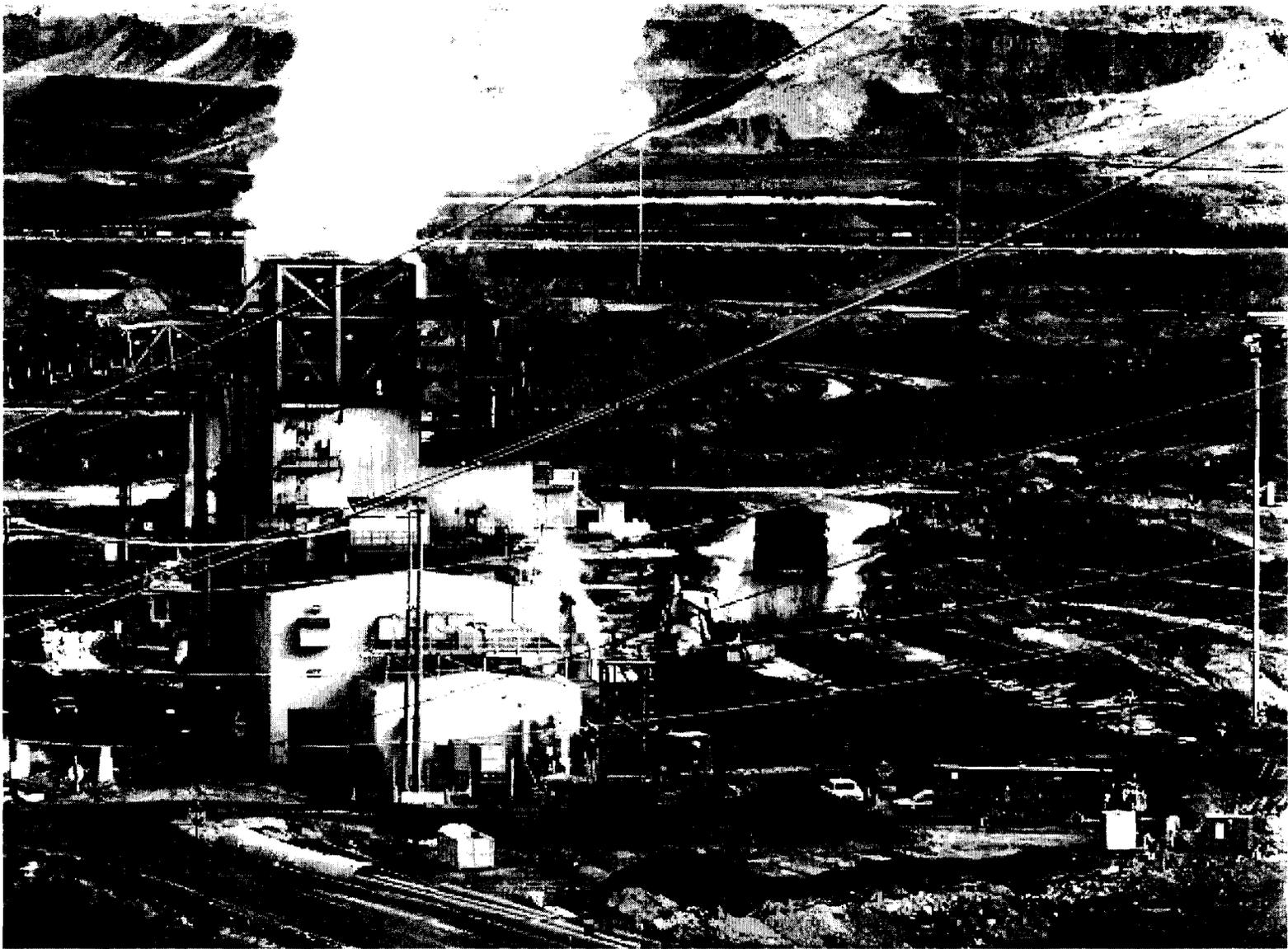


4.6 Protecting the Environment

In the rush to develop the oil sands, efforts to proactively manage the cumulative environmental impacts have proven inadequate. Neither the government nor industry has placed enough priority on identifying the ability of the regional environment to withstand impacts and developing plans to manage oil sands development within these constraints. As a result, numerous proposed oil sands projects under regulatory review will be considered without the extent of scientific information and cumulative impact management systems recommended by the government's own Regional Sustainable Development Strategy (RSDS).

While the members of CEMA remain supportive of their role in advancing and developing regional environmental management systems, we believe a number of changes are required to enable the organization's success.

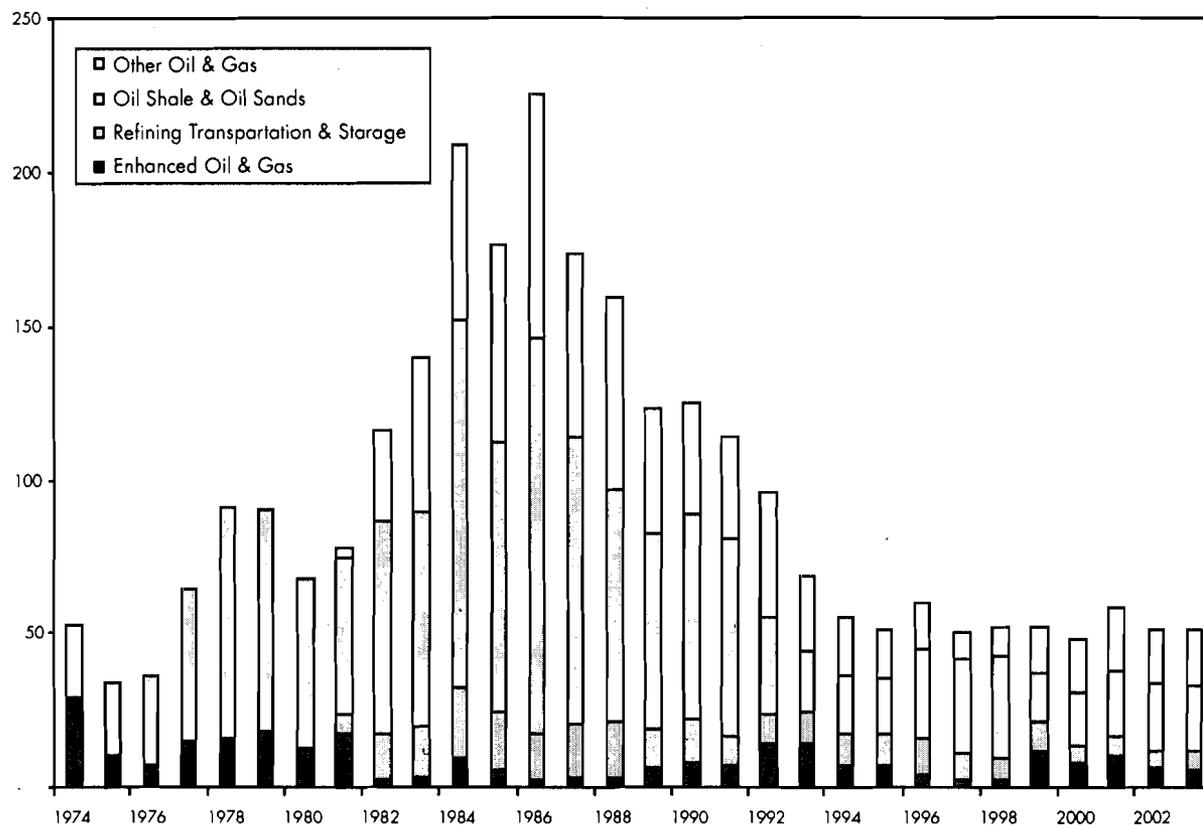
In addition, development should occur in a precautionary manner that continuously seeks to minimize environmental impacts. This continuous improvement can be driven by the establishment of clear environmental performance targets to encourage the oil sands industry to dedicate its considerable capacity for technological innovation towards achieving a reduction in environmental impacts.



▲ *A giant truck heading back to the mining area leaves an extraction plant*

PHOTO: MELINA MARA. © 2005, THE WASHINGTON POST. REPRINTED WITH PERMISSION

5 Government's Helping Hand



Source: International Energy Agency Database of Research and Development Expenditure

▲ FIGURE 31: Federal research and development budget for energy in Canada 1971-2003.

The governments of Alberta and Canada have played a significant role in bolstering the industry and creating strong incentives for investment. Given projected oil prices, oil sands companies will be generating significant profits. Therefore, continued government generosity will shortchange the public owners of the resource. In the 1980s and 1990s, government assistance came in the form of generous research and

development support (Figure 31) and incredibly favourable royalty and tax treatment.

These direct and indirect subsidies have contributed greatly towards overcoming technical and cost barriers and minimizing investment risk. Many of these subsidies are still in place today although the industry has attained an undeniable level of economic sustainability.

5.1 Rent Collection

5.1.1 Government as Steward

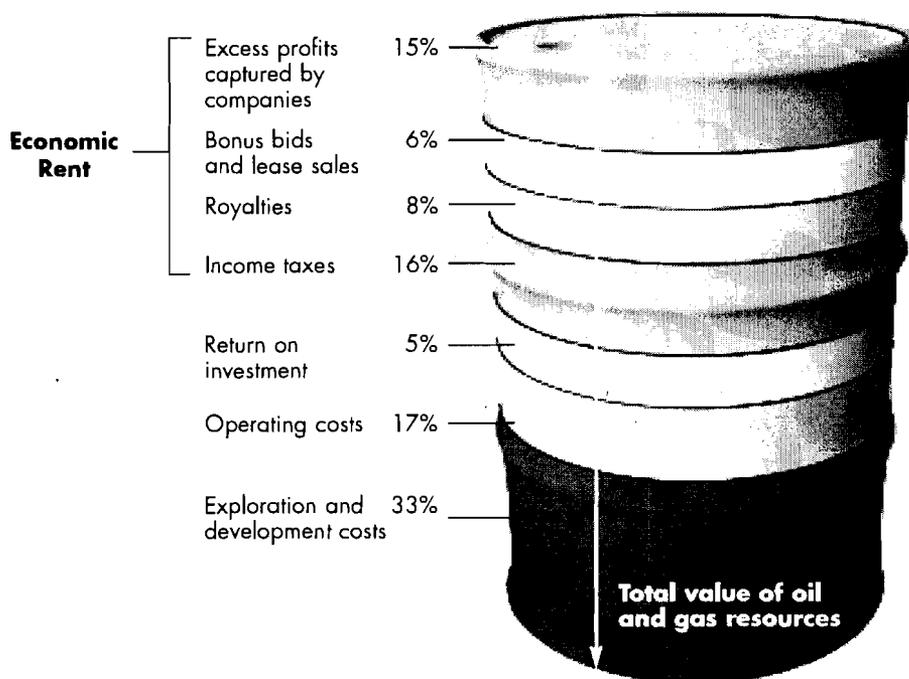
In Canada the citizens of a province own the majority of its natural resources. The government is the steward of the oil sands and is responsible for ensuring that the owners receive maximum benefit from their development. The government allows companies to produce the oil and earn a fair return on their investment, while at the same time ensuring that a portion of the revenue from the sale of the oil is transferred to the citizens of Alberta. The owners receive the dual benefit of economic growth and job creation, while also being compensated for the liquidation of the non-renewable resource.

5.1.2 Fair Compensation?

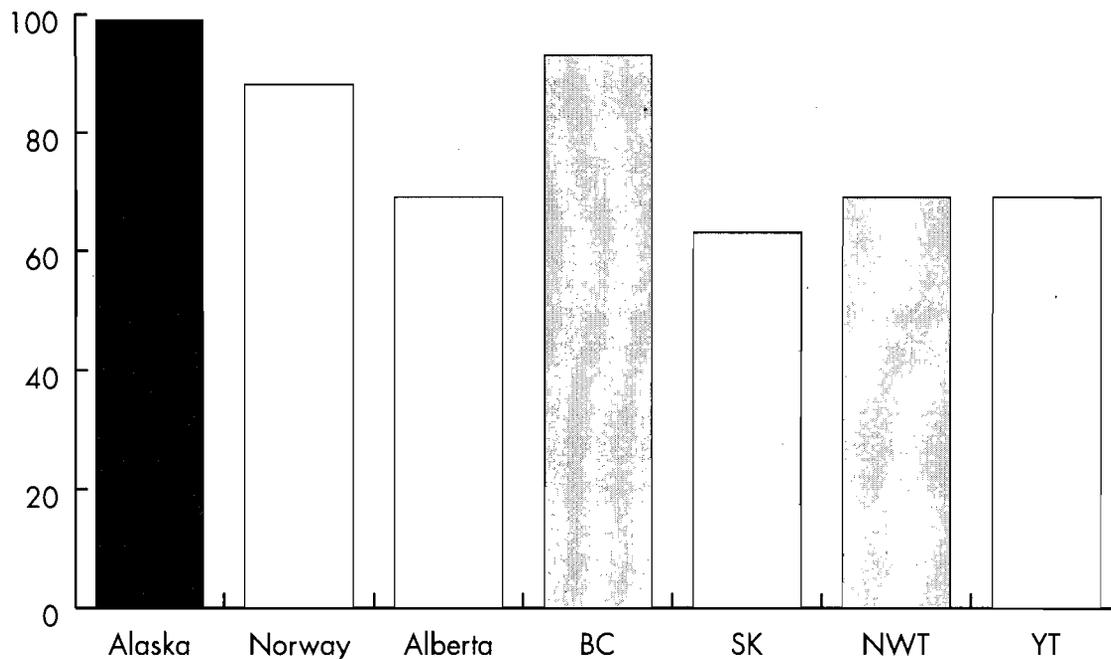
The governments of Alberta and Canada are responsible for collecting the economic rent associated with oil sands production. Their role is to capture as much of the "economic rent" that is available on the sale of a barrel of oil on behalf of the citizens of the province (Figure 32). The economic rent is the amount left over after a fair return on investment plus all the company's costs to find the resource (exploration costs), construct facilities (development costs) and operate facilities (operation costs) have been deducted from the sale price of the oil. The provincial government collects economic rent by charging fees in exchange for the rights to develop

certain oil sands deposits (bonus bids and lease sales) and by collecting royalties on the sale of the oil. The federal government has no direct jurisdictional authority over the development of a province's resources, but all Canadians benefit through the collection of federal taxes. If the provincial and federal government fail to capture all the available economic rent, oil companies receive profits in excess of their fair return on investment.

Successive years of windfall budget surpluses give the appearance that



▲ FIGURE 32: The economic rent for a barrel of oil



▲ FIGURE 33: Average portion of economic rent captured in each region 1995–2002.

the government of Alberta is doing an adequate job of collecting economic rent from its oil and gas resources.

However, economic rent capture has been decreasing in recent years, reaching a low of 31% in 2000. Alberta's average collection of rent from conventional oil and gas between 1995 and 2002, while comparable to some other Canadian jurisdictions, was considerably lower than that of both Norway and Alaska (Figure 33).²⁵⁹

The government may choose to leave excess profits in the hands of companies to promote additional investment in exploration and development, and to encourage companies to risk investment when prices are uncertain or technologies are unproven. This has been an explicit strategy of both levels of government to promote rapid development of the oil sands.

5.1.3 Alberta's Favourable Royalty Regime

In 1996, the government of Alberta acted on the recommendations of the National Oil Sands Task Force and implemented the Generic Royalty Regime with the following set of objectives:²⁶⁰

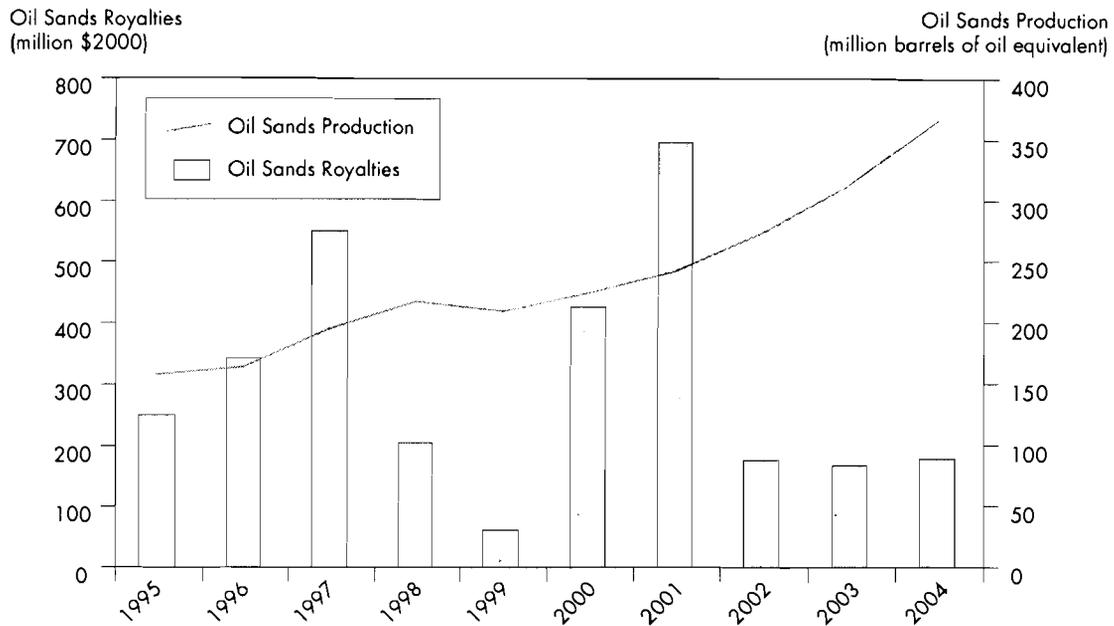
- Accelerating the development
- Facilitating development by private sector companies
- Ensuring that development is competitive with other petroleum development opportunities on a world scale

Under this regime, the Alberta government collects a 1% royalty until "project payout," which is defined to include all projects costs, including 100% of capital development and operating costs in the year incurred plus

"[Given the low royalties from oil sands production, it] appears that, at least implicitly, the government of Alberta has opted for higher activity levels in the oil and gas industry and a lower take on each unit of production."

*Institute for Public Economics, 2002*²⁶¹

5 Government's Helping Hand



▲ FIGURE 34: Oil sands production and royalties 1995–2004.

an acceptable rate of return. This means that new projects and expanded projects pay a very low royalty rate until all the initial costs have been recovered. After project payout is reached, the regime imposes a uniform 25% royalty payable on net project revenue, which equates to the gross revenue minus all costs.

With the significant increase in oil sands production taking place, one might expect to see a comparable increase in associated royalty revenues. However, the 1% royalty rate until project payout is a powerful incentive to reinvest profits from the oil sands into expansion, which further delays revenue collection by the Province. Figure 34 shows oil sands production is increasing (up 133% between 1995 and 2004), and royalties from oil sands are decreasing (down 30% over the same period). The Province obtained declining revenues for each barrel of oil equivalent (BOE) over

this period (from \$1.6/BOE of oil sands in 1996 to \$0.5/BOE of oil sands in 2004).²⁶²

5.1.4 Federal tax breaks

The federal government provides generous allowances for “writing-off” capital costs related to oil sands developments to encourage investment in the oil sands. This means that when a company makes a capital investment (such as the purchase of new equipment or the construction of new or expanded oil sands projects), it can use 100% of that expenditure to reduce the amount of tax that it has to pay on income from the project. In other words, the company only pays federal income tax on the income from the project once it has written off all eligible capital costs.²⁶³

These tax rules make oil sands projects much more attractive and profitable

than they would be otherwise. According to the Commissioner on the Environment and Sustainable Development, this results in a significant tax benefit relative to other energy sectors.²⁶⁴

The federal Department of Finance estimates that the tax benefits granted to oil sands companies are worth between

\$5 million and \$40 million for every \$1 billion invested.²⁶⁵ Between 1997 and 2004, capital investments in the oil sands totalled \$27.5 billion.²⁶⁶ Using the range estimated by the Department of Finance, between 1997 and 2004 oil sands companies received a benefit of between \$137.5 million and \$1.1 billion for these generous capital write-offs.

5.2 A New Fiscal Regime

In the decade since the governments of Alberta and Canada modified the fiscal regime for the oil sands, continued reductions in operating costs combined with radically improved market conditions have changed the economics of the industry. The oil sands are now a mature and extremely profitable sector. Now outdated, unnecessary and increasingly detrimental, the royalty and tax regimes create a powerful incentive

for rapid re-investment and growth. The current fiscal policy provides the oil industry and its shareholders with an inequitable share of the wealth derived from oil sands exploitation.

The majority of wealth derived from non-renewable resources rightfully belongs to the public. Further, the non-renewable nature of this resource makes it imperative that this wealth be invested to benefit multiple generations.

"Canada has shown that it can transform impossible energy dreams into reality. When the oil sands of the Athabaska [sic] were discovered in the 1960s, no technology existed to exploit them and the economics were simply crazy. It took decades of dedication and, especially, sustained federal support (\$40 billion in various fiscal incentives and tax breaks) to eventually transform this impossible project into a thriving industry that will provide enormous amounts of both energy and wealth to the country for decades to come."

Stéphane Dion, Minister of the Environment, Government of Canada



▲ From the air, the giant trucks look like little ants in the large mines. You can see the mine layering in this photo. The bottom of the mine is as deep below the surface of the former boreal forest as the length of a football field.

PHOTO: CHRIS EVANS, THE PEMBINA INSTITUTE

6 A Time for Stewardship and Leadership

Given the scale and pace of the development, it is clear that Canada has a global responsibility for demonstrating stewardship and leadership in preventing the current and rapidly increasing environmental impacts of oil sands exploitation. Furthermore, any development of the oil sands must be done in the context of a national strategy for the transition from environmentally intensive conventional energy to an economy based on sustainable energy.

The magnitude of the risks and opportunities arising from Canada's oil sands rush is unprecedented in the history of Canadian energy production. All Canadians, including future generations of Canadians, have a stake in the outcome. To improve

A SUSTAINABLE ENERGY SYSTEM IS ONE THAT

Provides the services of energy to meet peoples' needs today and the needs of future generations in an accessible, equitable and most efficient manner

Enables stabilization of atmospheric concentrations of greenhouse gases

Protects or restores the earth's air, land and water resources throughout its life-cycle

Is safe and results in no burdens of risk for future generations

Empowers communities to live satisfying and healthy lives

society's overall wellbeing and protect the environment, we provide the following key recommendations, organized under four core themes, for responsible stewardship and leadership:

6.1 Responsible Use

To demonstrate leadership in the more efficient use of natural resources, and in light of the increasing demand for energy and the associated environmental implications of today's energy systems, the government of Canada should

- *Develop a national energy framework by the end of 2006 with targets and supporting policies for energy efficiency, energy conservation, renewable energy and conventional energy in collaboration with the provinces, First Nations, industry and non-governmental organizations (NGOs).*
- *Provide incentives for responsible consumption.*
- *Regulate Canadian fleet fuel efficiency based on best available technology.*

6.2 Protecting the Climate

To ensure that the oil sands industry does its fair share in meeting Canada's GHG reduction obligations enshrined within the Kyoto Protocol, we recommend that the government of Canada

- *Define Best Available Technology Economically Achievable (BATEA)-based targets for the oil sands industry at a level that ensures new and expanded projects make a meaningful contribution towards meeting Canada's emission-reductions obligations.*
- *Invest in research and provide incentives to promote the commercialization of more efficient transportation-based technologies and the development of low-impact alternative fuels.*

Looking beyond 2012, we recommend that the governments of Canada and Alberta

- *Require all existing and new oil sands operations to be carbon-neutral (net zero GHG emissions) by 2020 through a combination of actual reductions and emission offsets.*

6.3 Protecting the Regional Environment

Over the next two years, regulatory agencies will be asked to review proposed oil sands projects that will push production to approximately 3.8 million barrels per day, more than triple the current production. Over the next several years, regulatory agencies may be faced with proposals to further increase production to five million barrels per day or more. These public-interest decisions must be made in an informed and precautionary manner to ensure that cumulative environmental impacts are proactively managed. We recommend that

The government of Alberta

- *Establish interim environmental limits that protect human health and the environmental integrity of the region before approving additional oil sands development.*
- *Establish clear reclamation expectations that ensure the long-term ecological sustainability of the region before approving additional oil sands development.*

The governments of Alberta and Canada

- *Create the conditions for CEMA to successfully refine environmental limits and develop regional environmental management systems to guide decisions about future oil sands development. This will require the development of specific memoranda of*

understanding between government and CEMA that include clear deliverables and a firm schedule, the provision of additional human and financial resources, and clear statements of political expectation and support for meaningful outcomes.

- *Assume responsibility for those issues that will not or cannot be addressed through the CEMA*

process in a timely fashion.

Commit to a process to consult with stakeholders and a schedule to implement new standards and systems to manage these issues.

- *Ensure that industry maximizes their use of best available technologies to minimize the rate of increase of cumulative environmental impacts.*

6.4 Establishing an Equitable Fiscal Regime

A significant shift in the fiscal regime is required to achieve a successful transformation towards a sustainable energy future. This shift includes full incorporation of the polluter-pay principle into a revised regime. We recommend that the governments of Alberta and Canada

- *Establish a timeline for eliminating federal subsidies, especially tax advantages, to the oil and gas sector.*
- *Redirect subsidies and favourable fiscal policies towards conservation of energy, energy efficiency and*

expansion of low-impact renewable energy.

- *Maximize the collection of royalties and taxes to compensate current and future generations of Albertans and Canadians for the utilization of this publicly owned, non-renewable resource.*
- *Invest a portion of the wealth derived from royalties and taxes into a permanent fund for sustainable energy to foster further innovation in energy conservation, energy efficiency and the production of low-impact renewable energy.*



▲ *Suncor oil sands upgrader.*

PHOTO: THE PEMBINA INSTITUTE

Endnotes

1 - 30

- 1 Data was taken from Table 2.3 and converted from hectares to square kilometres. Source: Alberta Energy and Utilities Board, *Alberta's Reserves 2004 and Supply/Demand Outlook/Overview* (2005), Statistical Series (ST) 2005-98, pp. 2-7.
- 2 The province of Alberta is 661,190 km² (260,000 mi²) in area.
- 3 Population data source: <http://www.woodbuffalo.net/population.htm>.
- 4 Alberta Energy and Utilities Board, *Alberta's Reserves 2004 and Supply/Demand Outlook/Overview* (2005), Statistical Series (ST) 2005-98, p. 2.
- 5 The EUB defines established reserves as "Those reserves recoverable under current technology and present and anticipated economic conditions specifically proved by drilling, testing, or production, plus the portion of contiguous recoverable reserves that are interpreted to exist from geological, geophysical, or similar information with reasonable certainty."
- 6 Kevin Hall, "U.S. energy future rests with development of Canadian oil sands," October 6, 2005. *Knight Ridder Newspapers*.
- 7 Data was taken from Table 2.3 and converted from cubic meters to barrels using a conversion factor of 6.2929 barrels/cubic metre. Alberta Energy and Utilities Board. *Alberta's Reserves 2004 and Supply/Demand Outlook/Overview* (2005), Statistical Series (ST) 2005-98, p. 2-7.
- 8 Doug Barnett, *An Early History of the Athabasca Oil Sands*, <http://www.usask.ca/education/ideas/tplan/sslp/yukon/bitumen.htm>.
- 9 National Energy Board, *Canada's Oil Sands - Outlook to 2015* (2000), p. 15.
- 10 Nickle's Energy, Information, Technology. *Syncrude and Alta. Gov's reach agreement on tar sands development - still hinges on federal gov's export tax*. September 19, 1973, http://www.nickles.com/history/article.asp?article=history%5Chistory_0925.html.
- 11 <http://www.centreforenergy.com/generator2.asp?xml=/silos/ong/oilsands/oilsandsHistoryXML.asp&template=1,1,1>.
- 12 <http://www.centreforenergy.com/generator2.asp?xml=/silos/ong/oilsands/oilsandsHistoryXML.asp&template=1,1,1>.
- 13 National Oil Sands Task Force, *The Oil Sands: A New Energy Vision for Canada* (1995), p. 33.
- 14 National Oil Sands Task Force, *The Oil Sands: A New Energy Vision for Canada* (1995), p. 5.
- 15 National Oil Sands Task Force, *The Oil Sands: A New Energy Vision for Canada* (1995), pp. 4, 6, 36 and 12 respectively.
- 16 Between 1995 and 2004, Alberta's crude bitumen production increased from 482,000 barrels per day to 1.1 million barrels per day. Data was converted from cubic metres to barrels using a factor of 6.2929 barrels/ cubic metre. Source of 1995 data: Alberta Energy and Utilities Board. (2004), ST98-2004 - Graphs and Data - Section 2 Crude Bitumen. <http://www.eub.gov.ab.ca/bbs/products/STs/st98-2004-data-2-bitumen.ppt>. Source of 2004 data: Alberta Energy and Utilities Board, *Alberta's Reserves 2004 and Supply/Demand Outlook/Overview* (2005), Statistical Series (ST) 2005-98, p.2.
- 17 In the summer of 2005, Total initiated a friendly takeover of Deer Creek Energy Limited, a small Canadian oil company focused on oil sands development. As of September 2005, Total had acquired 78% of the issued and outstanding shares of DCEL, with the intent of acquiring the remainder. Source: http://www.total.com/en/press/press_releases/pr_2005/050913_total_acquires_78_deer_creek_7917.htm.
- 18 Chinese investments in the oil sands include China Petroleum & Chemical Corp.'s (Sinopec) purchase of a 40% stake in Synenco Energy's Northern Lights project, CNOOC's purchase of one-sixth of MEG Energy, and PetroChina International Company Ltd.'s commitment to half of the capacity of Enbridge's proposed Gateway pipeline to the Pacific coast.
- 19 See, for example, Tamsin Carlisle, "A Black-Gold Rush in Alberta," *Wall Street Journal*, September 15, 2005, http://online.wsj.com/public/article/0,,SB112674051132041159-MVjoYsv_EzxxfBJ5r5QF2Oj3W54_20050921_00.html?mod=mkw.
- 20 Canadian Energy Research Institute (CERI), *Oil Sands Supply Outlook, Potential Supply and Costs of Crude Bitumen and Synthetic Crude Oil in Canada 2003-2017* (2004), Study No. 108, p. 1.
- 21 Premier Ralph Klein, "Western Canada's role in building a secure, abundant and sustainable energy future for North America," (presentation by Premier Ralph Klein to the Western Governors' Association - North American Energy Summit, Albuquerque, New Mexico, April 15, 2004.)
- 22 Report of the U.S. National Energy Policy Development Group, May 2001, http://www.dfaite-macsi.gc.ca/can-am/washington/trade_and_investment/energy-en.asp.
- 23 Data source: *Oil and Gas Journal*, December 2004.
- 24 The four mining operations approved over this period were Albian Sands Muskeg River Mine, TrueNorth (now UTS/PetroCanada) Fort Hills, CNRL Horizon Mine and Shell Jackpine Mine - Phase 1. The seven in situ projects approved included Suncor Firebag, EnCana Christina Lake, PetroCanada Mackay River, OPTI/Nexen Long Lake, ConocoPhillips Canada Surmont, PetroCanada Meadow Creek and Devon Jackfish.
- 25 Alberta Chamber of Resources, *Oil Sands Technology Roadmap - Unlocking the potential* (2004), p. 7.
- 26 Canadian Association of Petroleum Producers, *Canadian Crude Oil Production and Supply Forecast 2005-2015* (2005), p. 2.
- 27 Alberta Chamber of Resources, *Oil Sands Technology Roadmap - Unlocking the potential* (2004), p. 2.
- 28 "We project that oil sands production will make up half of all Canadian crude production sometime in late 2007, and reach 2 million barrels per day in 2013, double the 1 million barrels per day production reached in 2004, and reach 3 million barrels per day in 2018. The oil sands reach our very provisional peak number of 11 million barrels per day in 2047." Source: *Multicyclic Hubbert Curve Theory and Canada's Future Oil Outlook: Could Oil Sands production reach 11 million barrels per day?* First Energy Capital Corp, July 7, 2005.
- 29 <http://www.bloomberg.com/apps/news?pid=10000082&sid=aGFiywJ8Yr8s&refer=canada>.
- 30 <http://www.centreforenergy.com/generator2.asp?xml=/silos/ong/oilsands/oilsandsHistoryXML.asp&template=1,1,1>.

31 - 66

- 31 Alberta Department of Energy, http://www.energy.gov.ab.ca/com/Sands/Introduction/Oil_Sands.htm.
- 32 Alberta Department of Energy, http://www.energy.gov.ab.ca/com/Sands/Introduction/Oil_Sands.htm.
- 33 http://www.capp.ca/default.asp?TEMPORARY_TEMPLATE=29&V_DOC_ID=1135.
- 34 George W. Bush, President; President Fox of Mexico and Prime Minister Martin of Canada. Remarks at Bill Daniels Activity Center, Baylor University Waco, TX. March 23, 2005, <http://www.state.gov/p/wha/rls/rm/2005/q1/43847.htm>.
- 35 Data source: Alberta Energy and Utilities Board (2005), *Alberta's Reserves 2004 and Supply/Demand Outlook/Overview*. Statistical Series (ST) 2005-98, <http://www.eub.gov.ab.ca/bbs/products/sts/st98-2005-data.ppt>.
- 36 Alberta Energy and Utilities Board, *Alberta's Reserves 2004 and Supply/Demand Outlook/Overview* (2005), Statistical Series (ST) 2005-98, <http://www.eub.gov.ab.ca/bbs/products/sts/st98-2005-data.ppt>.
- 37 Alberta Energy and Utilities Board *Alberta's Reserves 2004 and Supply/Demand Outlook/Overview* (2005), Statistical Series (ST) 2005-98, pp.2-23.
- 38 National Energy Board, *Canada's Oil Sands – Opportunities and Challenges to 2015* (2004), p.32.
- 39 For examples, see Matthew Simmons, "Peak Oil: The Reality Of Depletion," presented at the Offshore Technology Conference in Houston, Texas on May 3, 2004, <http://www.simmonsco-intl.com/files/OTC-World%20Energy%20Supplies.pdf> and J. Mawdsley, J. Mikhareva, and J. Tension, *The Oil Sands of Canada – The World Wakes Up: First to Peak Oil, Second to Canada's Oil Sands* (Raymond James Equity Research, 2005) <http://www.raymondjames.com>.
- 40 Ian Mackinnon, "Commodity Strategists: Oil May Average \$93 in 2007," Bloomberg, September 9, 2005.
- 41 Roma Luciw, "Oil to fall to \$45: TD" September 22, *Globe and Mail*, September 22, 2005. Update edition.
- 42 Foster Natural Gas Report, *Outlook for oil sands production in Canada factors in significant demand for natural gas*. March 11, 2004. Citing a study released March 3, 2004 by the Canadian Energy Research Institute entitled *Oil Sands Supply Outlook: Potential Supply and Costs of Crude Bitumen and Synthetic Crude Oil in Canada, 2003-2017*.
- 43 Source of data for 1990-2004 from British Petroleum, *Statistical Review of World Energy 2005*. p. 14. Source of data for 2005: Bloomberg Market Data, October 21, 2005, <http://www.bloomberg.com/markets/commodities/energyprices.html>. Source of data for 2006-2007: Ian Mackinnon, "Commodity Strategists: Oil May Average \$93 in 2007," Bloomberg, September 9, 2005.
- 44 From a barrel of oil, 40% (by volume) is refined to gasoline for use in automobiles, 25% is refined to diesel fuel, 7% to jet fuel, (total of 72% to transportation fuels), 8% is refined to light fuel oil for heating, 7% to heavy fuel oil for power generation, 8% to "other" e.g., petrochemicals and 5% of the crude oil (or the equivalent amount of energy from natural gas) is consumed in the refining process. Centre for Energy, *Our Petroleum Challenge – 7th Edition* (2004), p. 16.
- 45 Projected oil demand in 2015 is estimated to be more than 24 million barrels per day. Steve Maich, "Alberta is about to get wildly rich and powerful," *Macleans*, June 13, 2005.
- 46 Alberta Chamber of Resources, *Oil Sands Technology Roadmap – Unlocking the potential* (2004), p.7.
- 47 The International Energy Agency has estimated global oil demand to be 121 million barrels per day in 2030. Source: Birol, Faith, International Energy Agency, *The Outlook to 2030* (2004), p.38, <http://www.world-petroleum.org/first/first2004/Birol.pdf>.
- 48 Richard Heavenrich, *Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2005* (U.S. Environmental Protection Agency, 2005), <http://www.epa.gov/otaq/fetrends.htm>.
- 49 Average specific consumption of vehicles in the European Union in 2003: ODYSSEE Energy Efficiency Indicators in Europe. <http://www.odyssee-indicators.org/>.
- 50 Kevin G. Hall, "U.S. energy future rests with development of Canadian oil sands." October 6, 2005. *Knight Ridder Newspapers*.
- 51 Canadian Press, "Clinton issues Alberta a global warming warning," October 19, 2005.
- 52 National Oil Sands Task Force, *The Oil Sands: A New Energy Vision for Canada* (1995), p. 12.
- 53 Vincent DiNorcia, "Editors Notes," *The Corporate Ethics Monitor*. Volume 17, Issue 4, July–August 2005.
- 54 David Kilgour, "Rise of an energy colossus," *National Post*, June 15, 2005.
- 55 Alberta Energy, *What is oil sands?* (2004), <http://www.energy.gov.ab.ca/100.asp>.
- 56 Alberta Energy and Utilities Board. 2005. *Alberta's Reserves 2004 and Supply/Demand Outlook/Overview* (2005), Statistical Series (ST) 2005-98, p.2-1.
- 57 Alberta Energy Research Institute. *Canadian oil sands: development and future outlook*. p. 1. http://www.aeri.ab.ca/sec/new_res/docs/oil_sands_dev_outlook_Isaacs_050214.pdf.
- 58 Data was taken from Table 2.3 and converted from hectares to square kilometres. *Alberta Energy and Utilities Board, Alberta's Reserves 2004 and Supply/Demand Outlook/Overview* (2005), Statistical Series (ST) 2005-98, pp. 2-7.
- 59 Alberta Energy, *Facts on Oil Sands* (2004), http://www.energy.gov.ab.ca/docs/oilsands/pdfs/FactSheet_OilSands.pdf.
- 60 http://www.cnrl.com/imageviewer.php?pic=client/body/22/54/sco_process_zoom.gif&alt=
- 61 http://www.syncrude.com/who_we_are/01_04_1.html.
- 62 Alberta Energy, *Facts on Oil Sands* (2004), http://www.energy.gov.ab.ca/docs/oilsands/pdfs/FactSheet_OilSands.pdf.
- 63 Brendan I. Koerner, "The Trillion-Barrel Tar Pit – Who needs "oil independence" – our friendly neighbour to the north is sitting on a black gold mine!" *Wired Magazine*, http://www.wired.com/wired/archive/12.07/oil_pr.html.
- 64 <http://rocktoroad.com/oilsands.html>.
- 65 L. Flint, *Bitumen Recovery: A review of long term research and development opportunities*, p. 10, <http://www.ptac.org/links/dl/osdnlreport.pdf> and L. Sawatsky, Golder Associates, *Improved Stewardship of Water Resources that are Entrusted to Oil Sands Mine* (presentation to "Water and Land Issues for the Oil and Gas Industry" March 22, 2004).
- 66 Alberta Chamber of Resources, *Oil Sands Technology Roadmap – Unlocking the potential* (2004), p.14.

67 - 100

- 67 National Energy Board, *Canada's Oil Sands – Opportunities and Challenges to 2015* (2004), p.25.
- 68 Petro-Canada, *Application for Approval of the Meadow Creek Project* (2001), vol. 1, pp. 3–4.
- 69 Alberta Chamber of Resources, *Oil Sands Technology Roadmap – Unlocking the potential* (2004), p. 14.
- 70 Alberta Chamber of Resources, *Oil Sands Technology Roadmap – Unlocking the potential* (2004), p. 3.
- 71 A Chevy Avalanche's fuel efficiency is 16 miles per gallon. Given that a barrel of oil can produce about 72 litres of gasoline, a barrel of oil produces enough gasoline to drive an Avalanche 490 kilometres. Sources: <http://www.energy.gov.ab.ca/1960.asp> and <http://www.fueleconomy.gov/>.
- 72 National Energy Board, *Canada's Oil Sands – Opportunities and Challenges to 2015*. May 2004. p. 110.
- 73 National Energy Board, *Canada's Oil Sands – Opportunities and Challenges to 2015*. May 2004. p. 86.
- 74 A typical Canadian home uses 72 GJ of energy each year for space heating (185 cubic feet of gas per day), on average. Source: Natural Resources Canada. http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/tablesrnds2/res_ca_2_e_3.cfm?attr=0.
- 75 As much as 1.2 billion cubic feet per day of gas could be available to move through the Mackenzie Valley Pipeline. Source: <http://www.mackenziegasproject.com/theProject/overview/index.html>.
- 76 Two billion cubic feet of gas could heat 10.8 million Canadian homes for a day. In 2001, Canada had approximately 11.5 million homes.
- 77 Alberta Chamber of Resources, *Oil Sands Technology Roadmap: Unlocking the Potential*. (2004), p. 14.
- 78 Eric Reguly, "Oil sands mother lode could doom gas reserves," *Globe and Mail*, May 28, 2005.
- 79 2004 data from National Energy Board, *Canada's Oil Sands – Opportunities and Challenges to 2015* (2004), p. 86. Production forecasts for 2012 and 2030, breakdown of production (SCO from in situ vs. surface mines and non-upgraded bitumen) and natural gas factors (for mining to SCO, in situ to SCO and in situ to crude bitumen) all from Alberta Chamber of Resources, *Oil Sands Technology Roadmap: Unlocking the Potential* (2004).
- 80 <http://www.innovationalberta.com/article.php?articleid=92>.
- 81 R.B. Dunbar, and T.W. Sloan, Canadian Energy Research Institute (2003), *Does nuclear have a role in the development of Canada's oil sands?* Paper 2003-096.
- 82 Dave Ebner and Simon Tuck, "Oil sands players eye nuclear option," *Globe and Mail*, September 23, 2005.
- 83 Canadian Press, "Klein says nuclear energy not a good option," October 18, 2005.
- 84 National Energy Board, *Canada's Oil Sands – Opportunities and Challenges to 2015* (2004), p. 86.
- 85 National Energy Board, *Canada's Oil Sands – Opportunities and Challenges to 2015* (2004), p. 110.
- 86 Alberta Chamber of Resources, *Oil Sands Technology Roadmap: Unlocking the Potential* (2004), p. 57.
- 87 National Energy Board, *Canada's Oil Sands – Opportunities and Challenges to 2015* (2004), p. 90.
- 88 National Energy Board, *Canada's Oil Sands – Opportunities and Challenges to 2015* (2004), p. 32.
- 89 National Energy Board, *Canada's Oil Sands – Opportunities and Challenges to 2015* (2004), p. 50.
- 90 Alberta Chamber of Resources, *Oil Sands Technology Roadmap – Unlocking the potential* (2004), p.13.
- 91 For more information on the proposed Gateway Pipeline, see <http://www.enbridge.com/gateway/>.
- 92 J. Mawdsley and J. Mikhareva, and J. Tensionon, *The Oil Sands of Canada - The World Wakes Up: First to Peak Oil, Second to Canada's Oil Sands* (Raymond James Equity Research, 2005), <http://www.raymondjames.com>.
- 93 For a complete discussion on this topic, see a forthcoming report examining the need for long-term deep reductions in GHG emissions, to be published by the David Suzuki Foundation and the Pembina Institute, November 2005.
- 94 Government of Canada, *Climate Change Plan for Canada* (2002), p. 29.
- 95 National Climate Change Process Analysis and Modelling Group, *Canada's Emission Outlook – An Update* (1999), pp. 45-46.
- 96 Information provided to Robert Collier, *San Francisco Chronicle*, by Environment Canada, May 5, 2005, and then provided to author.
- 97 For the natural gas and residue scenarios, two emission intensity improvements were used. The upper limit of each graph uses an improvement of 1% and the lower limit uses a 2.3% improvement. A 1% emission intensity improvement reflects the "autonomous energy efficiency index". The AEEI is a value energy modelers use to represent the natural, non-price induced change in energy efficiency over time. AEEI typically ranges from 0.5% to 1%.
- The 2.3% emission intensity improvement is what Alberta Environment's Climate Change Plan is targeting. By 2020, Alberta will cut emissions in the province relative to GDP by 50% below 1990 levels. A 50% improvement over 30 years is equal to a 2.3% annual improvement, assuming that contribution of oil sands to Alberta's GDP remains at the same level. Expansion in the oil sands is expected to increase and so will its contribution to the GDP.
- As an interesting note, in the last decade the oil sands have made a 26% reduction in emissions, which is equal to a 3% annual reduction. While this amount may not be sustainable over the long term it is not unreasonable to expect that a 2.3% improvement is possible especially when efficiency is driven by higher energy costs.
- Utilization of residue for hydrogen and as an energy source is expected to come on-line in 2012. This date was chosen since this is when Suncor expects it might use a gasifier with Phase Two of its Voyageur project.
- Sources: IPCC Third Assessment Report, *Climate Change 2001, Mitigation Report*, Section 3.5.5.6, http://www.grida.no/climate/ipcc_tar/wg3/index.htm; Alberta Environment, *Albertians and Climate Change – Taking Action* (October 2002); *Climate Change Plan for Canada* (November 2002) p. 29; Suncor Energy, *Voyageur Project EIA* (2005), volume 1A, pp. 1–2.
- 98 Natural Resources Canada, *Canada's Emissions Outlook – an "Events-Based" Update for 2010* (1998), p. 1, <http://www.nrcan.gc.ca/es/ceq/CEO-2010.PDF>.
- 99 Natural Resources Canada, *Canada's Emissions Outlook – an "Events-Based" Update for 2010* (1998), p. 11, <http://www.nrcan.gc.ca/es/ceq/CEO-2010.PDF>.
- 100 National Climate Change Process Analysis and Modelling Group, *Canada's Emissions Outlook – an Update* (1999), p. 42.

101 - 138

- 101 Analysis and Modelling Group, *The Magnitude of the Challenge: Revising the Gap* (powerpoint presentation to Joint Ministers Meeting, February, 2002).
- 102 Government of Canada, *Moving Forward on Climate Change – A Plan for Honouring our Kyoto Commitment* (2005), p. 12, http://www.climatechange.gc.ca/kyoto_commitments.
- 103 See, for example, P. Calarnai, "An elusive pollution target," *Toronto Star*, February 12, 2005.
- 104 World Resources Institute, *Climate Analysis Indicators Tool (CAIT) Version 2.0* (2005), <http://cait.wri.org/cait.php>. Here the industrialized world is taken to comprise the member countries of the Organization for Economic Co-operation and Development (OECD).
- 105 <http://www.eia.doe.gov/cmeu/cabs/canenv.html>.
- 106 http://www.ica.org/Textbase/press/pressdetail.asp?PRESS_REL_ID=140.
- 107 Average intensity for conventional oil derived from information provided in Canadian Association of Petroleum Producers, *A National Inventory of Greenhouse Gas (GHG), Criteria Air Contaminant (CAC) and Hydrogen Sulphide (H₂S) Emissions by the Upstream Oil and Gas Industry* (2004). Table 2. GHG Emissions For Year 2000 From Subject Oil and Gas Activity by Province/Territory, Pg. 19, Volume 1. Average intensity for oil sands SCO was calculated as the average of operating surface mining operation intensities (Suncor, Syncrude, Shell – 2004 data from respective Sustainability Reports) and the "SAGD to SCO" emission factor provided by Len Flint, Lenef Consulting (personal communication).
- 108 David Ljunggren, "Nothing must harm oil sands plans – Canada minister" Reuters, November 29, 2002, <http://www.planetark.com/avantgo/dailynewsstory.cfm?newsid=18831>.
- 109 Charles Caccia, "Taxation and Other Policies to Reduce Greenhouse Gas Emissions and Enhance Competitiveness." (2002), *Environmental Policy and Law*, Volume 32, Numbers 3-4, pp. 178-181.
- 110 J.Mawdsley and J. Mikhareva and J.Tennison, *The Oil Sands of Canada - The World Wakes Up: First to Peak Oil, Second to Canada's Oil Sands* (Raymond James Equity Research, 2005), p. 53, <http://www.raymondjames.com>.
- 111 http://www.shell.ca/code/values/climate/climate_asop.html.
- 112 <http://www.weforum.org/site/knowledgenavigator.nsl/Content/S1531?open>.
- 113 The Royal Society, *Joint science academies' statement: Global response to climate change* (2005), <http://www.royalsoc.ac.uk/document.asp?id=3222>.
- 114 Production of 3.7 million barrels per day was calculated using existing, approved and planned oil sands development figures. Shell Canada Ltd. 2005. *Application for the Muskeg River Mine Expansion*. Appendix 2-6.
- 115 Clifford Krauss, "In Canada's Wilderness, Measuring the Cost of Oil Profits," *New York Times*, October 9, 2005.
- 116 The Regional Municipality of Wood Buffalo, *Regional Profile: the Regional Municipality of Wood Buffalo* (2003).
- 117 The Athabasca Tribal Council represents the region's five First Nations groups who have lived in the area for centuries. For more information on First Nations within RMWB visit www.atc97.org.
- 118 Alberta Chamber of Resources, *Oil sands Technology Roadmap: Unlocking the Potential. Final Report* (2004), Figure 3.3, p. 21.
- 119 <http://www.pnr-rpn.ec.gc.ca/nature/whp/ramsar/df02s06.en.html>.
- 120 <http://www.pnr-rpn.ec.gc.ca/nature/whp/ramsar/df02s06.en.html>.
- 121 Of the 388 million cubic metres of water licensed for withdrawal from the Athabasca River, only 38 million cubic metres (10%) is licensed for return to the Athabasca River.
- 122 John Hollenhorst, "Environmental Impact a Consideration in Oil Sands Business," Online edition. *KSL News*, August 9, 2005.
- 123 Len Flint, *Bitumen Recovery: A review of long term research and development opportunities* (2005), p. 42, <http://www.ptac.org/links/dl/osdfnlreport.pdf>.
- 124 B. Peachey, *Strategic Needs for Energy Relate Water Use Technologies*. Water and the EnergyNet (2005), p. 34, http://www.aeri.ab.ca/sec/new_res/docs/EnergyNet_and_Water_Feb2005.pdf.
- 125 National Energy Board, *Canada's Oil Sands – Outlook to 2015* (200), p. 68
- 126 Len Flint, *Bitumen Recovery: A review of long term research and development opportunities* (2005), p. 10, <http://www.ptac.org/links/dl/osdfnlreport.pdf>.
- 127 Bruce Peachey (New Paradigm Engineering Ltd.), in discussion with the author, September 13, 2005.
- 128 Alberta Chamber of Resources, *Oil Sands Technology Roadmap – Unlocking the potential* (2004), p.3.
- 129 Adrienne Price and Carl A. Mendoza. How big is your man-made aquifer? *Groundwater flow and salt transport in sand tailings storage facility, Fort McMurray, Alberta*. (2004), Paper No.194-6. Geological Society of America Abstracts with Programs, Vol. 36, No. 5, p. 451.
- 130 The largest tailings pond at Syncrude Canada Ltd. is the Mildred Lake Settling Basin, which has a water surface of 13 square kilometres and contains over 400 – 10⁶ cubic metres of fine tailings. Source: P.M. Fedorak, D.L. Coy, M.J. Salloum and M.J. Dudas., "Methanogenic potential of tailings samples from oil sands extraction plants," *Canadian Journal of Microbiology* (2002), Volume 48, pp. 21-33, <http://cjm.nrc.ca>.
- 131 An Olympic-sized swimming pool holds 2,500 m³ of water.
- 132 Suncor Energy, 2005 *Report on Sustainability* (2005), p.67.
- 133 Conrad Environmental Aquatics Technical Advisory Group (CEATAG), *Naphthenic Acids Background Information Discussion Report* (1998), Alberta Department of Energy: Edmonton, AB, Canada.
- 134 M.D.MacKinnon and H.Boerger. *Description of two treatment methods for detoxifying oil sands tailings pond water*. Water Poll. Res. J. Can. 1986, 21, pp. 496-512.
- 135 V.V.Rogers, M. Wickstrom, K. Liber and M.D.MacKinnon. "Acute and subchronic mammalian toxicity of naphthenic acids from oil sands tailings." *Toxicol. Sci.* 2002, 66, pp. 347-355.
- 136 P.M.Fedorak, D.L. Coy, M.J. Salloum and M.J. Dudas, 2002. "Methanogenic potential of tailings samples from oil sands extraction plants." *Canadian Journal of Microbiology* (2002), volume 48, pp.21-33, <http://cjm.nrc.ca>.
- 137 National Energy Board, *Canada's Oil Sands: Opportunities and Challenges to 2015* (2004), p. 68.
- 138 Bruce Peachey, "Strategic Needs for Energy Relate Water Use Technologies." *Water and the EnergyNet*, (2005), p35; http://www.aeri.ab.ca/sec/new_res/docs/EnergyNet_and_Water_Feb2005.pdf.

139 - 173

- 139 For example, see p. 65 of Alberta Energy and Utilities Board, Canadian Natural Resources Ltd. Application for an Oil Sands Mine, Bitumen Extraction Plant, and Bitumen Upgrading Plant in the Fort McMurray Area, (2004), Joint Panel Report. EUB Decision 2004-005.
- 140 Alberta's Surface Water Quality Guidelines have been developed for the protection of aquatic life, agriculture, recreation and aesthetics. <http://www3.gov.ab.ca/env/protenf/publications/surfwrqual-nov99.pdf>.
- 141 John V. Headley and Dena W. McMartin, "A review of the occurrence and fate of naphthenic acids in aquatic environments," *Part A – Toxic/Hazardous Substances and Environmental Engineering* (2004), Vol. A 39, No. 8, pp. 1989-2010.
- 142 National Energy Board, *Canada's Oil Sands: Opportunities and Challenges to 2015, An Energy Market Assessment* (2004), p. 68.
- 143 Exploration Rio Alto Ltd. (now CNRL), Kirby Project Application for Approval to Alberta Energy and Utilities Board and Alberta Environment (2002), Vol. 2, p. C2-16.
- 144 CNRL has estimated that for its Horizon surface mine, its aquifer depressurization will have a potential drawdown zone of 98 square kilometres (9,820 ha) in size. Source: Canadian Natural Resources Ltd., *Horizon Oil Sands Project. Application for Approval* (2002), Volume 6, Section 4, pp. 4-37.
- 145 EnCana's figure for Foster Creek is based on the anticipated average for 2005–2025, assuming 15,900 m³/day of bitumen production or more.
- 146 Florence Hum, Peter Tsang, Harding Thomas and Kantzas A. Apostolos. *Review of Produced Water Recycle and Beneficial Reuse* (2005). Institute for Sustainable Energy, Environment and Economy, University of Calgary, p. 29.
- 147 Government of Alberta, *Water for Life: Alberta's Strategy for Sustainability* (2003), <http://www.waterforlife.gov.ab.ca/>.
- 148 Source of data is Golder Associates Ltd., *A compilation of information and data on water supply and demand in the lower Athabasca River Reach* (2005). Prepared for the CEMA Surface Water Working Group. Table 13.
- 149 For example, in 2003 the City of Calgary's population was 922,315 and its municipal water requirement was approximately 174 million cubic metres per year. Water use data: Sustainable Calgary, *2004 State of Our City Report* (2005), p. 48. <http://www.sustainablecalgary.ca/sooc/sooc2004.pdf>
Population data: <http://content.calgary.ca/CCA/City+Hall/Business+Units/Community+Strategies/Social+Data/Research+Services/Population+Size.htm>.
- 150 Golder Associates Ltd., *A compilation of information and data on water supply and demand in the lower Athabasca River Reach* (2005). Prepared for the CEMA Surface Water Working Group.
- 151 Source of data: Alberta Environment, personal communication with M. Griffiths of the Pembina Institute.
- 152 Environment Canada, *Western Boreal Conservation Initiative – Strategic Plan* (2004), p. 1.
- 153 Cited in Environment Canada, *Western Boreal Conservation Initiative – Strategic Plan*, p. 4.
- 154 Natural Resources Canada, *The State of Canada's Forests 2004-2005* (2005), p. 44.
- 155 Global Forest Watch Canada, *Boreal Canada: State of the Ecosystem, State of Industry, Emerging Issues and Projections – Report to the National Round Table on Environment and the Economy* (2004), p. 4.
- 156 Global Forest Watch Canada, *Boreal Canada: State of the Ecosystem, State of Industry, Emerging Issues and Projections – Report to the National Round Table on Environment and the Economy* (2004), p. 5.
- 157 Environment Canada, *Western Boreal Conservation Initiative – Backgrounder* (2004), p. 2.
- 158 Cumulative Environmental Management Association, *Review and assessment of environmental effects information for wildlife and fish indicators in the RSDS study area within the Athabasca oil sands region* (2003), p. 39.
- 159 Environment Canada, *Western Boreal Conservation Initiative – Backgrounder* (2004), p. 2.
- 160 National Energy Board, *Canada's oil sands: A supply and market outlook to 2015* (2000), p. 83.
- 161 Wilcox and Murphy in Boyce 1992. Cited in Cumulative Environmental Management Association (2003), *Review and assessment of environmental effects information for wildlife and fish indicators in the RSDS study area within the Athabasca oil sands region*, p. 48.
- 162 Alberta Environment, Conservation and Reclamation Information Letter – C&R/IL/00-2 -Guideline for wetland re-establishment on reclaimed oil sands leases (2000), <http://www3.gov.ab.ca/env/protenf/landrec/documents/2000-2.pdf>.
- 163 Daniel Farr, Steve Kennett, Monique M. Ross, Brad Stelfox, and Marian Weber, *Al-Pac Case Study Report – Part 1. Management Objectives*, Prepared for the National Roundtable on the Environment and the Economy. July 2004. p. 4.
- 164 Preston McEachern and Theo Charette, *Lakes in Alberta's Boreal Forest. Lakeline*, Winter 2003/04.
- 165 Global Forest Watch Canada, *Boreal Canada: State of the Ecosystem, State of Industry, Emerging Issues and Projections – Report to the National Round Table on Environment and the Economy* (2004), p. 12.
- 166 Alberta Center for Boreal Studies, *The Oil and Gas Industry in Alberta: Practices, Regulations and Environmental Impacts* (November 2001), p. 13.
- 167 Cumulative Environmental Management Association, *Review and Assessment of Environmental Effects Information for Wildlife and Fish Indicators in the Regional Sustainable Development Strategy (RSDS) Study Area within the Athabasca Oil Sands Region (AOSR)* (March 2003), p. 42.
- 168 Suncor Energy, *2005 Report on Sustainability* (2005), p. 67.
- 169 Syncrude Canada Ltd., *2004 Sustainability Report* (2005), p. 60.
- 170 <http://www3.gov.ab.ca/env/protenf/landrec/definitions.html>.
- 171 Alberta Energy and Utilities Board, *Conservation and Reclamation Information Letter – Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region* (January 1999).
- 172 National Energy Board, *Canada's Oil Sands: Opportunities and Challenges to 2015*. (2004), p. 71.
- 173 Alberta Environment, *Regulatory Perspective – Oil Sands Reclamation*. Presented at CONRAD/OSERN Symposium 2003, May 12 and 13, 2003, in Edmonton, Alberta.

174 - 207

- 174 John V. Headley and Dena W. McMarrin, "A review of the occurrence and fate of naphthenic acids in aquatic environment.", *Part A – Toxic/Hazardous Substances and Environmental Engineering* (2004), Vol. A39, No.8, pp. 1989–2010.
- 175 Syncrude's Aurora (North and South) mines, Albian Sands Muskeg River mine and Shell's Jackpine Mine-Phase 1 are already approved and/or operating in the Muskeg River watershed. Imperial's Kerul Mine, Albian's Muskeg River Mine expansion, and Husky's Sunrise SAGD project are all currently under regulatory review.
- 176 Alberta Energy and Utilities Board, *Shell Canada Limited Applications for a tar sands Mine, Bitumen Extraction Plant, Co-generation Plant, and Water Pipeline in the Fort McMurray Area* (2004), Joint Panel Report. EUB Decision 2004-009, p. 68.
- 177 Canadian Natural Resources Ltd., *Supplemental Responses*. (2004), Part 2, 21.5 (ii), p. 100.
- 178 Alberta Pacific Forestry Ltd., *Draft Al-Pac FMA Area Forest Management Plan* (2005), p. 157.
- 179 Cumulative Environmental Management Association, *Review and Assessment of Environmental Effects Information for Wildlife and Fish Indicators in the Regional Sustainable Development Strategy (RSDS) Study Area within the Athabasca Oil Sands Region (AOSR)*. March 2003, p. 42.
- 180 Ibid.
- 181 Daniel Farr, Steve Kennett, Monique M. Ross, Brad Stelfox and Marian Weber, *Al-Pac Case Study Report – Part 1. Management Objectives*. Prepared for the National Roundtable on the Environment and the Economy. July 2004, p. 5.
- 182 Daniel Farr, Steve Kennett, Monique M. Ross, Brad Stelfox and Marian Weber, *Al-Pac Case Study Report – Part 1. Management Objectives*. Prepared for the National Roundtable on the Environment and the Economy. July 2004, p. 5.
- 183 Daniel Farr, Steve Kennett, Monique M. Ross, Brad Stelfox and Marian Weber, *Al-Pac Case Study Report – Part 1. Management Objectives*. Prepared for the National Roundtable on the Environment and the Economy. July 2004, p. 5.
- 184 <http://www.energy.gov.ab.ca/108.asp>.
- 185 <http://www.energy.gov.ab.ca/108.asp>.
- 186 Transcripts from CNRL Horizon Joint Panel Review, p. 1299. Lines 10-15.
- 187 <http://www.albertawilderness.ca/Issues/ML/threats.htm>.
- 188 Alberta Environment, *Regulatory Perspective – Oil Sands Reclamation*. Presented at CONRAD/OSERN Symposium 2003, May 12 & 13 2003, in Edmonton, Alberta.
- 189 Alberta Environment. 2005. *State of the Environment* (2005), http://www3.gov.ab.ca/env/soe/land_indicators/41_oilsands_reclamation.html.
- 190 Albian Sands Energy Inc., *Muskeg River Mine Expansion Project*, Appendix 2-6.
- 191 Sources of data: Alberta Environment *State of the Environment 2004*, http://www3.gov.ab.ca/env/soe/land_indicators/41_oilsands_reclamation.html and Shell Canada Ltd. *Application for the Muskeg River Mine Expansion* (2005), Appendix 2-6.
- 192 <http://www.pollutionwatch.org/pressroom/factSheetData/PollutionWatch%20Alberta%20Overview%202003%20-%20FINAL.pdf>.
- 193 Environment Canada (2005), http://www.ec.gc.ca/pdb/ape/cape_home_e.cfm.
- 194 Commission for Environmental Cooperation, *Taking Stock: 2002 North American Pollutant Releases and Transfers* (May 2005), Overview, Page xxxiv.
- 195 http://www.acidrain.org/pages/acidEutrophications/sub3_1.asp.
- 196 <http://www.ec.gc.ca/acidrain/acidair.html>.
- 197 Commission for Environmental Cooperation, *Taking Stock: 2002 North American Pollutant Releases and Transfers* (May 2005), Overview, Page xxxvii.
- 198 <http://www.ec.gc.ca/acidrain/acidair.html>.
- 199 Canadian Council of Ministers of the Environment, "Canada-Wide Standard for Benzene Phase 1" (2000).
- 200 Environment Canada, *Canadian Acid Deposition Science Assessment: Summary of Key Results* (2004), pp. 10–11.
- 201 http://www.acidrain.org/pages/acidEutrophications/sub3_2.asp.
- 202 http://www.acidrain.org/pages/acidEutrophications/sub3_1.asp.
- 203 http://www.acidrain.org/pages/acidEutrophications/sub3_1.asp.
- 204 Polycyclic aromatic hydrocarbons (PAHs) are a group of more than 100 different chemicals formed during the incomplete burning of coal, oil and gas. PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal and automobile exhaust. The majority of PAH and metal emissions in the oil sands region can be attributed to combustion of diesel fuels from the mining fleets.
- 205 Information taken from the Horizon Oilsands Project, Application for Approval. Emissions intensity include emissions from mining operations and upgrading of bitumen product as well as on-site electricity production. The emissions intensity is based on each barrel of bitumen production. Information taken from "A National Inventory of Greenhouse Gas (GHG), Criteria Air Contaminant (CAC) and Hydrogen Sulphide (H₂S) Emissions by the Upstream Oil and Gas Industry," Volume 1 and Volume 2. Specific segments of the industry excluded from the inventory are petroleum refining, heavy oil upgrading, oilsands mining, extraction and upgrading, and natural gas distribution. As well, emissions from electricity are not included.
- 206 Emissions from SAGD operations have a lower emission intensity than oil sands mining, but this intensity is still substantially higher than that of conventional oil.
- 207 Information taken from the Horizon Oilsands Project, Application for Approval. Emissions intensity include emissions from mining operations and upgrading of bitumen product as well as on-site electricity production. The emissions intensity is based on each barrel of bitumen production. Information taken from "A National Inventory of Greenhouse Gas (GHG), Criteria Air Contaminant (CAC) and Hydrogen Sulphide (H₂S) Emissions by the Upstream Oil and Gas Industry," Volume 1 and Volume 2. Specific segments of the industry excluded from the inventory are petroleum refining, heavy oil upgrading, oilsands mining, extraction and upgrading, and natural gas distribution. As well, emissions from electricity are not included.

208 - 239

- 208 Pollution Watch, *Ranking facilities by air releases of CAC – Alberta* (2005), http://www.pollutionwatch.org/rank.do?change=&healthEffct=all&year=2003&provincesByList=RETR_TOTAL_COMBINED&facilitiesByList=RELE_AIR_CAC&provincesListFac=AB&facilitiesByBurton=Rank&companiesByList=RETR_TOTAL_COMBINED.
- 209 Pollution Watch, *Ranking facilities by air releases of CAC – Canada* (2005), http://www.pollutionwatch.org/rank.do?change=&healthEffct=all&year=2003&provincesByList=RETR_TOTAL_COMBINED&facilitiesByList=RELE_AIR_CAC&provincesListFac=all&facilitiesByBurton=Rank&companiesByList=RETR_TOTAL_COMBINED.
- 210 Albian Sands Energy Inc., Muskeg River Mine Expansion Project, Appendix 2-6, *Developments in the Oil Sands Region*, April 2005.
- 211 Figures for existing scenario for SO₂ and NO_x – Source: Predicted Ambient Concentrations and Deposition of Priority Substances Released to the Air in the Oil Sands Region – Final Report, RWDI West Inc. Submitted to Cumulative Environmental Management Association Trace Metal and Air Contaminant Working Group, December 2003. Table 2.3, page 14.
- 212 Existing scenario totals for PM_{2.5} and VOC are comprised of approved emissions for Syncrude Mildred Lake, Aurora North, Suncor Base Plant, Steepbank, Millenium, Upgrader and South Tailings, PetroCanada MacKay River and Imperial Cold Lake.
- 213 Alberta's Ambient Air Quality Guideline (AAQG) for nitrogen oxides (NO_x) is based on the prevention of human health effects. The guideline for sulphur dioxide (SO₂) is based on the prevention of effects to vegetation.
- 214 Canadian Council of Ministers of Environment, *Canada Wide Standards for Particulate Matter and Ozone* (2000), p. 4.
- 215 Albian Sands Energy Inc., Muskeg River Mine Expansion Project, *Air Quality and Noise Assessment*, April 2005, Table 3, p. 4.
- 216 Imperial Oil Resources Ventures Limited, Volume 1, Kearl Oil Sands Project – Mine Development (July 2005), pp. 5-64.
- 217 Imperial Oil Resources Ventures Limited, Volume 2, Kearl Oil Sands Project – Mine Development, Appendix 2B (July 2005), pp. 68-70.
- 218 Albian Sands Energy Inc., Muskeg River Mine Expansion Project, *Air Quality and Noise Assessment*, April 2005, Table 5, p. 11.
- 219 Albian Sands Energy Inc., Muskeg River Mine Expansion Project, *Air Quality and Noise Assessment*, April 2005, Table 4, p. 6.
- 220 World Health Organization Regional Office for Europe Copenhagen, *Air Quality Guidelines for Europe* (Second Edition, 2000), p. 192.
- 221 The Particulate Matter and Ozone Management Framework was recommended to government by the stakeholders of the Clean Air Strategic Alliance in 2003.
- 222 Albian Sands Energy Inc., Muskeg River Mine Expansion Project, *Air Quality and Noise Assessment*, April 2005, Table 17, p. 37.
- 223 Albian Sands Energy Inc., Muskeg River Mine Expansion Project, *Air Quality Planned Development Case Ambient Predictions*, April 2005, Table 16, p. 36.
- 224 Clean Air Strategic Alliance, *Particulate Matter and Ozone Management Framework* (2003), pp. 31-34.
- 225 Commission for Environmental Cooperation, *Taking Stock: 2002 North American Pollutant Releases and Transfers*, (May 2005), p. 53.
- 226 Albian Sands Energy Inc., Muskeg River Mine Expansion Project, *Air Quality and Noise Assessment*, April 2005, Table 3, p. 4.
- 227 Albian Sands Energy Inc., Muskeg River Mine Expansion Project, *Air Quality Planned Development Case Ambient Predictions*, April 2005, p. 28.
- 228 An expression of the potential to cause acidification in terms of equivalency to hydrogen ions deposited over a hectare of land per year.
- 229 Environment Canada, <http://www.ec.gc.ca/acidrain/acidforest.html>.
- 230 Albian Sands Energy Inc., Muskeg River Mine Expansion Project, *Environmental Impact Assessment Appendices for the Muskeg River Mine Expansion*, Appendix 2-9, Air and Noise Modelling Methods (April 2005), Tables 27 and 28, p. 107 and 108.
- 231 NO_x/SO₂ Management Working Group, 2004, NO_x and SO_x Sensitivity Mapping.
- 232 Canadian Council of Ministers of Environment, *Canada-Wide Standard for Benzene Phase 2* (2001), pp. 2-3.
- 233 Albian Sands Energy Inc., Muskeg River Mine Expansion Project, *Air Quality Planned Development Case Ambient Predictions*, April 2005, Table 13, p. 28.
- 234 Imperial Oil Resources Ventures Limited, Volume 5, Kearl Oil Sands Project – Mine Development Regulatory Application, (Volume 5, Appendix 2B (July 2005), p. 2B-70.
- 235 Albian Sands Energy Inc. Muskeg River Mine Expansion Project, *Environmental Impact Assessment Appendices for the Muskeg River Mine Expansion*, Appendix 2-9, Air and Noise Modelling Methods, April 2005, Tables 27 and 28, p. 107 and 108.
- 236 Marc Deslauriers, Pollution Data Branch – Environment Canada, "Emission Inventories and Projections" (presentation at the SMOG Science Workshop, March 8 and 9, 2005 in Toronto).
- 237 Environment Canada, 2004 Canadian Acid Deposition Science Assessment: Summary of Key Results.
- 238 <http://www.eub.gov.ab.ca/BBS/eubinfol/default.htm>.
- 239 In Alberta, the environmental assessment (EA) process is encompassed within the Environmental Protection and Enhancement Act (EPEA), more specifically within the Environmental Assessment (Mandatory and Exempted Activities) Regulation (AR111/93) and the Environmental Assessment Regulation (AR 112/93). Schedule 1 of AR 111/93 lists oil sands mines and commercial oil sands upgrading or processing plants as activities that require a mandatory environmental impact assessment (EIA). The Environmental Assessment Process is outlined in Part 2 of the EPEA, which describes the purpose of the process and the steps to prepare and submit an EIA. Section 49 of EPEA lists the required contents of an EIA report, which includes a description of monitoring plans for predicted environmental impacts and proposed mitigation measures.
- Similar to EPEA, the Canadian Environmental Assessment Act (CEAA) includes Comprehensive Study Regulations that identify projects and classes of projects that require a comprehensive study. Included in the comprehensive study list are oil sands processing facilities and mines.

240 - 266

- 240 Most commonly, federal involvement is triggered by an oil sands proponent's requirement of a permit under Section 35(2) of the Fisheries Act for the alteration, disruption, or destruction of fish habitat. Prior to DFO issuing an authorization, an environmental assessment of the project under the Canadian Environmental Assessment Act (CEAA) is required.
- 241 Fen Montaigne "The Great Northern Forest: Boreal," *National Geographic* (2002), vol.201, issue 6, pp. 42-66.
- 242 Alberta Environment, *Regional Sustainable Development Strategy for the Athabasca Oil Sands Area* (1999), p. 1-2. For more information on the RSDS see <http://www3.gov.ab.ca/env/regions/neb/rsds/>.
- 243 Alberta Environment, *Regional Sustainable Development Strategy for the Athabasca Oil Sands Area* (1999), p.1.
- 244 For more information on the Cumulative Environmental Management Association (CEMA) see <http://www.cemaonline.ca/>.
- 245 http://www3.gov.ab.ca/env/irm/irm_actions.html.
- 246 The Clean Air Strategic Alliance (CASA) was established in March 1994 as a new way to manage air quality issues in Alberta. CASA is a non-profit association composed of diverse stakeholders from three sectors – government, industry, and non-government organizations such as health and environmental groups. Stakeholders are committed to developing and applying a comprehensive air quality management system for all Albertans. For more information see: <http://www.casahome.org/>.
- 247 As of January 2005, CEMA's membership consisted of 15 government representatives, 21 industry representatives, 14 Aboriginal and Métis representatives, and 6 ENGOs representatives.
- 248 Alberta Environment & Sustainable Resource Development, *Regional Sustainable Development Strategy for the Athabasca Oil Sands Area – Progress Report* (July 2001), p. 12.
- 249 Alberta Environment & Sustainable Resource Development, *Regional Sustainable Development Strategy for the Athabasca Oil Sands Area – Progress Report* (July 2001) p.12.
- 250 CEMA Contract Summary. April 30, 2005.
- 251 EUB Decision Report 99-2, p. 39.
- 252 EUB Decision Report 2002-089, p. 55.
- 253 EUB Decision 2004-005, p. 76.
- 254 EUB Decision 2004-009, p. 77.
- 255 Cumulative Environmental Management Association, *Annual Report 2000 and 2001. Cumulative Environmental Management Association – Wood Buffalo Region.*
- 256 Cumulative Environmental Management Association 2002. *CEMA Schedule Compared to Oil Sand Development Profiles.*
- 257 Cumulative Environmental Management Association. 2004. *CEMA Five Year Strategic Plan – Summary of Working Group Activities.*
- 258 Cumulative Environmental Management Association General Meeting October 4&5, 2005. Taken from schedule updates provided by the working groups.
- 259 Amy Taylor et al. *When the Government is the Landlord* (Pembina Institute, 2004), http://www.pembina.org/publications_display.asp?category=11.
- 260 Richard Masson and Bryan Remillard., *Alberta's New Oil Sands Royalty System* (1996) Alberta Department of Energy.
- 261 A. Plourde and Bradford Reid, "Natural Resource Revenues and the Alberta Budget" in Wilson, L. S., ed. *Alberta's Volatile Government Revenues*. Edmonton, Alberta: Institute for Public Economics (2002).
- 262 All statistics from Alberta Energy and the Canadian Association of Petroleum Producers.
- 263 Appendix A-Government Support for Energy Investments.
- 264 Commissioner of the Environment and Sustainable Development, *Report of the Commissioner of the Environment and Sustainable Development* (2000).
- 265 Ken Ketchum, Robert Lavigne and Reg Plummer, *Oil Sands Tax Expenditure* (Department of Finance: 2001).
- 266 Source: <http://www.capp.ca/raw.asp?x=1&dt=NTV&c=PDE&dn=3402>.

Oil SANDS Fever

Until now the story of Canada's oil sands has only been partially told.

Tales about the vast economic potential of development have been told and re-told by the oil industry, government, energy analysts and the media, but there has been a dearth of information about the environmental consequences.

Oil Sands Fever: The environmental implications of Canada's oil sands rush fills a critical gap by providing a comprehensive overview of the impacts and making recommendations regarding their management.

pembina.org

oilsandswatch.org

THE PEMBINA
Institute

