigation effort we can imagine. . . Restoring a safe climate means the world very quickly building a zero-emissions economy without fossil fuels, and reducing the current level of greenhouse gases. It is a vast undertaking akin to a post-war reconstruction, but we have the technologies and the economic capacity. What we presently lack is an honest conversation about where we are headed, and the political will to build the solutions that are already available to us."

David Spratt, Co-author of *Climate Code Red*

"Out of the Earth we suck the liquefied remains of dead organisms. We burn our ancestors' remains in our engines, without ceremony. Then we go back to the Earth, like vampires, to suck out even more oil. . . Today, the climate itself threatens to bring everything full circle: if we keep pulling death from the ground, we will reap death from the skies."

Van Jones, author of *The Green Collar Economy*

"We have an opportunity to address an existential threat to human kind – a threat posed by climate change. The science is sobering. And climate change is happening much, much faster than you may realize . . . We must be ready and we must be committed to leave this planet Earth to succeeding generations more hospitable and more environmentally sustainable. That is our political and historical responsibility. . . as the leader of the G8, and as a chair of the G20 this year, and as one of the most developed countries in the world, Canada has a special role and special responsibility to play."

United Nations Secretary-General Ban Ki-moon,
speaking to an Ottawa audience in May 2010

"It is deceptive to measure the climate impact of oil sands based purely on current process emissions. All the oil produced is used, and emissions from use of oil sands derived fuels dwarf the process emissions. We can't keep taking carbon out of the ground and putting it in the atmosphere if we want to leave our children with a stable climate. This means there is no such thing as sustainable production of this resource. In the long run it must be shut down."

David Keith, Canada Research Chair in Energy and the Environment

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IHS CERA reports that, in 2009, 55% of the oil sands products imported to the United States were bitumen blends, with most being dilbit (70-75:30-25, bitumen:diluent). For SCO upgraded directly from bitumen in Canada the output volume is 85%, which would translate to 166 million barrels of SCO from 196 million barrels of bitumen. (IHS CERA puts output volume at 88%, which would mean even higher emissions relating to exported upgrading.)

According to RAND (sources Pembina Institute and GREET-Argonne National Laboratory), emissions produced per barrel of SCO for mining and extraction are 0.025 to 0.035 tonne CO_{2e}, and for in situ (SAGD) are 0.047 to 0.054 tonne CO_{2e}.

An even higher estimate for upgrading and refining of exported SCO is arrived at using figures from a December 2010 report: According to Karras, predicted refinery emissions for processing heavy oil/natural bitumen blends as feedstock are 0.097 to 0.165 tonne/barrel (0.61-1.04 tonnes/cubic metre), which, at the low end of this range, would amount to 19 Mt (for exported upgrading and refining) vs the exported upgrading and refining estimates of 11.4 Mt from upgrading and 3.2 Mt from refining (totaling 14.5 Mt) in this report.

The National Energy Board reported 122 million barrels (333,135 bpd) of SCO and 123 million barrels (338,053 bpd) of bitumen blend were exported to the U.S. in 2008. (This is a lower figure for bitumen blend than calculated above, but according to NEB statistical reports, some volumes of synthetic crude oil and blended bitumen may have been classified under their Conventional Heavy category.)

Petroleum Refining is reported as 17.5Mt under '2008 Greenhouse Gas Emissions by National Inventory Report category and economic category' and 'Details of trends in GHG emissions by sector' in the NIR

For diesel, 35% of the GHG emissions are due to the operations that process and upgrade the heavy portion of the crude oil and 43% of the GHG emissions are due to the sulfur removal processes. For example in the case of GHG emissions related to the refined product, for Canadian Conventional crude, National Energy Technology Laboratory reports a range of 0.034 tonnes CO_{2e}/bbl (for jet fuel) to 0.057 tonnes CO_{2e}/bbl (for diesel) for refining of Canadian Oil Sands feedstock.

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