

The Canadian Oil Boom

Scraping Bottom

Once considered too expensive, as well as too damaging to the land, exploitation of Alberta's oil sands is now a gamble worth billions.

By Robert Kunzig

<http://ngm.nationalgeographic.com/>, March 2009

One day in 1963, when Jim Boucher was seven, he was out working the trapline with his grandfather a few miles south of the Fort McKay First Nation reserve on the Athabasca River in northern Alberta. The country there is wet, rolling fen, dotted with lakes, dissected by streams, and draped in a cover of skinny, stunted trees—it's part of the boreal forest that sweeps right across Canada, covering more than a third of the country. In 1963 that forest was still mostly untouched. The government had not yet built a gravel road into Fort McKay; you got there by boat or in the winter by dogsled. The Chipewyan and Cree Indians there—Boucher is a Chipewyan—were largely cut off from the outside world. For food they hunted moose and bison; they fished the Athabasca for walleye and whitefish; they gathered cranberries and blueberries. For income they trapped beaver and mink. Fort McKay was a small fur trading post. It had no gas, electricity, telephone, or running water. Those didn't come until the 1970s and 1980s.

In Boucher's memory, though, the change begins that day in 1963, on the long trail his grandfather used to set his traps, near a place called Mildred Lake. Generations of his ancestors had worked that trapline. "These trails had been here thousands of years," Boucher said one day last summer, sitting in his spacious and tasteful corner office in Fort McKay. His golf putter stood in one corner; Mozart played softly on the stereo. "And that day, all of a sudden, we came upon this clearing. A huge clearing. There had been no notice. In the 1970s they went in and tore down my grandfather's cabin—with no notice or discussion." That was Boucher's first encounter with the oil sands industry. It's an industry that has utterly transformed this part of northeastern Alberta in just the past few years, with astonishing speed. Boucher is surrounded by it now and immersed in it himself.



Photograph by Peter Essick

Dust hangs in the sunset sky above the Syncrude Millennium mine, an open-pit north of Fort McMurray, Alberta.

Canada's oil sands are layers of sticky, tarlike bitumen mixed with sand, clay, and water. Around a hundred feet of soil must be stripped off to reach many deposits.

Where the trapline and the cabin once were, and the forest, there is now a large open-pit mine. Here Syncrude, Canada's largest oil producer, digs bitumen-laced sand from the ground with electric shovels five stories high, then washes the bitumen off the sand with hot water and sometimes caustic soda. Next to the mine, flames flare from the stacks of an "upgrader," which cracks the tarry bitumen and converts it into Syncrude Sweet Blend, a synthetic crude that travels down a pipeline to refineries in Edmonton, Alberta; Ontario, and the United States. Mildred Lake, meanwhile, is now dwarfed by its neighbor, the Mildred Lake Settling Basin, a four-square-mile lake of toxic mine tailings. The sand dike that contains it is by volume one of the largest dams in the world.

Nor is Syncrude alone. Within a 20-mile radius of Boucher's office are a total of six mines that produce nearly three-quarters of a million barrels of synthetic crude oil a day; and more are in the pipeline. Wherever the bitumen layer lies too deep to be strip-mined, the industry melts it "in situ" with copious amounts of steam, so that it can be pumped to the surface. The industry has spent more than \$50 billion on construction during the past decade, including some \$20 billion in 2008 alone. Before the collapse in oil prices last fall, it was forecasting another \$100 billion over the next few years and a doubling of production by 2015, with most of that oil flowing through new pipelines to the U.S. The economic crisis has put many expansion projects on hold, but it has not diminished the long-term prospects for the oil sands. In mid-November, the International Energy Agency released a report forecasting \$120-a-barrel oil in 2030—a price that would more than justify the effort it takes to get oil from oil sands.

Nowhere on Earth is more earth being moved these days than in the Athabasca Valley. To extract each barrel of oil from a surface mine, the industry must first cut down the forest, then remove an average of two tons of peat and dirt that lie above the oil sands layer, then two tons of the sand itself. It must heat several barrels of water to strip the bitumen from the sand and upgrade it, and afterward it discharges contaminated water into tailings ponds like the one near Mildred Lake.

They now cover around 50 square miles. Last April some 500 migrating ducks mistook one of those ponds, at a newer Syncrude mine north of Fort McKay, for a hospitable stopover, landed on its oily surface, and died. The incident stirred international attention—Greenpeace broke into the Syncrude facility and hoisted a banner of a skull over the pipe discharging tailings, along with a sign that read "World's Dirtiest Oil: Stop the Tar Sands."

The U.S. imports more oil from Canada than from any other nation, about 19 percent of its total foreign supply, and around half of that now comes from the oil sands. Anything that reduces our dependence on Middle Eastern oil, many Americans would say, is a good thing. But clawing and cooking a barrel of crude from the oil sands emits as much as three times more carbon dioxide than letting one gush from the ground in Saudi Arabia. The oil sands

are still a tiny part of the world's carbon problem—they account for less than a tenth of one percent of global CO₂ emissions—but to many environmentalists they are the thin end of the wedge, the first step along a path that could lead to other, even dirtier sources of oil: producing it from oil shale or coal. "Oil sands represent a decision point for North America

and the world," says Simon Dyer of the Pembina Institute, a moderate and widely respected Canadian environmental group. "Are we going to get serious about alternative energy, or are we going to go down the unconventional-oil track? The fact that we're willing to move four tons of earth for a single barrel really shows that the world is running out of easy oil."

That thirsty world has come crashing in on Fort McKay. Yet Jim Boucher's view of it, from an elegant new building at the entrance to the besieged little village, contains more shades of gray than you might expect. "The choice we make is a difficult one," Boucher said when I visited him last summer. For a long time the First Nation tried to fight the oil sands industry, with little success. Now, Boucher said, "we're trying to develop the community's capacity to take advantage of the opportunity." Boucher presides not only over this First Nation, as chief, but also over the Fort McKay Group of Companies, a community-owned business that provides services to the oil sands industry and brought in \$85 million in 2007. Unemployment is under 5 percent in the village, and it has a health clinic, a youth center, and a hundred new three-bedroom houses that the community rents to its members for far less than market rates. The First Nation is even thinking of opening its own mine: It owns 8,200 acres of prime oil sands land across the river, right next to the Syncrude mine where the ducks died.

As Boucher was telling me all this, he was picking bits of meat from a smoked whitefish splayed out on his conference table next to a bank of windows that offered a panoramic view of the river. A staff member had delivered the fish in a plastic bag, but Boucher couldn't say where it had come from. "I can tell you one thing," he said. "It doesn't come from the Athabasca."

Without the river, there would be no oil sands industry. It's the river that over tens of millions of years has eroded away billions of cubic yards of sediment that once covered the bitumen, thereby bringing it within reach of shovels—and in some places all the way to the surface. On a hot summer day along the Athabasca, near Fort McKay for example, bitumen oozes from the riverbank and casts an oily sheen on the water. Early fur traders reported seeing the stuff and watching natives use it to caulk their canoes. At room temperature, bitumen is like molasses, and below 50°F or so it is hard as a hockey puck, as Canadians invariably put it. Once upon a time, though, it was light crude, the same liquid that oil companies have been pumping from deep traps in southern Alberta for nearly a century. Tens of millions of years ago, geologists think, a large volume of that oil was pushed northeastward, perhaps by the rise of the Rocky Mountains. In the process it also migrated upward, along sloping layers of sediment, until eventually it reached depths shallow and cool enough for bacteria to thrive. Those bacteria degraded the oil to bitumen.

The Alberta government estimates that the province's three main oil sands deposits, of which the Athabasca one is the largest, contain 173 billion barrels of oil that are economically recoverable today. "The size of that, on the world stage—it's massive," says Rick George, CEO of Suncor, which opened the first mine on the Athabasca River in 1967. In 2003, when the *Oil & Gas Journal* added the Alberta oil sands to its list of proven reserves, it immediately propelled Canada to second place, behind Saudi Arabia, among oil-producing nations. The proven reserves in the oil sands are eight times those of the entire U.S. "And that number will do nothing but go up," says George. The Alberta Energy Resources and Conservation Board estimates that more than 300 billion barrels may one day be recoverable from the oil sands; it puts the total size of the deposit at 1.7 trillion barrels.

Getting oil from oil sands is simple but not easy. The giant

electric shovels that rule the mines have hardened steel teeth that each weigh a ton, and as those teeth claw into the abrasive black sand 24/7, 365 days a year, they wear down every day or two; a welder then plays dentist to the dinosaurs, giving them new crowns. The dump trucks that rumble around the mine, hauling 400-ton loads from the shovels to a rock crusher, burn 50 gallons of diesel fuel an hour; it takes a forklift to change their tires, which wear out in six months. And every day in the Athabasca Valley, more than a million tons of sand emerges from such crushers and is mixed with more than 200,000 tons of water that must be heated, typically to 175°F, to wash out the gluey bitumen. At the upgraders, the bitumen gets heated again, to about 900°F, and compressed to more than 100 atmospheres—that's what it takes to crack the complex molecules and either subtract carbon or add back the hydrogen the bacteria removed ages ago. That's what it takes to make the light hydrocarbons we need to fill our gas tanks. It takes a stupendous amount of energy. In situ extraction, which is the only way to get at around 80 percent of those 173 billion barrels, can use up to twice as much energy as mining, because it requires so much steam.

Most of the energy to heat the water or make steam comes from burning natural gas, which also supplies the hydrogen for upgrading. Precisely because it is hydrogen rich and mostly free of impurities, natural gas is the cleanest burning fossil fuel, the one that puts the least amount of carbon and other pollutants into the atmosphere. Critics thus say the oil sands industry is wasting the cleanest fuel to make the dirtiest—that it turns gold into lead. The argument makes environmental but not economic sense, says David Keith, a physicist and energy expert at the University of Calgary. Each barrel of synthetic crude contains about five times more energy than the natural gas used to make it, and in much more valuable liquid form. "In economic terms it's a slam dunk," says Keith. "This whole thing about turning gold into lead—it's the other way around. The gold in our society is liquid transportation fuels."

Most of the carbon emissions from such fuels comes from the tailpipes of the cars that burn them; on a "wells-to-wheels" basis, the oil sands are only 15 to 40 percent dirtier than conventional oil. But the heavier carbon footprint remains an environmental—and public relations—disadvantage. Last June Alberta's premier, Ed Stelmach, announced a plan to deal with the extra emissions. The province, he said, will spend over \$1.5 billion to develop the technology for capturing carbon dioxide and storing it underground—a strategy touted for years as a solution to climate change. By 2015 Alberta is hoping to capture five million tons of CO₂ a year from bitumen upgraders as well as from coal-fired power plants, which even in Alberta, to say nothing of the rest of the world, are a far larger source of CO₂ than the oil sands. By 2020, according to the plan, the province's carbon emissions will level off, and by 2050 they will decline to 15 percent below their 2005 levels. That is far less of a cut than scientists say is necessary. But it is more than the U.S. government, say, has committed to in a credible way.

One thing Stelmach has consistently refused to do is "touch the brake" on the oil sands boom. The boom has been gold for the provincial as well as the national economy; the town of Fort McMurray, south of the mines, is awash in Newfoundlanders and Nova Scotians fleeing unemployment in their own provinces. The provincial government has been collecting around a third of its revenue from lease sales and royalties on fossil fuel extraction, including oil sands—it was expecting to get nearly half this year, or \$19 billion, but the collapse in oil prices since the summer has dropped that estimate to about \$12 billion. Albertans are bitterly familiar with the boom-and-

bust cycle; the last time oil prices collapsed, in the 1980s, the provincial economy didn't recover for a decade. The oil sands cover an area the size of North Carolina, and the provincial government has already leased around half that, including all 1,356 square miles that are minable. It has yet to turn down an application to develop one of those leases, on environmental or any other grounds.

From a helicopter it's easy to see the industry's impact on the Athabasca Valley. Within minutes of lifting off from Fort McMurray, heading north along the east bank of the river, you pass over Suncor's Millennium mine—the company's leases extend practically to the town. On a day with a bit of wind, dust plumes billowing off the wheels and the loads of the dump trucks coalesce into a single enormous cloud that obscures large parts of the mine pit and spills over its lip. To the north, beyond a small expanse of intact forest, a similar cloud rises from the next pit, Suncor's Steepbank mine, and beyond that lie two more, and across the river two more. One evening last July the clouds had merged into a band of dust sweeping west across the devastated landscape. It was being sucked into the updraft of a storm cloud. In the distance steam and smoke and gas flames belched from the stacks of the Syncrude and Suncor upgraders—"dark satanic mills" inevitably come to mind, but they're a riveting sight all the same. From many miles away, you could smell the tarry stench. It stings your lungs when you get close enough.

From the air, however, the mines fall away quickly. Skimming low over the river, startling a young moose that was fording a narrow channel, a government biologist named Preston McEachern and I veered northwest toward the Birch Mountains, over vast expanses of scarcely disturbed forest. The Canadian boreal forest covers two million square miles, of which around 75 percent remains undeveloped. The oil sands mines have so far converted over 150 square miles—a hundredth of a percent of the total area—into dust, dirt, and tailings ponds. Expansion of in situ extraction could affect a much larger area. At Suncor's Firebag facility, northeast of the Millennium mine, the forest has not been razed, but it has been dissected by roads and pipelines that service a checkerboard of large clearings, in each of which Suncor extracts deeply buried bitumen through a cluster of wells. Environmentalists and wildlife biologists worry that the widening fragmentation of the forest, by timber as well as mineral companies, endangers the woodland caribou and other animals. "The boreal forest as we know it could be gone in a generation without major policy changes," says Steve Kallick, director of the Pew Boreal Campaign, which aims to protect 50 percent of the forest.

McEachern, who works for Alberta Environment, a provincial agency, says the tailings ponds are his top concern. The mines dump wastewater in the ponds, he explains, because they are not allowed to dump waste into the Athabasca, and because they need to reuse the water. As the thick, brown slurry gushes from the discharge pipes, the sand quickly settles out, building the dike that retains the pond; the residual bitumen floats to the top. The fine clay and silt particles, though, take several years to settle, and when they do, they produce a yogurt-like goop—the technical term is "mature fine tailings"—that is contaminated with toxic chemicals such as naphthenic acid and polycyclic aromatic hydrocarbons (PAH) and would take centuries to dry out on its own. Under the terms of their licenses, the mines are required to reclaim it somehow, but they have been missing their deadlines and still have not fully reclaimed a single pond.

In the oldest and most notorious one, Suncor's Pond 1, the sludge is perched high above the river, held back by a dike of compacted sand that rises more than 300 feet from the valley

floor and is studded with pine trees. The dike has leaked in the past, and in 2007 a modeling study done by hydrogeologists at the University of Waterloo estimated that 45,000 gallons a day of contaminated water could be reaching the river. Suncor is now in the process of reclaiming Pond 1, piping some tailings to another pond, and replacing them with gypsum to consolidate the tailings. By 2010, the company says, the surface will be solid enough to plant trees on. Last summer it was still a blot of beige mud streaked with black bitumen and dotted with orange plastic scarecrows that are supposed to dissuade birds from landing and killing themselves.

The Alberta government asserts that the river is not being contaminated—that anything found in the river or in its delta, at Lake Athabasca, comes from natural bitumen seeps. The river cuts right through the oil sands downstream of the mines, and as our chopper zoomed along a few feet above it, McEachern pointed out several places where the riverbank was black and the water oily. "There is an increase in a lot of metals as you move downstream," he said. "That's natural—it's weathering of the geology. There's mercury in the fish up at Lake Athabasca—we've had an advisory there since the 1990s. There are PAHs in the sediments in the delta. They're there because the river has eroded through the oil sands."

Independent scientists, to say nothing of people who live downstream of the mines in the First Nations' community of Fort Chipewyan, on Lake Athabasca, are skeptical. "It's inconceivable that you could move that much tar and have no effect," says Peter Hodson, a fish toxicologist at Queen's University in Ontario. An Environment Canada study did in fact show an effect on fish in the Steepbank River, which flows past a Suncor mine into the Athabasca. Fish near the mine, Gerald Tetreault and his colleagues found when they caught some in 1999 and 2000, showed five times more activity of a liver enzyme that breaks down toxins—a widely used measure of exposure to pollutants—as did fish near a natural bitumen seep on the Steepbank.

"The thing that angers me," says David Schindler, "is that there's been no concerted effort to find out where the truth lies."

Schindler, an ecologist at the University of Alberta in Edmonton, was talking about whether people in Fort Chipewyan have already been killed by pollution from the oil sands. In 2006 John O'Connor, a family physician who flew in weekly to treat patients at the health clinic in Fort Chip, told a radio interviewer that he had in recent years seen five cases of cholangiocarcinoma—a cancer of the bile duct that normally strikes one in 100,000 people. Fort Chip has a population of around 1,000; statistically it was unlikely to have even one case. O'Connor hadn't managed to interest health authorities in the cancer cluster, but the radio interview drew wide attention to the story. "Suddenly it was everywhere," he says. "It just exploded."

Two of O'Connor's five cases, he says, had been confirmed by tissue biopsy; the other three patients had shown the same symptoms but had died before they could be biopsied. (Cholangiocarcinoma can be confused on CT scans with more common cancers such as liver or pancreatic cancer.) "There is no evidence of elevated cancer rates in the community," Howard May, a spokesperson for Alberta Health, wrote in an email last September. But the agency, he said, was nonetheless conducting a more complete investigation—this time actually examining the medical records from Fort Chip—to try to quiet a controversy that was now two years old.

One winter night when Jim Boucher was a young boy, around the time the oil sands industry came to his forest, he was returning alone by dogsled to his grandparents' cabin from an

errand in Fort McKay. It was a journey of 20 miles or so, and the temperature was minus 4°F. In the moonlight Boucher spotted a flock of ptarmigan, white birds in the snow. He killed around 50, loaded them on the dogsled, and brought them home. Four decades later, sitting in his chief-executive office in white chinos and a white Adidas sport shirt, he remembers the pride on his grandmother's face that night. "That was a different spiritual world," Boucher says. "I saw that world continuing forever." He tells the story now when asked about the future of the oil sands and his people's place in it.

A poll conducted by the Pembina Institute in 2007 found that 71 percent of Albertans favored an idea their government has always rejected out of hand: a moratorium on new oil sands projects until environmental concerns can be resolved. "It's my belief that when government attempts to manipulate the free market, bad things happen," Premier Stelmach told a gathering of oil industry executives that year. "The free-market system will solve this."

But the free market does not consider the effects of the mines on the river or the forest, or on the people who live there, unless it is forced to. Nor, left to itself, will it consider the effects of the oil sands on climate. Jim Boucher has collaborated with the oil sands industry in order to build a new economy for his people, to replace the one they lost, to provide a new future for kids who no longer hunt ptarmigan in the moonlight. But he is aware of the trade-offs. "It's a struggle to balance the needs of today and tomorrow when you look at the environment we're going to live in," he says. In northern Alberta the question of how to strike that balance has been left to the free market, and its answer has been to forget about tomorrow. Tomorrow is not its job.



By Edward Burtynsky

Alberta Oil Sands #7 Fort McMurray, Alberta, Canada, 2007
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Photograph by Peter Essick

Squeezing Sand for Oil

Sand, water, and bitumen residues are finally piped to a tailings pond, where the water is extracted, cleaned, and reused in the mines.